

Refined health data on radiation effects

Two recent studies narrow in on the relationship between observable health effects and exposure to relatively low levels of ionizing radiation.

A study done by Scottish researchers of 197 British nuclear-dockyard workers has found chromosomal changes — aberrations — in a population of men occupationally exposed to radiation in doses below the maximum permissible occupational limits. The types of white-blood cell changes found and believed attributable to the radiation exposures (based on earlier studies) were dicentric (ring) aberrations, acentric fragments and other cells with “unstable” aberrations. A report of the study, by H. J. Evans, K. E. Buckton, G. E. Hamilton and A. Carothers of the Medical Research Council at Western General Hospital in Edinburgh, Scotland, appears in the Feb. 15 *NATURE*.

Workers who received cumulative exposures of 20 to 30 rem over the decade showed a fourfold increase in these aberrations — to 4 in 700 cells sampled — above their pre-employment levels. (Rem is a unit of absorbed dose that accounts for the relative biological destructiveness of the particular type of radiation received.) The current maximum-permissible occupational limit is five rem per year.

The men in this study worked at a British facility (which opened in 1968) to service and refuel nuclear submarines. As most workers had no previous radiation exposure, blood samples were taken prior to employment for use as background control samples against which future samples would be compared. Most men were then sampled several times over the 10-year period. Film-badge dosimeters providing approximate readings of the external exposures each received were compared with the degree of (or number of) cell changes.

The significance of the British study is that it shows a clear before and after change within a population exposed to low levels of radiation, according to William P. Brandom of the University of Denver. Brandom, who had not seen the British study but who is conducting similar research on plutonium workers and uranium miners, added that this study may be useful in establishing the degree of blood-cell changes that are attributable to external radiation exposures. Most of the workers he studies have inhaled radioactive particles that settle in the body and continue to emit radiation internally.

There is a long history of studies linking chromosomal changes in white blood cells with radiation exposure. In fact, measurement of the number of aberrations has been proposed as a possible “biological dosimeter,” particularly for those individuals on whom dose estimates

were not available.

(Brandom is in fact looking for elevated chromosome-aberration levels in five persons who may have been unwittingly exposed to radiation while working at one of four sites near Denver that in recent weeks were found to be emitting radiation in excess of federal safety limits. It's believed radium ore was mined at these sites around the turn of the century.)

The effects of dental X-rays on blood cells may diminish into the background level in time. Individuals who received large exposures, however, may show distinguishable imprints in their blood years later, although the types and number of changes will become less representative of the dose as the period from exposure increases. Brandom says chromosome aberrations are detectable in some Japanese atomic-bomb survivors today. It is possible that military personnel exposed to high radiation doses in nuclear-weapons tests during the 1950s (SN: 2/11/78, p. 92) may also show some latent imprints. In fact, such chromosome aberrations may be the best and perhaps only sign of possible radiation exposure among these veterans, many of whom are now requesting disability benefits for cancers and leukemias they fear are related to participation in bomb tests.

While it now appears that some soldiers who observed nuclear-weapons tests may have been exposed to dangerous radiation levels, those living downwind of the Nevada Test Site and subject to fallout were believed safe, according to official government reports. A study in the Feb. 22 *NEW ENGLAND JOURNAL OF MEDICINE* indicates otherwise. Joseph Lyon, Melville Klauber, John Gardner and King Udall studied all children 15 years of age or younger between 1951 and 1958 who died of leukemia, a cancer long associated with radiation; during that period, 26 nuclear tests dumped fallout onto Utah. The researchers found a 40 percent increase statewide in the leukemia incidence for that population over identical groups prior to and following that period. But for children born in southern Utah—a region receiving the highest fallout levels — childhood leukemia incidence was two and a half times higher than for children born before or after.

“We can't say from this study that fallout causes cancer,” Lyon says, “but I think we can say without question there is an association between fallout exposure and the increased incidence of childhood leukemia deaths in Utah.” The researchers estimate a bone-marrow dose of six to 10 rads could have produced the cancers.

Since that time childhood leukemia incidence throughout Utah has fallen back to normal levels, levels below the national average. A follow-up study will try to reconstruct radiation doses by community and confirm death diagnoses and place of residence for all children identified in the current study. □

Childhood leukemia: A 40 percent cure

Treatment of childhood leukemia is one of the great success stories of 20th century cancer research. In the early 1960s, Donald Pinkel, then medical director of St. Jude Children's Research Hospital in Memphis, with his colleagues started trying a combination of existing cancer drugs and radiation treatment on children with acute lymphocytic leukemia (the most common form of childhood leukemia). Now, 18 years later, the therapy package, called “total therapy,” has proved to be so successful in countering this formerly fatal form of cancer that it can be considered a real cure in many instances. A number of children with leukemia who were given the treatment are now disease-free adults, married and with children of their own. What's more, “total therapy” for childhood leukemia has been adopted by many hospitals in the United States and in other countries.

“Total therapy,” in fact, has been offered to child leukemia patients long enough now to better determine its ability to cure childhood leukemia, according to a report in the Feb. 8 *NEW ENGLAND JOURNAL OF MEDICINE* by Stephen L. George and his colleagues at St. Jude Children's Research Hospital.

George and his co-workers have followed the fates of 639 children with leukemia who were treated with “total therapy” at St. Jude between 1962 and 1975. They have found that 278 (44 percent) of all patients have been completely free from disease for two and a half years while on therapy and thus have qualified for stopping therapy altogether. What's more, four-fifths of this group (223 out of 278 patients) have not relapsed in the four years following cessation of therapy, and *none* of the 79 patients out of the 223 who have remained in complete remission at least four years have relapsed at all.

Thus, nearly 50 percent of all children with leukemia are able to stop therapy, 70 to 80 percent of this 50 percent will remain free from leukemia for at least four years and four years appears to provide an operational definition of a childhood leukemia cure.

Taking all these findings together, the investigators conclude that 40 percent of all children diagnosed for acute lymphocytic leukemia today can expect to be cured by “total therapy.”

Still other valuable information has emerged from this study that should make “total therapy” of childhood leukemia even more effective than it is now. The proportion of patients who have relapsed after treatment with two drugs was significantly lower than for patients receiving three or four drugs. In addition, the results showing that 70 to 80 percent of patients who stop therapy after two and a half years