Feeling the Heat in Fukushima□□福島第一原発、高温での作業

Cara O'Connell

Between 2012 and 2014 we posted a number of articles on contemporary affairs without giving them volume and issue numbers or dates. Often the date can be determined from internal evidence in the article, but sometimes not. We have decided retrospectively to list all of them as Volume 10, Issue 54 with a date of 2012 with the understanding that all were published between 2012 and 2014.

Asia-Pacific Journal Editors present Cara O'Connell

Most coverage of the plight of Fukushima Daiichi workers has rightly focused on the dangers of radiation exposure. On June 20, it was announced (http://www.yomiuri.co.jp/national/news/20110620-OYT1T00835.htm?from=main1) that another worker, the ninth since the crisis began in March, may have exceeded 250 mSv of radiation exposure, the absolute limit in emergency situations. One individual is reported to have been exposed to over 500 mSv. 115 have been exposed to more than 100 mSv. The Ministry of Health, Labor and Welfare and TEPCO are cooperating (http://www3.nhk.or.jp/news/html/20110627/t10013791061000.html) to organize health checks for Fukushima Daiichi workers, but it is unlikely that this will mitigate serious health problems, including dramatically increased risk of cancer. It is also unclear how potentially much more dangerous internal radiation exposure is being measured.

There are multiple allegations (http://www.shinmai.co.jp/news/20110615/KT110614ETI090012000.html) of safety lapses at the site, including a lack of protective boots and masks used without vital filters. There are also reports (http://mainichi.jp/select/weathernews/news/20110618ddm041040128000c.html) that some workers are not being told their level of exposure, effectively being left in the dark about potential short and long term health effects. In an editorial on June 16, the *Tokyo Shimbun* accused (http://www.tokyo-np.co.jp/article/column/editorial/CK2011061602000067.html) TEPCO and the Japanese government of continuing to take the health of Fukushima workers lightly. Other reportage (http://mainichi.jp/select/jiken/news/20110621ddm041040085000c.html) has played up the transient nature of nuclear work and the difficulty of tracking health effects – TEPCO and the Ministry of Health, Labor, and Welfare cannot locate 30 men who worked at the site after the March disaster.

Radiation, however, is not the only danger facing Fukushima Daiichi workers. In mid-May, a worker in his 60s lost consciousness at the site and died later in hospital. The worker suffered a heart attack, likely brought about by a combination of physically grueling work and advanced age. Incidents like this one raise questions about the nature of the work at Fukushima and what measures can be taken to safeguard the health of workers from factors

other than radiation, a different issue requiring a different response.

Below is a working paper by Cara O'Connell, a physical therapy specialist, who draws attention to the punishing heat that Fukushima workers endure and ways that their suffering can be alleviated.

Considerations for Fukushima Nuclear Power Plant Workers at Risk for Heat-Related Illness.

By Cara O'Connell PT

The crisis at Fukushima Dai-ichi Nuclear Power Plant is one of profound importance, affecting the health of workers at Fukushima and potentially people around the world. The health and safety of these honorable workers are of grave concern as they work in sweltering temperatures and high levels of humidity and radiation inside the buildings while burdened by several layers of protective gear. Unbearable conditions faced by these workers are unprecedented, and their needs are difficult to manage.

Currently workers at Fukushima can only tolerate 10-15 minutes working in the contaminated buildings due to high levels of radiation, humidity and heat. Excessive levels of humidity and heat near the reactors are causing an increasing number of workers to suffer from heat stroke. Tokyo Electric Power Company (TEPCO) has a plan to reduce the amount of humidity and radioactivity in Building #2, by opening doors to reduce the high levels of humidity, which is currently at 99.9%. TEPCO also reported planning to provide "cool vests" and air-conditioned rest spots with coolers and drinking stations for 100-1,000 workers. Additionally, the situation would benefit from a strategy that includes that includes worker training and providing access to basic healthcare for heat-related illness.

The rest areas could also serve as an acute care emergency reviving station for workers suffering from heat-related illness. Accurate assessment of workers' health, levels of dehydration, heat stresses, and access to available options may avert disaster. Heat-related illness can become severe and life threatening quickly, causing decreased coordination and altered mental status. Confusion, delirium and irrational behavior can occur. Access to proper hydration and methods of rapid cooling can prevent deterioration of the workers' condition. Consultation with regional experts in occupational and sports medicine may be beneficial.

Knowledge and correct actions are the keys to safely combat extreme conditions at Fukushima. Assessment of workers' medical history and normal weight can provide valuable baseline information in understanding how they might tolerate excessive heat. Providing a proper nutrition and hydration program is essential. Measuring and understanding the actual conditions the workers are in and the workload required would give an indication of the heat stresses they are experiencing and work-to-rest ratio required for safety. Training the workers to monitor dehydration, assess symptoms and treat heat-related illness is essential. Once all options, provisions, and variables are understood, appropriate modifications can be made that will allow workers to work smart with proper tools to maximize energy conservation.

Under these severe conditions large amounts of fluids, salt and electrolytes can be lost. In a hot, humid environment thirst and hunger do not provide enough incentive for adequate intake of fluids. It is quite complex to determine the amount and type of hydrating fluid needed.

A comprehensive nutrition and hydration program could allow workers to delay the onset of dehydration, enhance endurance, and forestall the progression of heat-related illness. Researchers from the Department of Health Policy and Management, Institute of Industrial and Ecological Sciences at the University of Occupational and Environmental Health (UOEH), Yahatanishi-ku, Kitakyushu, Japan have studied hydration for workers undergoing high heat stress and may be a valuable resource in developing an effective hydration program.

Workers at Fukushima must wear respirators and their fully encapsulated personal protective equipment (PPE), assumed to be Tyvek with three normal cotton blue base layers underneath. Tyvek suits are semi-pervious to moisture and, thus, inhibit evaporative cooling, adding 10-12°C To the wet bulb globe temperature. Looking at a heat stress index at a temperature of about 30°C (85°F) and at 90% relative humidity, we find a heat stress of 38.7°C (101.6°F).

When factors for the suits are added in, it is clear that workers are subject to very high heat stress risk at moderate ambient temperatures. There may be better and more modern alternatives to the usual undergarments to wick the moisture away from the body. DragonFur and OEL Structure Wear base layers are high tech PPE that can provide more tolerable working conditions. Workers are also having difficulty seeing through their fogged up masks. Solutions used by divers, is to rub toothpaste, spit or a drop of baby shampoo inside the mask. Watersorb is a beaded polymer that holds water and may provide additional cooling or absorption of excess moisture. Heat flux transducers may also be worn by workers to determine the actual heat stress they are experiencing. Researchers at UEOH in Japan have recently developed a way of assessing continuous core body temperature by using special earplugs with transducers.

The workers on the ground at Fukushima Dai-ichi are obviously subject to very high levels of heat stress, and are likely to suffer from a spectrum of signs and symptoms of heat-related illness. It is advantageous to be well informed and prepared to prevent the potentially serious consequences of heat stroke in this environment.

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currently being submitted for publication. Please contact the author for additional information or copies of the complete article: caraoc@embarqmail.com