Is radiation an essential trace energy?

John Cameron

Introduction.

Radiation protection policy in the United States and in most of the world is based on the assumption that the risk of a radiation induced fatal cancer is linearly proportional to the dose. This is known as the linear, no-threshold (LNT) model of radiation risk. There are no human data to support this assumption for a short-term dose below 0.2 Gy¯the equivalent of about two centuries of exposure to natural gamma radiation. If there is a threshold at 0.2 Gy (and much larger for low dose rate radiation) or benefits from the low dose rate radiation received by many workers, billions of tax dollars can be saved annually in the U.S.

I describe two little known peer reviewed human radiation studies, which strongly support the hypothesis that ionizing radiation stimulates the immune system. The U.S. National Council for Radiation Protection and Measurements (NCRP), has ignored these data in providing guidance on health effects of radiation to the U.S. Congress. These data suggest the need for research on radiation benefits. Currently, radiation research concentrates on the known cancer risk at large doses.

The U.S. Gulf States have a high cancer death rate compared to the mountain states although background radiation is much lower in the Gulf States. I suggest they are suffering from radiation deficiency. I will propose a double blind study using increased radiation to stimulate the immune systems of senior citizens in the U.S. Gulf States. The idea that radiation is beneficial is not new. For centuries, millions of people have visited health spas with high radiation levels. There is an extensive literature on radiation benefits. (Luckey 1980; 1991)

The nuclear shipyard worker study (NSWS)

Nuclear ships have been built and maintained in seven US shipyards for over 40 years. In 1980, the US Department of Energy (DOE) gave a contract to the School of Public Health at Johns Hopkins University to study radiation risks to nuclear shipyard workers. This study, which extended for more than a decade, cost the taxpayers $10 million. This was the World's best epidemiological study of nuclear workers. The study has yet to be published more than 12 years after its completion in early 1988. The final report of the study has been available since 1991 (Matanoski 1991)

Although the nuclear shipyard worker data have not been published, the study had excellent peer review during its eight-year duration. The DOE contract provided for peer review twice a year by a panel of eight scientists with expertise relevant to the research. Appendix 2 of the final NSWS report states: "The Technical Advisory Panel (TAP) was formed in 1980 as a standing committee of experts who would provide objective advice to the project staff on a continuing basis. In selecting its members, it was important for each [TAP member] to have had personal research experience with some of the problems related to the Shipyard Study. Disciplines which we believed to be important and which were included in the group are: radiation biology and radiation physics, medicine, genetics, industrial hygiene, epidemiology and biostatistics." The scientists who served as members of TAP were Dr. Arthur Upton, (chair); Gilbert Beebe, John Cameron (the author of this article), Carter Dennison (who resigned in 1983), Merril Eisenbud, Philip Enterline, Philip Sartwell and Roy Shore. TAP met twice a year to review data, question the scientific staff and make suggestions. Early in 1988, TAP approved the draft of the final report.

The summary in the final NSWS report (p. 393) states: "The shipyard nuclear worker population represents a large number of individuals exposed to low documented [doses] of radiation. They receive this radiation almost exclusively from gamma rays due to the decay of cobalt-60. Within the [shipyard] population there are comparable groups of workers exposed to negligible or no radiation at their shipyard jobs but who engage in similar work. Therefore this is an ideal population in which to examine the risks of ionizing radiation in which confounding variables can be controlled. *"

Note that the study was to examine "risks" rather than "health effects" or "health benefits". The final report concludes, "The [exposed] population does not show any risk which can be clearly associated with radiation exposure in the current analysis." Since the study was looking for risks, the final report does not mention the significant health benefits of radiation to the nuclear workers. No article has been published on the results of the NSWS. After waiting for over a decade, I feel it is appropriate to call the results of this important study to the attention of other scientists

The nuclear shipyard worker study consisted of three groups: nuclear workers with cumulative doses greater than 0.5 rem dose effective (NW>0.5); (A dose of 0.5 rem is roughly five years of background radiation, excluding contributions of radon progeny to the lungs.); nuclear workers with cumulative doses less than 0.5 rem (NW<0.5); and non-nuclear workers (NNW) of similar ages and jobs as the nuclear workers The numbers in each group are given in Table 1. The total study group consisted of nearly 71,000 workers with a total of over 922,000 person-years.

Although the study involved radiation, no summary is given of the cumulative dose in "rem-years". An estimate can be made from Table 3.1.C1 in the final report. Doses to the NW>0.5 group were divided into four dose categories. A worker may contribute to each of the four groups. A rough estimate from that table suggests that the NW>0.5 group, had average doses 5 to 10 times their cumulative dose from background (excluding radon progeny.) Their occupational dose was comparable to background doses received by people living in mountain states.

When the study started, the statistical power of the shipyard worker study was known to be inadequate to show an increase in cancer. The final NSWS report (p. 379) states "The shipyard worker study has less than a 20 percent chance of detecting an excess of leukemia at the level of the BEIR III report estimates." Rather than showing increased cancer, the cancer death rate of the NW>0.5 group was over four std. dev. lower than the NNW control group. This good news is not mentioned but the data are available in the final report.

The important finding from the NSWS is support of the hypothesis that a moderate dose rate of radiation is beneficial to the health. The NW>0.5 group had a death rate from all causes 24% lower than the control group. That is, their death rate was 16-std. dev. lower than the controls (p< 10-16). . If the study aim had been to look for health benefits of ionizing radiation, it would have been a huge success. As a study to find radiation risks, it was an abysmal failure. This may explain the reason the study has yet to be published. I published a brief summary of the results in 1992, shortly after the final report was submitted. (Cameron 1992) I know of no other publication or reference to this important study.

The British radiologists study (1900-1980)

The reader may think that the nuclear shipyard study is contradicted by other_human studies. I know of no contradictory studies. One other radiation worker study¯the British radiologists study. (Smith and Doll 1981)¯ also looked at the death rate from all causes. It gives results_consistent with NSWS. (Table 2.) Radiologists in the study were divided into two groups¯those who joined a radiological society before 1921 and those who joined such a society after 1920. The dividing date was chosen because the British x-ray safety committee became active about 1920. There was a need for the committee as data in Table 2 indicate. The large radiation exposures to early radiologists significantly increased their cancer death rate compared to three control groups of men in England and Wales.

Despite the large occupational exposure to the early radiologists, their death rate from other causes decreased. That is, there was no statistical evidence of a decrease in longevity compared to the three control groups. This suggests that radiation stimulation of their immune systems canceled the radiation induced cancer deaths.

There can be little doubt that the British x-ray safety committee did its work well. Note the great decrease in cancer death rate after 1920. More importantly, the study provides strong support for radiation stimulation of the immune system. Note the statistically significant decrease in deaths from all causes. The probability of this health improvement being accidental is generally lower that 0.001.

Short-term (acute) radiation doses may also be beneficial

Short bursts of radiation appear to stimulate the immune system. The article by Feinendegen et al (1998) suggests that a short-term (acute) dose of 0.1 Gy to animals ¯about 100 years of background dose, excluding radon progeny¯is about optimum.

A proposed human study of radiation stimulation of the immune system.

When there are controversies in science, it indicates inadequate data. The present controversy over the health effects of low dose rate radiation calls for a prospective double blind human study. The DOE has set aside research funds to study risks of low dose rate radiation but no funds to study benefits, such as demonstrated in the British radiology and the nuclear shipyard worker studies.

I propose a prospective double blind human study to see if increased radiation stimulates the immune system. If the results are positive, additional studies will be needed to determine the Recommended Annual Dose Rate. Such a study of the immune system should be relatively short compared to a cancer induction study, which might require years. For example, they are still seeing a few radiation induced cancer deaths among the a-bomb survivors from over 50 years ago.

I suggest that people in the Gulf States are suffering from radiation deficiency. (Jagger 1998) Evidence is the 25% higher cancer death rate in three U.S. Gulf States (LO, MS & AL) compared to three mountain states (ID, CO & NM)¯which have a much higher background level. In studying any deficiency disease it is logical to choose the group most likely to benefit from an increase of the essential factor. Increased background radiation can be easily and safely produced by containers of weak radioactive sources under the beds of the study cohort. The sources would increase the radiation level to the background level found in the mountains. Similar containers without radioactivity would be placed under the beds of the controls. Neither the participants nor their medical caregivers would know which participants were receiving supplemental radiation. It would be useful to record infectious diseases and their duration as a measure of the function of the immune system. The most important data will be a comparison of the longevity of the two groups. The study would involve routine inspections to monitor the radiation sources and the similar containers under the controls. The study could be done in large retirement homes where many subjects would be readily available to participate in the study. Replacement participants would be added from time to time. The study would be inexpensive, as it would not require additional medical care, medication or expensive laboratory studies. I am sure many senior citizens will be willing to participate in the study since it would not involve taking medication or receiving injections. The possibility that more radiation will prolong their life will appeal to many. It will be much cheaper than for them to move to the mountains or visit a radiation health spa.

References:

Cameron, J.R. The Good News About Low Level Radiation Exposure Health Physics Society Newsletter Feb pp. 9-11(1992)

L. E. Feinendegen, Victor P. Bond, Charles A. Sondhaus Can Low Level Radiation Protect Against Cancer? Physics and Society 27:pp 4 - 6 (1998)

Jagger, J Natural Background Radiation and Cancer Death in Rocky Mountain and Gulf Coast States Health Physics Oct. pp 428-4 (1998)

T. D. Luckey Hormesis with Ionizing Radiation CRC Press, Boca Raton, FL (1980)
T. D. Luckey Radiation Hormesis CRC Press, Boca Raton, FL (1991)

Matanoski G: Health effects of low-level radiation in shipyard workers final report. 471 pages Baltimore, MD, DOE DE-AC02-79 EV10095, (1991)

Smith PG, Doll R. Mortality from all causes among British Radiologists Br. J Radiol 1981; 54: pp 187-194 (1981)

Table 1
Deaths from All Causes, Person-years and Death Rates(1) for high dose nuclear workers (NW>0.5)); low dose nuclear workers (NW<0.5); and non-nuclear workers (NNW) (after Matanoski 1991 p. 333)

	High dose	Low dose	Zero dose
Workers in subset	27,872	10,348	32,510
Person-years	356,091	139,746	425,070
Deaths	2,215	973	3,745
Death Rates Per 1,000(2)	6.4	7.1	9.0
Death rate (SMR)(3)	0.76	0.81	1.00
95% C.l.(4)	(0.73,0.79)	(0.76,0.86)	(0.97,1.03)

1 Rates calculated per 1000 person-years.
2 Adjusted for deaths excluded from analysis due to unknown date of death.
3 Using age-calendar time specific rates for U.S. white males.
4 C.1. = 95% Confidence intervals.

Table 2 Mortality of British Radiologists 1900 to 1980
Deaths of British radiologists were compared to three groups:
A¯All men in England and Wales; B¯All men in social class I; C¯All male medical practitioners. A total of 1338 radiologists were divided into two groups: "Before 1921" All British physicians who joined the British Institute of Radiology or the Royal College of Radiologists before 1921 and "after 1920" All British physicians who joined either society after 1920 (From Smith PG, Doll R. 1981)

O/E = OBSERVED/EXPECTED

		BEFORE 1921		AFTER 1920	
		OBSERVED	O/E	OBSERVED	O/E
DEATH FROM	A		0.95		0.76***
ALL CAUSES	B	319	1.04	411	0.89*
	C		0.97		0.87**
DEATH FROM	A		1.26*		0.63***
ALL CANCERS	B	62	1.44**	72	0.79*
	C		1.75***		1.05
DEATH FROM	A		0.95*		0.79***
OTHER CAUSES	B	257	0.97	339	0.92
	C		0.88*		0.84**

STATISTICAL SIGNIFICANCE: * p<0.05 ** p< 0.01 *** p<0.001

John Cameron, Professor Emeritus
UW-Madison Departments of Medical Physics, Radiology & Physics
PO Box 405 Lone Rock, WI 53556
(608) 583-2160; Fax (608) 583-226
jrcamero@facstaff.wisc.edu