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14. ABSTRACT: Jet propulsion fuel 8 (JP-8) has recently been recognized by the Department of Defense as the single largest chemical exposure for its personnel. The primary aim of the project is to conduct an epidemiological field study to examine the relationship between JP-8 fuel exposure and adverse neurological outcomes in military personnel working in a cold climate environment. The research objectives include 1) determination of the individual service member's level of exposure to JP-8 components while carrying out his/her job tasks, as measured by urinary and dermal biomarkers of exposure, and 2) examination of whether acute, or cumulative exposure to JP-8 is significantly associated with hypothesized neurocognitive and neurophysiologic performance outcomes. The project has two phases: Tier I is to conduct onsite exposure assessment techniques to fully characterize JP-8 exposure parameters in the military occupational field setting required for the planned field study; Tier I1 is the conduct of the full-scale neuroepidemiology field study to examine predicted dose-response relationships. The field study is being carried out with military (Air Force) personnel. Working groups have been convened and currently, the Tier I phase is being planned.						
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Introduction

Jet propulsion fuel 8 (JP-8) has recently been recognized by the Department of Defense as the single largest chemical exposure for its personnel. The primary aim of the project is to conduct an epidemiological field study to examine the relationship between JP-8 fuel exposure and adverse neurological outcomes in military personnel working in a cold climate environment. The research objectives include 1) determination of the individual service member's level of exposure to JP-8 components while carrying out his/her job tasks, as measured by urinary and dermal biomarkers of exposure, and 2) examination of whether acute, or cumulative exposure to JP-8 is significantly associated with hypothesized neurocognitive and neurophysiologic performance outcomes. The project has two phases: Tier I is to conduct the onsite exposure assessment techniques to fully characterize JP-8 exposure parameters in the military occupational field setting required for the planned field study; Tier II is the the conduct of the full-scale neuroepidemiology field study to examine predicted dose-response relationships. The field study is being carried out with military (Air Force) personnel.

Body

Table 1 presents the timetable for the approved Statement of Work (SOW for the 20-month project.

Table 1. Approved SOW for 20-month project

Tier I Phase	Months 1-4	Task 1	-Plan & conduct exposure assessment study (Tier I study). -Analyze area and personal exposure samples from Tier I study.
	Months 4-6	Task 2	-Convene Working Groups: to plan and finalize logistics and procedural aspects for the Tier II study.
Tier II Phase	Months 7-12	Task 3	-Conduct Tier II neuroepidemiology field study. -Initiate analyses of environmental and biological samples from Tier II study. -Perform data management tasks to integrate multiple data sources.
	Months 13-15	Task 4	-Complete analyses of environmental and biological samples.
	Months 16-20	Task 5	-Complete data analyses of exposure-outcome hypothesis relationships. -Prepare Final Report and manuscript(s).

In this report, we provide a status report documenting work to date on the first 8 months of the funded project period: 1 Nov 2005 to 30 June 2006.

The project funding was awarded 1 Nov 2005. As of 30 June 2006, *Task 1* and *Task 2* are currently in progress. They are not completed yet, as there were administrative delays in the various human subjects' approval processes. Namely, the HSRRB granted its approval in April 2006 for the USARIEM Human Use Review Committee (HURC) to serve as the oversight research committee for this project. And, review and approval of the study protocol by the Air Force Research Laboratory (AFRL) IRB and subsequently the Air Force Surgeon General's Office was completed in May 2006.

These delays, which caused a lag of approximately 6 months time, have meant a further delay in completing the Tier I study data collection (*Task 1*) given the seasonal timing requirement of this study. The study design calls for carrying out the Tier I (as well as the Tier II) study phase in a cooler temperature environment, namely in the winter months. We had originally planned to conduct the Tier I phase in early Winter 2005, but now, our current working plan is to conduct Tier I in late Fall/early Winter 2006.

Before the official start of the funding period, the PI made contact with the NH Air National Guard at Pease AFB in Portsmouth, NH as they have a small shop that performs repair and maintenance of fuel cells and therefore have personnel working with jet fuel regularly. In late October 2005, the PI and Boston-area study team members visited Pease AFB to observe the work procedures involved in fuel cell maintenance and the opportunities for potential exposure to JP8.

In January 2006, the PI, Project Manager, and core Exposure Assessment Methodology Working Group members (McClellan, Herrick, and Allen) made a site visit to Grand Forks Air Force Base (GFAFB) to meet with study POCs and tour the various shops in which there are varying levels of JP8 exposure.

A letter of support from GFAFB for this study has been provided. (See Appendix.)

While visiting GFAFB, it became evident that an additional performance site may need to be included in the Tier II phase, as GFAFB may not have sufficient numbers of persons working in jobs with higher levels of JP8 exposure. The PI is currently pursuing contact with other AF bases, and also Army posts, in colder weather locations that employ larger numbers of persons involved in jobs with high JP8 exposure.

Over the past 8 months, the Boston area members of the Exposure Assessment Methodology Working Group have met monthly to plan and discuss the logistical, analytical, and scientific issues related to the Tier I phase (part of *Task 2* activities). Additionally, several in-person meetings with the Director and staff from the Harvard University Organics Laboratory (the lab contracted to conduct the analytical measurements for both Tier I and II phases) have taken place. The Laboratory is in the process of finalizing a Technical Methods Report document that will describe the planned analytical procedures to be followed in conducting the environmental and biomonitoring sample analyses in this study. There have been several recent publications describing the exposure assessment results from the earlier Air Force study of JP8 exposure (Chao et al, 2005a; 2005b; Kim et al., 2006). As a result, the Exposure Assessment Methodology Working Group also has consulted with several researchers involved with the

earlier Air Force study to better understand the assessment and analytical methods used in that study.

Members of the Data Management and Logistics Working Group have met on an *ad hoc* basis and discussions between the PI and researchers at ARIEM regarding cold weather physiology are on-going (part of *Task 2* activities).

Besides the delay in the study timetable, no additional delays or problems are foreseen with regards to carrying out the approved SOW tasks.

Key Research Accomplishments

Below is a bulleted list of the accomplishments over this study period:

- The Exposure Assessment Methodology Working Group, with Core members from the Boston area, has been meeting monthly since November 1. The Data Management and Logistics Working Group has been meeting on an *ad hoc* basis.
- The PI and Study team members visited Pease AFB in late Oct 06.
- Researchers involved with the earlier AF research study involving JP8 exposures have been consulted about methods and procedures they used. Several of these researchers have indicated willingness to consult and provide advice on a semi-regular basis.
- The PI and Study team members visited GFAFB in Jan 06.
- The HSRRB granted its approval in April 2006 for the USARIEM Human Use Review Committee (HURC) to serve as the oversight research committee for this project.
- Review and approval of the study protocol by the Air Force Research Laboratory (AFRL) IRB and subsequently the Air Force Surgeon General's Office was completed in May 2006.
- The Harvard University Organic laboratory is finalizing a report on the analytical methods and procedures they will follow for conducting the environmental and biomonitoring sample analyses in this study.

Reportable Outcomes

1. Reports, manuscripts, abstracts

A Technical Methods Report, describing analytical methods and procedures to be followed for the environmental and biomonitoring sample analyses, is being prepared.

2. Research training opportunities

One Boston University School of Public Health doctoral student is currently working on this project. We anticipate that at least one additional doctoral student will also join the study team when we begin the field data collection phases.

3. Funding applications based on work supported by this award

Henk C. Trap, BSc, from TNO Defense Security and Safety (The Netherlands) has recently submitted a proposal to USAMRMC for funding consideration. The project is titled "Profiling Jet Fuel on Neurotoxic Components with 'Comprehensive Two-Dimensional GC'". In this project, the researchers propose to screen samples of jet fuel for the presence and mixture composition of suspected neurotoxic compounds using a relatively new and effective instrumental technology, 'Comprehensive two-dimensional GC', in combination with a Time of Flight Mass spectrometer (ToF-MS). Experiments will be performed to monitor the vapor concentration time profile of a maximum of 20 compounds of interest specifically in JP-8. On the basis of these results, exploration will proceed to determine whether this information can be used to estimate a 'toxic load' for several neurotoxic compounds following exposure to JP-8 vapor under realistic conditions. The PI plans to consult on this proposed project.

Conclusions

The work on this funded project is on-going. Although there have been delays due to administrative and seasonal constraints, no additional delays or problems are foreseen with regards to carrying out the approved SOW tasks. When completed, the study will provide important occupational health and exposure assessment information concerning JP8.

As stated in the recent report (National Research Council, 2003), field research studies that combine the in-depth assessment of on-the-job exposure levels with concurrent assessment of adverse health effects are needed and will contribute significantly to the knowledge of the subclinical effects of both acute and chronic exposure to occupational solvent exposures.

References

Chao YC, Gibson RL, Nylander-French LA. Dermal exposure to jet fuel (JP-8) in Air Force personnel. Ann. Occup. Hyg. 2005a; 49, 639-645.

Chao YC, Kupper LL, Serdar B, Egehy PP, Rappaport SM, Nylander-French LA. Dermal exposure to jet fuel JP-8 significantly contributes to the production of urinary naphthols in fuel – cell maintenance workers. Environ. Health Perspect. Doi: 10.1289/ehp.8288, Online 29 Sep 05.

Kim D, Andersen ME, Nylander-French LA. Dermal absorption and penetration of jet fuel components in humans. Toxicol Letters 2006; 165:11-21.

APPENDIX

Letter of support from GFAFB



DEPARTMENT OF THE AIR FORCE

HEADQUARTERS 39TH AIR REFUELING WING (AMC)
GRAND FORKS AIR FORCE BASE, NORTH DAKOTA

14 JUN 2006

MEMORANDUM FOR Dr. Susan P. Proctor, Principal Investigator
Military Performance Division,
US Army Research Institute of Environmental Medicine,
Kansas St., Bldg. 42, Natick, MA 01760

FROM: 319 ARW/CC
460 Steen Blvd
Grand Forks AFB ND 58205-6231

SUBJECT: Grand Forks AFB Letter of Support: "Jet Fuel Exposure and Neurological Health in Military Personnel"

1. I am pleased to support the Department of Defense research study assessing potential exposures from JP-8 jet fuel to include potential exposures to Airmen at Grand Forks AFB.
2. I appreciate your efforts to conduct this research on a non-interference basis while we continue to perform our air refueling mission, during our established work hours, work conditions, and the convenience of personnel involved.
3. I understand that the study has received the required approvals from the Army and Air Force Institutional Review Boards required for human use studies and has been approved and funded by the US Army Medical Research and Materiel Command.
4. The Bioenvironmental Engineering Flight of the 319th Aeromedical Dental Squadron will directly support your coordination with the respective work centers to ensure non-interference and execution of our respective missions during the data collection phase of your study. Contact commercial (701) 747-5597 or DSN (362) 5597, if any questions.

WILLIAM J. BENDER, Col, USAF
Commander

Cc:
319 ADS/SGGB