STAFF EXHIBIT 31 RAS 14598

›mas McLaughlin - DU Air Transport Paper

m: "Cloud, Paul D RDECOM" <paul.d.cloud@us.army.mil>
"'Thomas McLaughlin'" <TGM@nrc.gov>
e: 07/18/2005 8:56 AM
ject: DU Air Transport Paper
"Kuykendall, Joyce E RDECOM" <joyce.kuykendall@us.army.mil>, "John J. Welling (john.j.welling@us.army.mil)" <john.j.welling@us.army.mil>, "Frederick Kopp (koppf@ria.army.mil)" <koppf@ria.army.mil>, "Shia Corinne (Shia, Corinne)" <corinne.m.shia@saic.com>

: Joyce forwarded your request to me. Attached is a copy of the document that your have requested. There is one small pen nk addition to the first page where I converted the degrees "C" to degrees "F" for my own information.

D. Cloud
BEC
BTC for JPG
Field Office
410-436-2381 DSN 584-2381
410-436-1409

U.S. NUCLEAR REGULATORY COMMISSION
In the Matter of US Army (Jefferson Proving Ground)
Docket No. 40-8838MLA Official Exhibit No. 31
OFFERED by Applicant/Licensee Intervenor ______
NRC Staff Other ______
IDENTIFIED on ______ Witness/Panel ______
Action Taken: ADMITTED REJECTED WITHDRAWN
Reporter/Clerk ______

DOCKETED
USNRC

October 25, 2007 (2:00pm)

OFFICE OF SECRETARY
RULEMAKINGS AND
ADJUDICATIONS STAFF

Docket No. 40-8838-ML

TEMPLATE = SECY-027

SECY-02

STAFF EXHIBIT 31

Thomas McLaughlin - DU Air Transport Paper

From: "Cloud, Paul D RDECOM" <paul.d.cloud@us.army.mil>
To: "'Thomas McLaughlin'" <TGM@nrc.gov>
Date: 07/18/2005 8:56 AM
Subject: DU Air Transport Paper
CC: "Kuykendall, Joyce E RDECOM" <joyce.kuykendall@us.army.mil>, "John J. Welling (john.j.welling@us.army.mil)" <john.j.welling@us.army.mil>, "Frederick Kopp (koppf@ria.army.mil)" <koppf@ria.army.mil>, "Shia Corinne (Shia, Corinne)" <corinne.m.shia@saic.com>

Tom: Joyce forwarded your request to me. Attached is a copy of the document that your have requested. There is one small pen and ink addition to the first page where I converted the degrees "C" to degrees "F" for my own information.

Paul

Paul D. Cloud
JPG BEC
OSD BTC for JPG
NCR Field Office
TEL: 410-436-2381 DSN 584-2381
FAX: 410-436-1409

Mail Envelope Properties (42DBA6DE.5CF : 8 : 5583)

Subject:	DU Air Transport Paper
Creation Date	Mon, Jul 18, 2005 8:55 AM
From:	"Cloud, Paul D RDECOM" <paul.d.cloud@us.army.mil>
Created By:	paul.d.cloud@us.army.mil

Recipients

nrc.gov
 twf4_po.TWFN_DO
  TGM (Thomas McLaughlin)

saic.com
  corinne.m.shia CC (Corinne) Shia Corinne (Shia)

ria.army.mil
  koppf CC (Frederick Kopp (koppf@ria.army.mil))

us.army.mil
  john.j.welling CC (John J. Welling (john.j.welling@us.army.mil))
  joyce.kuykendall CC (Joyce E RDECOM Kuykendall)

Post Office	**Route**
twf4_po.TWFN_DO	nrc.gov
	saic.com
	ria.army.mil
	us.army.mil

Files	**Size**	**Date & Time**
MESSAGE	351	Monday, July 18, 2005 8:55 AM
TEXT.htm	1249	
DU Airborne Transport.pdf	1347755	
Mime.822	1847865	

Options

Expiration Date:	None
Priority:	High
ReplyRequested:	No
Return Notification:	None
Concealed Subject:	No
Security:	Standard

Date: January 13, 2005

To: Paul Cloud, Jefferson Proving Ground (JPG) BRAC Environmental Coordinator and Joyce Kuykendall, Radiation Safety Officer, Radiation Program Manager/Radiation Safety Officer RDECOM

From: Corinne Shia, SAIC

cc: Joe Skibinski, Steve Snyder, Mike Barta, Todd Eaby, MD Rahman, Bruce Murray, Seth Stephenson, SAIC

Subject: Airborne Transport of Depleted Uranium (DU) and Site Characterization Needs

The following discussion provides background on the potential for the release and atmospheric transport of DU in fires. Prescribed burns have been and are being conducted at JPG in support of resource management objectives in areas that contain both unexploded ordnance and DU penetrators. The purpose of this discussion is to identify if the DU transport through air is a potential concern at JPG and if further characterization is necessary.

INTRODUCTION

Airborne transport of uranium involves particles. Vaporization is not a significant transport route because uranium metal has a boiling point of 3818°C. Powdered uranium metal may burn spontaneously in air, but larger pieces of metal, such as penetrators, require a heat source ranging from 700°C to 1000°C to produce ignition. A DU projectile creates very fine particles of uranium oxides (typically 75 percent U_3O_8 and 25 percent UO_2) upon impact or burning. These particles settle according to Stokes Law. The larger particles [> 5 micron] settle rapidly and travel only short distances through air because they are so dense (specific gravities of 8.3 and 10.96, respectively) (AEPI 1994).

Aerosols of DU may be formed by the impact of a DU projectile (especially hard targets) in a fire involving DU, or through resuspension of particles deposited on the ground or other surfaces by activities causing a disturbance. Such aerosols may be inhaled by personnel close to or downwind of the source.

There are concerns about DU transport in the smoke generated during controlled burns at JPG and subsequent doses to receptors via this pathway. Prescribed burns and wildland fires were an annual occurrence throughout much of the southern portion of the area North of the Firing Line and now occur under the direction of U.S. Fish and Wildlife Service (FWS), which manages this portion of JPG (now referred to as the Big Oaks National Wildlife Refuge).

Records documenting the extent of the Army's prescribed fires at JPG are available from 1981 to 1997. Annual prescribed fires were primarily conducted in the spring but occasional fall fires are recorded. Total area burned varied from a high of approximately 15,000 acres in 1981 to a low of 1,000 acres in 1988. Due to Army personnel constraints no burns were conducted in 1994 & 1996. Beginning in spring 1998, the FWS initiated its prescribed fire program with a 4,000 acre burn. The FWS continued its prescribed fire program in 1999 with a 7,400 acre burn. The FWS presently conducts these burns in accordance with procedures and controls identified in the Fire Management Plan. These protocols include measures to prevent risks to potential onsite personnel and offsite receptors. These annual events may involve up to four fire management units, two of which are in the DU Impact Area (FWS 2001).

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.

RELATED RESEARCH AND FIELD STUDIES

There is some evidence that DU and other natural and anthropogenic radionuclides could be transported considerable distances and result in small doses to receptors due to physical disturbances (Kerekes et al. 2001; and Royal Society 2002a and b). Total radioactivity increased in smoke from fires related to battle (Royal Society 2002b), controlled burns, and wildfires (Argonne National Laboratory 1998 and 2000; Johansen et al. 2001; and Kraig et al. 2001a and b), but the increased radionuclide concentrations did not result in significant doses to receptors. For example, Kraig et al. (2001a and b) showed that the estimated dose to firefighters at the scene of a fire that lasted several days was approximately 0.2 mrem, whereas the estimated dose to people away from the fire scene was approximately 0.06 mrem. These small increases in doses to various receptors were dominated by naturally occurring radioactive materials, such as uranium in soils and/or worldwide fallout (Kerekes et al. 2001; and Royal Society 2002b).

The Kraig et al (2001) research assessed three potentially exposed receptors to determine the potential radiological impacts of the May 2000 Cerro Grande fire itself and of any radionuclides of Los Alamos National Laboratory (LANL) origin that may have been dispersed during the fire (Kraig et al 2001). Several explosive testing areas within the LANL used uranium and depleted uranium for testing from 1949 to 1970.

Three doses were calculated: (1) hypothetical maximally exposed firemen or volunteer who was working actively in the Los Alamos area throughout the worst of the burn duration, (2) the maximally exposed member of the public outside Los Alamos; and (3) a fireman or other worker in the vicinity of AIRNET (LANL's ambient air monitoring network) Station #23 in Mortandad Canyon where elevated levels of LANL-derived airborne uranium occurred during the peak of the fire (Kraig et al 2001). The results of this assessment indicated the following:

- **Maximally Exposed Person Within Los Alamos Area** - No health effects are expected from the short-term increase in natural radioactivity associated with the Cerro Grande fire. There was no measurable increase in LANL-derived airborne radionuclides in the Los Alamos town-site or residential areas during the fire.

- **Maximally Exposed Person Outside the Los Alamos Area** - The doses from the three uranium isotopes were less than 0.008 mrem and is insignificant when compared with the approximately 360 mrem dose received each year from natural background radiation in northern New Mexico, primarily from cosmic radiation and naturally occurring radioactive materials in soil and food. The calculations indicate that the doses are insignificant. No health effects are expected to occur as a result of radiological intakes during the Cerro Grande fire.

- **Worker Exposed to Elevated Uranium Near the AIRNET Station** - Sixty hours of intake at the concentrations of uranium at AIRNET Station #23 would have resulted in an intake of 0.0017 mg, several orders of magnitude below the MRL of 1.2 mg assuming a breathing rate of 2.5 m3/hr. No radiological or toxicological health effects are expected from these potential exposures.

Additional relevant data to JPG regarding fires where DU penetrators are present include a series of studies completed for Aberdeen Proving Ground (Argonne National Laboratory 1998 and 2000 and APG 2001). Argonne National Laboratory (1998) used atmospheric dispersion computer models to evaluate the potential for human health impacts from exposure to contaminants that could be dispersed by fires on testing ranges at Aberdeen Proving Ground. The screening level assessment did not estimate actual human health risks. One of the contaminants present in soil and vegetation as a result of past operations was DU. In this study, the computer plume model, FIREPLUME, was used to predict ground level concentrations resulting from releases of hazardous materials from a forest fire. The primary fire scenario was represented by a 100-m line source of fire occurring in 25 acres of either forest or grassland. Three classes of meteorological stability were considered (Classes A, D, and E). The maximum release concentration for DU was 6.58×10^{-5} milligrams per cubic meter (mg/m^3). This exposure level was four orders of magnitude lower than the non-carcinogenic air screening levels for an adult and child of 0.9 and 0.44 mg/m^3, respectively. The carcinogenic air screening level for DU was not calculated because it is known to be lower than the non-carcinogenic risk (Davis 1990).

This study (Argonne National Laboratory 1998) concluded that range fires at APG do not pose a significant health risk to workers or surrounding populations. This 1998 report was modified in October 2000 (Argonne National Laboratory 2000) to include actual air emissions data from a controlled burn. FIREPLUME was used to calculate estimated ground-level contaminant concentrations during a range fire. Exposure levels were then estimated to evaluate human health impacts. The model-predicted concentrations were one to two orders of magnitude greater than the field measured concentrations. This 2000 study also concluded that the risk of adverse health from the mobilization of contaminants from range fires was extremely small.

In a more recent study (Aberdeen Proving Ground [APG] 2001), air emissions sampling was conducted during the course of three controlled burns at APG and the results were assessed to determine the potential impacts to human health. Air sampled were analyzed for gross alpha and beta activity and specific radionuclides by gamma spectroscopy and compared to radionuclide cocnetration limits indicated in Table 2 of Appendix B 10 CFR Part 20. At all three sites, the level of airborne radioactivity could not be distinguished from ambient concentrations and were considered not to pose a health risk.

RECOMMENDATIONS

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. The benefit/cost ratio of an air sampling program is extremely low (i.e., the benefits are small and the costs of the program high). Therefore, an air monitoring program is not recommended given the low probability of DU release and transport and the negligible effects on receptors.

REFERENCES

Abbott, D. Review of Environmental Monitoring Data at U.S. Army JPG, Madison, Indiana. Prepared by EG&G Mound Applied Technology, Ohio. July.

Aberdeen Proving Ground (APG). 2001. Controlled Burn Air Sampling Technical Report, APG, MD. Final. Prepared by General Physics Corporation. August.

Army Environmental Policy Institute (AEPI). 1994. Health and Environmental Consequences of DU Use by the US Army. June.

Argonne National Laboratory. 2000. *Potential Health Impacts from Range Fires at Aberdeen Proving Ground*. Draft. Prepared by Argonne National Laboratory, Ill for the U.S. Army Garrison, Aberdeen Proving Ground, MD. October.

Argonne National Laboratory. 1998. *Potential Health Impacts from Range Fires at Aberdeen Proving Ground*. Report ANL/EAD/TM-79. Prepared by Argonne National Laboratory, Ill for the U.S. Army Garrison, Aberdeen Proving Ground, MD. March.

Davis. 1990. Environmental Assessment for Testing Uranium Penetrator Munitions at U.S. Army Combat Systems Test Activity, Aberdeen Proving Ground, Maryland.

FWS (U.S. Fish and Wildlife Service). 2001. Fire Management Plan. Big Oaks National Wildlife Refuge, Madison, Indiana. March.

Kerekes, A., Capote-Cuellar, A., and Koteles, G. J. 2001. "Did NATO attacks in Yugoslavia cause a detectable environmental effect in Hungary?" *Health Physics* 80:177–178.

Kraig, D. H., Buhl, T. E., Eberhart, C. F., and Gladney, E. S. 2001. *Updated Calculation of the Inhalation Dose from the Cerro Grande Fire Based on Final Air Data*. Los Alamos National Laboratory Report, LU-UR-01-1132, Los Alamos, New Mexico.

U.S. Army. 1986. Request to Amend NRC License SUB-1436 and SUB-1299. Amendment 1. April 10.