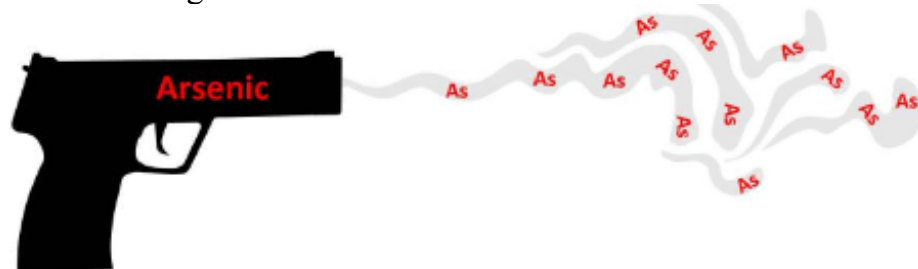


# Arsenic - Not Always the Smoking Gun for Chemical Munitions

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While arsenic can be the smoking gun for discarded military chemical munitions and agents, it is not always the smoking gun. The waters off the State of Hawai'i, especially off the island of O'ahu, have served as disposal sites for dredge spoil as well as discarded military munitions (DMM), both conventional and chemical. In 1944 in the area designated HI-05, off the south shore of O'ahu, 16,000 World War II M47A2, 100-pound (45 kg) mustard bombs were discarded in waters deeper than 1,970 feet (600 m). As part of the Hawai'i Undersea Military Munitions Assessment (HUMMA) Program, the University of Hawai'i at Mnoa (UHM) Department of Oceanography undertook an ambitious sampling program that included collecting sediment samples with UHM's manned submersibles for analysis of select chemical agents (CA) and their degradates (e.g., sulfur mustard or HD, Lewisite, and their degradates), energetics (e.g., RDX, TNT and its degradates), as well as arsenic, copper, lead, and mercury. The analysis of any sediment that tested positive for CA was performed by the U.S. Army Edgewood Chemical Biological Center (ECBC). UHM Oceanographers used multivariate statistics, specifically, nonmetric multidimensional scaling (NMDS), to look for patterns in the data.

The results of NMDS analysis (plot) indicate that arsenic (As) and lead (Pb) are associated with samples collected from control sites and DMM that tested negative for CA and not with the samples that tested positive for chemical agents such as HD and its degradates 1,4-dithiane (1,4-Dt); mercury (Hg) also clustered with the samples containing CA. Lewisite and its degradates were not detected in the sediments and yet arsenic was detected in sediments at concentrations ranging from

The source of this arsenic, in all likelihood, originated from sources on land, possibly resulting from the past use of arsenical pesticides on O'ahu. In conclusion, although arsenic is found in the marine sediments surrounding O'ahu, chemical munitions are not the source of this arsenic.

For details, refer to: Tomlinson, MS, and De Carlo, EH. 2015. *Occurrence and possible sources of arsenic in seafloor sediments surrounding sea-disposed munitions and chemical agents near O'ahu, Hawai'i*. Deep-Sea Research II, [dx.doi.org/10.1016/j.dsr2.2014.11.022](https://doi.org/10.1016/j.dsr2.2014.11.022).

