RAS 14493

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. 00-776-04-MLA
(Jefferson Proving Ground Site)	)	September 18, 2007

PREFILED REBUTTAL TESTIMONY OF

DIANE S. HENSHEL, PH.D.,

IN SUPPORT OF CONTENTION B-1

OF INTERVENOR SAVE THE VALLEY, INC.

DOCKETED
USNRC

October 25, 2007 (2:00pm)

OFFICE OF SECRETARY
RULEMAKINGS AND
ADJUDICATIONS STAFF

TEMPLATE = SECY-028

SECY-02

Q.1. Please state your full name.

A.1. My name is Diane S. Henshel.

Q.2. Are you the same Diane S. Henshel who previously filed initial testimony in this matter on July 20, 2007, on behalf of Intervenor Save the Valley, Inc.?

A.2. Yes, I am.

Q.3. What is the purpose of your rebuttal testimony?

A.3. The purpose of my rebuttal testimony is to respond to certain matters raised by witnesses for the Army and the Staff in initial testimony they filed on August 17, 2007.

I. Response to Army Witness Paul Cloud

Q.4. Have you reviewed the testimony of Army witness Paul Cloud as it relates to your initial testimony?

A.4. Yes. I have reviewed his written testimony dated August 11, 2007.

Q.5. Do you agree with his correction to your description of the role you played as a technical advisor for the JPG RAB?

A.5. I agree in part and disagree in part. I agree I served as a technical advisor for only the community members of the JPG RAB from 1999 to 2003, and that my position was funded by the DOD TAPP program, and specifically by the Army. I do not agree that my involvement with the JPG RAB was restricted to issues associated with potential environmental contamination and restoration of the areas of JPG that are below the firing line.

In fact, as demonstrated by the minutes of the JPG - RAB meetings that are available in

ADAMS (Accession Numbers ML003729433, ML010570042, ML012630206) and through the official JPG website (http://www.jpgbrac.com/community/rab_minutes.htm), there were 12 meetings which I attended of the JPG - RAB between 2000 and mid 2003, when I received my last DOD-generated TAPP program pay check, during which issues associated with the DU Area were presented to the meeting participants and during which I discussed issues associated with DU with Mr. Cloud and other official government representatives in attendance. (Relevant dates include: 4/30/00, 5/31/00, 2/6/01, 5/16/01, 8/22/01, 11/14/01, 2/6/02, 5/1/01, 8/14/02, 11/6/02, 2/5/03, 4/30/03.) Additionally, in my capacity as technical advisor to the RAB's community members, I visited the JPG DU site, including the DU area north of the firing line.

There were an additional three JPG- RAB meetings (11/5/03, 8/5/03, 11/3/03) during which I was present and the DU area was discussed which occurred after I received my last TAPP funding but before the February 2, 2005 date when Mr. Cloud explicitly stated for the first time that the DU Area issues were no longer part of the JPG remediation activities that fell under the TAPP guidance and with the RAB's purview. At those three RAB meetings, I was serving as a consultant only to STV. However, even during the period including those meetings, there were several discussions among myself, Richard Hill (President of STV and Co-Chair of the RAB) and Mr. Cloud about whether the JPG TAPP funding would be extended and supplemented to continue my role as the RAB technical advisor, in part to address the DU Area issues. At no time prior to February, 2005 did Mr. Cloud communicate

to me that my advising about issues associated with the DU Area was not appropriate to the purposes of the JPG RAB or the TAPP funding of my services as technical advisor to the RAB's community members.

II. Response to Army Witness Joseph Skibinski

Q.6. Have you reviewed the testimony of Army witness Joseph Skibinski as it relates to your initial testimony?

A.6. Yes. I have reviewed his written testimony dated August 15, 2007.

Q.7. Do you agree with Mr. Skibinski's testimony as it relates to your initial testimony?

A.7.. No.

Q.8. What are the principal respects in which you disagree with Mr. Skibinski's testimony?

A.8. I disagree with Mr. Skibinski's testimony with respect to (1) the degree of JPG DU site characterization which must be achieved by the Field Sampling Plan (FSP) in order to comply with applicable regulatory requirements, (2) the extent of JPG DU site characterization which should be achieved by the FSP as a matter of sound regulatory policy, (3) whether my use of the word "accuracy" instead of the word "precision" in a single sentence of my testimony brings my professional qualifications into issue, (4) whether DU has a significant role in the calculation of radioactive doses at JPG, and (5) whether I properly evaluated duplicate deer samples collected by the Army.

Q.9. Why do you disagree with Mr. Skibinski's testimony regarding the degree of site characterization which must be achieved by the FSP in order to comply with applicable

regulatory requirements?

A.9. I disagree for two reasons. First, Mr. Skibinski mischaracterizes the applicable regulatory requirements. Second, Mr. Skibinski improperly prejudges the results of the FSP and thereby errs in defining its purpose.

Q.10. How does Mr. Skibinski mischaracterize the applicable regulatory requirements, as you understand them?

A.10. Mr. Skibinski asserts (A.7), without supporting documentation, "It is neither necessary nor desirable to complete site characterization to the degree described by [myself] and Mr. Norris to determine if the release criteria are met." He also states (A.7) that "the program described by the interveners" to characterize the JPG DU site is "not required by NRC's regulations." Finally, Mr. Skibinski claims (A.7) that that our requested site characterization approach is "ill-conceived" and "exceeding regulatory requirements." In making these statements, Mr. Skibinski is apparently assuming that the only regulatory purpose of the FSP is to determine whether the numerical Total Effective Dose Equivalent (TEDE) criteria established by 10 CFR § 20.1403 for restricted release of the JPG DU site will be met when the Army performs a RESRAD model run for the site once it has site-specific estimates for the values of the input variables necessary to do so. As I understand the applicable regulatory requirements, Mr. Skibinski's view is mistaken in two crucial respects.

First and foremost, all of the NRC's decommissioning and license termination actions for facilities like the JPG DU site must comply with NEPA (1969), which

explicitly requires evaluations of major federal actions to assess their impacts on both "human health and the environment." In fact, NUREG 1757 explicitly cites NEPA as one of the three statutes for which regulatory guidance is being provided in order to assure compliance. Specifically, NUREG 1757, Section 4.2, Statutes, states:

> NRC's decommissioning and environmental protection regulations derive their authority from the following statutes:
>
> - Atomic Energy Act (AEA) of 1954, as amended;
>
> - Energy Reorganization Act of 1974, as amended; and
>
> - National Environmental Policy Act of 1969, as amended.

As a result, as part of the approval process for the decommissioning plan for the restricted release of the JPG DU site, the Army will be required to prepare an Environmental Report and the NRC Staff will be required to prepare an Environmental Impact Statement which meets the requirements of NEPA and its implementing regulations.

Second, 10 CFR § 20.1403(a), Criteria for Termination Under Restricted Conditions, specifically requires the Army to establish that the dose levels associated with restricted release are ALARA, i.e., the lowest achievable without inducing "net public or environmental harm."

In other words, the NRC decommissioning process must comply with NEPA and its implementing regulations, and even though one particular aspect of the regulatory guidance regarding dose or one of the specific models developed to address and facilitate decision making (e.g. the main RESRAD model, which primarily addresses human exposure to

radionuclides in soil) is limited in scope, the full scope of NEPA ("human health and the environment") must still ultimately be addressed.

Q.11. How does Mr. Skibinski prejudge the results of the FSP and thereby mistakenly define its purpose?

A.11. Mr. Skibinski does not fully justify his statement, but states (A7) that "DU has been reliably detected in samples collected near penetrators or fragments of penetrators" and then prejudges the results of the FSP by adding that "there is no indication that there is routine or widespread DU contamination outside the DU area." In fact, the Army cannot justifiably claim that something does not exist someplace if it has not reliably evaluated its presence or absence. In essence, Mr. Skibinski's argument is that if the Army does not fully investigate whether DU has migrated away from the DU area, but instead makes the assumption that DU has not migrated away from the DU area, then it does not need to check that assumption because there is no evidence to question it.

I disagree with this logic, and draw an analogy to support my position. If one drops a box of marbles near a lamp post at night, and then finds some of the marbles within the light shed by the lamp post, it is not logically reasonable nor justifiable to then infer that ALL of the marbles still lie within that circle of light shed by the lamp post and will continue to do so indefinitely. Some of the marbles may have already rolled into the dark area outside the circle of light. With the force of gravity or precipitation, other of the marbles may now be still within the circle of light but may move out of it with the passage of time.

The situation at JPG is similar. We know that the DU penetrators (exclusive of some skips) are found within the DU area, and that most of the DU released from the penetrators by weathering and other processes will be detectable at first in the highest concentration in close proximity to the penetrators, and thus still within the DU area. But, laboratory and field testing of DU fragments have clearly shown that the highest concentrations of DU will be in close proximity to the penetrators *only within the limited time frame of the testing*. The regulatory period of concern with respect to peak dose under 10 CFR § 20.1403 is 1000 years; the period of concern for an Environmental Report and Environmental Impact Statement could be even longer, depending on the results of site characterization. Only by locating and accounting for all of the DU will the Army be certain that none of the DU has migrated or will migrate away from the DU area. This of course, is virtually impossible. No one (including STV) expects that the Army, or any one else, could gather all the DU, all the little grains and molecules of DU that have come off the penetrators at the time of impact or subsequently and account for 100% of the DU shot into the DU area and not previously collected. Instead, the Army needs to evaluate the alternative, whether and how much DU currently has migrated and is migrating away from the DU area, and then needs to use that information to accurately model how much will migrate in the future and via which pathways. And, the Army can only reasonably assure how much is migrating by using careful, statistically-driven testing of the areas in and around JPG, and by using testing regimes that consider pathways by which DU may migrate, accumulate and concentrate over time, such as lichen, mollusks and other biota. Only given

appropriate testing under the auspices of the FSP will the Army be able to reliable determine whether Mr. Sibinski's unsupported assumption (that DU is not moving away from the penetrations) is true or false.

Q.12. Why do you disagree with Mr. Skibinski's testimony regarding the degree of site characterization which must be achieved by the FSP in order to comply with sound regulatory policy?

A.12. Mr. Sibinski states (A7) that "the program described by the intervenors is neither fiscally responsible nor required by NRC's regulations." Again, the fiscal responsibility component of this statement is not supported by any study or calculations. However, in my opinion, it is more fiscally responsible to at least preliminarily characterize the contamination of a site and develop a reasonably delineated risk model that is based on the reality of the site, than to use assumptions that may or may not be valid for JPG, carry out a limited risk assessment for JPG that does not even attempt to model the site realistically, and then go back later and do confirmatory testing, only to find out that the simplifying assumptions put into the model produced projected results are not valid for JPG. At that time, the whole site characterization process would have to be reinstituted, which would add significant additional administrative costs in the future. Further, by better characterizing the site now, the Army and the NRC will be able to make decisions that are much more likely to be supported by the community when the decommissioning plan is eventually proposed, which will reduce the risk and cost of a contentious adjudicatory process at that time like the present one.

Finally, Mr. Cloud has repeatedly stated in the JPG RAB meetings that the Army will, in effect, be responsible for the JPG DU site forever, regardless of whether the site is decommissioned for restricted release or the license is terminated. Therefore, at some future time, if some scientist or health official demonstrates that DU from JPG is accumulating to potentially effective concentrations in some animal or in humans on or off site, the Army will still be liable for addressing the DU problem at that time. So, the risks and costs of inadequate characterization will not end with approval of a restricted release decommissioning plan for the JPG DU site.

Q.13. Why do you dispute Mr. Skibinski with respect to his claim that DU plays a minimal role in the RESRAD calculation of radioactive dose at JPG?

A.13. Mr. Skibinski states (A7) that "DU is less hazardous than natural uranium," which is true. However, DU (the composition of which is variable) is any where from about 1/6 to 1/20th as potent as enriched uranium (the composition of which is also variable) from a specific activity or disintegrations/second/mg perspective. (From one source: enriched uranium ranges from 81.5 to 276.2 Bq/mg, while DU ranges from 14.6 to 22.5 Bq/mg. *See* http://www.wise-uranium.org/rup.html .) This does not mean, as Mr. Skibinski states, that DU "has little bearing on the results of the RESRAD modeling" in a situation in which DU is the main source of uranium present. Even were enriched uranium present, as well as significant amounts of natural uranium, whether DU is a significant contributor to the net radioactivity to which the receptors / target organisms / "member of the critical group" (as defined by 10 CFR §

20.1402) are exposed is only a matter of the relative amount of DU compared to natural and enriched uranium. If, for example, in a situation in which all three forms of uranium were present there is > 200x the amount of DU compared to the total of natural and enriched uranium, it would be the radioactivity contributed by the DU which would drive the RESRAD model, not the enriched or natural uranium present. After all, if x = y/20, 200x still equals 10y.

Q.14. What is your difference of opinion with Mr. Skibinski regarding the evaluation of duplicate deer samples collected by the Army?

A.14. Mr. Skibinski states (A11) that it was inappropriate for me to evaluate the relative percentage differences in the duplicate samples in the deer sampling results because "there were no positive duplicate results that could be compared and calculated." I am not sure why Mr. Skibinski says that there were no *positive* duplicate results, since certainly some of the results are labeled "J" and above detectable limits, and there were certainly duplicate samples taken from one deer in each sampled group (DU Area, Nearby Hunting Zone, Background Hunting Zone), and samples from multiple organs of each of those deer were sent for duplicate analysis. This was made clear on page 2-3 of the Sample Design and Procedures section of the August 2006 Deer Tissue Sampling Results document (ML062210019): "A duplicate sample was collected from one deer within each sampling area." Indeed, the duplicate results were reported, and it was from these duplicate results that I did the calculations for the relative percentage differences, based on the NRC guidance.

Q.15. How do you respond to Mr. Skibinski's challenge to your credibility for using the term

"accuracy" when he says the correct term was "precision"?

A.15. Mr. Skibinski casts doubt on my credibility (A11) because I chose to use the term "accuracy" when, as he points out, the term "precision" (as defined by the EPA) is a better fit for that particular sentence. And, in fact, were I intentionally using the terms as defined by the EPA, I would have better phrased the sentence if I had used the word "precision" instead of "accuracy." However, in common usage, accuracy and precision have similar meanings, and one is given as a synonym for the other in multiple thesauruses. The online Oxford English Dictionary provides the following definitions:

> ACCURACY: The state of being accurate; precision or exactness resulting from care; hence, precision, nicety, exactness, correctness.
>
> PRECISION: b. The fact, condition, or quality of being precise; exactness, accuracy.
>
> c. The degree of refinement in a measurement, calculation, or specification, esp. as represented by the number of digits given. Contrasted with accuracy (the closeness of the measurement, etc., to the correct value).
>
> d. Statistics. The reproducibility or reliability of a measurement or numerical result; a quantity expressing this.

When I wrote the sentence in question, I was trying to point out that there was, overall, a degree of carelessness exhibited with the data, as evidenced also by the mislabeling of the deer samples or taking samples from the wrong deer (as the explanation for why there is a discrepancy in the samples taken.) Thus, I was also remarking on the apparent absence of "the state of being accurate" resulting from a lack of "precision," as well as an apparent lack of

careful QA/QC.

III. Response to Army Witness Michael Barta

Q.16. Have you reviewed the testimony of Mr. Michael Barta filed in this proceeding on behalf of the Army in response to your initial testimony?

A.16. Yes. I have reviewed his written testimony dated August 14, 2007.

Q.17. Do you agree with Mr. Barta's testimony?

A.17. No. I disagree with Mr. Barta's testimony in numerous respects.

Q.18. Please describe your initial disagreement with Mr. Barta.

A.18. In A7, Mr. Barta states that there is no regulatory requirement to collect any ecological data, and in A9 Mr. Barta states that the deer sampling sampling data were only "designed to respond to requests from the NRC as well as align with the Army's approach to conduct the sampling in a step-wise or phased manner." In this context, I would like to point out that STV itself suggested deer sampling be done to ensure the safety of the hunters; it was explicitly requested at multiple JPG RAB meetings, as well as during conference calls between the Army and NRC at which members of STV were participants. So, STV does not object per se to the deer sampling effort, but considers it to be only one part of the needed initial biotic sampling, the results of which will inform the later NRC's decisions with regard to decommissioning. However, as I also point out in response to other testimony, all ultimate decisions by the NRC regarding decommissioning are made within the regulatory framework laid out under NEPA (1969 and as later amended). NEPA explicitly mandates evaluation the impacts of major

federal action on "human health and the environment."

Regulations and regulatory guidance are developed in discrete parts and each part cannot realistically be developed to address every requirement applicable to every decommissioning situation. Thus 10 CFR 20.1403, for example, does refer principally to radioactive doses to humans and NUREG 1757 primarily addresses concerns about human health. Similarly, the main RESRAD model addresses risks to humans from exposure to radionuclides in soil. But, there are other NRC regulations (e.g., 10 CFR 51.45 and 51.50) and guidance documents (e.g., NUREG-1748) which primarily address decommissioning impacts on other organisms and the larger environment. There are also other RESRAD models that address the ecological (RESRAD Ecorisk) and non-human (RESRAD Biota) risks.

Q.19. What is the second issue raised by Mr. Barta's testimony about which you disagree?

A.19. Mr. Barta states, "Based on the deer sampling results, which indicated that DU was not present in the deer tissues, no additional deer sampling is warranted." In fact, based on the poor study design, as it was implemented in reality rather than as originally planned, no conclusions could be drawn from this data. As stated in my initial testimony, two fallacies prevent the data from the deer sampling study from being interpreted in the way Mr. Barta, and the report, claim:

Fallacy 1: The deer from the Background Hunting Zone represent a true background with no potential for exposure to the residual DU remaining on the site from the prior DU-including testing activities.

There are two potential problems with this syllogism. First, without tracking the deer, the Army and SAIC cannot prove that these deer do not travel down to the areas of JPG closer to or even in the DU Area. Whereas multiple sources do verify that the primary home range for white tailed deer is approximately 1 square mile, a paper by MA Nelson ("Home range location of white-tailed deer," USDA Forest Service ResearchPaper NC-173, 1978) demonstrates by radio-tracking that deer do migrate, especially seasonally, and can travel more than the 5 miles between the BHZ and the DU Area. "It is now apparent that deer movements are a complex part of deer ecology and should be examined when proposing or evaluating habitat management... Four of the five migratory deer examined for habitat preferences in this study migrated 8 km between the same winter and summer ranges for the 3 years they were studied. The fifth deer... made one 14-km spring migration but was killed by wolves during his return migration the next winter." (Paper available through the following web site: http://www.treesearch.fs.fed.us/pubs/10694.)

The second potential problem with this syllogism is the assumption made, without testing, that no DU has migrated to the northern reaches of the JPG area. Certainly, it is reasonable to expect that less DU will be there, but without testing it is a fallacy and wrong to just assume that the northern reaches of JPG are completely uncontaminated by the residual DU in the DU area or by "skips" of the DU fired towards the DU Area.

Fallacy 2: The deer in the three regions of JPG (in the DU Area, the Nearby Hunting Zone, and the Background Hunting Zone) are distinguishable as populations, and at the very

least that the deer in the BHZ could not be of the same population as the deer in the DU Area or the NHZ.

This conclusion is based on the first fallacy (that the deer caught in the BHZ were not potentially exposed to any residual DU from the activities at JPG). The argument against this syllogism is, part, the same as above - without tracking the specific deer in the herds under the same conditions as used in the sampling events (with bait traps set, same times of year), no one can prove that the deer do not migrate from the north of JPG towards the DU Area between seasons (November to February). From this concern is our added concern that the deer be sampled within the same time frame, to at least reduce the chance that the deer have moved from one area of the base to the other. However, even when doing this, without a complementary tracking study to prove that the deer populations do not mix between the north of the base and the area around the DU Area, SAIC and the Army can not be sure that the populations are indeed distinct and could potentially be compared.

Q.20. Are there other concerns raised by Mr. Barta that you wish to address?

A.20. Yes, I have several more concerns with Mr. Barta's testimony.

First, Mr. Barta appears to contradict himself in trying to contradict me. In A21, Mr. Barta asserts that "All historical animal samples obtained from the DU affected area showed no radiological evidence of DU contamination by virtue of both the magnitude of uranium concentration and the U-238/U-234 activity ratio. " Later, in A31, Mr. Barta discusses that, indeed, there were samples collected from a "4-5 year old female killed in the DU Impact

Area" in the SEG, Inc, 1996, survey results.

In cases of contamination where the background level of a contaminant (here uranium) has no chance of being in high concentrations due to its presence in a very diluted, dispersed state (in its natural form), then any sample with unusually high contaminant concentrations had to have either been exposed to a natural mother lode of the substance, or was exposed to the source of contamination introduced unnaturally, that is by anthropogenic activity. In this case, the only anthropogenic use of uranium any where near JPG was part of the Army activities at JPG. In the case of a single clearly contaminated individual in a sampled population of few individuals, it would be presumptuous and scientifically unethical to just dismiss one sample's results because it appears to be an outlier.[1] Therefore, although Mr. Barta would prefer to just ignore the inconveniently contaminated deer from the 1996 SEG report, by his own testimony he supports my comment that because of the existence of that deer, even the deer appear to be increasingly at risk or exposure to DU from the DU Area.

Second, in A9, Mr. Barta makes an unsupported assumption that seems illogical in my opinion. In trying to argue not to sample any of the other hunted species at JPG (turkey and squirrel), Mr. Barta states that people would eat less of the squirrel and turkey than the deer. ("I would expect that the mass of turkey meat or squirrel meat consumed per individual hunter

[1] From a sampling perspective, 10 or less is very few, and clearly not a statistically representative sample of a population in which hundreds of individuals ["approximately 400 to 800 deer are harvested per year" Mr. Barta in A9] are culled without harm to the total population size. One would expect at least 100 deer to have been sampled, and at least 25 - 50 per site, in order to be able to declare that they had even approached a solid sampling of the population.

would be less than for deer.") Without justifying his argument, one presumes this is based on the weight of the individual animals, and since deer are much larger, there would be more deer meat available per animal than turkey meat or squirrel meat per animal. Yet, if people are relatively poor (and the area around JPG includes some of the counties with some of the lowest income per capita in Indiana), they will eat whatever they can kill. Thus, if they kill more turkeys, they will eat more turkeys. If they kill more squirrels, they will eat more squirrels.

Third, Mr. Barta excludes known human food sources. Both crayfish and small creek fish are eaten by Hoosiers. In an area where crayfish can be readily found in a stream or creek that's not flooded, the crayfish will be eaten. (I have surveyed multiple classes about their consumption of creek caught fish and crayfish. Every year I have asked, students from rural parts of Indiana report that they really like to go out and catch a meal from local creeks, and the meal will consist of whatever they find, and has included fish and mollusks [crayfish and larger shellfish].) I suspect that Mr. Barta is making assumptions about what people in southern Indiana eat without having surveyed the population.

Q.21. Mr. Barta asserts that you are asking for "numerous pathways, no matter their significance, be sampled." (A20) Do you agree with this interpretation of your testimony?

A.21. Yes and no. I agree that STV is asking for sampling of more pathways than is currently being considered by SAIC and the Army (although SAIC also suggests that other biotic sampling, including, as mentioned by Mr. Barta [A21], "aquatic filter feeders and terrestrial vegetation",

would be more sensitive indicators of DU migration into food webs than deer are). However, I disagree with the dismissive phrasing "no matter their significance." I find it amazing that a scientist would presume to know the significance of a pathway without having the data to support that belief. Scientists are trained to draw conclusions based on facts and observations, not presumptions fed by a desire not to spend money, or by pressure from the client. Should data be gathered using solid study designs and carried out as defined in the study designs, with careful QA/QC throughout, and that data says that the DU is not migrating off site or into any food webs that pose a risk of exposure to human health or the environment, I will support a decision to decommission JPG. Until that data is gathered, however, I will remain a scientist and ask for proof of all these assumptions being generated by the Army and its consultants.

Q.22. Mr. Barta (A34) states that you have confused accuracy with precision. Do you agree?

A.22. In my answer at issue here, I did not use the terminology as defined by EPA, and instead used the terminology as used in common english. (Definitions are included in my response to Mr. Skibinski's testimony.) I was very much trying to point out that many small details pointed to a general careless and inaccuracy (or - in EPA parlance - precision) in either the taking or the analyzing of the samples. I continue to assert that when a goal for the relative precision difference (RPD) between duplicate samples is supposed to be less than 50%, and a majority of the duplicate samples have an RPD of greater than 50%, there is a problem with the data, and the data should not be trusted. In my laboratory, such imprecision, and poor results, would

result in an experiment being done over. As a editorial reviewer for scientific journals, I would never accept a paper with such data in it for publication, and would tell the authors to go back and reanalyze their data or get new samples. To begin with, every sample should have been taken in duplicate. The protocols call for at least duplicate field samples (not one of 10 deer in a group being collected in duplicate). When most of the duplicate samples fail the pre-determined test for acceptability, the results of the whole study must be called in to question.

Q.23. Mr. Barta says you don't understand the results of the Deer Sampling Study. Do you agree?

A.23. No. I understand that many of the results report only one or no isotopes with radioactivity levels high enough to detect reliably given the methods used (i.e. with the "J" labeling). However, some do have levels high enough. In addition, I was following the lead of the SAIC report, which itself says that there are no detections (though there are), and then talks about the isotopic ratios. If the isotopes aren't being detected, how can the SAIC report talk about the ratios?

According to page 3-3, section 3.4 Statistics: "No formal statistical comparisons were conducted to determine whether deer from the NHZ, DU Impact Area, and BHZ were from the same -population because no DU was detected in any samples." According to page 3-4, section 3.5 Summary: "The U-238/U-234 ratios indicated the presence of natural uranium. ... In a manner similar to the total uranium concentration data, proximity to the DU Impact Area did

not necessarily result in the highest U-238/U-234 ratios. In fact, the highest individual ratios were observed for two (bone and muscle) of the four tissue types from deer collected in the BHIZ. The NHZ had the highest kidney and liver U-2381U-234 ratios.")

IV. Response to Army Witness Harold Anagnostopoulos

Q.24. Have you reviewed the testimony of Mr. Harold Anagnostopoulos in this hearing filed in response to your initial testimony?

A.24. Yes. I have reviewed his written testimony dated August 15, 2007.

Q.25. Do you agree with Mr. Anagnostopoulos ' testimony?

A.25.. No. I disagree with Mr. Anagnostopoulos' testimony in several respects.

Q.26. Please describe your first disagreement with Mr. Anagnostopoulos.

A.26. First, I think it is important to clarify that STV's request for air sampling is not based on an assumption that the air pathway is a significant contributor to peak exposure for humans (A7 among other places). Our request for air sampling is based on the scientific principle that one can not decide about the relative contribution of any pathway without at least some evidence. Even Mr. Anagnostopoulos points out that "the air pathway is nearly always a potential pathway for nearly any contaminant and situation." (A8). Moreover, the regulatory period of concern for cumulative exposure in a restricted release scenario is quite long (1000 years). Therefore, STV requested that the Army conduct air sampling before, during and after a controlled burn, and in a few seasons, in order to assess whether the air pathway is a potential contributor to cumulative exposure for humans or other biota.

Should the air sampling prove the Army and SAIC's unsupported assumptions that the air pathway is not significant, we would be happy to agree with them, and support their decision to ignore the air pathway from that point on. However, we strongly believe that one draws conclusions based on data, not on unsupported beliefs. For the same reason that air sampling is conducted for the HASP ("for the purposes of collecting negative data" [A8], or, in other words, to make sure that the air pathway is not contributing exposure to the workers"), STV is requesting at least a baseline of air sampling to make sure that the air pathway is not contributing exposure that would be potentially significant over time to the humans and biota who live, work or hunt on or around JPG.

Q.27. Please describe your next concern with Mr. Anagnostopoulos' testimony.

A.27. Mr. Anagnostopoulos says that "STV has not identified these prime conditions at JPG" (A8) with regard to our assertion that the every three years (or more frequent) burns could contribute to migration of DU-containing dust into the air. In fact, I have personally seen the ground a couple of weeks following a burn that included the DU Area, and there is documentation published by the USFWS that details the use of, reasons behind, and scheduling for the controlled burns in the Big Oaks National Wildlife Refuge ("Big Oaks National Wildlife Refuge Fire Management Plan," USFWS, March 2001).

Q.28. Have you read Mr. Anagnostopoulos' testimony regarding the significance of the Whicker study of the air dispersion of radionuclides after burns at the Los Alamos National Laboratory (LANL)?

A.28. Yes.

Q.29. What is your opinion of Mr. Anagnostopoulos' responding testimony regarding the Whicker study?

A.29. I would note that Mr. Anagnostopoulos has generated some very nice calculations that would imply that the risk to a hunter who visits JPG on occasion is relatively low when considering the air pathway alone. I would also note, however, that he recognizes that burning can have (and has been demonstrated to have) a significant effect on the amount of DU dust re-suspended in air, and that this increase in DU-contaminated dust can be detected at a distance that goes well beyond the distance from the DU Area to the boundaries of JPG. As Mr. Anagnostopoulos points out in A15, LANL is much larger than JPG. And since the increased resuspended DU was detected at the boundaries of LANL, clearly this indicates that the resuspended DU from the burning at JPG will also be detectable well beyond the boundaries of JPG.

I would also remark that Mr. Anagnostopoulos' maximum load calculations demonstrate that at LANL, the air pathway alone could conceivably increase an individual's peak exposure to DU following a burn to well over half of the regulatory limits of the allowable increase in exposure to radioactivity (ie 14 mrem/yr [A9] compared to the regulatory allowable excess exposure of 25 mrem/yr), and that "the study did estimate that potential doses to occupational workers at LANL increased by 38%" (A8). It is important to point out that it is only the comparison to the regulatory limit that is relevant, not the comparison to one's exposure to radiation from any and all other sources (A15).

Q.30. Do you have any other concerns with Mr. Anagnostopoulos testimony?

A.30. I have another concern that Mr. Anagnostopoulos seems to forget that there are year round on-site federally employed workers above the firing line, and volunteers who spend more than just a few hours during hunting season in the area. For these people, contrary to Mr. Anagnostopoulos' assertion, it is reasonable to assume that they will spend an entire working year in or near the controlled burn areas at JPG..." (A9). In fact, these workers do indeed spend entire working years in and near the controlled burn areas at JPG, and these workers are the ones who monitor the burns and make sure they stay controlled. Further, families live year round in the houses that line the east and west boundaries of JPG, the areas closest to the DU Area, and those parts of the cantonment area (below the firing line) that have been converted to residential use. With continuity in the identity of these persons over time, they could also have cumulative exposures through the air pathway over time that would be significantly greater than that of the occasional visitor or even transient resident in the JPG area.

In A19, Mr. Anagnostopoulos points out that "the airborne concentration will generally decrease with increasing distance from the source, following a general inverse-square relationship." This is true, in an ideal situation in which no outside forces affect the distribution of the resuspended particles (and where gravity does not pull down the heavier particles first, the lighter particles later). However, no outside situation reflects such an ideal situation. In a situation with directional wind flow, the wind stream can direct a majority of the contamination, sometimes even without much dilution except at the edge of the windstream or until the

windstream hits a cross-wind. This effect on the "undisturbed" spherical dispersion of small particulates from a point source is built into the gaussian plume model put forth by the EPA and refered to by Mr. Anagnostopoulos. This can be visualized by comparing the dispersion of a drop of dye in a still water bath, and comparing this to the migration and slow dispersion of a drop of dye in a smoothly flowing water stream. Thus, the assumption of reduction of the airborne concentration with the square of the distance is only a first order ideal approximation, and not valid for environmental situations.

Finally, should modeled calculations of air pathway exposure, as determined by realistically carried out confirmatory air sampling, prove to be insignificant, both in terms of peak and cumulative exposures, STV would concede to the Army that from that point forth, the air pathway could be dropped from additional consideration. In this case, the question is not whether the air pathway contributes the full allowable regulatory peak exposure of 25 mrem/year but whether the air pathway contributes any significant amount to the total excess exposures to radioactivity from JPG-derived anthropogenic sources of DU. Therefore, I still maintain that the Army should do confirmatory air sampling that includes, for example, two week accumulation times, during dry periods before a burn, during a burn, after a burn, and during the dry part of the summer when the ground vegetation has died back from drought periods.

V. Response to Staff Witness Adam Schwartzman

Q.31. Have you reviewed the testimony of Mr. Adam Schwartzman filed on behalf of the

Staff in this proceeding in response to your initial testimony?

A.31. Yes. I have reviewed his undated written testimony which I received on August 21, 2007.

Q.32. Does Mr. Schwartzman correctly represent your initial testimony?

A.32. No. Mr. Schwartzman appears to have misread the STV testimony. Mr. Schwartzman repeatedly states, and is responding to, an imagined request for "a full-time air sampling program at JPG." (A8, A10, A17) This is an incorrect reading of the STV testimony and of all the prior requests made by STV during meetings and conference calls. STV is requesting sufficient air sampling that will enable the Army and interested parties to ascertain whether the air pathway contributes enough JPG-related anthropogenically sourced radiation exposure from the residual DU at JPG to warrant including or excluding the air pathway from future modeling of risk associated with exposure to the residual DU at JPG. We are merely asking for appropriately generated confirmatory air sampling, not a full scale or full time air sampling program, unless the confirmatory sampling indicates that the air pathway contributes a significant proportion of the total estimated exposure to DU from all sources to any critical receptor / target organism / critical group over the extended period regulatory concern (i.e., 1000 years) associated with a restricted release decommissioning program.

Q.33. Do you have any other concerns about Mr. Schwartzman's testimony?

A.33. Yes, I have two additional concerns.

First, Mr. Schwartzman reasonably examined the air sampling data at APG to bring it to bear on the JPG situation. However, Mr. Schwartzman did not recognize that APG is a

much moister ground situation than is found at JPG, especially during dry springs, summers, falls, and even winters with little snowpack. Due to the relatively high clay content of the soil, and the fact that JPG rests almost directly on karst, the soils at JPG and southern Indiana in general do not naturally retain water for long periods of time without consistent periods of rainfall. In fact, it is due to this inability to retain large amounts of water that southern Indiana, including JPG, is prone to seasonal spring, and frequently fall, flooding as the water can not sorb to the soil, the karst ridden bedrock fills with water quickly, and the water table rises dramatically within short periods of time (a few hours or less, depending on recent weather and the amount of rain per hour). Thus, there a long periods of time during most years when the areas around and within JPG could best be described as arid or sere, or at the very least, very dry. Thus the comparison to APG only holds during wet years, and the comparison (made here and elsewhere) to LANL, holds better during dry years.

Second, I would like to again make the point that the comparison made by Mr. Schwartzman and Mr. Anagnostopoulos to natural atmospheric radiation exposure is not relevant here. Only the comparison to the regulatory limits of the increased allowable exposure to radiation due to the residual DU left on the site (JPG) and generated initially by anthropogenic activity, to whit the Army's DU testing program, matters here.

VI. Response to Staff Witness Dale Condra

Q.34. Have you reviewed the testimony of Mr. Dale Condra filed in this proceeding on behalf of the Staff in response to your initial testimony?

A.34. Yes. I have reviewed his undated written testimony I received on August 21, 2007.

Q.35. Do you have concerns about Mr. Condra's testimony?

A.35. Yes, I have two concerns about Mr. Condra's testimony.

Q.36. What is your first concern about Mr. Condra's testimony?

A.36. Mr. Condra premises his comments on the comparison of DU in contaminated deer to the DU in background deer samples, presumably those from the Background Hunting Zone. However, as discussed in detail in response to Mr. Barta's comments, without tracking data, and given that most of the BHZ samples were taken months (and a season) apart from the DU Area data, the Army and SAIC can not demonstrate whether the two sets of deer samples are in fact from the same or an overlapping population. Deer do migrate 5 miles between seasons (see citations in response to Mr. Barta). If there is any likelihood that the populations overlap, as there is, then there is no justification for using the BHZ deer samples as background, and there is no true background sample set for this study.

According to the definition of "background radiation" in NUREG 1757: "Background radiation does not include radiation from source, byproduct, or special nuclear materials regulated by NRC (see 10 CFR 20.1003)." *See* NUREG–1757, Vol. 1, Rev. 2, p. xxvii. Thus, if the deer samples taken in the BHZ area were from deer that are also exposed via the DU Area, these deer samples do not qualify as background samples and are an inappropriate comparison group.

Q.37. What is your second concern about Mr. Condra's testimony?

A.37. Mr. Condra acknowledges that there are problems with the duplicate samples. ("While the concentrations of the duplicates may not be statistically equal..." [A7]). He then reverts back to the argument that there isn't a problem anyway because (to paraphrase what he says in A7) the concentrations of DU found in the DU Area deer samples are the same as those in the BHZ deer samples (his "background"), so there is no elevated DU in the DU Area deer compared to background. However, first, the sample data itself is a problem, as Mr. Condra acknowledges. Second, the Army and SAIC have yet to prove that the BHZ deer and the DU Area deer are, indeed, separate populations, so Mr. Condra cannot compare the two supposedly separate groups to conclude that the DU Area deer are not taking up DU from the residual DU left in or migrating off the DU Area.

VII. Response to Staff Witness Tom McLaughlin

Q.38. Have you reviewed the testimony of Dr. Thomas Mclaughlin filed in this proceeding on behalf of the Staff in response to your initial testimony?

A.38. Yes. I have reviewed his undated written testimony I received on August 19, 2007.

Q.39. Do you have concerns about Dr. McLaughlin's testimony?

A.39. Yes, I do.

Q.40. Please identify your concerns about Dr. McLaughlin's testimony?

A.40. First, while Dr. McLaughlin acknowledges that people in the area around JPG do eat deer, he goes on to state that this could be "the only significant completed pathway with the potential to cause a radiological dose detrimental to the public health." (A14). He does not even, like Mr.

Barta, acknowledge that both turkey and squirrel are officially hunted at JPG. Nor does he acknowledge that humans might ingest DU accumulated into aquatic organisms on or off site.

I have been told by students who live in the JPG area that local people eat whatever they can find in the streams that provides enough meat to add to a stew or other dish. That people are not allowed to fish from the streams in JPG is only relevant to the decommissioning scenario which assumes institutional controls endure. Obviously, such a restriction is wholly irrelevant in the scenario in which institutional controls are assumed to fail. Moreover, once it is in the aquatic pathway, like in the air pathway, it is virtually impossible to control the migration of dissolved or particulate DU.

Furthermore, bioaccumulation and biomagnification phenomena result in many orders of magnitude increases in concentrations of that which is bioaccumulated within the bioaccumulating organism compared to the concentration of the contaminant in the water phase. In a single step up the food chain, bioaccumulation can increase the concentration of a contaminant two to three orders of magnitude. Biomagnification of a contaminant through the food chain can lead to increases in concentration of nine orders of magnitude (i.e. a billion fold) or greater. Long lived filter feeding and carnivorous aquatic organisms like fish and crayfish can contain concentrations of a bioaccumulative contaminant (like uranium) that can result in significant exposures for people who regularly eat the organisms.

Additionally, as pointed out by Dr. Barta (A21), deer are not the best bioindicators of DU migration through the ecosystem and into the food webs. Both aquatic filter feeders and

terrestrial vegetation, by Mr. Barta's own words, would be more appropriate indicators to use.

Q.41. Do you have other concerns about Dr. McLaughlin's testimony?

A.41. Yes. Dr. McLaughlin says that "no DU has been detected in ground water, surface water, or sediment outside of the DU impact area, indicating that DU has not migrated outside of the DU. impact area." (A14). In fact, there is evidence that DU may be migrating via the aquatic pathway from a 2002 invertebrate (and other biotic) survey of caves in the Big Oaks National Wildlife Refuge (JPG/BONWR) conducted by Lewis et al and submitted to the USFWS and INDNR. (*See* http://www.fws.gov/midwest/BigOaks/Reports/BONWRReport.doc). In this study, the authors note that within the DU area caves, and only in the DU area caves, the aquatic invertebrates are affected to the extent that whole populations are missing. No expected populations are missing from caves outside the DU impact areas (even those apparently hit directly by munitions), nor from caves in the areas away from the impact areas. Missing populations is a comparatively extreme effect, and one would expect lesser effects at lower exposures away from the DU area. Furthermore, this study provides fresh evidence that DU may be migrating into the aquatic pathway. Once in the aquatic pathway, it is only a matter of time before the DU migrates away from the DU area and off site.

VIII. Conclusion

Q.42. Please summarize your professional opiniton with respect to the overall design of the FSP as it is currently defined and you expect it to evolve, in view of the initial testimony of the Staff and Army witnesses you have rebutted.

A.42. In my opinion, the FSP as designed and as it appears to be being implemented has some major flaws, and will not be sufficient to determine whether even all of the potential exposure pathways for humans (including via ingestion), when summed, will or will not sum to the maximum excess allowable exposure from the residual DU at JPG. In addition, several witnesses' testimony (Mr. Barta, Dr. McLaughlin) made it quite clear that they do not consider it necessary to conduct additional biotic sampling, even for the purposes of estimating risk to humans, even though RESRAD only considers risk from soil contamination, and even though the cave invertebrate survey of Big Oaks National Wildlife Refuge (JPG/BONWR), conducted by Lewis et al (http://www.fws.gov/midwest/BigOaks/Reports/BONWRReport.doc), and submitted to the USFWS and INDNR in 2002, clearly indicates that DU may be migrating through the aquatic pathway and is being taken up by aquatic animals.

In my opinion, the FSP sampling program needs to incorporate both confirmatory air sampling to evaluate whether the air pathway needs to be included in the risk analyses that will be used as the basic for decision making about decommissioning, and also needs to include the additional biotic sampling (in part as laid out nicely by Mr. Barta) that will assess whether any other biota would be impacted by DU contamination for purposes of a Final Environmental Impact Statement associated with the NRC's Record of Decision on the Army's expected submission of a restricted release decommissioning plan for the JPG DU site.

Q.43. Please summarize your professional opinion with respect to the biological and air sampling components of the FSP as it is currently defined and you expect it to evolve,

in view of the initial testimony of the Staff and Army witnesses you have rebutted.

A.43. In my opinion, the Army and Staff wish to minimize all sampling, and rely as much as possible on assumptions that were derived from other sites, and which can not be refuted as there will be little or no reliable site-specific data to test their realism. Given the potential long term consequences of leaving the DU in the ground and allowing it to continue to corrode and migrate through the environment over time (DU, while having only 1/20th of the specific activity of enriched uranium, has a half life of well over a billion years), it would be prudent to make decisions based on real data, not on a belief system established to save the Army money.

Q.44. Does this conclude your testimony?

A.44. Yes, it does.

I affirm, under the penalty of perjury, that the foregoing testimony is true to the best of my knowledge, information and belief.

Diane S Henshel

Diane S. Henshel, Ph.D.