Senate Democratic Policy Committee Hearing

"The Exposure at Qarmat Ali: Did the Army Fail to Protect U.S. Soldiers Serving in Iraq?"

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Good afternoon. I am Dr. Herman Gibb. Thank you for the opportunity to testify before you today. I am testifying today in my personal capacity and do not in any way represent the interests, beliefs or opinions of my employer.

I have a Ph.D. in Epidemiology from the Johns Hopkins University and an M.P.H. in Environmental Health from the University of Pittsburgh. I spent 29 years at the U.S. Environmental Protection Agency (EPA). Most of my time at the EPA was spent at the National Center for Environmental Assessment where I served in the capacities of Assistant Center Director and Associate Director for Health. Based on my experience working at the EPA on risk assessments of hexavalent chromium and my study of chromate production workers, the symptoms reported by some of the soldiers who served at Qarmat Ali are consistent with significant exposure to sodium dichromate.

EPA maintains an online database of risk assessments on over 500 substances, including an evaluation of the potential of these substances to cause cancer in humans. Hexavalent chromium is classified as a human carcinogen. Among those substances that the EPA has classified as carcinogenic to humans and has estimated a cancer inhalation unit risk, the highest risk is that for hexavalent chromium. In 2000, while at the EPA, I was the senior author of two publications on the health risks experienced by chromate production workers at a facility in Baltimore, MD. The first publication reported the results of a mortality study, the second examined the risk of clinical irritation experienced by the workers. The hexavalent chromium

exposure at the facility was primarily from sodium dichromate. For my work on these studies, the EPA awarded me the Agency's Scientific and Technological Achievement Award.

I became interested in studying the group of workers in Baltimore because of the considerable amount of exposure data available for the facility. The group was relatively large – 2,357 males; there were 122 deaths from lung cancer. Hexavalent chromium was found to be significantly associated with an increased risk of lung cancer, even after controlling for smoking. Half of those who developed lung cancer had worked at the facility for less than ten months.

In 2006, based in large measure on our study, the Occupational Safety and Health Administration (OSHA) set a Permissible Exposure Limit (PEL) for hexavalent chromium of 5 micrograms per cubic meter ($\mu g/m^3$) as an 8-hour time-weighted average based on the carcinogenic dose response. The new OSHA PEL reduced the previous PEL by over 10-fold.

Clinically diagnosed symptoms of irritation were found to occur in our study within a relatively short time period after beginning employment. The median time to develop an irritated nasal septum was only 20 days, an ulcerated nasal septum 22 days, a bleeding nasal septum 92 days, a perforated nasal septum 182 days. We recorded 10 different types of clinically diagnosed irritation. What was also remarkable was the high percentage of the group that was diagnosed with signs of irritation. For example, sixty-eight percent of the group was diagnosed at one time or another with nasal irritation.

The signs of irritation which the soldiers and workers experienced at Qarmat Ali are consistent with what we reported in our study. The testimony by the soldiers in the hearing today and by the civilian workers in the previous hearing held on this subject suggest that they are experiencing signs of hexavalent chromium exposure.

A report from the Army's Center for Health Promotion and Preventive Medicine (CHPPM) indicated that blood samples were collected from 137 potentially exposed soldiers and DOD civilians. CHPPM's description of these results is confusing and lacks sufficient detail.

- CHPPM suggests that the chromium in the red blood cells of the vast majority of the individuals in their study are within normal ranges. However, CHPPM notes, in italicized print, that "there are some other literature references that use lower limits." Unfortunately, CHPPM does not specify the literature sources nor do they indicate how low these "lower limits" are. Where did CHPPM get their reference values? How good are these reference values?
- Although CHPPM reports that nearly all of the test results were below the limit of detection, CHPPM also reports that ninety-eight percent of the samples showed chromium levels within the range of 4 to 5 micrograms per liter (µg/L). How is it possible that ninety-eight percent of the samples could be within the range of 4 to 5 micrograms per liter when they report that nearly all the results were below the limit of detection?
- In a 1987 article cited by the National Institute for Occupational Safety and Health (NIOSH), Dr. Angerer and others found that exposures 10X the current OSHA limit will result in a red blood cell level of 0.6 micrograms per liter (µg/L). Assuming Angerer and his co-authors are correct and accounting for at least a 40-day delay in CHHPM's collection of blood samples, the air concentration to which the Qarmat Ali soldiers were exposed could be estimated to be approximately 80 - 200 times the current OSHA limit. Why did CHPPM fail to explore inconsistencies in its data with that of other literature?

These limitations call for greater scrutiny of the CHPPM results.

The samples drawn from some of the soldiers and workers at Qarmat Ali were taken a month after remediation measures were taken to limit the exposure. In its draft Toxicological Profile on Chromium, the Agency for Toxic Substances and Disease Registry (ATSDR) reports that the half-life of chromium in red blood cells is 30 days. In other words, 30 days after the exposure has ended, we would expect to see only 50 percent of the chromium in the volume of red blood cells that would have been there initially. Furthermore, the measurement of chromium in red blood cells is an insensitive method of detecting hexavalent chromium exposure. The measurement of chromium in the red blood cell only captures the hexavalent chromium that makes its way into the cell. It does not measure how much hexavalent chromium may have been inhaled and remained in the nose or lung or was reduced in the body to trivalent chromium which does not get into the red blood cell.

It should be noted that NIOSH, in its draft update on hexavalent chromium states that biomarkers, which would include blood tests, are of uncertain value as early indicators of potential hexavalent chromium-related health effects. Nevertheless, CHPPM still put a great deal of emphasis on the red blood cell analyses from samples taken at least four weeks after possible exposure to hexavalent chromium. An analogy would be like giving a breathalyzer to a person three days after they were pulled over for erratic driving. The toxin would have been eliminated from the body in the intervening period.

Given the limited usefulness of these red blood cell tests, they should not be used as a bottom line indicator of the hexavalent chromium exposure that the soldiers and workers experienced. And they certainly should not be extrapolated to other individuals who were exposed at Qarmat Ali. Nasal perforations, bloody noses, and skin irritation would be far more

telling about the soldiers' and workers' exposure than measures of chromium in red blood cells taken a month after remediation has taken place.

In summary, the symptoms that have been reported by the soldiers in this hearing and by the civilian workers in the previous hearing on Qarmat Ali are consistent with what has been experienced by other workers exposed to hexavalent chromium. Judgment on whether these soldiers and civilian employees were exposed should not be based on measurements of chromium in red blood cells taken 30 days after remediation measures were taken, nor should such results be extrapolated to other individuals who were present at the facility.