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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	Docket No. 40-8838-MLA
U.S. ARMY	)	
	)	ASLBP No. 04-819-04-MLA
(Jefferson Proving Ground Site)	)	
	)	

ARMY'S RESPONSE TO SAVE THE VALLEY, INC.'S CONCERNS AND CONTENTIONS AS SET FORTH IN ITS PETITION TO INTERVENE FILED HEREIN ON NOVEMBER 23, 2005

Pursuant to 10 CFR §2.309 (h) (1), the Army hereby files its response to the Contentions set forth in the "Petition to Intervene and Request for Hearing of Save The Valley, Inc." stating as follows:

The Army has applied for an alternate schedule for submittal of a decommissioning plan pursuant to 10 C.F.R. § 40.42 (g) (2). As Save The Valley (STV) rightly points out, there are three factors that the Commission must consider in granting that application: 1) whether the alternative schedule is necessary to the effective conduct of decommissioning operations; 2) whether it presents no undue risk from radiation to the public health and safety; and 3) whether it is otherwise in the public interest. None of STV's Contentions address themselves to these three factors. Rather, STV's Contentions seem to address themselves to a decommissioning plan which is not yet before the Commission. In other words, STV is attempting to convert a motion for a continuance into a trial on the merits on a decommissioning plan which is as yet only speculative. To the extent that STV's contentions do not address themselves to the three factors of § 40.42 (g) (2) they are irrelevant and immaterial. The contentions of the intervener are required to be "material to the findings the NRC must make to support the action that is involved in the proceeding." 10 C.F.R. §2.309 (f) (iv). The one thing STV's Contentions do accomplish is to make licensee's case that the alternate schedule is indeed necessary to the effective conduct of decommissioning operations (Factor 1 above).

I.
Specific Responses To The Contentions Relating To The Environmental Radiation Monitoring Plan (ERMP), Field Sampling Plan (FSP), And Health And Safety Plan (HASP) Found In The Petition To Intervene

A. ERMP Contentions

In conjunction with its superseded 2003 request for an alternate decommissioning schedule, the Army submitted an Environmental Radiation Monitoring Plan ("ERMP"). *See* ADAMS Document ML032731017. This ERMP has not been further updated by the Army in conjunction with its current request for an alternate schedule to correct deficiencies previously identified by STV. *See* STV Comments and Request for Hearing, ADAMS Document ML040360299.

Response: The September 2003 ERMP was submitted in response to NRC's April 8, 2003, request for information to support its evaluation of the Army's contingent request for an alternate schedule for submittal of a Decommissioning Plan (DP). Since that time, the Army has continued its assessment of its plans and data to support decommissioning and submitted additional information to NRC demonstrating the need to complete additional site characterization of the DU Impact Area. This document, *Responses to the NRC May 20, 2004, Request for Additional Information Regarding the Environmental*

Monitoring Program Plan, dated November 2004, points to the need to complete additional site characterization and addresses most, if not all, of STV's concerns. The responses provided herein should provide further clarification and discussion on these issues.

NRC has not approved the Draft ERMP; therefore, the Army is implementing the current protocol documented in *Standard Operating Procedure (SOP) DU Sampling Program, ERMP SOP No. OHP 40-1* (March 10, 2000). The FSP (SAIC 2005), as noted in Section 4, (Table 4-1 and Figure 4-1) indicates that the results of the site characterization program will be used to revise the current monitoring program. Given that the Draft ERMP has not been approved, the Army is implementing the current standard operating procedure approved in 2000, subject to three updates involving the analytical procedures (use of isotopic analyses in lieu of fluorometric analyses), health and safety protocol, and quality assurance procedures. The sampling locations, number of samples, media sampled, and action levels remain as defined in the 2000 SOP. It should also be noted that the 2003 ERMP was not discussed at the September 8, 2005 meeting with NRC staff, and that the NRC staff identified no action items for the Army regarding the ERMP at the September 8, 2005 meeting. Therefore the Army considers all STV ERMP contentions as not being relevant or germane to the Army request for an alternate decommissioning schedule.

The Army's responses to STV's statements below, regarding the ERMP, are provided in the context of the above discussion:

a. Basis. The ERMP states with respect to the monitoring results for the various environmental media that, at 50% of Action Level, SBCCOM will conduct an "independent assessment" of the results and any trends. See ERMP, Table 3-1. Yet, there is no specification of the assessment that will be performed and no explanation offered as to how an assessment, however specified, will be "independent" if it is performed by the Army. The ERMP should further define and explain the "independent assessment."

Response: An independent assessment encompasses multiple and independent layers of analysis and review. The Army's contractor would complete the initial assessment of the results and any trends. The assessment will examine trends for the location and the surrounding sampling points; the isotopic results to evaluate whether the elevated result is from natural U or DU; activities and weather conditions in the sampled area to see if these may have caused the change; and a projection as to whether the location is likely to exceed the action level at the next sampling time. This report would be submitted to the Army for review by the Army staff. In addition, the results would be provided to the NRC staff for their review and evaluation. Therefore, there are three organizational reviews of these results.

Note: The action levels currently being implemented are the ones documented in the 2000 SOP, not the Draft ERMP (September 2003). When the ERMP is revised after completion of site characterization activities, the action levels will be reassessed to determine if changes are appropriate.

b. Basis. The ERMP also states with respect to the monitoring results for the various environmental media that, if an Action Level is reached and that result is confirmed by additional sampling, specific remedial actions and timetables "may" be defined. *See* ERMP, Table 3-1. But, the whole point of an "Action Level" is to establish a monitoring result at which defined remedial action "shall" occur. Otherwise, the concept becomes meaningless. The ERMP should define and commit to perform remedial actions at specified "action levels."

Response: The action levels and related actions defined in the 2003 Draft ERMP were based on the then current understanding of the fate and transport of DU, the nature and extent of DU contamination, potential adverse health effects, and any media-specific regulatory limits. It is not possible to define a prescriptive process *a priori* to related action levels without specific knowledge of the medium/media impacted, the location(s) where action levels are exceeded, the magnitude of the contamination, and the historic trend. Moreover, a remedial action is not mandated when an action level is reached. Actions that may be taken include notifications, additional sampling, trend assessment, evaluation of possible causes, and determination if a response action is necessary. The Army has elected to retain a flexible process defined to respond specifically to the event that incorporates the key decision-makers, including the NRC, into defining appropriate follow-on actions.

c. Basis. The ERMP incorrectly denies the existence of neighbors who use private wells for drinking water: On-site and off-site human and ecological receptors could be impacted by DU leaching through soil to the underlying aquifer. Contaminated groundwater can enter the human or ecological food chain indirectly (e.g., via livestock drinking water) or directly (e.g., via drinking water supply). Direct exposure of humans to drinking water is unlikely given that the aquifer is not a drinking water source and is of poor quality (Rust 1998). *See* ERMP, at 3–4. However, it has previously been established that two of the original STV affiants who live directly west of JPG get their drinking water from a private well, as do some other nearby residents. The *Training Range Site Characterization and Risk Screening, Regional Range Study, JPG Madison, IN, Final* (CHPPM, August 2003) [hereafter the "Regional Range Study"] also acknowledges that "[t]here are limited numbers of private wells in the area surrounding JPG (Ebasco, 1990)." *See* Regional Range Study, Section 6, at 4. The ERMP should acknowledge and address this fact.

Response: The Draft Final RI (Montgomery Watson, 2002) indicates that the potential for direct exposure of humans to groundwater is unlikely given that there are few wells in the vicinity of JPG that are used for domestic water supplies, and that there was only one well identified within 1 mile down gradient from the area south of the Firing Line at JPG. During the site characterization, the Army will confirm the presence or absence of private wells in the vicinity of JPG. This information will be used to support the revised CSM and related RESRAD modeling in support of the revised DP.

d. Basis. The aquifer underlying the JPG site is not sufficiently characterized to demonstrate its extent and gradient – as the Army itself has previously conceded. *See* Regional Range Study, Section 6.5.2.3.2, Hydrogeology, at 35 ("Monitoring wells near and within the Delta Impact Area south of Big Creek are too widely spaced to construct a meaningful groundwater elevation contour map.") The ERMP should acknowledge and address this critical fact.

Response: The ERMP will be revised after completion of site characterization activities to reflect the then current understanding of the site hydrogeology.

e. Basis. The entire monitoring data history for the JPG site is not used in the ERMP's trend analyses. Most of the trending analyses begin in 1994 or 1996, with some beginning as late as 1998. The absence of discernable trends over the selected time period is then cited as the justification for not performing expanded sampling. *See, e.g.,* ERMP, at 3–6. Examination of the entire data history, i.e., 1984/85 to present, would provide a more complete picture for analysis purposes. Moreover, the ERMP characterizes historic data trends (or the absence thereof) in narrative terms, but the actual data are not included for review and confirmation of the Army's conclusions. The ERMP should acknowledge and address the entire monitoring history of the JPG site.

Response: Historic data trends noted in the ERMP were based on a statistical analysis of available data and may be made available if requested. However, note that related analyses are expected to be revised to reflect all available information on the DU Impact Area, including the results of the planned site characterization program documented in the FSP (SAIC 2005). The latter information will provide more complete and valid data from which to conduct trend analyses and draw conclusions.

f. Basis. The ERM dismisses the need for air monitoring during future prescribed burns. *See* ERMP, at 3–10 to 11. It also denies the need for future biota sampling. *See* ERMP, at 3–12. However, this conclusion is based on insufficient site-specific information and general references to other studies at other sites, which are not representative of JPG. The ERMP should either provide for air monitoring during future prescribed burns or support its absence with site-specific information. The ERMP should also be updated to reference the future biota sampling included in the Army's Field Sampling Plan ("FSP") filed May 25, 2005, as it may be modified in response to NRC Staff comments and/or STV's contentions below regarding the FSP.

Response: Air monitoring was conducted in support of the ERM program in February 1984, April 1985, January 1986, and October 1987, and assessed in U.S. Army 1986 and Abbott 1988. This information was included in the Army's NRC Amendment 1 application (U.S. Army 1986) and Amendment 5 to License SUB-1435 (NRC 1989). Air sampling was completed at locations near the intersection of "C" Road, "D" Road, Wonju Road, and Morgan Road under worst-case conditions (during the dry season and burning events). There was not any detectable uranium in the samples. Both studies concluded that depleted uranium had not impacted this potential pathway to man.

The assessments at JPG, LANL, and APG, among other sites, indicate that risks associated with potential transport of DU in the air from controlled burns are negligible.

These studies provide additional lines of evidence of the potential impacts of DU if airborne under various conditions for the source term, distance to receptors, receptor scenario, exposure parameters, etc.).

The Army is not recommending an air-monitoring program given the low probability of DU release and transport and the negligible effects on receptors.

The Army acknowledges the potential need for possible future biota sampling in the FSP (November 2005). This plan is a tiered, time-phased approach for site characterization to allow decision-making at intermediate milestones regarding the need for collecting additional site data. Refer to Table 4-1 and Section 6.3. Section 6.3 indicates, "*There also is potential for DU uptake by wildlife other than deer. Although most wildlife other than deer would not be consumed by humans, uptake and subsequent movement through the non-deer part of the food web could cause adverse effects in these organisms. As a result, sampling of biota other than deer also may occur. Please note that the level of detail concerning the sampling of other biota is limited in comparison to the deer sampling in this FSP, but will be presented in subsequent addenda if these samples need to be collected.*" The ERMP will be revised as necessary after completion of site characterization activities.

B. FSP Contentions

In its requests for hearings on prior Army POLA requests, STV has repeatedly identified two primary concerns regarding JPG site characterization. First, without adequate site characterization, the Army cannot properly estimate the immediate and long-term risks to public health and safety from radiation resulting from an indefinite delay in decommissioning and decontamination. Second, without expanded and improved ground and surface water monitoring, the Army will not be able to detect the current level of risk and whether that risk is increasing over time as decommissioning and decontamination are delayed.

To construct an adequate exposure scenario for a site, the licensee must utilize accurate and complete information about the site and the surrounding area. Site characterization plays a foundational role in making calculations and determinations about radioactive dose, environmental remediation, and institutional controls at a site. If the site characterization is inaccurate or invalid, the calculations and determinations required to predict future effects on public health and safety will be correspondingly erroneous, and the source term model will be invalid.

As previously noted by both STV and the Staff during the review of prior POLA requests, the JPG Conceptual Site Model (CSM) is generic, flawed, inaccurate, and incomplete. Specifically, the Army has failed to present verifiable data regarding dose modeling or the effects on exposure pathways of meteorological, geological, hydrological, animal, and human features specific to JPG and the surrounding area. This failure results in an inability by the Army to predict with accuracy the effects from radiation on public health and safety of an indefinite delay in decommissioning and decontamination. While it should and could correct this failure, the FSP proposed in conjunction with the current POLA does not do so.

Response: The STV (1) recommends additional site characterization and (2) notes that the CSM is "generic, flawed, and incomplete." A careful reading of the FSP would confirm that the objectives of the JPG site characterization program address both of these concerns via the three-fold objectives:

- Enhance the understanding of the nature and extent of contamination in the DU Impact Area and the fate and transport of DU in the environment.
- Define and verify the CSM.
- Provide the basis for modifying the current monitoring program within the next 2 to 3 years and for completing a revised Decommissioning Plan in 5 years.

Furthermore, the scope of the program addresses all media defined to address the data needs defined in the Army's Response to NRC's RAI (U.S. Army, *Responses to the NRC May 20, 2004, Request for Additional Information Regarding the Environmental Radiation Monitoring Plan*, 2004) and in its letter to NRC in January 2005 regarding data to be collected for off-site modeling (U.S. Army, *Letter from Alan Wilson, Garrison Commander, U.S. Army, to Tom McLaughlin, Materials Decommissioning Branch, NRC*, January 31, 2005). A review of these documents indicates the plans to fill data gaps and define and validate the CSM for the site based on a comprehensive site characterization program. Therefore, these comments are obviated given the Army's acknowledgement of the issues and site characterization plans. The Army considers this STV contention as not being relevant or germane to the Army request for an alternate decommissioning schedule.

Contention B-1: As filed, the FSP is not properly designed to obtain all of the verifiable data required for reliable dose modeling and accurate assessment of the effects on exposure pathways of meteorological, geological, hydrological, animal, and human features specific to the JPG site and its surrounding area.

a. Basis. The EI geophysical study, which will follow the fracture analysis study, as described in Section 6.1 of the FSP, is supposed to find all significant karst features and location of the water table. From these studies, 10 to 20 pairs of monitoring wells are proposed to attempt to tie into "conduits" of groundwater flow. This study may help to site monitoring wells, but stream-gauging studies should be an early and integral part of the search for likely conduits. The stream reaches of strong gain would be a very strong, direct indicator of the discharge points of groundwater "conduits." EI is an indirect technique and can miss conduits or identify features that are not conduits. The FSP alludes to doing stream gauging in its discussion of well location criteria, but the timetable shown indicates stream studies will follow the groundwater studies by a year.

Response: The stream and cave gauging proposed in the FSP will develop an understanding of the hydrologic cycle or water budget at JPG. Specifically, the responses of the water basin to precipitation, i.e., the proportion of precipitation water that runs off on the surface versus infiltrates the ground surface, would be determined. The proposed stage-gauging stations would be operated continuously and data recorded by an electronic data logger connected to a pressure transducer. The stations will be calibrated by gauging stream/cave stream flows and combined with the stage data to develop a flow curve for each station. The continuous recording of stream stages will be completed through low-, mid-, and high-flow periods. This surface water information will be compared to continuous water level recordings in the wells to be installed after the EI Survey. In this manner, responses of the streams, cave streams, and groundwater to precipitation can be observed, and components of the hydrologic budget can be separated and quantified. The Army is planning the installation and monitoring of the stream and cave stream gauging stations for the spring of 2006. Also being planned is the addition of two gauging locations along Big Creek and three gauging locations along Middle Fork Creek. Simultaneous records of precipitation, groundwater levels, and streams will still be required to accomplish the proposed task originally scoped.

The type of stream gauging that the STV recommends was not proposed in the FSP and would require a much different and additional level of effort than what was proposed. This type of gauging does not involve installation of automatic and continuous stage-recording stations, but consists of teams manually collecting flow measurements along the course of the stream and at cave streams and springs using current meters. Information gathered during this type of gauging could be evaluated and possibly assist in the identification or validation of the locations of groundwater discharges to surface water, or losses of surface water to the groundwater, which often occurs at fracture trace intersections. The information gained could be a factor in selecting surface water and sediment sample locations. If the manual stream gauging were to be completed, Fracture Trace Analysis results should be available to better design the manual surface water-gauging task (frequency and locations of gauging stations relative to identified fracture trace intersections with creeks). The Army considers the need for this type and level of effort of stream and cave gauging to be premature and should be further evaluated following the completion of the Fracture Trace Analysis.

b. Basis. The discussion in Section 6.2.1 is disturbing in its failure to set out the chemistry of the monitoring system at this stage and its cavalier dismissal of groundwater as a direct exposure route to humans due to its supposedly "poor quality." The "poor quality" that is being cited is, in part, a function of existing data being sampled from wells that are definitely not in "conduits" that would presumably flush frequently and carry good water. Instead, the "poor quality" data are drawn often from tight, clayey wells and wells that may well have had multiple types of contaminating material falling into them due to poor maintenance.

Response: The Draft Final RI (Montgomery Watson, 2002) provides the details on the basis for the conclusion that the groundwater is of poor quality and low productivity and would be marginal as a potable water source. Furthermore, the potential for direct exposure of humans to groundwater is unlikely, as this report indicates, given that there are few wells in the vicinity of JPG that are used for domestic water supplies and that there was only one well identified within 1 mile down gradient from the area south of the Firing Line at JPG. Therefore, based on available information, these are reasonable statements.

The current FSP defined for groundwater sampling does not currently include analysis of parameters to indicate groundwater quality (e.g., total dissolved solids, sodium, sulfate, iron, etc.); however, the Army will update this plan via an addendum to include these analyses and other cations and anions. More detailed information on groundwater sampling will be contained in FSP addenda.

c. Basis. The wells to be used for staging should not be limited *by assumption* to six wells, as proposed in Section 6.2.2. Six may be enough, but it also may not be. The actual number should be a function of results achieved, not assumptions made. (It is hoped that the last sentence in this section mistakenly left an "s" off the word "well.")

Response: The number of wells at this point in time was estimated to support program planning, schedule, and budgeting and will be revised, as appropriate, when additional information becomes available. Finally, the word "well" in the last sentence of Section 6.2.2 should be revised to "wells."

d. Basis. The FSP specifies in Section 6.2.4 that the "conduit" wells will be paired, but does not describe or explain the reason(s) for the relative positions of the two wells at each well site. Presumably, the objective is to provide a means of measuring vertical gradients at each site, but that is not explained or discussed. Nor is there an indication of whether the "paired" well will be above or below the "conduit" well or whether that relative position would change depending upon unspecified geologic or hydrogeologic conditions.

Response: The assumption is correct that the paired wells will be open to the aquifer at different vertical positions. Conduits may vary significantly from a continuous, vertically connected feature hundreds of feet deep to a very small feature only tens of feet high (or there could be highly transmissive "conduits" separated vertically by less transmissive zones). Based on the electrical image results, the well pair will be designed to sample two depths within the selected location to characterize the conduit. If a deep, continuous zone is indicated by the electrical imaging, the two wells will be distributed vertically to best represent the flow in the entire zone. If separate vertical zones are apparent, the pair will be positioned to monitor each zone. If only one zone is indicated by the electrical imaging, one well will be screened in the permeable zone, while the second well will be screened either above or below the permeable zone, depending on the depth of the overburden and the permeable zone.

The well pair design will be subject to modification based on the drilling results. To the extent that drilling information enhances the understanding of the subsurface and the distribution of permeable zones, well design will be modified to achieve a best representation of the flow characteristics of the aquifer and conduit feature.

e. Basis. The FSP also specifies in Section 6.2.4.3 that a boring that does not produce enough water for a well will be abandoned. If lack of production occurs because the system is "tight" (i.e., impermeable), that makes some sense. However, the nature of karst terrain is such that conduits may not produce water because the flow is highly transient and, unless there is a new flow event at the time of drilling and/or testing, a well may be dry even though it has been placed in an appropriate and important location. To ensure the problem is a temporary lack of water, rather than a permanent lack of permeability, it is necessary to monitor the boring for enough time to be sure it never produces before abandoning it.

Response: The intent is to install wells below the water table and not to build dry wells inside caves that occasionally flood. The portion of groundwater run-off that discharges through caves that occur above the water table will be assessed by monitoring and sampling stream and cave stream flows.

f. Basis. The FSP states in Section 6.2 that all new wells to be completed will be in "conduit" settings in bedrock. This placement is too limited. Certainly, most off-site transport is likely to occur through bedrock karst features. But, the projectiles and the DU reside in the till and/or the weathered bedrock/colluvium. Simply because good, shallow wells were not completed in the original set of JPG wells does not mean that properly located and completed shallow wells are not necessary to characterize properly the hydrogeology of the site.

Response: The FSP will be modified (via addenda) indicating that if significant water-bearing materials are present above the bedrock, then wells may be constructed with screened intervals above the bedrock. Note that the majority of groundwater flow and the potential for migration of DU to receptors are anticipated to be the greatest within the bedrock conduits.

g. Basis The FSP states in Section 6.2.4.4 that the new wells will not be tested for permeability. Granted, if a particular well is sunk into a well-developed conduit, it will not be feasible to measure permeability. But, the nature of karst features is to be hard to locate precisely, so it is likely that at least some of the wells will simply be in bedrock with some enhanced permeability, which should be measured if it can be. Moreover, the conductivity of the rock adjacent to and feeding the conduit is a major determinant of flow through the system. The same holds true for aquifer testing. If pumping the aquifer shows interconnection among two or more of these conduit pairs, that result will provide very valuable information about the system transporting DU from the site.

Response: Slug testing of wells is generally not useful in this hydrogeologic environment. Connectivity of the aquifer is important, and this information is obtained from drilling information and water level monitoring. Aquifer testing, in the form of a long-term (multi-day) pumping test on one or more specially constructed wells may be useful, and will be planned in the future, as the site conceptual model is developed. T

h. Basis. Contrary to Section 6.2.4.3, geophysical testing and videotaping of all of the well drilling should be required in intervals where it is physically possible. The understanding obtained from cuttings (particularly air-drilled cuttings), what material has been drilled through, and in which a well is being completed is extremely limited. Logging and videoing the borings as they are being drilled actually records what the boring encountered and provides much valuable information for reasonably interpreting the water data that are later collected over time. If turbidity precludes videotaping of a boring, teleview logging is a valuable alternative. Where boring logs cannot safely be run, logging through the casing can be done.

Response: The Army does not recommend geophysical borehole logging and/or borehole video at this time. Geophysical and video logging can be useful tools, but with the conditions expected at JPG during placement of the conduit wells, it is not practical.

The Army's contractor has used the proposed method of fracture trace analysis, electrical imaging (EI) survey, and the proposed drilling method of continuous casing advancement at numerous sites in karst aquifers to find groundwater flow conduits. In tight bedrock with secondary porosity (i.e., fractures, karst conduits), it is critical to identify the areas of increased permeability for characterization of groundwater flow and contaminant transport. The Army's contractor has demonstrated numerous times at several karst aquifer sites that this method, when properly executed, results in the successful characterization of a site such as at JPG. The Fracture Trace Analysis and EI survey are used to locate these areas of probable secondary porosity (conduits) and identify drilling locations for wells to be constructed within the conduits. An experienced rig geologist is able to accurately log, characterize the drill cuttings, and use drill penetration rates to (1) support interpretation of subsurface conditions and (2) properly direct the construction and design of the wells such that the most connected sections of the well to the aquifer are monitored. In addition, the Army has requested the presence of a NRC staff geologist/hydrologist at JPG during well drilling operations in case changes to specific operations need to be implemented based on site specific circumstances observed during drilling.

These conduit features, which present very difficult drilling conditions (weathered and fractured rock), often result in unstable subsurface conditions. These conduit features present the most probable locations and pathways for significant and often high-volume and velocity groundwater flow; therefore, it is critical that monitoring wells are installed within these features so that they can be monitored and characterized. Because of the difficult drilling conditions, non-typical drilling methods consisting of continuous casing advancement systems (i.e., Odex®, Stadex®, etc.) have been found to be most successful at overcoming and mitigating the unique and highly variable drilling conditions.

Geophysical and video logging of the wells cannot be conducted using these drilling techniques because logging requires an open borehole. The drilling method proposed in the FSP will have a steel casing advanced in the borehole simultaneously while drilling. To complete the recommended logging method, alternate drilling methods would have to be applied. Previous attempts at advancing boreholes into the identified features using methods other than continuous casing advancement have resulted in lost or broken tooling, unstable boreholes, and borehole collapse/loss. If an alternate method were proposed, borehole collapse and muddy conditions would result in incomplete geophysical/video data. Down hole video and geophysical tooling are very expensive (from $1000s to tens of $1000s), and most operators would not be willing to risk their equipment in known unstable boreholes. If drilling conditions are found to be more stable, future drilling programs may use a different method, at which time logging of the open hole would be evaluated.

i. Basis. Specifying the exact number and precise locations of the surface water sampling and gauging points at the outset of FSP implementation, as proposed in Section 6.4.1, is not a good idea. Until the groundwater data show where to look for discharges, such points cannot be reasonably selected. There is no scientific reason why the surface water sampling locations and the sediment samples need be in the same location(s). Each medium should be sampled at locations that are appropriate for that medium. Sediment buildup has nothing to do with the location of base flow connections between ground and surface water. Similarly, the FSP concept in Section 6.4.2 of putting in only five gauging stations, which are sited before the groundwater system is better understood, is both too limited in number and may well be counter productive in location.

Response: The proposed number and location of surface water and sediment sampling points were used to support program planning, scheduling, and budgeting. The precise sampling locations have not been finalized; the locations listed in the FSP are general locations based on the flow into, through, and out of the area of investigation. As stated in Sections 6.4.1 and 6.6.1.1 of the FSP, the sample locations will be revised based on ongoing investigation activities, such as soil verification, surface soils characterization, locations of physical features (e.g., caves, fracture traces, etc.), and results of hydrogeologic investigations. Through the course of surface sampling and gamma walkover surveys, additional surface water drainage ways and areas of erosion (sediment transport) may be identified and proposed for additional sediment and surface water sampling locations.

The stream and cave gauging proposed in the FSP will develop an understanding of the hydrologic cycle or water budget at JPG. Specifically, the responses of the water basin to precipitation, i.e., the proportion of precipitation water that runs off on the surface versus infiltrates the ground surface, would be determined. The proposed stage-gauging stations would be operated continuously and data recorded by an electronic data logger connected to a pressure transducer. The stations will be calibrated by gauging stream/cave stream flows and combining with the stage data to develop a flow curve for each station. The continuous recording of stream stages will be completed through low-, mid-, and high-flow periods over an extended time span to account for potential seasonal variations. This surface water information will be compared to continuous water level recordings in the wells to be installed after the EI Survey. In this manner, responses of the streams, cave streams, and groundwater to precipitation can be observed, and components of the hydrologic budget can be separated and quantified. The Army is currently planning on the installation and monitoring of the stream and cave stream gauging stations in the spring of 2006. Also being planned is the addition of two gauging locations along Big Creek and three gauging locations along Middle Fork Creek. Simultaneous records of precipitation, groundwater levels, and streams will still be required to accomplish the proposed task originally scoped.

The majority of the proposed stream-gauging stations will be located at existing bridges or culverts on the streams in close proximity to the DU Impact Area, and at known cave streams within the area of study. One proposed gauging station location on Big Creek is located immediately upstream of the DU Impact Area boundary. These are locations where the gauging stations could be established cost-effectively. These gauging stations should provide the data to fulfill that purpose, but the acquired data will be evaluated to determine if additional gauging may be necessary.

j. Basis. The entire K_d exercise described in Section 2.3.4.3 is inaccurate, unreliable, and, particularly when it forms such a key element of the modeling, rife with opportunities for abuse. It is described in the FSP text as "an important input parameter" for the results of exposure calculations. But, the exercise does not yield a real number and its functionality is based upon assumptions that are known to be invalid. The biggest erroneous assumption is the one spelled out in the text: "the underlying assumption is that rapid equilibrium is reached between the dissolved and sorbed concentrations of a chemical species, and that these two concentrations are linearly related through the K_d factor." At best, there are an infinite number of K_d values based upon the infinite number of combinations of soil types, sorbent contents, groundwater compositions, and oxidation states that may exist along the flow path from any individual DU projectile. USEPA tried to use the K_d approach in its modeling for solid wastes, and only recently completed spending almost five years to find an alternative way because K_ds just do not work. They don't even work for such simple, monovalent contaminants as lead or cadmium; it is preposterous to rely on the K_d approach for something that is so pH-Eh dependent as the uranium system. Field observations should be used to calibrate geochemical modeling with a program on a par with Geochemist's Workbench, with a lot of soil analyses to identify the abundances of sorbents in the soil that will control the mobility of the uranium. And, if the exposure program that SAIC is using requires the K_d approach, it should also be replaced with one that has more sophistication.

Response: The K_d approach for determination of radionuclide distribution coefficients specific to site conditions is supported and recommended by the NRC. Should the NRC propose an alternate method, the Army will address this alternative, as well as an evaluation of cost and schedule impacts. RESRAD is not dependent on the K_d method. However, the distribution coefficient can be a critical parameter in assessing the impact from radioactive contamination in soil. Unless the NRC proposes an alternate method, this contention is not relevant or germane to the Army's request for an alternate decommissioning schedule.

k. Basis. The FSP lacks any plan for analysis of penetrators for transuranics such as plutonium, americium, technetium, and neptunium or other impurities such as uranium-236. Table 4-1, p. 4-3 of the FSP indicates that 24 penetrators will be collected to establish a "corrosion/dissolution rate." However, there is no mention in the plan to assay the rounds for these other elements. This failure was challenged in previous Army plans by the NRC Staff (Sept. 27, 2001) and ATSDR (Oct. 30, 2002), but has not been corrected in the FSP.

Response: The Army does not plan to analyze penetrators for transuranics based on the low activity level in penetrators, slow degradation rates, and potentially low contribution of TRUs to the total annual exposure.

The Army validated its conclusions through a top-level analysis of the potential exposure of a human receptor to one transuranic, plutonium, from a DU penetrator. From this very brief evaluation, the plutonium activity present in a DU penetrator is estimated to have a negligible impact on the annual exposure (see **Attachment 1**).

The U.S. DoD, U.S. DOE, World Health Organization (WHO), United Nations Environment Programme (UNEP), etc., all indicate that, if present in a DU penetrator, the contribution of TRU in DU contamination to exposure is approximately 0.8% of the total exposure. In a February 2001 press release, UNEP states that the content of TRU found in contamination associated with DU penetrators is "very low and does not have any significant impact on overall radioactivity." An earlier report (January 2001) also states the "content of U236 in depleted uranium is so small that the radio-toxicity is not changed compared to DU without U236." This contention is not relevant or germane to the Army's request for an alternate decommissioning schedule.

These reports also provide degradation rates for uranium metal in the environment – with a lifetime for a 1-kg piece of U metal ground into 1 gram pieces of 400 years in a humid environment – a solid DU penetrator with a mass of 1.3 kg has a lifetime of 2,100 years – and a 300 g penetrator has a lifetime of 500 years. The WHO report on penetrators found in Kosovo states "the rate of corrosion of uranium metal in the environment is slow...Consequently, it is regarded as unlikely that the penetrators will degrade quickly once in the environment and hence will only contribute a very slow leaching of uranium into the environment."

I. Basis. The background levels being proposed in Sections 6.2.3, 6.3.1, and 6.6.1.4 of the FSP are inappropriate. There is an assumption that natural uranium could exist in the rock and geological formations of JPG. This could be true. However, given the nature and chronology of DU use at JPG, standard fate and transport theory would say that DU on-site but away from the DU area and even off-site would have increased since DU was first used at JPG. Conditions such as the air and water dispersal of aerosolized or particulate DU that occurs when the DU projectiles land on hard objects (rocks, other DU and UXO projectiles, etc.), and the physical movement of DU fragments due to flooding that occurs especially in the spring would all contribute to this increase.

Risk Assessment Guidance for Superfund (RAGS) and eco-risk texts (e.g., Suter, G. W. II, et al.) say that a monitoring site is inappropriate for background if it is potentially contaminated by the contaminant of concern. Therefore, two alternatives could be used for the "background" readings that are required for accurate assessments and reliable models:

1) Data obtained from USGS cores, or any other soil, water and air data obtained prior to the start of DU testing (i.e., 1983 or earlier) is preferred.

2) For fill-in data, potential "background" samples (air, water, and soil) that clearly do not have the DU isotope ratio signature could be used. However, it is better to be conservative in what is considered to be a background isotope ratio.

Response: The FSP does not propose background levels. The FSP does identify the need and method for determining background concentrations for the radionuclides of concern at JPG in the media of interest, i.e., soil and water. The FSP requires background determination in areas that have not been impacted by DU activities at JPG – this may be on site or off site.

Activity ratios for natural and depleted uranium are widely published and routinely referenced. These values will be used to validate the presence of uranium isotopes and verify the origin as natural or depleted uranium. Background sample results that do not fall within the range of expected values for activity ratio for natural uranium, if any, will not be included in the background data set.

Historical data will be used, if available, and of sufficient quality to support FSP objectives.

Note that the MARSSIM, endorsed by NRC, DOE, and EPA, is the appropriate guidance the Army will follow for this program, not RAGS. MARSSIM provides guidance on collection of background samples, if necessary. This contention is not relevant or germane to the Army's request for an alternate decommissioning schedule.

m. Basis. Air remains a potential exposure pathway as evidenced by the air sampling requirements to be implemented for the field workers (Health and Safety Plan, Section 4.2.2.1). If short-term air exposure is a concern for the workers, long-term air exposure is a concern for residents in surrounding communities, as well as for the animals living in the JPG ecosystem. Thus, the FSP is deficient for purposes of adequate site characterization in providing for no air sampling whatsoever.

Response: This correlation has no foundation. The HASP gives the Radiation Protection Manager (RPM) the discretion to require air sampling as conditions warrant. For the activities proposed in the FSP, air sampling for determining occupational exposure may be conducted for the sampling activity with the greatest potential for generating airborne radioactivity, i.e., preparation of penetrator samples for dissolution analysis and physical examination. In this instance, airborne radioactivity will be controlled through appropriate work practices. However, air sampling may be conducted to establish airborne concentrations the sampler may be exposed to, if any, for determination of "dose" or validating "no dose." This is a standard and accepted industry practice and has nothing to do with long-term exposures of receptors or potential receptors at or close to the site boundary from airborne radioactivity. This contention is not relevant or germane to the Army's request for an alternate decommissioning schedule.

n. Basis. In order to really do a site-specific environmental and human health risk assessment, understanding the fate and transport (F&T) of DU within the JPG ecosystem is critical. In order to develop such a model, standard eco-risk-associated field sampling practices specify samples from different parts of the ecosystem within the same approximate period of time and definitely within the same field season in order to identify the distribution of the contaminant (DU) at that time. Further it is best to take multiple samples from these different locations over time. Thus, to truly model F&T within the JPG ecosystem (which is NOT the Yuma or Aberdeen Proving Ground ecosystem), a particular sample taken at a particular time should include all media and relevant biota and each of these media and biota should be sampled on multiple occasions. Ideally, samples should also be taken under different types of field conditions, as appropriate for the changes that occur at the site of concern. For example, at a site that floods, as JPG does, samples should be taken from all media and biota at high flow (flood season) and low flow. Similarly, in a seasonal environment like JPG, samples should be taken from all media and biota in different seasons. When reproduction is seasonal for the biota of potential concern, seasonal sampling is of special concern. Thus, the much more limited sampling described in Section 6.3 of the FSP is deficient for purposes of adequate site characterization.

Response: This site characterization program is in support of the NRC's D&D process. The RI/FS paradigm implemented under CERCLA does not apply. Furthermore, an ecological risk assessment is neither planned for nor required. The Environmental Report prepared by NRC will address ecological and human health risks from the perspective of

National Environmental Policy Act (NEPA). This contention is not relevant or germane to the Army's request for an alternate decommissioning schedule.

The proposed biota sampling program was designed to respond to requests from the NRC as well as align with the Army's programmatic constraints. As a result, deer are proposed for sampling first (see also the response to FSP Comment "o" below). Based on the deer sampling results, additional deer sampling may be warranted as well as other biota sampling. All samples will be collected during the same season of the year. At most, two seasons of deer and other biota sampling are proposed. The Army believes that these data, in conjunction with various abiotic data (e.g., surface soil and surface water) are sufficient to determine if DU is migrating at JPG.

o. Basis. Although deer are not the most representative biota to sample, they are the only biota proposed for sampling by Section 6.3 of the FSP. Nonetheless, when data from samples early and late in DU testing are not combined, it is evident that DU levels in even the deer are increasing. This result in deer clearly mandates sampling other, more representative biota as well. Based on what little data is available, the bioaccumulation factors (BAFs) for vegetation and the aquatic filter feeders such as crayfish (both of which are eaten by higher animals and humans) are relatively high, on the order of 10^2 to 10^3 times as high as the BAFs for persistent, bioaccumulative, and toxic chemicals (PBTs) listed as being of concern by the U.S. EPA and the Persistent Organic Pollutants (POPs) Treaty. Clearly, vegetation and aquatic filter feeders are better indicators of DU migration into the eco-food chain than are deer and they should be sampled.

Response: The FSP does not state that deer are the most representative biota to sample. Rather, deer are being collected in direct response to the NRC's request. The Army does not agree that the historical data support the contention that DU levels in deer are increasing. However, the collection of deer is proposed to occur before any other biota are considered for sampling because of the hunting that occurs in and near JPG. In addition, STV has raised concerns about deer ingestion in the past.

The Army agrees that other biota might be beneficial indicators of DU uptake and has proposed collection of other biota (plants, earthworms, fish, small birds, and small mammals) **if** the deer data, in conjunction with the abiotic data (e.g., surface soil, surface water), suggest that migration and subsequent uptake could be occurring.

p. Basis. Several non-standard data gathering and modeling tools are not being employed in the FSP, but should be. These would help the future risk modeling. For example, GIS modeling of individual data points (all samples) will help identify migration and will better pinpoint movements of DU into and through JPG and its surrounding ecosystem. Identification of individual vegetation samples will also help identify whether there is preferential uptake of DU into specific types of plants – a potentially significant phenomenon which can be detected by the relatively new phyto-remediation technologies being developed at Purdue with EPA funding.

Response: Although tools were not identified specifically in the FSP, the Army intends to use cost-effective tools, such as GIS, where appropriate to support the DU Impact Area license termination process.

The Army's contractor is vigilant in keeping pace with and applying current and innovative technologies to enhance understanding of challenging issues and streamline program planning and execution. This added value service will be applied to this project for the Army.

q. Basis. DU dissolution rates should be calculated for different soils and under different site-specific wetness and temperature regimes in order to measure accurately DU dissolution at JPG. However, Table 4-1 and related text of the FSP do not specify such multiple measurements.

Response: The FSP addresses evaluation of DU corrosion for the two soil types present at JPG. The leachability test, using the testing regime in ANS/ANSI-16.1, will provide an estimate of the "theoretical" corrosion/dissolution rate. Further testing of DU penetrators in a controlled environmental chamber will provide data to evaluate and validate the "theoretical" corrosion/dissolution rate.

r. Basis. The Independent Technical Review Team Leader for the HSP and FSP is the same person as the Project Manager (Corinne Shia, SAIC). *See* FSP, Certification 4 - Contractor Certification of Independent Technical Review, and HSP, Certification 4 - Contractor Certification of Independent Technical Review. To assure "independent" technical review, these roles should be performed by different individuals.

Response: Independent reviews are completed by individual (s) who are not the primary authors on the document and who have educational and/or work experience in the area being reviewed. It is appropriate, and at times preferred, to have the same independent reviewer complete reviews of documents that are interdependent, such as multiple volumes or a series of separate documents related to a program purpose (e.g., site characterization plans). This review permits identification of consistencies in technical and programmatic aspects of the documents.

This reviewer was not the primary author on these documents and has the requisite education, experience, and skills to complete independent reviews of both documents. Ms. Shia is a senior program manager and mechanical engineer with over 30 years of experience on environmental programs similar to the one proposed. This contention is not relevant or germane to the Army's request for an alternate decommissioning schedule.

C. HASP Contentions

1. Contention C-1: The HASP is very generic and not site-specific in nature, without identification of the particular UXO hazards to be addressed or the specific locations in which they are found.

General Response: The HASP is intended to address health and safety aspects of the JPG site characterization program comprehensively. Addenda are planned to address specific field elements of the program and are anticipated to include activity-specific hazard analyses and associated detailed health and safety procedures beyond the protocol specified in the HASP. This strategy is noted repeatedly in the HASP (e.g., Sections 1 and 4).

The HASP procedures for UXO are specified in Section 8.13; the basic strategy to be employed is to use UXO surveys and to operate only in cleared areas, i.e., where UXO has been determined not to be present based on visual and magnetometer surveys.

Note that the Army contractor's corporate health and safety program includes specific procedures (as cited in the HASP) and detailed reviews and oversight prior to and during field operations. The health and safety of all field personnel is of the highest priority and will not be compromised. Future addenda will expand upon the principles and protocol cited in the HASP as appropriate. An example is the HASP Addendum recently completed for the deer sampling event. This addendum specifies, in detail, specific UXO requirements and procedures to be implemented during this field activity (SAIC, *Final HASP Addendum, Depleted Uranium Impact Area, Site Characterization: Deer Sampling (WBS 2.1.1), JPG, Madison, Indiana*, November 2005).

a. Basis. Table 2-1, "DU Impact Area Site Characterization Project On-site Tasks" (page 2-2), lists "Installation of 10 multi-well clusters ...", "Collect 24 samples (penetrators) from the DU Impact Area", and an optional task to sample "other biota (plants, earthworms, birds, mammals, and fish)" as project tasks that will be accomplished. It is possible that UXO may be encountered while performing these operations, but there is very little specific information on the UXO safety precautions required to be followed during these activities. For example, common industry practice is to have a UXO specialist locate a clear entry and exit pathway for the drill rig and then ensure that no subsurface metal objects are located at the well location. Then, the UXO specialist usually performs downhole geophysical avoidance surveys during the well drilling operation (this is usually done by hand boring the cleared area as far as possible and then removing the drill from the well at 2-ft. increments to check that no metal objects are in the path of the drill until a specified depth is reached).

Response: The HASP procedures for UXO are specified in Section 8.13; the basic strategy to be employed is to use UXO surveys and to operate only in cleared areas, i.e., where UXO has been determined not to be present based on visual and magnetometer surveys. Bullets 3 and 4 in Section 8.13.2 states that area's for intrusive work will be cleared before work begins and also states that the work areas will be cleared and marked before work begins. This practice also will be applied to all field activities, including well drilling operations as specified in the comment.

Note that the Army contractor's corporate health and safety program includes specific procedures (as cited in the HASP) and detailed reviews and oversight prior to and during field operations. The health and safety of all field personnel is of the highest priority and will not be compromised. Future addenda will expand upon the principles and protocol cited in the HASP as appropriate. An example is the HASP Addendum recently completed for the deer sampling event. This addendum specifies, in detail, specific UXO requirements and procedures to be implemented during this field activity (SAIC, *Final HASP Addendum, Depleted Uranium Impact Area, Site Characterization: Deer Sampling (WBS 2.1.1), JPG, Madison, Indiana*, November 2005).

b. Basis. In Section 8.12, "Drill Rig Operations," there are also no specific precautions described for UXO. The text in this section appears to be standard drill rig precautions and should be modified to emphasize the potential UXO hazards that may be encountered during this intrusive operation and what specific UXO avoidance measures will be used to ensure the safety of the drillers.

Response: Section 8.12 of the HASP specifies the standard drill rig operations while Section 8.13 of the HASP specifies UXO safety precautions. Future addenda (supplemented by daily H&S briefings on-site) will integrate the two protocols to ensure that field personnel will implement procedures correctly. An example of an addendum that has further defined UXO protocol is the HASP Addendum recently completed for the deer sampling event. This addendum specifies, in detail, specific UXO requirements and procedures to be implemented during this field activity (SAIC, *Final HASP Addendum, Depleted Uranium Impact Area, Site Characterization: Deer Sampling (WBS 2.1.1), JPG, Madison, Indiana*, November 2005).

c. Basis. Section 8.13 on "Unexploded Ordnance" is more general boilerplate. There is no site-specific information presented. This is highly unusual for field operations on a known UXO contaminated site. In what specific locations are the samples going to be collected? What is the type and density of UXO that is expected to be encountered in these locations? How deep are these UXO expected to penetrate (important information for the drillers)?

Response: The safety precautions listed in this section are basically identical to those cited in USACE, EP 385-1-95a. The type and density of the UXO in the DU Impact Area is unknown. Basically, the UXO could be any type that was tested at JPG during operations. One of the largest ordnance item tested was the 155mm, which penetrates to a depth of approximately 3 feet. The Senior UXO Supervisor on-site should be able to clear the drill rig to that depth.

Note that the Army contractor's corporate health and safety program includes specific procedures (as cited in the HASP) and detailed reviews and oversight prior to and during field operations. The health and safety of all field personnel is of the highest priority and will not be compromised. Future addenda will expand upon the UXO principles and protocol cited in the HASP as appropriate. An example is the HASP Addendum recently completed for the deer sampling event. This addendum specifies, in detail, specific UXO requirements and procedures to be implemented during this field activity (SAIC, *Final HASP Addendum, Depleted Uranium Impact Area, Site Characterization: Deer Sampling (WBS 2.1.1), JPG, Madison, Indiana*, November 2005).

d. Basis. Appendix B is an "Example Activity Hazard Analysis." However, since this HASP is intended to be a site-specific health and safety plan, it would be most appropriate to include the completed activity hazard analyses instead of just an example. Since this HASP does not contain the site-specific activity hazard analyses, when will they be completed and how will they be presented to the site personnel? This question was addressed to Army and SAIC personnel during a conference call on September 8, 2005. The only response was that that the HASP would be subsequently supplemented with the necessary site-specific hazard analyses. To date, no such supplementary analyses have been supplied.

Response: The HASP is intended to address H&S aspects of the JPG site characterization program comprehensively. Addenda are planned to address specific field elements of the program and are anticipated to include activity specific hazard analyses and associated detailed H&S procedures beyond the protocol specified in the HASP. This strategy is noted repeatedly in the HASP (e.g., Sections 1 and 4).

A site-specific hazard analysis will be completed for each field event and coupled with appropriate controls. This information will be documented and presented in HASP addenda. An example is the HASP Addendum recently completed for the deer sampling event. This addendum includes an activity hazard analysis in Appendix B for the specific activities planned for this event.

2. Contention C-2: The HASP is not effectively integrated with the FSP.

a. Basis. The person identified in Table 3-1 to serve as Field Manager for the FSP (Seth Stephenson) possesses the training and experience required to serve as the UXO expert on the project. However, he is the only UXO support person listed for the project. One UXO specialist is only able to monitor one field operation at a time, such as one sampling team or one drill rig. It is not likely that he will be able to perform any additional duties associated with being the Field Manager when sampling operations are being conducted because his presence will be required at the sampling site as the UXO expert. It is likely to be much more efficient to have the project Field Manager and UXO support specialist(s) be different people.

Response: The field program is being planned to support key field events that will be performed sequentially. Based on initial analyses, the Field Manager will be able to perform UXO activities while serving his lead site role.

The Army's contractor will evaluate workloads prior to commencing activities and obtain additional EOD support if the Field Manager is unable to perform both roles simultaneously.

b. Basis. The last bullet in Section 4.0 notes that UXO is present at the site and also states that, "Site investigation plans will be adjusted, as appropriate and necessary, to ensure that the H&S of all field personnel are always protected." This type of statement shows an almost complete lack of knowledge and concern for UXO on the project. Accepted safety procedures on UXO sites require plans to be developed to safely perform sampling operations before beginning work, thereby minimizing the need to adjust the plans to maintain safety once sampling has begun. There is virtually no planning for UXO safety incorporated into the sampling procedures included in the FSP.

Response: The HASP procedures for UXO are specified in Section 8.13; the basic strategy to be employed is to use UXO surveys and to operate only in cleared areas, i.e., where UXO has been determined not to be present based on visual and magnetometer surveys. Bullets 3 and 4 in Section 8.13.2 states that area's for intrusive work will be cleared before work begins and also states that the work areas will be cleared and marked before work begins. This practice also will be applied to all field activities.

Note that the Army contractor's corporate H&S program includes specific procedures (as cited in the HASP) and detailed reviews and oversight prior to and during field operations. The H&S of all field personnel is of the highest priority and will not be compromised.

Future addenda will expand upon the principles and protocol cited in the HASP as appropriate. An example is the HASP Addendum recently completed for the deer sampling event. This addendum specifies, in detail, specific UXO requirements and procedures to be implemented during this field activity (SAIC, *Final HASP Addendum, Depleted Uranium Impact Area, Site Characterization: Deer Sampling (WBS 2.1.1), JPG, Madison, Indiana*, November 2005).

c. Basis. Section 4.2 on "Applicable Regulations/Standards" does not mention any of the guidance documents covering UXO avoidance and safety procedures for environmental sampling projects. These documents are available on the website of the U.S. Army Corps of Engineers Engineering and Support Center, Huntsville, Alabama.

Response: Future addenda for both the FSP and HASP will expand the list of applicable documents cited in Section 13 of the HASP for UXO safety. Note that the Army contractor's corporate H&S program (as cited in the HASP) includes procedure EC&HS 120 "UXO/OE/CWM Safety." This procedure references dozens of applicable regulations/ standards used in the development of the procedure such as:

- U.S. Department of Defense Contractors' Safety Manual for Ammunition and Explosives, DOD 4145.26-M, Under Secretary of Defense Acquisition and Technology, 1997.
- *U.S. Department of Defense Standard 6055.9-STD, DoD Ammunition And Explosives Safety Standards*. Under Secretary of Defense for Acquisition, Technology and Logistics, Revision 1 - 27 August 2002.
- *U.S. Army Explosives Safety Program, Army Regulation (AR) 385–64*. Headquarters Department of the Army, Washington, D.C. 28 November 1997.
- U.S. Ammunition and Explosives Safety Standards, Department of Army Pamphlet (PAM) 385-64. Headquarters Department of the Army, Washington, D.C. 15 December 1999.
- U.S. Army Corps of Engineers Engineer Pamphlet (EP) 75-1-2, Unexploded Ordnance (UXO) Support During Hazardous, Toxic, And Radioactive Waste (HTRW) and Construction Activities. 20 November 2000

The HASP Addendum recently completed for the deer sampling event cites applicable UXO references (SAIC, *Final HASP Addendum, Depleted Uranium Impact Area, Site Characterization: Deer Sampling (WBS 2.1.1), JPG, Madison, Indiana*, November 2005) in Sections 1 and 5 and Appendix D.

d. Basis. Section 6.1 describes the field procedures that will be accomplished during "Geophysics (Electrical Imaging)." This process involves driving electrodes into the ground and transmitting electrical current between the electrodes. This involves UXO hazards caused by driving the electrodes into the ground and also by emitting electromagnetic radiation, which may be a potential initiation source for electrically initiated ordnance. UXO safety procedures must be specified to support this sampling procedure and the issues involved with electromagnetic radiation must be incorporated in the plan.

Response: Section 6.1 of the FSP specifies the protocol for the EI survey while Section 8.13 of the HASP specified UXO safety precautions. Future addenda (supplemented by daily health and safety briefings on-site) will integrate the two protocols to ensure that field personnel will implement procedures safely and correctly.

EI will not be used in UXO areas as a means of locating subterranean voids and conduits for groundwater migration unless it can be demonstrated unequivocally beforehand to be non-hazardous based upon the types of munitions used at JPG. The National Defense Center for Environmental Excellence (NDCEE) is conducting a study using fuses that are potentially susceptible to electrical charges such as those that would be induced during the EI investigation, if this type of instrument were to be used. In addition, safety personnel at the U.S. Army Corps of Engineers – Huntsville Center are determining whether or not these potentially susceptible fuses were used at JPG. If there is any doubt about the possibility of the induced electrical current triggering an explosion, then types of geophysical locating are available and have been addressed in the FSP.

e. **Basis.** Section 6.2 on sampling "Groundwater" contains no information on UXO avoidance or safety even though this section describes drilling wells. For example, Figure 6-1, the "Drill Rig Operational Checklist," lists numerous safety requirements including fire extinguishers, grounding the drill rig, watching for electrical lines, etc. However, there is *nothing* on the safety requirements for drilling in an area contaminated with UXO. Also, page 6-14 references setting three or four steel well guards in concrete 2 feet into the ground around each well. But, again, there is no mention of having UXO safety support for this intrusive operation.

Response: Section 6.2 of the FSP specifies the protocol for the groundwater data collection while Section 8.13 of the HASP specifies UXO safety precautions. Future addenda (supplemented by daily health and safety briefings on-site) will integrate the two protocols to ensure that field personnel will implement procedures correctly. Refer to the HASP and FSP Addenda recently completed for the deer sampling event integrates deer sampling and UXO protocol (SAIC, *Final FSP Addendum, Depleted Uranium Impact Area, Site Characterization: Deer Sampling (WBS 2.1.1), JPG, Madison, Indiana*, November 2005 and SAIC, *Final HASP Addendum, Depleted Uranium Impact Area, Site Characterization: Deer Sampling (WBS 2.1.1), JPG, Madison, Indiana*, November 2005).

f. Basis. Sections 6.5 and 6.6 relate, respectively, to "Soil Sampling" and "Sediment Sampling." These sections contain no information on or references to specific UXO safety procedures for performing these two operations, both of which are intrusive and would be expected to encounter UXO.

Response: The safety precautions for UXO avoidance is listed in Section 8.13 of the HASP. Future addenda will expand upon the principles and protocol cited in the HASP as appropriate. Both the FSP and HASP Addenda recently completed for the deer sampling event are examples of where this detail was provided. These addenda specify UXO requirements and procedures to be implemented during this field activity (SAIC, *Final FSP Addendum, Depleted Uranium Impact Area, Site Characterization: Deer Sampling (WBS 2.1.1), JPG, Madison, Indiana*, November 2005 and SAIC, *Final HASP Addendum, Depleted Uranium Impact Area, Site Characterization: Deer Sampling (WBS 2.1.1), JPG, Madison, Indiana*, November 2005).

II.
Specific Responses To The Contentions Relating That Various Documents And Financial Assurances Are Required To Support An Application For Alternate Scheduling As Set Forth In The Petition To Intervene

3. Contention D-1. The alternate schedule being proposed fails to meet the requirements of 10 C.F.R. § 40.42 of a *definite* schedule for *timely* decommissioning of the JPG site.

a. Basis. A major STV concern with the Army's 2003 POLA request was that the indefinite postponement of decommissioning and decontamination at JPG would be inimical rather than essential to the conduct of effective decommissioning operations. The whole purpose of 10 C.F.R. § 40.42 is timely decommissioning and decontamination.

. . .

Here, the alternate schedule being proposed fails to "place a limit on the time permitted to decontaminate and decommission" the site, as required by the Timely Decommissioning Rule. The Army's May 25, 2005 letter does not state when decommissioning will start nor when it will end. Instead, it simply requests approval to extend the time for submission of a DP by five years following approval of the current

POLA request. In effect, the current five-year POLA request, as filed, represents no more than the first installment of the indefinite POLA with five year renewals previously proposed and supposedly withdrawn by the Army.

Response. Since the initiation of decommissioning efforts at JPG, it has been generally recognized by the Army and the NRC Staff that JPG is one of several license sites that could not meet the criteria for unrestricted release in their current status but possibly could in the future. Generally, these involved sites that had isotopes that could be addressed by "decay in place" or other options for meeting the release criteria. In addition, the site characterization and monitoring studies needed for a restricted release of the JPG site were not clearly delineated. Substantial dialogue with the NRC Staff, together with some changes in regulation, has now brought the Army to a point were it believes that a consensus can be reached with the NRC as to the preliminary studies necessary for restricted release of the JPG site.

Although STV attempts to broaden the factors that the NRC must consider in approving an alternative schedule, 10 C.F.R. § 40.42 (g) (2) is clear that the determination is to be made based on three factors: 1) the alternative schedule is necessary to the effective conduct of decommissioning operations; 2) presents no undue risk from radiation to the public health and safety; and 3) is otherwise in the public interest. The Army's application for an alternate decommissioning schedule is predicated on the presentation to the NRC of an appropriate decommissioning plan once the proposed tests and studies have been completed. The plan itself is not now before the Commission and STV's objections thereto are irrelevant. Subsection (f) (iv) of 10 C.F.R.

§2.309 requires the contention of the intervener must be "material to the findings the NRC must make to support the action that is involved in the proceeding." The contention raised by STV here is not material to the three factors for re-scheduling set forth in § 40.42 (g) (2).

As to those factors, all of the parties here recognize that some additional studies and monitoring are necessary to the effective conduct of the decommissioning plan ultimately approved here. An alternate schedule presents no undue risk from radiation to public health and safety, as discussed herein at page 24. And as STV's underlying argument in its Petition shows, it is in the public interest to do the decommissioning right.

b. Basis. The current proposal also fails to "place the burden of proof directly on the licensee to demonstrate that a longer period of time is required for completing decommissioning" as required by the Timely Decommissioning Rule. The Army's May 25, 2005 letter does not even commit to completing decommissioning with twenty-four months of DP approval. Instead, it effectively places the burden on STV (or any other concerned group in the future) to demonstrate that a shorter, more definite period is required. This effectively turns the Timely Decommissioning Rule on its head and creates precisely the type of situation which the rule was adopted to correct and prevent: the postponement of the decommissioning and decontamination of licensed sites. And, it does so at a former SDMP site at which there have already been multiple, lengthy delays in decommissioning.

Response. The plan to be approved by the NRC is dependant on the outcome of the proposed testing, plus any further testing that the results of the currently proposed tests may dictate. The Army, in writing and in discussion with the NRC Staff, has demonstrated that length of time requested to complete the studies and tests leading to the formulation of a decommissioning plan is necessary and reasonable. As previously stated, STV's own Contentions concerning the Environmental Radiation Monitoring Plan (ERMP), Field Sampling Plan (FSP), And Health And Safety Plan (HASP) tend to show that delay is necessary.

c. Basis. The Army's current proposal provides no description of its regulatory history, especially but not exclusively at the JPG site, to establish a pattern of compliance with the Commission decommissioning rules and guidance which would instill confidence that timely decommissioning will actually occur at JPG. Such a showing is especially critical in a situation in which the Army is once again requesting an extended period of delay in decommissioning and decontamination at a former SDMP site at which there have already been multiple, lengthy delays in decommissioning. Such a showing is also expressly contemplated by Commission guidance on the evidence required for an alternative schedule for decommissioning. In particular, NUREG-1757, Vol. 3, Section 2.6, provides, in pertinent part: To demonstrate that delaying the start of decommissioning will not be detrimental to public health and safety, a licensee should submit the following: a discussion of its record of regulatory compliance, particularly its compliance with NRC regulations."

Response. The history and status of these proceedings is already well documented and is intimately known to all of the parties to these proceedings. The Army with its current application does not come before the NRC Staff as a stranger. The NRC Staff has never suggested to the Army that it has concerns about the Army's ultimate compliance.

Contention D-2: The financial assurance provided port h Army's alternate schedule for decommissioning is insufficient to meet the requirements of 10 C.F.R. § 40.36 and 40.42 for a complete, definite and quantified financial commitment for the decommissioning of the JPG site.

a. Basis. The indefiniteness of the Army's alternate schedule is compounded by the vagueness of its funding. All the Army says in its May 25 letter to the NRC Staff is, "All actions under the plan are subject to funding of course." There is no specific budget for the overall plan, its principal components, or the individual years in the five-year implementation period. There is no formally expressed or executed statement of intent on the part of an Army official with authority to approve or even to request the necessary funds. This effectively turns the relationship between the NRC as regulator and the Army as licensee on its head, making the Army the ultimate authority with respect to JPG decommissioning by virtue of its budgeting decisions and funding requests determining whether and when the site is characterized, decommissioned and decontaminated in accordance with NRC regulations. Inverted relationship promises nothing other than continuation of the pattern of repeated delays and changes in plans which has characterized the Army's decommissioning activities regarding the JPG site over the past ten years and recently resulted in the establishment of this docket following the referral of this unacceptable situation to the Commission for its consideration and action.

b. Basis. In response to a Request for Additional Information from the NRC Staff following submission of its May 25 letter, the Army belatedly submitted a purported Statement of Intent on September 14, 2005. See ADAMS Document ML052710071. However, this Statement does not satisfy the requirements of 10 C.F.R. § 40.36 (e) (4): "In the case of Federal, State, or local government licensees, a statement of intent containing a cost estimate for decommissioning . . . and indicating that funds for decommissioning will be obtained when necessary." In the first place, the Statement of intent submitted by the Army contains no cost estimate to conduct the FSP and implement the HASP, let alone to perform eventual site decommissioning as required by the rule. There is also no indication in the Army's Statement as to what effect, if any, the requested delay in decommissioning will have on the eventual cost of decommissioning. NRC guidance puts the Army on specific notice that this is significant information to be submitted in support on an alternate schedule request. *See, e.g.* NUREG-1757, Vol.3, Section 2.6 (requiring "discussion of the current decommissioning cost estimate and the potential for increased decommissioning costs if an extension of the time is approved") *and* Vol.1, Section 5.4 (stating "waste disposal costs have, in the past, increased at rates significantly higher than the rate of inflation and therefore delaying remediation will result in higher costs to the public.") In the second place, the Army's Statement of Intent does not provide adequate documentation that the funds required to perform decommissioning, whatever the amount may be, will be obtained when necessary. The stated intention to seek and secure funds is limited to actions contemplated in the Army's May 25 letter to support an alternate schedule, namely conducting the FSP and implementing the HASP; it does not include eventual decommissioning itself. There is no documentation whatsoever of the authority of the letter's signator to request and approve disbursement of the funds necessary for these actions, let alone decommissioning the site. Indeed, there is no express reference or other evidence in the Army's statement of any conscious effort to follow the Commission's written guidance for a statement of intent which would meet the applicable regulatory requirements. *See* NUREG-1757, Vol.3, Sections 4.3.1 and 4.3.2.13 and Appendix A-16.

Response to a and b: The Army has supplied the NRC Staff with statements of financial intent and updates thereof numerous times in these proceedings. All have been in the form STV now criticizes. In addition, the Army has supplied the NRC Staff with further financial information whenever asked. There has never been any indication by the NRC Staff that the form or content of the information provided is unacceptable.

Moreover, STV seeks to impose non-existent or illegal requirements on the Army. Its reliance on NUREG-1757 is misplaced. The purpose of NUREG-1757 is to provide guidance to the NRC Staff and the licensee: "This guidance is not a substitute for regulations, and compliance is not required. Methods and solutions different from those set down in this volume will be acceptable, if they provide a basis for the NRC Staff to conclude that the licensee's decommissioning actions are in compliance with the Commission's regulations." NUREG-1757, Vol.3, Section 1.1.

Neither is any Statement of Intent submitted by the Army required to satisfy the requirements of 10 C.F.R. § 40.36 (e) (4). In fact, for the Army to do so might very well be illegal. The Anti-deficiency Act, 31 USCS § 1341 (a) (1) (A) and (B), provides that an officer or employee of the United States Government may not make or authorize an expenditure or obligation exceeding an amount available in a current appropriation; and may not involve the government in a contract or obligation for the payment of money before an appropriation is made. A certification by the licensee obligating the Army to make unappropriated funds available for the decommissioning when necessary would be a violation of the Anti-deficiency Act.

The contradiction between § 40.36 (e) (4) and the Anti-deficiency Act is apparently recognized in § 40.36 (e) (5) which is controlling here and provides that, when a government entity is assuming custody and ownership of a site, the method for providing financial assurance for decommissioning is "an arrangement that is deemed acceptable by such governmental entity."

CONCLUSION

It is the Army's position that previous submittals in the JPG proceedings and the matters and documents discussed herein demonstrate that the three factors which the Commission must consider in order to grant an alternate schedule have been met. The contentions listed by STV seem to be somewhat contradictory. The first eleven pages of the contentions (pages 14-24) argue that the current and proposed ERMP, FSP and HASP are materially deficient and must be revised. However, in the final four pages (pages 25-28), STV argues against granting an alternate schedule, based on the documents submitted, with the implication that the Army should be rejected or, in the alternative, made to proceed with decommissioning, apparently on the basis of the tests and studies already submitted to the NRC Staff. The Army asks that the Commission order STV to recast Contentions A through C, and each sub part thereof, in terms clearly relevant and material, as required by 10 C.F.R. §2.309 (f) (iv), to the findings the NRC must make under 10 C.F.R. § 40.42 (g) (2); and that STV's Contentions D-1 and D-2 be dismissed as immaterial, pursuant to 10 C.F.R. §2.309 (f) (iv).

Dated this Friday, December 16, 2005.

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Attachment 1. Potential Human Exposure to Transuranics (TRUs): Case Study for Plutonium

Calculation of the exposure due to the potential presence of transuranic activity in depleted uranium (DU) penetrators (back of the envelope or detailed) is difficult without an estimate of TRU activity or activity fractions. To complete this analysis, existing data were reviewed and a rough estimate performed to provide a general indication of the potential risks to humans.

A report published by the United Nations Environment Programme (UNEP), *Depleted Uranium in Kosovo, Post-Conflict Environmental Assessment*, dated November, 2000, provides analytical results for 4 retrieved penetrators, with Pu-239/240 activities ranging from < 0.8 to 12.87 Bq per kg penetrator mass. The report indicated that most results were less than the established detection sensitivity.

To provide a very conservative evaluation of the potential impact of Pu-239/240 on the overall exposure resulting from DU penetrators at JPG, the upper value of 12.87 Bq/kg was used.

DATA

12.87 Bq/kg = 3.48E-7 μCi/g = 0.348 nCi/g Pu-239/240

DU specific activity ~ 3.6E-7 Ci/g (3.6E-1 μCi/g)

U-238, U-235 and U-234 isotopic abundances are 99.8%, 0.2% and 0.0007%, respectively.

Therefore, the Pu-239/240 activity fraction compared to total activity in a DU penetrator is 9.7E-7 or 0.0001%. Similarly, the Pu-239/240 activity fraction compared to U-238 in a DU penetrator is 1.1E-6, also 0.0001% since U-238 constitutes a majority of the activity in DU.

EXPOSURE CALCULATION

Although the World Health Organization (WHO) has published several reports indicating that the TRU activity in a DU penetrator accounts for 0.8% of the radiation exposure, it is not clear what exposure scenario was used, i.e., exposure resulting from handling DU penetrators or long-term exposure as a result of DU penetrator degradation in the environment and subsequent transport and intake/uptake by a receptor.

To estimate the effects of this TRU activity level in a DU penetrator on long-term exposure, an evaluation was conducted using RESRAD Version 6.22 and the parameters previously used in the exposure assessment for a resident farmer (with irrigation) in the

Dose Assessment in Support of Decommissioning Plan for Jefferson Proving Ground, dated May 2002, with one minor exception, i.e., the length of contaminated area parallel to the aquifer was set equal to the square root of the contaminated area.

In addition to these parameters, Pu-239 was added as a radionuclide with a concentration equivalent to the Pu-239: DU penetrator fraction multiplied by the DU soil concentration of 225 pCi/g and a contaminated area of 1.2E6 square meters. It is important to note that this analysis does not quantify an annual dose, but rather, the analysis evaluates the potential impact of TRU activity on the annual dose. The results of this analysis are presented in **Table 1.**

Table 1. Estimated Dose from Plutonium in a DU Penetrator Over Time

Dose	Elapsed Time (T) In Years							
	T=0	T=1	T=3	T=10	T=30	T=100	T=300	T=1000
Total dose (mrem/year)	24.8	23.6	21.2	14.9	5.3	0.12	23.0	25.7
Pu dose (mrem/year)	3.75E-5	3.72E-5	3.66E-5	3.46E-5	2.89E-5	1.1E-5	2.6E-12	1.8E-11
Pu dose fraction	1.51E-6	1.58E-6	1.72E-6	2.32E-6	5.43E-6	9.55E-5	1.13E-13	6.86E-13
Pu dose %	0.0002	0.0002	0.0002	0.0002	0.0005	0.0095	0.0000	0.0000

As noted above, this analysis focused on establishing the relationship between Pu-239/240 and the uranium isotopes present in DU penetrators. Note that analytical processes for isotopic analysis are not able to distinguish between Pu-239 and Pu-240; therefore, all activity was simply assigned to Pu-239.

Even though the final exposure scenario and applicable parameter values have not been assigned to model the contaminants present at JPG and provide final annual dose estimates, the relationship between TRU dose and dose due to all isotopes present at JPG should remain fairly consistent with that presented in the Table 1.

In Table 1, an apparent transition occurs between year 30 and year 300. From time T=0 to T=100, the "water independent" pathways predominate the annual dose. From time T=300 on, the "water dependent" pathways become the primary contributors to receptor annual dose.

CONCLUSION:

Based on the data and analysis provided herein, the stated plutonium activity present in a DU penetrator is estimated to have a negligible impact on annual exposures.

WISE Uranium Project - Fact Sheet

Hazards from depleted uranium produced from reprocessed uranium

There has been concern about the detection of uranium-236 in depleted uranium (DU) used for the production of ammunition. U-236 is an artificial nuclide of uranium which only can result from the use of uranium recycled from spent fuel. Therefore, the question is raised, whether other nuclides usually found in spent fuel, such as the transuranics plutonium (Pu-239) and neptunium (Np-237) might also be present in the depleted uranium, and what the health hazard from their presence would be. Due to their heavy atomic weights, transuranics introduced into the enrichment process would concentrate in the tails stream and would therefore show up in the depleted uranium.

The amounts of recycled uranium used in U.S. enrichment plants were first disclosed by the U.S. Department of Energy (DOE) in 1999:

> "At the Paducah uranium enrichment plant, recycled uranium was introduced into the enrichment "cascade" shortly after the startup of the plant in 1953 and continued through 1964. Activities were resumed in 1969 and continued through 1976. Paducah received approximately 100,000 tons (90,000 metric tons) of recycled uranium containing an estimated 328 grams of plutonium, 18.4 kilograms of neptunium and 661 kilograms of technetium-99. Operations at Paducah included the conversion of uranium oxide to uranium hexafluoride at a feed plant located onsite. The converted material was subsequently introduced into the gaseous diffusion "cascade" for further enrichment." [DOE_1999a]

These figures are based on [DOE_1984]; more details are also available in [DOE_2000].

For an assessment of the hazards from the transuranics, we first have to determine the concentrations of all nuclides of interest in the depleted uranium. For this purpose, we first need to calculate the mass balance of the enrichment process. We then calculate the inhalation doses from the depleted uranium and compare the dose contributions from the nuclides of interest.

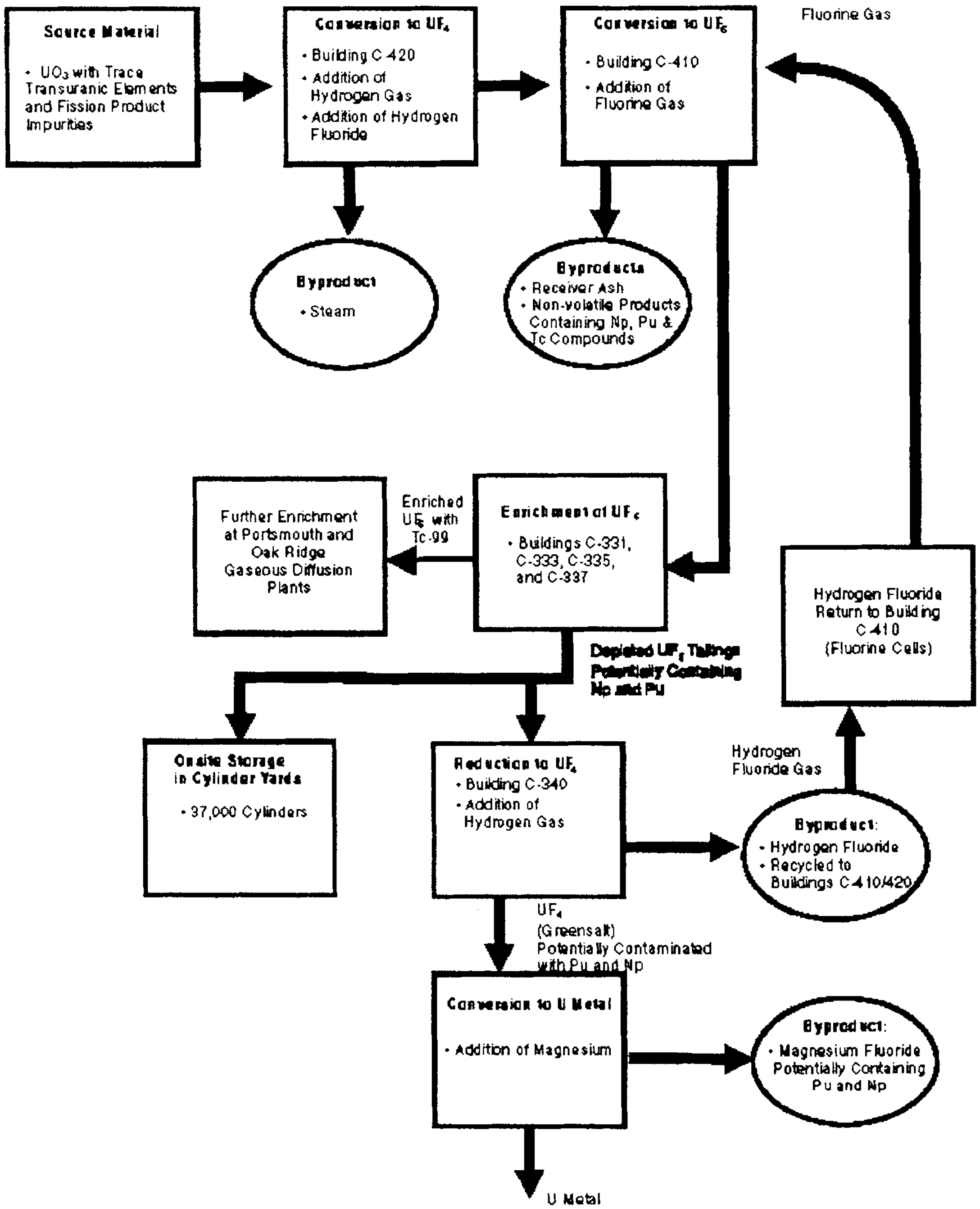
Mass balance for uranium enrichment at Paducah [DOE_1984, p.35]

	Feed	Product	Tails	Other
Mass [st]	758002	124718	621894	11390
Mass fraction	100.00%	16.45%	82.04%	1.50%

Concentration of plutonium in tails (depleted uranium) from enrichment of reprocessed uranium, assuming that all plutonium were transfered to the tails:

$$0.328 \text{ kg} / (101{,}268 \text{ st} \cdot 907.185 \text{ kg/st} \cdot 0.8204) = 4.352 \cdot 10^{-9} = 4.352 \text{ ppb}$$

Concentration of neptunium in tails from enrichment of reprocessed uranium uranium, assuming that all neptunium were transfered to the tails:



Schematic of historic uranium enrichment process at Paducah [DOE_1999b]

18.4 kg / (101,268 st • 907.185 kg/st • 0.8204) = 2.441 • 10^{-7} = 244.1 ppb

For comparison, we first calculate the inhalation dose from depleted uranium produced from natural uranium. We assume that the short-lived decay products have reached secular equilibrium with their parent nuclides (shown in bold).

Inhalation Dose from Depleted Uranium from Enrichment of Natural Uranium
(from enrichment to 3.5%, tails assay 0.2%)
ICRP72 (public) inhalation, adults, Type S (insoluble forms)

Nuclide	Half-life	Spec. act. [Bq/g]	Conc. [wt_%]	Dose fact. [Sv/Bq]	**Eff. dose** [Sv/g DU]	Dose fraction
U-238	4.468e9 a	1.245e+04	9.980e+01	8.000e-06	9.936e-02	83.73%
Th-234	24.1 d			7.700e-09	9.563e-05	0.08%
Pa-234m	1.17 m					
U-235	7.038e8 a	8.001e+04	2.000e-01	8.500e-06	1.360e-03	1.15%
Th-231	25.52 h			3.300e-10	5.281e-08	0.00%
U-234	2.445e5 a	2.313e+08	8.210e-04	9.400e-06	1.785e-02	15.04%
Total			1.000e+02		**1.187e-01**	100.00%

(Nuclide concentrations after [Neghabian_1991])

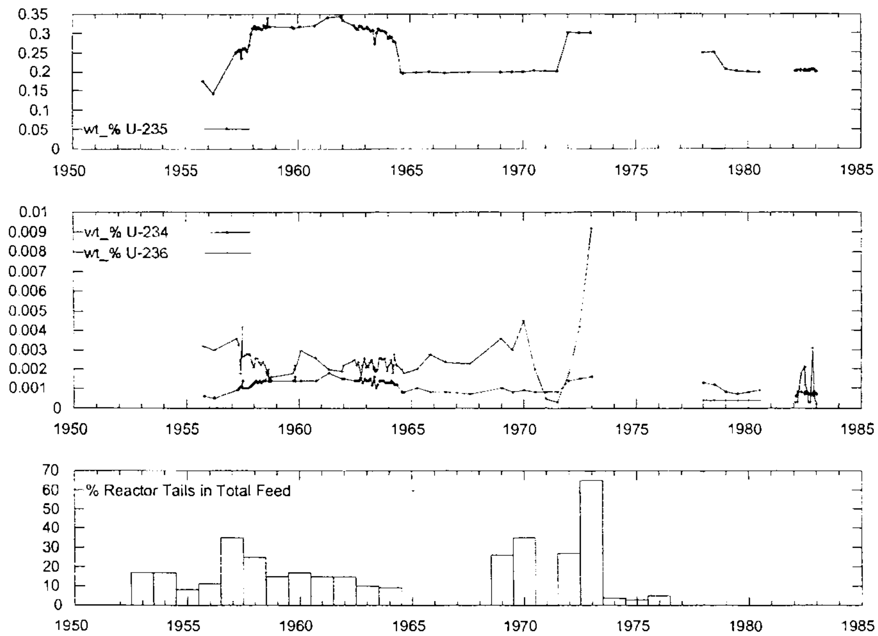
So, the effective dose from inhalation of depleted uranium produced from natural uranium would be 119 mSv/g.

For depleted uranium from enrichment of reprocessed uranium, the isotope composition is different, and several new nuclides have to be considered - mainly U-236, Pu-239, and Np-237.

Data from Paducah tails shows concentrations of U-236 of up to 0.0045 wt_%, with typical values in the range of 0.002 - 0.003 wt_% for a tails assay of 0.2% U-235 [DOE_1984 pp.18, 53-55]. Actual monitoring results from DU used for ammunition are as follows: [AEPI_1995] gives a figure of 0.003% U-236; this was confirmed by independent measurements in the U.S. [Dietz_1996]; UNEP found a slightly lower 0.0028% in Kosovo [UNEP_2001a].
Note: these figures are about 75-fold lower than would be expected, if the Paducah feed had been obtained from commercial reactors. This is due the fact that the vast majority of the reprocessed material came from military reactors in Hanford and Savannah River, and that the reprocessed material constituted only approx. 13% of the Paducah feed.

U-234 concentrations in Paducah tails ranged rom 0.0006 to 0.0010 wt_% for a tails assay of 0.2% U-235 [DOE_1984 p.15]; this is a typical tails assay for the DU used in ammunition [AEPI_1995].

Minor uranium isotopes in Paducah tails [after DOE_1984]



With this data, we obtain the following results:

Inhalation Dose from Depleted Uranium used in DU penetrators
(assuming that all Pu-239 and Np-237 shows up in tails)
ICRP72 (public) inhalation, adults, Type S (insoluble forms)

Nuclide	Half-life	Spec. act. [Bq/g]	Conc. [wt_%]	Dose fact. [Sv/Bq]	**Eff. dose** [Sv/g DU]	Dose fraction
U-238	4.468e9 a	1.245e+04	9.980e+01	8.000e-06	9.936e-02	83.45%
Th-234	24.1 d			7.700e-09	9.563e-05	0.08%
Pa-234m	1.17 m					
U-236	2.342e7 a	2.396e+06	3.000e-03	8.700e-06	6.254e-04	0.53%
U-235	7.038e8 a	8.001e+04	2.000e-01	8.500e-06	1.360e-03	1.14%
Th-231	25.52 h			3.300e-10	5.281e-08	0.00%
U-234	2.445e5 a	2.313e+08	8.000e-04	9.400e-06	1.739e-02	14.61%
Pu-239	24131 a	2.295e+09	4.352e-07	1.600e-05	1.598e-04	0.13%
Np-237	2.14e6 a	2.610e+07	2.441e-05	1.200e-05	7.645e-05	0.06%
Pa-233	27 d			3.900e-09	2.485e-08	0.00%
Total			1.000e+02		**1.191e-01**	100.00%

So, the inhalation dose from DU used for penetrators would be only 0.7% higher than from DU obtained from enrichment of natural uranium. U-236 would contribute 0.53% to the dose, Pu-239 0.13%, and Np-237 0.06%.

The above calculations have assumed that all transuranics contained in the reprocessed uranium would have been introduced into the enrichment cascades. This is, however, a gross overestimation:

> "At both Paducah and Oak Ridge sites, the majority of the plutonium and neptunium was separated out as waste during the initial chemical conversion to uranium hexafluoride. Because of this, only a fraction of the plutonium contamination was actually introduced to the gaseous diffusion cascade at either plant. This waste was subsequently reprocessed to recover additional uranium and then reused.
> Of the 328 grams of plutonium present in the 100,000 tons of recycled uranium processed at the Paducah plant, only 0.1 gram of plutonium is estimated to have been introduced into the Paducah cascade. Transuranics including plutonium are believed to have been deposited on internal surfaces of the feed process equipment, with concentrations also being deposited in waste products." [DOE_1999a] (emphasis added)

If it is assumed, that all of these 0.1 g of plutonium were transfered to the tails, the plutonium-concentration in the tails would be 0.0013 ppb. It is, however, questionable whether any significant fraction of these 0.1 g of plutonium was transfered to the tails, according to DOE [DOE_1984 p.17].
There exists only sporadic monitoring data of plutonium concentrations in Paducah tails and in DU metal made from it for the years the reprocessed uranium was fed into the cascade. In no case has plutonium been found in amounts above the detection limit given by the respective measuring techniques used:

Monitoring data for plutonium in Paducah tails and products made thereof

Year	Item	Plutonium concentration	Reference
1957	DU metal	< 1 ppb (based on U)	[DOE_1963]
1963	tails	< 1 ppb (based on U)	
1964	tails	< 10 ppb	[DOE_1984, p.17]
1973	tails	< 0.01 ppb	
from 1975	tails	< 0.01 ppb	

1 ppb = 1 part per billion = 10^{-9}

And, of the18.4 kg of Np-237, only 4.6 kg is estimated to have been fed into the cascade. [DOE_1984 p.11]

According to these estimates, only less than 0.03% of the total plutonium and 25% of the total neptunium could have shown up in the tails. **Therefore, the inhalation dose from plutonium would cause only less than 0.000039% of the total dose, and the dose from neptunium would cause less than 0.016% of the total dose from the DU used for penetrators.**

Since February 2001, first monitoring results for plutonium in DU penetrators spent in Kosovo are available. In several cases, the detection limit was low enough to actually find traces of plutonium. The results confirm, albeit for a few penetrators only, that the above assumptions (0.0013 ppb) are realistic. New data from a single penetrator recovered from a target area in Southern Serbia shows a plutonium concentration that is one order of magnitude higher.

Monitoring data for plutonium in uranium penetrators

Location	Plutonium concentration	Reference
Kosovo	< 0.0032 ppb (based on U)	[GSF_2001]
Kosovo	0.00035 - 0.0056 ppb	[UNEP_2001b]
Southern Serbia	0.019 ppb	[McLaughlin_2001]

1 ppb = 1 part per billion = 10^{-9}

For comparison: these values are in the range of a few thousandth parts of a ppb naturally found in uranium ore deposits: uranium-238 captures neutrons coming from various natural sources, such as cosmic radiation, and spontaneous fission of uranium-235. The product is uranium-239, which decays at a half-life of 23.4 minutes to neptunium-239, which, in turn, decays at a half-life of 2.355 days to plutonium-239. The plutonium actually found in penetrators would, however, nearly completely be from artificial sources. This is a result of the chemical processing of the material, reducing plutonium concentrations from any source.

The only database available so far of more than sporadic monitoring data of contaminants found in DU is for DU metal used for the fabrication of tank armor: The Idaho Nuclear Technology and Engineering Center (INTEC) has analyzed 60 samples of depleted uranium metal billets for transuranics and fission products [Army_2000]. Transuranics concentrations above the detection limits have been identified in this material, including not only plutonium-239, but also americium-241, neptunium-237, and plutonium-238. Furthermore, the fission product technetium-99 was detected.

Monitoring data for transuranics and fission products in DU armor

	Nuclide data			max. values found in DU armor		
	Half-life	Specific Activity [Bq/g]	Dose Coeff. [3]) [Sv/Bq]	Activity Conc. [2]) [Bq/g DU armor]	Conc. by weight [ppb]	Effective Dose [3]) [Sv/g DU armor]
Am-241	432.2 a	1.271e+11	4.2e-05	0.703	0.0055	3.0e-05
Np-237	2.140e6 a	2.611e+07	2.3e-05	0.137	5.2470	3.2e-06
Pu-238	87.75 a	6.340e+11	4.6e-05	0.074	0.0001	3.4e-06
Pu-239/240 [1])	24.13e3 a	2.296e+09	5.0e-05	0.1	0.0436	5.0e-06
Tc-99	213.0e3 a	6.280e+08	4.0e-08	19.98	31.8153	8.0e-07
Total						4.2e-05

[1]) nuclide data of Pu-239 only
[2]) [Army_2000]
[3]) ICRP 72 (Public) Inhalation, Adults, AMAD = 1 µm, Class M (Note: Other than for uranium and technetium, the inhalation dose coefficients for the transuranics increase rather than decrease with the solubility of the material.)

Thus, for DU armor containing 0.2% U-235 and 0.003% U-236, **the excess inhalation dose from transuranics and fission products of max. 0.042 mSv/g represents only a 0.035% dose increase**.

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September 13, 2001

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD PANEL

Before Administrative Judges:

Alan S. Rosenthal, Chair
Dr. Paul B. Abramson
Dr. Richard F. Cole

In the Matter of	)	Docket No. 40-8838-MLA
	)	
U.S. ARMY	)	ASLBP No. 04-819-04-MLA
	)	
(Jefferson Proving Ground Site)	)	December 16, 2005
	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of the U. S. Army's "RESPONSE TO SAVE THE VALLEY, INC.'S CONCERNS AND CONTENTIONS AS SET FORTH IN ITS PETITION TO INTERVENE FILED HEREIN ON NOVEMBER 23,2005" in the above captioned proceeding have been served on the following persons by U. S. Mail, first class, and (as indicated by asterisk) by e-mail this 16th day of December, 2005:

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