

RADIATION HAZARDS

THE MILITARY EXPERIENCE

Recent developments indicate that exposures previously thought safe may be anything but

BY JANET RALOFF

Between 1946 and 1964, the United States detonated 183 nuclear weapons in the atmosphere. During and directly following many of these blasts, military troops were brought in for field exercises — essentially to show them that they could survive a nuclear blast and go on to conduct war maneuvers near the blast site, known as “ground zero.” Donald Kerr, the Energy Department’s acting assistant secretary for defense programs, estimated that 500,000 soldiers may have been exposed to radiation in connection with such tests since 1945, and that as many as 900 persons may have been overexposed (by current radiation-exposure standards).

What worries many investigators more is that a higher than normal incidence of leukemia appears to have developed among men who participated in the exercises but who supposedly received only low doses of ionizing radiation — doses previously thought safe. This leads to three immediate hypotheses: (1) Doses shown on monitoring devices worn by the troops did not record exposures correctly, (2) lower levels of exposure are more harmful than previously believed, or (3) these cancers are not totally related to the nuclear blasts.

Congress and a number of federal agencies are trying to sort through the confusing morass of military records, bureaucratic red tape, fading memories and epidemiological statistics in an attempt to evaluate these hypotheses. And the outcome is important. If either of the first two hypotheses is chosen, the stricken men or their survivors will qualify for much needed financial aid from the Veterans Administration. More important, if the second is chosen, it questions complacency over such voluntary low-level exposures as “routine” diagnostic X-rays.

What attracted attention to the problem was Paul Cooper, a victim of acute myelocytic leukemia at the VA hospital in Salt Lake City. In late 1976, an epidemiologist formerly with the Center for Disease Control in Atlanta learned that Cooper had been present at Smoky, an atmospheric test that was conducted in Nevada. Since ionizing radiation is known to cause cancer, particularly leukemia, the epidemiologist notified CDC, suspecting that the

agency might be interested. Another case soon appeared, Donald Coe of Kentucky, a victim of hairy-cell leukemia.

Glyn Caldwell, a CDC epidemiologist, set out to identify all persons present at Smoky and to determine which had cancer. The Energy Research and Development Administration, now the Department of Energy, told Caldwell that although troops had participated in nuclear tests, their exposures had been within what were considered safe limits. Although no systematic records of personnel exposed in tests during the 1940s and '50s had been kept, beginning in 1964, some data had been collected retrospectively. The Department of Defense told Caldwell that if he could provide names, serial numbers and social security numbers — data which he did not have — it might be able to find radiation-exposure data.

Cooper’s media exposure brought calls and letters to CDC from many who had been in Smoky or other nuclear tests, but this did not provide enough data. Finally, a military subcontractor provided a list it had of the units that had been present, together with film-badge readings for 3,153 persons; the VA has death certificates for 164 and medical records for possibly 1,231 more. The Army is looking up the last known address of those not in VA files. Progress is slow, but already 6 additional cases of leukemia have turned up.

Expected leukemia incidence for the 3,153 can only be approximated until the exact ages of Smoky participants are known because cancer-incidence rates vary greatly by age, Caldwell says. Assuming most were about 20 years old in August 1957, the time of the Smoky blast, a total of only two cases would be expected in a group of this size. If the ages were higher, expected leukemia incidence would also be higher, he said.

Many of the troops present wore film badges. These are valuable in estimating health risks due to radiation exposures, says Karl Z. Morgan of the Georgia Institute of Technology, a specialist on the effects of internally-deposited radiation. But “film badges give no indication whatsoever of the inhalation hazard of the alpha-emitting radio nucleants,” he said, and “the badges used were limited almost entirely to the gamma” radiation, although the blast is thought to have emitted neutrons, alpha and beta particles. Morgan says that



Department of Energy

The Smoky blast, August 31, 1957.

inhalation of dust contaminated with alpha-emitters, for example, could lead to their deposition in bone, liver or lung tissue where they “would irradiate the human body for the rest of the person’s life.”

As a helicopter pilot, Thomas Stedman ferried troops between exercises. “I recall that the entire exercise area was covered with a heavy dust cloud caused by the blast,” he told congressional investigators. “This dust cloud extended from ground level to a height of several thousand feet. I recall low visibility. ... I believe the dust remained throughout the entire day.”

Martin Sperling, a La Jolla, Calif., scientist who testified before Congress on his studies of potential radiation exposure for those present at Smoky, said the winds caused by helicopters “could have resulted in essentially all the deposited radioactive material being resuspended into the air” until the cloud settled. “At a distance of 20 years, it is impossible to determine the precise effects ... but assuming an average resuspended cloud height of 10 feet for a period of 10 minutes, Coe could have inhaled a bone-marrow dose of 13.2 rem. That would increase his probability of getting leukemia about 44 percent,” Sperling said. Coe’s film badge covering the Smoky test read 0.2 rem. The annual cumulative allowable dose is 5 rem. (One rem is the dosage of an ionizing radiation that will cause the same biological effect as one roentgen of X-ray or gamma-ray dosage.) Paul Cooper claims to have walked 3,000 yards “to within 100 yards of ground zero, arriving at about one hour after detonation, and remaining in the vicinity for a period of 30 minutes to an hour,” Sperling says. “Based on Mr. Cooper’s description, the inhaled dose could have been extremely high, in the vicinity of 100 rem ... strictly as a result of troop movements” stirring up the air.

Two witnesses attribute sterility to their radiation exposures. One, Russell Jack Dann, said he has osteoporosis (weakening of the bones) and a blood disease. “I started losing my hearing almost immediately [after troop exercises in the Nevada nuclear tests]. My teeth started falling out immediately and my hair

This is the first of two articles on the biological effects of radiation.

started falling out in blotches severely, all over my head," he added. He said the military doctor diagnosed "nerves." Dann has been denied VA compensation because his film badge read within the safe, low-dose range, but his description of action at Smoky indicates he may have inhaled contaminated dust.

Was Smoky particularly bad? The actual yield was 48 kilotons, roughly three times that at Hiroshima. Morgan recounts, "Although our realization of the risks of radiation has changed, even in 1957 I was frightened and appalled when I first heard these troops were in trenches and would go to point zero shortly after the blast." Many didn't even have trenches.

Morgan said that "in discussion I had with the person in charge of my program," (Morgan was head of the health physics department at Oak Ridge National Laboratory) during the blast, "he indicated that this event led to more residual contamination than any of the other tests we covered, so much so that as they drove in at high speed to collect their instruments they turned around and retreated when they got within three or four miles of point zero."

Major Alan Skerker of the U.S. Army's nuclear division says there were more dangerous assignments than Smoky. For example five tests in July 1957 — Nancy, Badger, Simon, Apple II and John — were manned by volunteers trained in nuclear effects. Many resulting exposures were high — 16.3 rads for both Simon and Badger. It will be difficult to follow up on these since even the names of some participants are unknown.

Congress, sharply critical of the lack of follow up on persons known or believed to have been overexposed, has promised to investigate further. To date, the Army has assigned only four men, spending one-quarter to one-half their time since December, in assisting Skerker track down Smoky participants and other high-risk individuals for CDC; Congress has insisted the situation be given higher priority and manpower. In December a joint-agency task force recommended that an independent study be conducted on several groups exposed to different nuclear tests.

Film badges present a complicating factor. There weren't always enough to go round, so in many cases the badges were simply doled out one per busload or one per group; whether all members of the group stayed together on the field and received the same exposure is unknown, as is who comprised each group.

Finally, even if all who participated are located, Caldwell wonders how researchers can correlate film-badge readings with actual exposure. "Field activities varied so much that people with identical readings could have very different actual exposures. Whether you can ever prove [actual exposure or what participants now remember] I don't know," lamented Caldwell. "That's the hardest part." □

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BELOW THE BELT: A Book about the Pelvic Organs — John G. Deaton — Franklin, 1978, 160 p., drawings by Mimi Deaton, \$8.40. A physician explains how the pelvic organs work and why they work the way they do.

THE CANCER LADY: Maud Slye and Her Heredity Studies — J. J. McCoy — Nelson, 1977, 191 p., illus., \$6.95. The story of cancer research and this scientist's untiring quest into the relationship between cancer and heredity.

CAULDRON OF HELL: TUNGUSKA — Jack Stoneley — S&S, 1977, 216 p., illus., \$8.95. Tells the story of this unsolved mysterious phenomenon which devastated nearly 800 miles of forest in the Tunguska region of Siberia in 1908.

THE CHILDHOOD EMOTIONAL PATTERN AND COREY JONES: A Psychoanalytical Biography — Leon J. Saul — Van Nos Reinhold, 1977, 336 p., \$13.95. A psychoanalyst traces the emotional development of a fellow psychiatrist and attempts to show how his childhood emotional pattern shaped his life.

CURRENT MEDICAL DIAGNOSIS & TREATMENT 1978 — Marcus A. Krupp and Milton J. Chatton et al — Lange, 1978, 1098 p., paper, \$17. Revised annually, this volume is intended to serve the practicing physician as a useful desk reference on widely accepted techniques currently available for medical diagnosis and treatment. Current references to the clinical literature and general bibliographies are included.

DIABETIC MENUS, MEALS AND RECIPES — Betty M. West, Revised by Nancy Greene Eash — Doubleday, 1978, 194 p., \$7.95. In addition to sample menus and recipes designed to make the diabetic diet tasty and easy to prepare, this book has been expanded to include a description of the various aspects of diabetes and information on the principles of nutrition.

ENJOYING NATURE WITH YOUR FAMILY — Michael Chinery — Crown, 1977, 192 p., drawings & photographs, \$12.95. Explores the wild life, the plant life and geology of town and country with fascinating projects and experiments. Beautifully illustrated.

HANDBOOK OF ENVIRONMENTAL DATA ON ORGANIC CHEMICALS — Karel Verschueren — Van Nos Reinhold, 1977, 659 p., \$37.50. Comprehensive information on harmful organic-chemical product emissions into the biosphere and their control measures.

THE HOME ENERGY SAVER: All the Facts You Need to Save Energy Dollars — Irene Cumming Kleeberg — Butterick Pub, 1977, 208 p., illus., paper, \$3.95. Discusses basic principles for the use of energy, helps you analyze your home to decide if it saves energy and gives easy ways of increasing your home's energy efficiency.

HUMANKIND — Peter Farb — HM, 1978, 528 p., illus., \$15.95. Probes the fascinating biology and the

amazing repertoire of behaviors of humankind, ranging over a wide variety of human societies and over millions of years of human history to ask, and answer, questions about why we are the way we are.

MODES OF SPECIATION — Michael J. D. White — W H Freeman, 1978, 455 p., illus., \$27.50. Less emphasis is placed on geographic isolation (allopatry) as an absolute precondition for speciation and a much larger role is attributed to structural chromosomal rearrangements.

RESEARCH ON CHILDREN: Medical Imperatives, Ethical Quandaries, and Legal Constraints — Jan van Eys, Ed. — Univ Park, 1978, 152 p., photographs by LaNetta Collier, paper, \$9.75. Proceedings of a conference held at Houston, Tex., on April 29 and 30, 1977.

SEXUAL STRATIFICATION: A Cross-Cultural View — Alice Schlegel, Ed. — Columbia U Pr, 1977, 371 p., \$20, paper, \$7.50. The papers were selected to illustrate social setting of sexual equality or inequality and the conditions under which they arise.

SOLAR AGE CATALOG: A Guide to Solar Energy Knowledge and Materials — SOLAR AGE — SolarVision (Cheshire Books), 1977, 232 p., illus., paper, \$8.50. Lists the latest products by category, includes performance charts and comparative data tables, a directory of manufacturers, a listing of architects, engineers and designers and an annotated reading list.

SOLAR ENERGY BOOKS — International Compendium — National Solar Energy Education Campaign, 1977, 118 p., illus., paper, \$4.50. A catalogue of books on solar energy and related subjects to aid the homeowner, teacher and student, businessman and librarian with the selection of titles of interest to them.

TOXIC AND HALLUCINOGENIC MUSHROOM POISONING: A Handbook for Physicians and Mushroom Hunters — Gary Linoff and D. H. Mitchell — Van Nos Reinhold, 1977, 267 p., color plates & drawings by Irene E. Liberman, \$16.95. Discusses specific symptoms of various kinds of mushroom poisoning and treatment for the different types. Line drawings and color plates aid in identifying poisonous mushrooms and the text describes these toxic mushrooms.

TWO HUNDRED YEARS OF FLIGHT IN AMERICA: A Bicentennial Survey — Eugene M. Emme, Ed. — AAS (Univelt), 1977, 310 p., illus., \$25. Based on a history symposium held at the National Air and Space Museum, November 4, 1976. Reviews historical events in ballooning, the utilization of the airship, general aviation, military aviation, commercial aviation, instrumented use of space and manned space flight.

WHAT'S SO FUNNY ABOUT SCIENCE? — Sidney Harris — W. Kaufmann, 1977, 120 p., drawings, \$7.95, paper, \$3.95. These delightful cartoons, originally published in *AMERICAN SCIENTIST*, point up the humor in modern science and technology.

THE YEAR OF THE DINOSAUR — Edwin H. Colbert — Scribner, 1977, 171 p., drawings by Margaret Colbert, \$9.95. Various lines of evidence were used by this paleontologist to reconstruct the activities of the dinosaurs for this story of a year in the life of a brontosaurus.

YOU CAN FIGHT FOR YOUR LIFE: Emotional Factors in the Causation of Cancer — Lawrence LeShan — M Evans, 1977, 192 p., \$7.95. The cancer victim, according to the author, usually has a psychological orientation that increases the chances of getting cancer and makes it more difficult for many individuals to fight for their lives when they do develop a malignancy (See SN: 1/21/78, p. 44).

THE ZAPPING OF AMERICA: Microwaves, Their Deadly Risk, and the Cover-Up — Paul Brodeur — Norton, 1977, 343 p., illus., \$11.95. We have begun to subject ourselves, the author says, to levels of microwave and radio-frequency radiation that are millions of times as high as those occurring naturally, and we are without any idea of how such radiation may affect us or future generations.