Medical Concerns Regarding Deployment Exposure Incidents: 2009 Iraqi Lithium Battery Warehouse Fire

FACT SHEET 64-020-0212

Purpose: To document what is known about an incident that occurred during active military operations in Iraq which resulted in potential personnel exposures to hazardous air pollutants. This document is intended to address post-deployment questions of potentially exposed military personnel and their providers.

SYNOPSIS:

This incident involved a week-long fire in July 2009 at a lithium battery warehouse facility near Camp Brooklyn, a Ra Ali contractor-run section near the Bagdad National Airport and the U.S. Camp Victory Complex in Iraq. Anecdotally, reports of visible smoke and odors and the results of field air sampling from about a quarter mile down wind indicated sulfur dioxide (SO_2) was a potential acute hazard concern. The fire was put under control by U.S. contractors and local Iraqis. Field reports indicated that during the response efforts, a hazard zone of 75 meters was established and all responders within that zone had to wear self-contained breathing apparatus (SCBA). The U.S. Army medical assets were advised to be prepared for potential influx of patients to clinics due to the fire. Despite anecdotal indication that some personnel initially reported to clinics for evaluations associated with the fire, no reports of individuals affected by exposures there have been identified. Based on the reported information, the levels of SO_2 did not appear to substantially impact the overall air quality of Camp Brooklyn or the military-run Camp Victory Complex. The PHC assumes that those directly responding were adequately protected with SCBA, and concludes that while some other personnel outside the hazard zone may have been experienced short-term exposures that were mildly irritating to the eyes or respiratory tract, these exposures were not likely severe enough to pose a risk of chronic, long-term health consequences that requiring any follow-up evaluation or medical surveillance. Any individual present at the location during the fire who did seek medical evaluation and treatment may have had a unique experience. The details of such an individual's exposure history should be documented in their individual medical record.

Incident Description:
According to field reports, a fire started at the Ra Ali (contractor) Warehouse near Camp Brooklyn, Iraq, on 24 July 2009. Camp Brooklyn appears to be the name of a contractor operated section of the Camp Victory Base Complex near Bagdad International Airport, Iraq. The fire initiated as a result of lithium batteries that were improperly discharged and stored. The fire burned and emitted a smoke plume until approximately 31 July. U.S. Kellog, Brown, and Root (KBR) contractors and local Iraqis responded to control the fire. Personnel responding were reported to have worn self-contained breathing apparatus (SCBA). The site command and facility engineers established a 75 meter exclusion zone to restrict access by those that were not part of the official response efforts in order to prevent exposure to potential fumes from unknown chemical hazards. Personnel were advised to seek medical care, as needed.

During the response, the U.S. Army 224th Medical Detachment (Preventive Medicine) was requested to perform an air quality assessment of conditions associated with the fire:

On 25 July 2009, preventive medicine (PVNTMD) personnel sampled for sulfur dioxide (SO_2) and nitrogen dioxide (NO_2) using a direct reading instrument (rapid Draeger tests). These substances were considered potential hazards associated with a fire of this nature. The sampling was conducted in an area referred to as the "Bronx" parking lot on Camp Brooklyn, which was about 500 feet downwind from the fire, but still within the smoke plume. The team sampled twice, once around noon and then again 5 hours later. The initial sampling detected the presence of (SO_2), but this pollutant was not detected 5 hours later. The NO_2 was not detected during either sampling time.

On 26 July 2009, a 24 hour ambient air fine particulate matter sample (less than 2.5 micrometers or $PM_{2.5}$) was collected and sent to the USAPHC laboratory for analyses of 10 heavy metals. It was noted that the fire was visibly burning for only 5 of the 24 hours that the sample was collected. Final results of this single sample were

reported after the incident. The results indicated a fine particulate matter level similar to that in most areas of Iraq. The only metal detected above the health screening was cadmium.

Exposure Assessment:
The information and sampling data regarding the exposure levels to personnel are very limited in time, number, and location. The types of pollutants that were sampled for reflect the resources that were available to field personnel and do not represent all the potential combustion products that may have been released during the fire. In addition, the direct field instrumentation used for the SO_2 and NO_2 is of limited precision and sensitivity. Finally, the locations and activities of personnel deployed to the area relative to the plume of the fire were not explicitly documented. Anecdotal reports and pictures indicate that the fire and smoke were visible from a distance and that the smoke direction was towards the Bronx area of Camp Brooklyn. The field assessment concluded that the primary plume was limited to within a few hundred feet of the area. It is not clear if any U.S. personnel in or near the Camp Victory Complex were within that distance.

While the results of the one laboratory sample indicated the presence of $PM_{2.5}$ and cadmium at levels above health-based screening levels, the conservative screening levels are based on continuous exposure every day for 2 weeks to a year. Because the incident lasted only a week, continuous exposures to these hazards were not considered likely. The single direct reading result of SO_2 was at a level that exceeded a short term exposure screening level. This indicates exposures could have resulted in odor or even mild irritation to eyes and respiratory tract during the time of the incident. These effects were consistent with those anecdotally reported.

Though limited, the available sample data and information indicates that fire-related smoke exposures to personnel were of limited duration and severity.

Acute Health Effects and Medical Response:
Acute exposures to SO_2 gas can cause coughing and/or can produce irritation of the eyes, nose and throat. Since this gas is water soluble, it typically penetrates only as far as the nose and throat. Minimal amounts reach the lungs unless the person is breathing heavily, breathing only through the mouth (both conditions potentially present with exertion related to a job), or the concentrations are extremely high (much higher than the one sample obtained during this incident). At high levels, SO_2 can react with moisture on the skin and in the lungs which can cause severe irritation or even burns. Even higher concentrations can cause severe airway obstruction, pulmonary edema (a life threatening accumulation of fluid in the lungs). There is no indication that high level exposure conditions occurred at Camp Brooklyn.

Despite recommendation to collect rosters of personnel who were anticipated to be reporting to the clinics, the USAPHC was unable to verify that any personnel had sought medical care for exposures related to this fire. In addition, no roster of personnel exposed responders was found. Though no documentation regarding any specific individual requiring medical treatment has been identified, it is possible that some individuals sought medical evaluation.

Potential Long Term Health Consequences:
Extremely high, short term exposures that result in severe acute effects such as those described above could result in permanent lung injury. Based on the information provided for this incident, however, it does not appear that such high level exposures occurred. Several human studies have also shown that repeated, long-term exposures to low levels of SO_2 have caused permanent pulmonary impairment; this would not have resulted from this short term incident. However, it is acknowledged that sensitivity varies among people, and that some persons with short exposure to even relatively low concentrations have been found to produce a reversible decrease in lung function and bronchial constriction. For example, asthmatics have greater susceptibility to effects at lower concentrations.

Based on the information reported, the USAPHC has concluded that there is no evidence of risk for specific long term health consequences requiring medical surveillance or post deployment medical follow-up resulting from the lithium battery fire incident. However, this is a general risk characterization that is based on very limited data. If individuals reported specific exposure related acute symptoms or illness during the time of the fire, they may have a situation which requires medical follow-up. Providers or individuals with specific concerns regarding exposures during this incident can contact the USAPHC Environmental Medicine Program for additional medical assistance.

Key public references:

- National Defense Authorization Act (NDAA) Report to Congress for 2009 Activities of the Force Health Protection Quality Assurance Program of the Department of Defense; July 2010
- *U.S. Army Public Health Command Epidemiological Consultation No. 64-FF-064C-07, Mishraq Sulfur Fire Environmental Exposure Assessment: Appendix B – Possible Health Effects Associated with Sulfur Dioxide*
- Toxicological Profile for Sulfur Dioxide; U.S. Department of Health and Human Services Public Health Service; Agency for Toxic Substances And Disease Registry December 1998

If you have questions or have additional information regarding this incident please contact:
U.S. Army Public Health Command's
Environmental Medicine Program (EMP)
USAPHC-EnvironmentalMedicineProgram@AMEDD.army.mil
5158 Blackhawk Road, Aberdeen Proving Ground, Maryland 21010-5403
DSN 584-2714; COMM (410) 436-2714; FAX Extension-4117