ABSTRACT: Methods were developed to calculate individual estimates of exposure and dose with associated uncertainties for a subcohort (1,857) of 115,329 military veterans who participated in at least one of seven series of atmospheric nuclear weapons tests or the TRINITY shot carried out by the United States. The tests were conducted at the Pacific Proving Grounds and the Nevada Test Site. Dose estimates to specific organs will be used in an epidemiological study to investigate leukemia and male breast cancer. Previous doses had been estimated for the purpose of compensation and were generally high-sided to favor the veteran's claim for compensation in accordance with public law. Recent efforts by the U.S. Department of Defense (DOD) to digitize the historical records supporting the veterans' compensation assessments make it possible to calculate doses and associated uncertainties. Our approach builds upon available film badge dosimetry and other measurement data recorded at the time of the tests and incorporates detailed scenarios of exposure for each veteran based on personal, unit, and other available historical records. Film badge results were available for approximately 25% of the individuals, and these results assisted greatly in reconstructing doses to unbadged persons and in developing distributions of dose among military units. This article presents the methodology developed to estimate doses for selected cancer cases and a 1% random sample of the total cohort of veterans under study.