

Experts Face Challenge of Educating Public about Risk and Radiation

LESSONS OF CHERNOBYL: SNM MEMBERS TRY TO DECONTAMINATE WORLD THREATENED BY FALLOUT

"In our judgment, the standards of permissible nonmedical exposure have already been reduced, in a succession of revisions over the past several years, to the point where they. . . are likely to give rise to an unnecessary apprehension on the part of the general public concerning radiation levels."

"There is a brighter day coming when the words 'nuclear energy' will no longer trigger the awful vision of destruction, but elicit instead our gratefulness for what this marvelous science will have accomplished in diagnosing cancer and saving lives."

Part II of a Two-Part Series

Part I of "Lessons of Chernobyl" was published in the April 1987 issue of Newsline.

Fallout from the Chernobyl nuclear power accident has contaminated almost every locality on earth, and the nuclear medicine community has begun to assume its share of responsibility for the slow-moving decontamination process. By definition, fallout originates from a nuclear explosion, so technically the radioactive cloud set loose from the steam explosion at Chernobyl was not fallout. The consequences of the subsequent radiation hysteria that spread to global proportions, however, do fit another definition of fallout—and this type of fallout may turn out to be more insidious than the radioactive particles that generate so much fear.

The citizens of the Soviet Union (USSR) who worked and lived near the Chernobyl nuclear power plant, of course, have every reason to express fears about the accident that claimed 31 lives and caused radiation

injuries to hundreds of plant workers, fire fighters, and paramedics. The rest of the world, however, has been exposed to levels of radiation so low that the hysterical aftermath of the accident was unwarranted, although not unexpected.

As Robert E. Henkin, MD, of Loyola University Medical Center in Maywood, Illinois, said, "The dangerous fallout in the United States (US) is not the trace quantities of radioactive material that have been detected, but rather the further undermining of 'things nuclear,' and of technology in general." In the July/August 1986 *Scanner*, a newsletter published by the American College of Nuclear Physicians (ACNP), Dr. Henkin made this observation: "At the very time we have more to offer diagnostically than any other time in history, we hear more and more often the refrain from patients, 'I don't want that stuff. I would rather have heart disease (stroke, osteomyelitis, abscess, etc.) than cancer.'"

In actuality, Chernobyl just added one more layer to the nuclear fear fallout that has enveloped the earth since the first atomic bombs were detonat-

ed. "The mother of nuclear medicine was scared by the atomic bomb and scarred by the AEC [US Atomic Energy Commission] during gestation (*1*)," said Marshall Brucer, MD, who was director of the Medical Division at the Oak Ridge Institute for Nuclear Studies (ORINS) from 1948 to 1961. Dr. Brucer was also president of The Society of Nuclear Medicine (SNM) in 1957-58.

Past Ignorance of Dangers

Even before the bomb, Nobel Laureate Marie Sklodowska Curie died in Paris on July 6, 1934, of aplastic anemia, caused by her exposure to radiation. Also in the 1930s, radium dial painters developed cancers of various organs. (Invented by a German scientist in 1902, radioluminous material was used for such products as the luminescent instrument dials on World War I airplanes. During the early 1920s, young women in New Jersey and Illinois were hired to paint a radium-laced substance on watch dials. These women kept the tips of their paint brushes sharp by frequently twirling them between their

(continued on page 934)

(continued from page 933)

lips, and unknowingly ingested dangerous amounts of radium.)

These tragedies "were results of an understandable and honest ignorance of radiation dangers," noted Dr. Brucer, and they quickly led to radiation safety standards. Later, the Manhattan District Project gave birth to the health physics field, as well as to the bomb. In the 1950s and 1960s, the pendulum swung toward an ultra-conservative approach to radiation safety, and it stayed there.

The SNM gave its first Nuclear Pioneer Award in 1960 posthumously to Nobel Laureate Ernest O. Lawrence, PhD, who invented the cyclotron. Fallout was the main topic of the first SNM Nuclear Pioneer Lecture, given by Edward Teller, PhD, on June 25, 1960, at the 7th SNM Annual Meeting in Estes Park, Colorado (2).

"Fallout is not dangerous. But the fallout scare is," said Dr. Teller, the Hungarian-born American physicist who helped develop the atomic and hydrogen bombs. Referring to the public's fear of adverse health consequences from the atmospheric nuclear weapons testing conducted by the US and the USSR, Dr. Teller noted that many patients realized that one radiograph exposes them to 100 times the amount of radiation they receive from fallout.

"What Is Past Is Prologue"

"How many people have been scared away from x-rays?" he asked rhetorically. Dr. Teller described how his own sister required radioiodine treatment for a thyroid disorder, and how his mother almost prevented that treatment because she was afraid of the radiation. "Public education is essential, and public education can be undertaken by no one as effectively as by you," Dr. Teller told the SNM audience.

Almost three decades later, the nuclear medicine community still faces that same challenge. The exaggerated

fears of radiation have been handed down to another generation, and compounded by the accelerating arms race, the environmentalist movement of the 1960s, the Three Mile Island nuclear power plant accident in 1979, the "nuclear winter" theory expounded in 1983, and the Chernobyl disaster in 1986.

Under the headline, "What Is Past Is Prologue," the April 1987 issue of the Health Physics Society (HPS) *Newsletter* recently published a letter sent to the US Atomic Energy Commission in 1959 to comment on 10 CFR [Code of Federal Regulations] Part 20, "Standards for Protection Against Radiation." The prediction made in the opening paragraphs has come true: "In our judgment, the standards of permissible nonmedical exposure have already been reduced, in a succession of revisions over the past several years, to the point where they approach the status of an unwarranted impediment to research, to education, and to technology, and are likely to give rise to an unnecessary apprehension on the part of the general public concerning radiation levels."

On April 26, 1986, a runaway nuclear chain reaction led to the horrendous explosion of the Chernobyl-4 unit, a light-water, graphite-moderated, pressure-tube reactor. When elevated radiation levels were detected two days later in Europe, radiation experts—including nuclear medicine professionals—were inundated with frantic requests for information from government officials, public health administrators, the news media, and the general public.

Stig A. Larsson, PhD, chief of the Department of Hospital Physics at the Karolinska Hospital in Stockholm, Sweden, said that the lack of information from the USSR caused one of the major problems in the public's understanding of the situation. "When one doesn't know exactly what kind of disaster has occurred, one has to establish quite strict regulations for the

first few days to ensure that public health is protected," said Dr. Larsson. By the time enough data were collected to show that the countermeasures could be relaxed, the public was already alarmed, and the revised recommendations caused confusion.

Early Notification

In an effort to prevent this problem in the future, the International Atomic Energy Agency (IAEA), a United Nations agency based in Vienna, Austria, last September adopted the Convention on Early Notification of a Nuclear Accident, which has been signed by more than 60 nations, including the USSR.

The Karolinska Hospital received phone calls from many anxious travelers who had just returned from Poland or Hungary, said Dr. Larsson, and his group decided to provide thyroid measurements for these people. Residents of Stockholm learned of this service, and also requested thyroid gland measurements for radioiodine exposure.

Per-Erik Asard, PhD, of the Danderyd Hospital in Stockholm, said that information management was a major problem in the aftermath of Chernobyl. In particular, "action levels" for contamination of food and the environment were established in a controversial manner.

As soon as the accident was discovered in Sweden, chief medical doctors began calling hospital physicists for advice. "We could not get through to the National Institute of Radiation Protection because the lines were busy, so we were forced to obtain all our information from the mass media," said Dr. Asard, who is president of the Swedish Hospital Physicists Association. [In Sweden, no physician specialty of nuclear medicine exists. The procedures that are considered part of nuclear medicine practice in other countries are performed in Sweden by hospital physicists.]



These scenes depicting responses to the Chernobyl nuclear power accident of April 1986 were part of the Soviet Union's display at the post-accident review meeting held last August at the International Atomic Energy Agency in Vienna, Austria.
(Courtesy of the International Atomic Energy Agency)

After a television program aired in Sweden entitled, "Warning: Radioactivity," which, in Dr. Asard's opinion, exaggerated the risks in Sweden from Chernobyl, the Swedish Hospital Physicists Association organized a press conference for the next day, but no journalists showed up. The hospital physicists tried to disseminate information about the risks of low-level radiation, but the few journalists who interviewed them wanted instead to know their opinions about the nuclear power industry in Sweden, said Dr. Asard.

Bo Lindell, PhD, of Sweden's National Institute of Radiation Protection, said that the first mistake in determining whether contaminated food should be consumed was to call the established recommendations for maximum radioactivity "limits"—

"which were perceived as the borderline between absolute safety and impending danger"—rather than "action levels." The second mistake was to apply action levels indiscriminately without considering the quantities consumed; the emphasis was mistakenly placed on the activity concentration rather than the total activity intake, explained Dr. Lindell.

Sweden established a 300 Bq/kg (8.1 nCi/kg) action level for cesium-137 contamination of food, meaning that food with higher measurements would be rejected from the market. This decision caused severe detriment to the Laplanders, nomads of northern Scandinavia who herd reindeer and sell the meat. In some instances, reindeer found to contain marginally higher levels, 331 or 408 Bq/kg, for example, were deemed un-

fit for consumption, said Dr. Asard.

Last fall, slaughtered reindeer in Sweden averaged 3,000 Bq/kg. It has been calculated that a person who consumes five pounds of this meat would receive a whole-body dose of 1×10^{-5} Gy (1×10^{-3} rad). Dr. Asard said that he believes the 300 Bq/kg action level was based not on health risk, but on the political concerns surrounding import and export of foodstuffs.

Throughout Europe, newspaper headlines evoked alarm over measurements of hundreds or thousands of Becquerels, and the press did not convey the message that one Becquerel (2.7×10^{-11} Curies) is an exceedingly small amount of radioactivity. Governmental attempts to reassure the public while protecting them with overly cautious countermeasures, noted Dr. Asard, resulted in a double message: "Don't be scared because you're only being exposed to low doses of radiation, but don't eat the food because it's contaminated with low levels of radiation." The cost of Sweden's emergency measures was estimated at \$100 million (US dollars), according to Dr. Lindell.

In the Federal Republic of Germany (FRG), information management after Chernobyl was also a major problem. "A system needs to be set up whereby nuclear medicine physicians automatically get information from officials instead of from newspapers," said Prof. Dr. med. Peter Pfannenstiel, of the German Diagnostic Clinic in Weisbaden. He was one of four radiation experts who appeared on a one-hour television broadcast during which 1,200 viewers telephoned the station with questions such as: Is it safe to hang laundry on the clothes line? I have just eaten a salad, and now I feel a lump in my neck; could it be from the radiation?

Prof. Pfannenstiel said that when he tried to explain that driving on the

(continued on page 936)

(continued from page 935)

autobahn (superhighway) poses more of a risk than the radiation from Chernobyl, "people didn't like these comparisons and got angry because they wanted instead to know their exact risk of cancer from Chernobyl."

A government official later called Prof. Pfannenstiel to ask whether children should be allowed to play in sandboxes, and how many grains of sand a child could safely ingest. Dr. Larsson in Stockholm encountered the same question, and calculated that a child would have to ingest 12 kg of sand to receive the same whole-body radiation dose as one dental x-ray would give in a localized area.

"I, personally, was at a loss when confronted by some of these questions, and I spent considerable time researching and calculating the answers. Nuclear medicine physicians must learn more about radiobiology so we will be prepared to give advice under emergency circumstances," said Prof. Pfannenstiel. He noted that a reporter from the magazine *Der Spiegel* interviewed several radiation experts, and published an article showing how they gave different answers to the same questions.

Guidelines for Nuclear Physicians

In an effort to provide nuclear medicine professionals with background information so they can answer such questions more accurately, Prof. Pfannenstiel and his coeditors at *Der Nuklearmediziner* will devote a future issue to Chernobyl data and fundamentals of radiobiology. [For more information on explaining radiation risk to the public, see "A Radiation Primer," by Lauriston S. Taylor, PhD, *Newsline*, Feb. 1985, pp. 118-121.]

Three daily newspapers for physicians are published in Germany, and they ran a series soon after Chernobyl that explained radiation units, measurements, and risks. Despite such educational efforts, Prof. Pfannenstiel noted a decline in referrals for radio-

nuclide studies just after Chernobyl, and both physicians and patients requested alternatives such as ultrasound.

Prof. Dr. med. Ludwig E. Feinendegen, of the Jülich Nuclear Research Center, agreed that radiobiology needs to be more prominent in the curricula of nuclear medicine training programs. "The nuclear medical community was asked to respond, and unfortunately was not always prepared to respond because of a lack, at times, of basic knowledge about radiation biology," said Prof. Feinendegen, who was a member of the emergency response group commissioned by the Ministry in Bonn to evaluate data and make recommendations during the immediate aftermath of Chernobyl.

Setting action levels in a decentralized system created confusion. At first, 500 Bq/l was established for milk, but then it was calculated that if a child drank 10 liters of contaminated milk, the iodine-131 dose to the thyroid would be too high, said Prof. Pfannenstiel. Some FRG states maintained the 500 Bq/l action level, while other states lowered it to 20 Bq/l. The general public didn't know whether milk from different parts of the country was safe to drink.

In Germany, as in many other countries, local emergency plans—involving communications, action levels, evacuation, and countermeasures such as distribution of potassium iodide—have been established in areas near nuclear power plants. "We were not at all prepared, though, for the logistics of handling an accident that occurred elsewhere, and which contaminated the environment with such low levels of radiation," said Prof. Pfannenstiel.

Outside Europe

Yoshiharu Yonekura, MD, DMSc, of the Kyoto University School of Medicine, said that the Japanese government referred several travelers to

his department for examination in the whole-body counter. The general public in Japan was very concerned about radiation from Chernobyl, reported Dr. Yonekura. The majority of press interviews were given by radiobiologists and radiation safety scientists, not nuclear medicine physicians, he recalled. "I think our major role is to assess the contamination of those involved in the accident since nuclear medicine facilities are equipped with measuring devices," said Dr. Yonekura.

"The population of South Africa was aware of the radiation accident at Chernobyl, but in view of the remote chance of any radiation danger at the vast distance, no major concern was voiced," said Jan D. Esser, of the Johannesburg Hospital, University of Witwatersrand. Instead, South Africans questioned the safety of nuclear power plants there, particularly at Koeberg in Cape Town, said Dr. Esser, adding that he and his colleagues were not asked to advise governmental agencies or make statements to the press.

In the Middle East, fresh lamb and beef from Rumania, Bulgaria, and Turkey are imported daily. Tawfiq H. Minwer, MD, who runs a nuclear medicine clinic in Amman, Jordan, reported that the Royal Scientific Society asked him to analyze the meat. "I checked a sample of minced meat with a thyroid uptake system, recording counts for two minutes. I was surprised to see a very high count when the isotope selector was set on iodine-125," said Dr. Minwer. Some shipments were sent back to Europe, and others were destroyed. "Only educated people were worried about the accident," he added.

The public in Uruguay is somewhat unaware of the advantages and/or disadvantages of nuclear energy because at present there are no utility or research reactors operating in the country, explained Eduardo F. Touya,

(continued on page 937)

(continued from page 936)

MD, of the Clinical Hospital in Montevideo. "I think that only the scientific and academic communities realized the importance of Chernobyl. Newspapers, however, cannot always be trusted to give an honest account of the facts because they are frequently influenced by political problems between the Western World and socialist countries, and between the Northern and Southern Hemispheres," said Dr. Touya. He and his nuclear medicine colleagues were contacted by print and broadcast journalists, "but we told them to contact the National Atomic Energy Commission for more first-hand information. Since our comments would not be based on accurate data, they could lead to errors and unjustified sensationalism."

Real Versus Perceived Dangers

William H. Bland, MD, of the Wadsworth Veterans Administration Medical Center in West Los Angeles, California, assessed the exposures of six tourists who had spent three days in Kiev. With a whole-body counter, traces of iodine-131, cesium-137, ruthenium-103, cerium-141, and niobium-95 were detected. "Approximately 0.05–0.1 μ Ci (1.8–3.7 kBq) of each identified radionuclide was computed to be present in each person," said Dr. Bland. The radiation exposure from this trace contamination, essentially, is equivalent to the cosmic radiation exposure received when flying from Kiev to California by jet, explained Dr. Bland, who is also a past president of the SNM (1977–78).

This type of comparison, however, did not reassure everyone. An article entitled "60 'Hot' Americans Get Cold Shoulder, Exams for Kiev Returnees Grudging," published July 23, 1986, in the weekly newspaper *Medical Tribune*, illustrated the fears of some of these tourists, including one vocal physician.

"I know, they say that a jet trip will expose an individual to the amount of

radiation we got in Kiev, but that's not really comparable—at all. In a plane, there are no radioactive dust particles to get lodged in your body. That's where the real danger lies and no one has adequately explained to me the long-term effect of one radioactive dust particle which gets lodged in the lung or nasal cavity. . . There are several different theories about what constitutes a dangerous level of radiation. One side says you need to exceed a certain level of radiation before facing danger, whereas others maintain that any increase over background radiation statistically increases the chances of long-term complications," said Dennis Haughton, MD, a family physician at the Cigna health maintenance organization (HMO) in Phoenix, Arizona.

In a recent interview with *Newsline*, Dr. Haughton said that he has read several books (including publications from the Union of Concerned Scientists) about radiation since last year, and he now realizes that his chances of developing cancer from his Chernobyl radiation exposure are estimated in the range of 10^{-4} to $10^{-5}\%$. Considering that 20–25% of the population develops cancer, the added risk for him from Chernobyl is negligible.

Dr. Haughton also said that if he and others in his tour group had received better information from a more organized network ready to respond to their questions, they might not have been so scared. The group had assumed that health officials would be ready at the airport to assess their radiation exposures, but they were only met by journalists. Customs officials waved them through quickly as if they were afraid to touch their luggage.

Once they reached home, the tourists contacted family physicians and government agencies for advice, but received very little. Although some who contacted nuclear medicine departments at local hospitals under-

went examinations and received the appropriate reassurance, others said they were told that the departments were too busy or that measurements of their exposures were unnecessary.

Allay Public Anxiety

Even when exposures are known to be minimal, some nuclear medicine professionals feel a responsibility to provide scans and reassurance to those who are frightened by their radiation exposures. "The philosophy of my colleagues is that nuclear medicine physicians do have a role to play, which is principally to allay public anxiety. In practice, it seems that the best way to do this is to perform a series of simple measurements," said Ivor Surveyor, MD, president of the Australian and New Zealand Society of Nuclear Medicine. Several hospitals in Australia performed thyroid scans and urine and/or plasma assays for travelers returning from Eastern Europe. "In no case, to my knowledge, was any activity detected above background," he said.

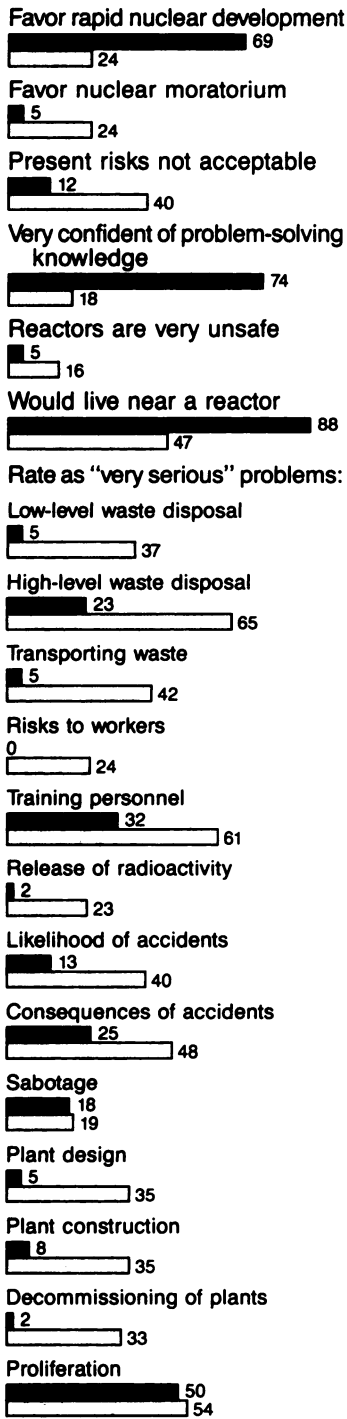
The main antinuclear concerns in this country are directed toward war ships visiting Australian ports, said Dr. Surveyor, of the Royal Perth Hospital. "A few local authorities have declared their regions 'nuclear-free' zones, but even so, they give a general amnesty toward medical uses of radionuclides, and we do not, fortunately, find ourselves drawn into this debate," he added.

Ronald I. Veatch, MD, of the Winona Hospital in Indianapolis, has been giving lectures over the past year about Chernobyl and radiation risk to a variety of audiences.

"After the Chernobyl accident, some members of my church who have relatives serving as missionaries in Czechoslovakia and Poland asked me about their risk from the radiation. I realized that I could perform a public service by informing people about these subjects," said Dr. Veatch.

(continued on page 938)

Figure 1. Attitudes of Nuclear Experts and Science Journalists Toward Nuclear Energy (%)



Nuclear experts ■ Journalists □
 Source: Lichter SR, Rothman S, Rycroft RW, Lichter LS, *Nuclear News*, Center for Media and Public Affairs, Washington, DC, 1986

(continued from page 937)

One of his lectures was a few days before Nuclear Medicine Week, July 27-August 2 (see *Newsline*, April 1987, pp. 418-419). "I wore my Nuclear Medicine Week button and used the occasion to inform the audience about the medical uses of radiation as well as the risks," he said.

SNM Public Relations

After Chernobyl, the SNM Central Office in New York City received numerous telephone calls from the press requesting information on the health risks of radiation. Stanley J. Goldsmith, MD, of The Mount Sinai Medical Center in New York City, who was also president of the SNM last year, gave 12 interviews to various radio and television news programs, and several more to the print media, during the first week. Dr. Goldsmith's main message was one of reassurance and perspective in light of the low levels of contamination everywhere except for the Chernobyl vicinity.

Dr. Goldsmith and the many other SNM members who were asked to comment on Chernobyl also used the opportunity to educate the public about nuclear medicine, and to convey the benefits as well as the risks of nuclear science and technology.

Although the media provide an avenue for getting information about nuclear issues to the public, those whose work involves nuclear energy are often dismayed by the way the media cover these topics. In an address last year to the American Nuclear Society (reprinted in the March 1987 *HPS Newsletter*), the president of Science Concepts, Inc., pointed out how both sides could work toward an improvement. The scientific/engineering community may not fully understand news reporting, and may not have developed the skills to translate technical subjects into lay language. On the other hand, journalists may tend to be more skeptical of those who

work in nuclear science or technology than they are of nuclear critics. To some extent, the differences in how journalists and their news sources view nuclear issues may affect how this type of news is presented (see bar graph on this page).

Despite these problems, the SNM views its public relations efforts as a necessary means of public education.

Some of the responses to Chernobyl clearly manifested the need to educate not only the public, but the health care world as well:

- A Swedish medical physicist reported that some American radiologists who had planned to attend an international congress on neuroradiology, held in Sweden two weeks after Chernobyl, canceled out at the last minute. Some said they wanted to avoid being exposed to radiation from Chernobyl, and others cited the threat of terrorists as their reason for staying home.

- According to the IAEA, an estimated 100,000-200,000 wanted pregnancies were aborted in Western Europe because physicians mistakenly advised patients that the radiation from Chernobyl posed a significant health risk to unborn children. Several nuclear medicine physicians in Europe said that they were contacted by obstetricians for advice on whether they should recommend abortions for their patients.

- Evangelos C. Georgiou, MD, PhD, of Athens, Greece, said that the Greek Endocrine Society urged the government to distribute potassium iodide tablets (a prophylaxis for iodine-131 uptake in the thyroid) to the population after the contamination had reached that area. The Greek Nuclear Medicine Society, however, strongly disapproved of this plan, and the government and public witnessed a debate between the two medical societies. "Fortunately, we convinced the government that it was too late for any potassium iodide to be effective, and the government then convinced

the public," said Dr. Georgiou.

According to David V. Becker, MD, of New York Hospital—Cornell Medical Center: "If 100 mg of potassium iodide is administered at the same time that the thyroid is exposed to iodine-131, the prophylaxis will have an almost 97% protective effect, meaning that the thyroid will take up 3% of the iodine-131 that it would normally take up without the potassium iodide. If potassium iodide is given one hour after exposure, it will have an 85% protective effect; after three hours, it will have a 50% protective effect; and after six hours, it offers essentially no protection to the thyroid gland." (3)

- The 1986 annual meeting of the Council of Biology Editors (CBE), an international organization with more than 800 members, was held about one month after the Chernobyl accident. During a plenary session discussion (which, ironically, included some remarks about the responsibility of journal editors to demand well-documented scientific evidence to support authors' conclusions) the editor of a peer-reviewed public health journal said that he expects future studies to show that low levels of radiation are much more dangerous to public health than radiobiologists currently believe. Many of the approximately 200 attendees nodded their heads in agreement. Although this group represented some of the most prestigious biomedical journals listed in *Index Medicus*, not one editor asked for the evidence upon which this projection was based.

Concentrate on Efficacy, Not Radiation Dose

Nuclear medicine professionals, themselves, may at times unintentionally promote an exaggerated fear of low-level radiation when they list lower radiation exposure to the patient as an advantage of one diagnostic test compared with another. "I think this type of comparison is overdone

in both nuclear medicine and radiology," said Letty G. Lutzker, MD, of Woodhull Hospital in Brooklyn, New York. "We need to concentrate more on the *efficacy* of these procedures and stop implying that the patient incurs a significantly greater risk with a slightly higher diagnostic radiation dose. All diagnostic radiation levels pose an extremely minimal, if not zero, risk to patients," said Dr. Lutzker.

Political Realities

In the same vein, health care professionals who work with nuclear magnetic resonance (NMR) often cite the benefit of patients' avoiding exposure to ionizing radiation. Again, such statements imply, unjustifiably, that the ionizing radiation from diagnostic tests poses a significant risk.

Some health care professionals who use ionizing radiation seem almost relieved when they can replace it with something else. Attitudes toward radiation safety vary in different parts of the world, and the power of antinuclear movements has made some nuclear medicine professionals accept radiation hysteria as a political reality.

In Austria, citizens have voted to prohibit nuclear power plants in that country, pointed out Dr. med. Emil Ogris of the City Hospital in Vienna-Lens. He said that one can see examples of a general tendency to avoid any technology that uses nuclear energy. Physicians are turning away from radioimmunoassays (RIAs), for example, merely because the alternative tests do not make use of ionizing radiation, he said.

Lynn R. Witherspoon, MD, recently appointed as the new chairman of the SNM Committee on RIA Cost-Effectiveness, said that, "although this committee was charged with evaluating the cost-effectiveness of RIAs, it seems that there are various other reasons for the growing popularity of other assays, one of which

is that ionizing radiation in any form is unacceptable to many people." Dr. Witherspoon, of the Ochsner Medical Institutions in New Orleans, Louisiana, added that maybe the committee should consider broadening its purpose to address these issues.

"It didn't hurt the public image of nuclear medicine that the *in vitro* idea occurred right at the peak of an intense radiation hysteria," said Dr. Marshall Brucer (4). "The early literature on the *T3 [radioactive liothyronine] test is full of references to the radiation damage aborted by *in vitro* procedures," he observed. The trend seems to be that health care will embrace any alternative that gets the radiation out of the patient, and then any new alternative that gets the radiation out of the hospital altogether.

Alternatives

After the Three Mile Island accident, the people of Sweden passed a referendum calling for all nuclear power plants in that country to be phased out by the year 2010. In an article in the June 1986 issue of *Administrative Radiology*, Bertil R.R. Persson, PhD, of the University of Lund in Sweden, said that the "nuclear fear syndrome" can be cured only by public education. In the same breath, however, Dr. Persson said: "The risks of being exposed in medical practice must also be weighed against the benefit for the patient. Perhaps it will become evident that x-rays and nuclear medicine are not always the only alternative. Other non-nuclear diagnostic methods, such as ultrasound and magnetic resonance, might give the same diagnostic information. It might also be possible to develop newer and better methods in imaging with nonionizing radiation. Methods such as impedance measurements, thermal imaging, and diaphanoscopy (transillumination of tissue with visual light) should be investigated more in order

(continued on page 940)

(continued from page 939)

to find alternatives to diagnostic procedures using ionizing radiation and radioactive materials."

It is highly unlikely, though, that the nuclear medicine community would ever give up on the boundless potential for scientific and clinical advances offered by physiologic studies with radiotracers. As Leonard M. Freeman, MD, chairman of the SNM Public Relations Committee, once said: "There is a brighter day coming when the words 'nuclear energy' will no longer trigger the awful vision of destruction, but elicit instead our gratefulness for what this marvelous science will have accomplished in diagnosing cancer and saving lives."

Risk Misperception

To the nuclear medicine community, radiation hysteria might look like the root of the entire problem, noted Dr. Stanley Goldsmith. In actuality, he explained, radiation hysteria is merely one symptom of a more pervasive disorder: risk misperception. This disorder commonly surfaces when people make decisions about suspected or proven carcinogens, teratogens, and mutagens.

(Risk misperception, however, is not limited to that dreaded threesome. Whether the radiologists who refused to attend the conference last year in Sweden based their decisions on a fear of Chernobyl-released radiation or a fear of terrorist attacks, their decisions were based on risk misperception; they most assuredly incurred greater risks—such as possible car or household accidents—going about their everyday lives at home.)

In an extensively documented book, *The Apocalyptics: How Environmental Politics Controls What We Know About Cancer*, author Edith Efron portrays the enormous gap between society's perceptions of environmental threats—radiation and chemicals—and the actual threats as demonstrated by scientific investiga-

tion (5). Although the news media are often blamed for the public's misperceptions, Ms. Efron's painstaking historical account of the environmental movement and the "war on cancer" shows that the public's unrealistic demands for zero-risk choices can be traced back to authoritative scientific sources.

"Several methods for making calculations of risk have been considered and used, but the most prudent method available to us today is to assume no threshold for a carcinogen," said Marvin Schneiderman, PhD, in 1977 when he worked for the US National Cancer Institute. One year before, Umberto Saffiotti, MD, chief of the Laboratory of Experimental Pathology in what was then the NCI's Division of Cancer Cause and Prevention, said: "For a prudent toxicological policy, a chemical should be considered guilty until proven innocent."

The radiobiology community is familiar with the controversy over the shape of the dose-response curve for radiation exposure and over whether a threshold (a dose below which no effect occurs) exists. In 1959, the US Federal Radiation Council (FRC) was formed, and it published eight reports through 1964, when the National Academy of Sciences (NAS) established what is now called the Committee on the Biological Effects of Ionizing Radiations (BEIR). One of the FRC reports established the linear no-threshold model for extrapolating risk from high to low levels of exposure. "The decision to accept that model was a scientifically unfounded political expediency that damned the uses of low-level radiation for years," said Henry N. Wellman, MD, a member of the BEIR III Committee, which published its report in 1980.

The BEIR III report adopted the linear-quadratic dose-response curve, which lowered the calculated risk of low-level radiation, and stated that a threshold possibly exists but proof of

its existence is "practically impossible." (6) Dr. Wellman, of the Indiana University Medical Center in Indianapolis, calls the BEIR III report a "tremendous breakthrough," but the modified dose-response curve is still not universally accepted. In fact, the chairman of the BEIR III Committee publicly stated that he still supports the linear no-threshold model.

Chemical pathologists face the same dilemma of establishing dose-response models. In 1972 the NAS Committee on the Biological Effects of Atmospheric Pollutants stated: "Because it is impossible, at very low doses, to obtain reliable data without enormous numbers of animals. . . the concept of a threshold dose is probably meaningless, and it would be prudent, because of these uncertainties of measurement, to extrapolate dose-response curves to zero in a linear fashion." (7)

Don't Blame Chemicals Without Scientific Proof

It is not uncommon to hear SNM members, when exasperated with the public's overly fearful attitude toward radiation, make statements such as: "People are so afraid of radiation, but look at how chemicals are poisoning the environment, ruining health, and causing cancer."

Members of the chemical sciences community, on occasion, make the same type of statement, but with the words "radiation" and "chemicals" switched around, noted Sandor Szabo, MD, PhD, head of the Chemical Pathology Laboratory at Brigham & Women's Hospital in Boston, Massachusetts. "The radiobiology and chemopathology scientists are in the same boat when it comes to educating the public about risk perception. It is not constructive for us to promote exaggerated and unfounded fears in this manner," said Dr. Szabo, who is also director of the Chemopathology Resource Center, a nonprofit Boston-

(continued on page 941)

(continued from page 940)

based entity founded to educate the public on the health effects of chemicals.

Dr. Szabo is working to create a Subdivision on Chemical Pathology and Toxicology within the American Chemical Society. One of the primary missions of this subdivision would be public education on the health risks of chemicals, he said. In addition, Dr. Szabo is the editor of a quarterly educational newsletter, *Boston Bulletin on Chemicals and Disease*, that is distributed to the public. "The SNM might consider a similar newsletter to educate the public about radiation," said Dr. Szabo, who distributed one issue of his newsletter in a special mailing to lawyers.

The no-threshold theories inevitably lead to the tenets that one x-ray, one gamma ray, or one molecule can cause cancer. Understandably, the public can become alarmed by minimal amounts of radioactive or chemical substances, and demand the most conservative safety standards and regulations—often with a blatant disregard for scientific evidence.

Legal decisions also reflect this trend. Last year, *The New England Journal of Medicine* reported that a court awarded \$5 million to a couple who sued a pharmaceutical company that manufactures a spermicidal jelly which allegedly caused their child's birth defects (8). Although the US Food and Drug Administration (FDA) found insufficient medical evidence to warrant the inclusion of fetal anomalies among the warnings on the product's label, the lower court's decision was upheld on appeal. The higher court found "that a cause and effect relationship need not be clearly established by animal or epidemiologic studies before a doctor can testify that, in his [her] opinion, such a relationship exists."

When four plaintiffs filed suit against the US government for supplying radioluminous dials to their

“Even when exposures are known to be minimal, some nuclear medicine professionals feel a responsibility to provide scans and reassurance to those who are frightened by their radiation exposures.”

former employer, two physicians testified during the 1984 trial that their patients' cancers were caused by radiation emitted from the dials. Unlike the spermicide case, however, this one was heard by a judge who demanded more scientific evidence, and the plaintiffs lost (see *Newsline*, Sept. 1985, pp. 970–971).

Lawsuit Against Mallinckrodt

Mallinckrodt, Inc., is now being sued by St. Louis residents who live near the radiopharmaceutical manufacturer. The plaintiffs in *Bennett v. Mallinckrodt* have demanded closure of the plant and \$1 billion for current and future injuries caused by radioactive emissions (which are in compliance with US Nuclear Regulatory Commission standards) from the factory. It will take several months, or even years, for the case to come to trial. Depending on what kind of judge or jury weighs the testimony, the ruling could have far-reaching ramifications for nuclear medicine.

Vanguard of a New Movement

If what is past really is prologue, maybe a promise given by Edward R. Murrow, the father of broadcast journalism who once hosted the CBS News show, "See It Now," bodes a more sane approach in the future toward nuclear technology and radiation science. "We will not be driven

by fear into an age of unreason," said Mr. Murrow on March 9, 1954, as he concluded the historic television broadcast that illustrated flaws in Senator Joseph McCarthy's arguments about the traitorous activities of certain US citizens. The news media, long culpable of promoting risk misperceptions about radiation, may soon join the vanguard of an awakening movement to steer society away from another impending "age of unreason."

The National Association of Science Writers in the US has critiqued news coverage of Chernobyl, and recognized that ignorance about radiation is only one segment of a much larger body of ignorance about all sorts of relative risks.

At the last meeting of the American Medical Writers Association, an award was presented to Elizabeth M. Whelan, ScD, MPH, executive director of the New York-based American Council on Science and Health, an educational organization formed in 1978 to encourage public policy makers to base decisions on "sound science, not emotion." Dr. Whelan's lecture to the medical writers included numerous examples of the public's dire need for more education on risk perception, particularly about suspected carcinogens and the "risks inherent in not taking risks."

(continued on page 942)

COMMENTARY

WHO SPEAKS FOR NUCLEAR MEDICINE?

I was invited to write this commentary after I submitted a letter-to-the-editor last December to *The Journal of Nuclear Medicine* in which I stated that nuclear medicine physicians in academic centers had done little to defend the nuclear medicine practitioner against physicians in other specialties who denigrate our procedures. This denigration has adversely affected nuclear medicine's service to patients and eroded our income.



Avir Kagan, MD

One example is the poor response of the nuclear medicine community to a 1986 article in *Annals of Internal Medicine* (1), accompanied by an editorial (2), concluding that bone mineral densitometry is too costly and of no help in the fight against osteoporosis. Since December, *Newsline* has reported some positive activity in this area (3). Such fights, however, must be carried to the very influential journals that make the attacking statements in the first place.

Another example is the conclusion from a University of

California at Los Angeles (UCLA) conference, published in 1982 in *Annals of Internal Medicine*, stating that radio-nuclide scanning of thyroid nodules is not cost-effective and not necessary (4). According to my hospital's endocrinologists, the subsequent 50% reduction in thyroid radio-nuclide scans at my institution is a direct result of this publication. This dogma is now part of the diagnostic "flow" training for medical residents.

Why was there no significant attempt by prestigious nuclear medicine practitioners to deal with this misconception at the source—the *Annals of Internal Medicine*? An almost passing mention in a recent educational review in *The Journal of Nuclear Medicine* (5) is not what I have in mind. What is needed is something more like the inspirational editorial in a recent issue of *The New England Journal of Medicine* (6) that discusses the future of positron emission tomography (PET). Such writing about the more "bread and butter" nuclear medicine procedures should be tailored to these primary care medical journals.

I can cite more examples of nuclear medicine procedures unfairly criticized in prestigious refereed medical journals. Probably the most famous is a 1977 "perspective" article

(continued on page 943)

(continued from page 941)

Leaders in the nuclear medicine community also want to join that vanguard. Peter J. Ell, MD, of The Middlesex Hospital Medical School in London, England, said last year during the European Nuclear Medicine Congress in Goslar, FRG, that it is imperative for organized nuclear medicine to carry out an intensive campaign to educate the public on radiation risks, and to insert this information into a general discussion on the risks of life.

"One does not live without risk. A healthy person carries a risk, just by living, that can be measured. The

population does not understand that, and it must be enlightened. If we fail to carry out these public relations exercises in a serious, consistent, and structured manner, we will continue to be victimized by policy decisions made by those who take comfort in emotional, nonfactual ways of dealing with problems," warned Dr. Ell.

Linda E. Ketchum

References

1. Brucer M: The maximum ridiculous dose. *Vignettes in Nuclear Medicine* No. 19, 1967
2. Teller E: The hazards of radiation. *J Nucl Med* 1962;3:1-9

3. Becker DV: Physiological basis for the use of potassium iodide as a thyroid blocking agent—logistic issues in its distribution. *Bull NY Acad Med* 1983;59:1003-1008

4. Brucer M: The *T3 test. *Vignettes in Nuclear Medicine* No. 8, 1966

5. Efron E: *The Apocalyptic: How Environmental Politics Controls What We Know About Cancer*. New York: Simon & Schuster, 1984

6. Committee on the Biological Effects of Ionizing Radiations: *The Effects on Populations of Exposure to Low Levels of Ionizing Radiation: 1980*. Washington, DC: National Academy of Sciences, 1980:22,142

7. Committee on the Biological Effects of Atmospheric Pollutants: *Particulate Polycyclic Organic Matter*. Washington, DC: National Academy of Sciences, 1972:91

8. Mills JL, Alexander D: Teratogens and "litogens." *N Engl J Med* 1986;315:1234-1236