Chapter 3

DEPLOYMENT TO AL ANBAR: A SEABEE BATTALION SURGEON'S PERSPECTIVE

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INTRODUCTION

The Naval Mobile Construction Battalion SEVENTEEN (NMCB-17) was mobilized in October 2007 to support Operation Iraqi Freedom. This reserve battalion underwent 4 months of rigorous military training at Port Hueneme Naval Base (Oxnard, CA) and at Fort Hunter Liggett (California) prior to deployment to southwest Asia (SWA). The vast majority of these deployed Seabees performed combat construction projects in Al Anbar Province, Iraq, from February to September 2008.

The medical department consisted of 3 Independent Duty Corpsmen, 14 Navy Corpsmen, and 1 Medical Officer (the author). The medical and command staffs were concerned about the potential negative impact of airborne hazards and dust exposure on the health and operations since measured particulate matter (PM) levels in Iraq frequently exceeded US Environmental Protection Agency standards.[1] There were also published cases of novel respiratory conditions, including eosinophilic pneumonia associated with military operations in this region.[2] Our Seabees might have been more susceptible to respiratory disorders because reservists tend to be older than their active duty counterparts, and military personnel also have higher smoking rates (32% vs 21%) than age-matched civilian controls.[3] Seabees might also have additional novel inhalation exposures unique to their construction duties, including welding, fueling, and vehicle equipment maintenance operations.

The NMCB-17 logged approximately 98,000 km of convoy operations to deliver Seabees and various construction materials to remote project sites. During combat outpost construction operations, Seabees engaged in diverse activities, including

- welding,
- building,
- plumbing,
- electrical work,
- vehicle and earth-moving equipment maintenance and operations,
- drilling,
- concrete work,
- bridge construction, and
- security.

The administration, planning, intelligence, communication, and supply personnel needed to support this high operational tempo of multiple simultaneous construction projects "outside the wire" were conducted by staff working in the Headquarters Company and Combat Operations Center at Al Asad Airbase, Iraq. The PM exposures varied greatly because some Seabees worked and slept exclusively in air-conditioned spaces while others manned gun turrets on convoys, often spending more than 60 hours a week exposed to very high levels of ambient and vehicle-generated dust. The extremely high temperatures, which often exceeded 120°F, made it very difficult to perform construction duties or convoy operations using any type of respirators or masks. As a result, most Seabees used issued cravats to cover their mouths and noses when working outside during dust storms, on high PM days, or in gun turrets.

PREDEPLOYMENT

All mobilized NMCB-17 personnel reported to the Navy Mobilization Processing Center at Port Hueneme Naval Base, and were screened by the author, who also monitored their health and performance during rigorous field exercises at Fort Hunter Liggett before allowing them to deploy to this combat zone. All Seabees were required to maintain Navy weight standards and pass the Physical Readiness Test, which included a timed 1.5-mile run. Only one member with a preexisting respiratory condition was permitted to deploy. This Seabee had recent-onset, well-controlled asthma with medication and was able to work exclusively in an air-conditioned space in Al Asad in close proximity to the Battalion Aid Station and the Combat Support Hospital.

RESPIRATORY CONDITIONS DURING DEPLOYMENT

More than 90% of NMCB-17 Seabees received their medical care at one of two Battalion Aid Stations by an Independent Duty Corpsman, the author, or a Navy Corpsman during convoy operations or at remote construction sites. During the first month of deployment, nonspecific respiratory complaints were frequently observed, including nonproductive cough and nasal congestion. During the first 1–2 months, these minor respiratory complaints were only exceeded by musculoskeletal injuries. However, those visits fell dramatically in subsequent months as these noninfectious maladies were not treated with medications. There were no medical evacuations, referrals to the Combat Support Hospital,

confinement to quarters, or limited duty restrictions from respiratory conditions during this 7-month deployment to SWA. Only one Seabee developed new-onset asthma, which was documented using an EasyOne Spirometer (ndd Medizintechnik AG, Zurich Switzerland), and responded well to albuterol and glucocorticoid inhalers following a brief course of oral prednisone. However, the Seabee with preexisting, well-controlled asthma experienced no exacerbations in Iraq, during field exercises, or while at Port Hueneme. Following demobilization at Port Hueneme, no personnel were transferred to the Medical Hold Battalion in San Diego, California, because of any respiratory conditions.

AIR QUALITY STUDY

During this deployment, colleagues from the US Army Center for Health Promotion and Preventive Medicine (currently the US Army Public Health Command, Aberdeen Proving Ground, MD) supported NMCB-17 efforts to determine if air quality had any negative effect on operations. The PM_{10} levels (10 μm) were measured using a MiniVol Portable Air Sampler (Airmetrics, Eugene, OR; Figure 3-1) operating at 5 L/min for 24 hours at Al Asad Airbase. Samples were obtained and deposited onto quartz filter discs every 6 days from April through August 2008 on nine separate occasions when the author was not traveling outside the base and independent of weather conditions. Calibration of the MiniVol Portable Air Sampler and the collection techniques were identical to previously published methods and verified by Colonel Ron Ross, US Army Public Health Command scientist at Al Asad.[4] The author performed all of the sampling and shipped the filters in sealed plastic cassettes in two separate batches to the US Army's Aberdeen Proving Ground laboratories in Maryland. Metal analysis was performed by an acid extraction method of PM samples using inductively coupled plasma-mass spectrometry.[5,6]

RESULTS

The average and range of PM_{10} measurements from the separate samples were similar to results reported in other bases in Iraq previously by Englebrecht.[4] In addition to PM_{10} measurements, the following metals were also analyzed in the samples after acid digestion: antimony, arsenic, beryllium, cadmium, chromium, lead, manganese, vanadium, and zinc.

- PM (10 μm) concentrations averaged 190.92 μg/m³ (range: 13.1–576.8 μg/m³) (n = 9).
- Detection of the following metals from Al Asad Airbase Iraq was as follows:
  - <0.6980 μg/m³ zinc;
  - <0.2792 μg/m³ manganese and vanadium;
  - <0.1396 μg/m³ antimony and lead; and
  - <0.0697 μg/m³ arsenic, beryllium, cadmium, and chromium.

The "<" symbol indicates the lowest reliable level of detection for each group of metals. These low levels of metals measured in our PM_{10} samples were reassuring that inhalation exposure to these metals was unlikely to cause adverse health outcomes. The potential health hazards of these inhalation metal exposures is referenced in the Military Exposure Guidelines based on information also derived from US Environmental Protection Agency guidelines and workplace exposures.[7]

However, the National Research Council (Washington, DC) and the Institute of Medicine (Washington, DC) reviewed this method of measurement on PM_{10} samples that often exceed >150 μg/m³ and raised concerns that these detection limits may have been set too high because most of the prior samples reported from southwest Asia (including Joint Base Balad) also had nondetectable levels of metals of interest.[8,9] The author also noted that, on days with poor visibility, after 24 hours the discs were overloaded with such a large volume of dust that the PM_{10} levels were likely be underestimated. In the future, replacing the discs every 6 hours on high dust days may yield more accurate PM_{10} results and metal measurement values.

Figure 3-1. The author using the MiniVol Portable Air Sampler (Airmetrics, Eugene, OR) during a 2008 dust storm in Al Asad, Iraq.

SUMMARY

Despite high PM_{10} particulate exposures, which on average exceeded the 1990 Clean Air Act US Environmental Protection Agency guidelines of 150 μg/m³ in 24 hours, no serious respiratory conditions were observed during this deployment that affected combat construction operations. The vast majority of construction workers in a Reserve Seabee unit may have also had prior industrial airborne toxicant exposures in their civilian construction or vehicle maintenance jobs, yet they still did quite well during this deployment.

The measured airborne metal exposures from Al Asad Airbase were negligible. However, these findings may differ from other bases within SWA because this sampling was from a single location. We planned on obtaining simultaneous PM samples from our other base in Camp Fallujah, but since the additional MiniVol air sampler could not be repaired, no samples from other regions in Iraq were obtained for analysis**.** We were also unable to obtain measurements from remote construction sites or during convoy operations that probably generated much higher PM levels than we measured from Al Asad Airbase. Furthermore, this air sampling was not performed in close proximity to factories or burn pits that could contribute to higher airborne contaminants.

This author's experience demonstrates that significant respiratory conditions during deployment were minimal among a well-screened, fit population exposed to these high dust levels. However, these findings may not be applicable to other populations (eg, civilian employees and contractors) or military units that allow members with undiagnosed or inadequately treated reactive airway disease to deploy.

Despite the lack of adverse health effects during this deployment from respiratory conditions, the long-term health effects of high $PM_{2.5}$ or PM_{10} exposures could prove more significant. Vanderbilt University Medical Center (Nashville, TN) investigators reported that 49 soldiers underwent video-assisted thoracoscopic lung biopsy that confirmed constrictive bronchiolitis in 38 soldiers who deployed to SWA. Ten of these cases were documented among soldiers who had no sulfur fire exposure.[10] Asthma rates have also been reported to be higher among deployed veterans (Operation Iraqi Freedom/Operation Enduring Freedom) versus nondeployed veterans from one Veterans Affairs medical center.[11] There is a long latency period from exposure to asbestos, beryllium, and the onset of respiratory symptoms among susceptible individuals. The $PM_{2.5}$-μm dust particles are small enough to penetrate the terminal airways and airspaces where they would require macrophage clearance by immune mechanisms.[12] Results from cohort-controlled epidemiology research studies, such as the Millennium Cohort Study, following deployers versus nondeployers should help identify the potential long-term respiratory health consequences of military deployment to SWA.

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