A Primer in the Art of Deception

The Cult of Nuclearists, Uranium Weapons
and Fraudulent Science

by Paul Zimmerman

Chapter 6

The Most Heinous Crime in History:
The Betrayal of Mankind
by the Radiation Protection Agencies

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Author's Note:

In August 2009, I self-published a book entitled *A Primer in the Art of Deception: The Cult of Nuclearists, Uranium Weapons and Fraudulent Science*. My purpose in writing it was to expose the widespread deceit published by our guardian institutions regarding the health effects of low levels of internal emitters, radionuclides absorbed from nuclear pollution in the environment which undergo radioactive decay while sequestered within the human body's interior. The international radiation protection community interprets the hazard from this type of exposure by relying on a theory of radiation effects which was developed prior to the discovery of DNA in 1953 and the revolution in molecular and cellular biology which followed. Although expedient for its time, aspects of this theory have been proven antiquated and in need of revision. But no change has been forthcoming. The thesis of my work is that this situation has developed because the science of radiation effects has been infiltrated by those with a political agenda to minimize the perception of hazard of radiation released into the environment.

The chapter in my book, reproduced here, which reveals the deceit which permeates current approaches to radiation safety is entitled *The Most Heinous Crime in History: The Betray of Mankind by the Radiation Protection Agencies*. A trial is convened, with the reader as the jury, and evidence for the prosecution is presented to demonstrate fraud within the science used to dictate what constitutes a safe level of radiation exposure. This material is so important to the common welfare of humanity that it is my desire to share it with as large an audience as possible.

The roll I took upon myself in writing this chapter was that of a reporter. The scientific ideas are not my own. They originate from researchers all over the world. I have compiled their work and organized it in a nontechnical form so as to make it as widely accessible as possible. Every statement of scientific import is referenced, so the reader may go back to the original source if required. The ideas presented herein are slowly gaining acceptance is Europe as evidence continues to mount that low levels of internal emitters are producing more disease in exposed populations than what is predicted by the models of risk published by the International Commission on Radiological Protection. A free exchange of ideas on this important subject has yet to occur in the United States.

(**In order to follow the arguments presented in *The Most Heinous Crime in History: The Betrayal of Mankind by the Radiation Protection Agencies*, some background information is required. What follows is an excerpt from Chapter 5.**)

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Radiation Safety in Its Infancy: 1895 - 1953

...In returning to the historical narrative, the discussion now arrives at a fateful moment in the history of radiation safety. The Manhattan Project was a gigantic experiment in applied physics. Physicists dominated all aspects of the science required to build the bomb. This included all aspects of the Health Division. When the Manhattan Project got under way, the only standards available to the Health Division were those established prior to the war by, respectively, the US Advisory and the International Committees on X-ray and Radium Protection. The complicated undertaking of building the bomb and having thousands work in close proximity to high levels of radioactivity and novel radioisotopes demanded a revolution in all aspects of radiation safety. Herbert M. Parker, a British radiological physicist, headed the Protection Measurements Group of the health physics section of the Health Division. Besides being responsible for designing a new generation of radiation detection equipment, Parker had to overcome the major obstacle that had confounded researchers and radiologists over the previous two decades: how to devise a meaningful way of relating x-ray exposure to biological effect. The exposure to x-rays impinging on the surface of the body from an outside source was quantified by so many roentgens — a measure of the amount of ionization that quantity of x-ray energy would produce in air. Once that x-ray energy passed into the body, it was traveling through a different, nonuniform medium and interacting with a variety of biologically significant molecular structures. Some means were necessary for quantifying the changes being induced within the biological system. Ionization of the air external to the body, or the gas within a radiation detector, was one phenomenon. Biological changes in an organism due to that radiation was another phenomenon. The problem was how to connect these two into a meaningful

framework. A further problem also confronted Parker. The roentgen was a measurement for x-rays and gamma rays. People working in the Manhattan Project were potentially going to be exposed to additional radiation in such forms as alpha particles, beta particles, and neutrons. In order to effectively protect workers from the cumulative effects of different types of radiation, what was required was a method of quantifying the dosages from different types of radiation by a single unit of measurement. In this way, exposure to a combination of gamma rays and beta particles, for instance, could be combined in a meaningful way to denote the total dosage of radiation received.

Parker was a physicist. He brought a physicist's mindset to the problem of how radiation impacted on biological systems. And the simple and practical solution he devised was a physicist's solution. To Parker, when looked at abstractly, the essence of radiation's interaction with matter was the transfer of energy. X-rays transfer electromagnetic energy from an x-ray machine to the human body. These x-ray photons, interacting with the atoms of the body, transfer their energy to orbital electrons. Alpha particles and beta particles, with the kinetic energy they derive from being ejected from an atom undergoing radioactive decay, transfer energy from the nucleus of atoms to the electrons of the atoms within the human body with which they collide. What these types of ionizing radiation have in common is this capacity to transfer their energy into the body where it is absorbed by electrons, thus exciting them in their orbits and/or ejecting them from the atoms to which they are bound. As the amount of energy absorbed by the body is increased, so greater is the amount of ionization and biochemical disturbance to the system. Sufficient disruption results in altered function which is manifested in various forms and degrees of injury. *Thus, from this point of view, the extent of alteration to a biological system is directly related to the amount of energy absorbed*. To quantify this phenomenon, Parker devised a new unit of measurement for absorbed dose. The *rep* (roentgen equivalent physical) measures dosage as the amount of energy in ergs deposited per gram of material. Undergoing slight modification, the rep evolved into the *rad* (radiation absorbed dose) which represents the absorption of 100 ergs per gram of material. The rad is a convenient unit of measure. It is used to describe the amount of energy absorbed by any type of material (be it wood, metal, bone, muscle, or whatever) from any type of radiation.[8] To understand the impact that Parker's mentality

[8] The roentgen was retained as a unit of measurement for exposure. In health physics it represented the amount of ionization in air caused by a quantitiy of radiation as measured from outside the body. The rad was the unit of absorbed dose, measuring how much energy was absorbed by the material with which it interacted. Precise measurement determined that 1 roentgen corresponded to the absorption of 83 ergs per gram of air and the absorption of 93 ergs per gram of tissue at the body's surface. So close were the two units of measurement that they began to be used interchangeably. This also permited gas filled detectors, that measured ionization, to provide information about the absorbed dose at the surface of the body.

and mode of thinking had on the subsequent development of radiation safety, one point is essential to keep in mind: in Parker's conceptual model, the quantity of energy absorbed is treated as if it is uniformly distributed throughout the mass that absorbs it, i.e., the energy is "averaged" over the entire mass. This is what the rad represents, ergs per gram. To do this makes perfect sense within the mathematically oriented discipline of physics. However, as we shall see later in the discussion, this model is woefully inadequate when transferred into the discipline of biology where averaging energy over a mass of living cellular material is, in many instances, a useless concept for determining biological effect.

Parker was aware that the model he was developing had to account for the fact that different types of radiation (x-rays, alpha particles, beta particles, etc.) differed in how effectively they induce change in a biological medium. Consequently, Parker devised a second unit of measure that took these differences into account. First, for each type of radiation, experimentation was conducted to determine its Relative Biological Effectiveness (RBE) — the relative damage each caused to living tissue. The biological dose delivered by a quantity of radiation was then determined by multiplying the amount of energy absorbed (measured in reps or roentgen equivalents physical) by the RBE of the type of radiation that delivered the dose. The unit of measure of the product of these two quantities was the *rem* (roentgen equivalent man). As a hypothetical example, suppose the health effect to a type of tissue created by 1 rep delivered by alpha particles is compared to the health effect delivered by 1 rep of gamma rays, and it is found that the alpha particles produce ten times as much health effect. Alpha particles would be assigned an RBE of 10. What would be said is that the alpha particles deliver 10 rem to the body while the gamma rays deliver 1 rem. Both forms of radiation deliver the same amount of energy to the body. The biological impact of the alpha particles, however, is ten times as great.

The quantitative model that Parker developed introduced clarity into people's thinking about radiation's interaction with matter. So successful was this approach that it influenced all future thinking on the subject of radiation protection. According to this model, the biological effects of radiation were proportional to the amount of energy absorbed by the target, whether this was a particular organ or the body as a whole. To determine the amount of energy transferred, all types of ionizing radiation were now quantifiable using a single unit of measure, and the varying capacity for different types of radiation to produce biological alterations could be accounted for mathematically. Scientific investigation could now proceed to build a body of knowledge comparing the quantities of radiation absorbed to the biological effects they produced in different types of cells, tissues, organs, systems, and the whole body. Radiation protection was given a scientific footing that would allow it to keep pace with the revolution that was taking place in nuclear physics and in the new world

created by the Manhattan Project.

But a subtle flaw lay at the heart of Parker's model. It was all built upon the unfounded assumption that biological effects of radiation depended solely on the amount of energy absorbed. What made perfect sense from the point of view of the physicist was not in harmony with basic biological realities. At first, this wasn't apparent. Only in the latter part of the 1950s, after new fundamental discoveries were made in biology, did the major shortcomings to the model begin to intrude into what was already orthodoxy in radiation physics. Thus, the physics-based model — which was hugely successful in advancing radiation research — turned out in time to have been a conceptual blunder that blinded many to a true understanding of the biological effects of radiation. More significant is the fact that it continues to blind the understanding of people, even people who have spent years of study on the subject.

While recounting this history, we are simultaneously stalking the resolution to a mystery. Long after discoveries in biology highlighted the shortcomings of the physics based model of radiation's effects on living systems, it nevertheless continued to serve as the basis for formulating radiation protection standards. Although scientific understanding advanced, an antiquated and inaccurate model continued to be relied upon for determining the health effects of ionizing radiation on the human body.

The enigma that must be unraveled is WHY?

The answer lies in events that occurred soon after the end of the Second World War.

To conclude this section, a public relations campaign on behalf of the radioactive atom was forced into existence at the very beginning of the nuclear age. After the bombings of Hiroshima and Nagasaki, portions of the surviving Japanese population of these cities began manifesting symptoms of acute radiation syndrome. Newspapers and radio broadcasts around the world carried the message that people who had escaped the blast unscathed were nevertheless dying of some mysterious unidentified malady in the weeks following. Wilfred Burchett, the first civilian reporter to enter Hiroshima unescorted, wrote an article entitled "I Write This Warning to the World" which was published in London's *Daily Express* on September 5, 1945. The article stated:

> In Hiroshima, 30 days after the first atomic bomb, people are still dying, mysteriously and horribly — people who were uninjured in the cataclysm — from an unknown something which I can only describe as the atomic plague.

Such a report was in sharp contrast to press releases from the US government purporting that residual radioactivity in the cities was insignificant and delayed radioactive effects among the population would likewise be insignificant. General Leslie Groves, military director of the Manhattan Project, was forced to mount a public relations campaign to rescue American respectability and assuage the mounting worldwide concern over the lingering aftereffects of an atomic bomb detonation. An investigating team was hastily dispatched to Japan to prove that radioactivity was not a problem. After surveying the wreckage of Hiroshima, this team reported their findings at a news conference held in Tokyo on September 12. They announced that radioactivity presented no problem to the people of Hiroshima, and no further deaths would occur as a result of the blast. Any people still suffering were suffering from burns and traditional blast effects. Much later, the truth emerged. Medical investigators who spent time in Hiroshima estimated that between 15 and 20% of the deaths were due entirely to radiation. *Minimum* estimates suggested that 20,000 people died of radiation and that another 20,000 suffered from radiation injuries of various kinds.

Radiation Safety After the War

While the Second World War was being fought, the work of both the US Advisory Committee on X-Ray and Radium Protection and the ICRP lapsed into inactivity. During their absence from the scene, the nuclear sciences underwent a revolution. The meaning and implications of "radiation safety" before the war had little to do with the new realities in existence by war's end. In the 1930s, issues of radiation safety revolved around establishing exposure limits, primarily to patients and medical personnel. In the post-Manhattan Project world, radiation safety had to encompass the burgeoning nuclear industry as well as potential exposure to the entire population by radioactivity released into the environment. These new realities reinforced the implication, inherent in the concept of "permissible dose," that what was deemed an acceptable risk was a judgment call made by members of regulatory agencies, and that members of society had to accept an element of risk to their own health for nuclear technology to flourish. Defining exactly what constituted *acceptable* risks to the general populace, however, was never a topic of public debate. It was left in the hands of those few charged with developing radiation protection standards who, needless to say, were people directly involved in the development of weapons of mass destruction or who were intimately associated with such people. And it is in their hands that radiation safety has remained up until today.

With the quantum leap in the amount of radioactive material present in the human

domain after the war, new standards of safety were urgently needed, but a temporary void existed as to what organization would develop them. The Atomic Energy Commission came into being on August 1, 1946, and took charge of all the facilities and all of the nuclear materials of the Manhattan Project. Twenty days later, Lauriston Taylor revived the US Advisory Committee and began a vigorous campaign to have that organization recognized as *the* voice of authority on radiation protection in the United States. Taylor's advocacy succeeded. The first meeting of the Committee was convened with the intention of initiating revision of the National Bureau of Standards Handbook 20, *X-ray Protection*. At that meeting, the decision was made to adopt a new name, the National Committee on Radiation Protection (NCRP). (When the NCRP became a US Congressional Charter Organization in 1964, its name changed again to the National *Council* on Radiation Protection and Measurements.) The decision was also made that membership should be extended beyond those with an interest in the medical application of radiation to include representatives from all organizations that had a vested interest in furthering standards for radiation protection. When reformed, membership on the committee consisted of eight representatives from various medical societies, two from manufacturers of x-ray equipment, and nine from government agencies including the Army, Navy, Air Force, National Bureau of Standards, the Public Health Service, and the Atomic Energy Commission. As time passed, the NCRP evolved into an organization of tremendous influence. The recommendations it propounded, along with those of the ICRP, became the basis of federal, state, and local statutes for managing radiation hazards.

From the outset of their formation, a codependent relationship developed between the Atomic Energy Commission, the agency that managed the nation's nuclear program, and the NCRP, the organization which recommended standards of safety. Soon after the formation of the two organizations, the AEC began exerting pressure on the NCRP to formulate permissible dosages for workers in the nascent nuclear industry. Not only was this required to ensure worker safety but to protect the AEC from future liability. To legitimize the conditions in their facilities, the AEC was in need of backing from a respected scientific organization that had all the appearances of being independent. At the same time, it had to assure that standards of safety were not set so stringently that they would hamper the development of the nation's nuclear program. To seduce the NCRP into providing these services, the AEC first offered to accord the committee semiofficial status as a regulatory body if it would quickly publish standards. This offer was turned down. According to Taylor, the AEC then promised financial aid "'after we had demonstrated that we could do something for them'" (Caufield). Despite the desire to maintain appearances of being an independent agency, the NCRP was in a hopelessly incestuous relationship with the AEC. Half its members were government representatives. A great deal of the information it required to carry out its work was classified as top secret and access could only be attained

through AEC clearance. And the AEC was the chief beneficiary of the committee's work. Further, the NCRP was not able to maintain its financial independence. The AEC footed the tab for part of the NCRP's administrative and travel expenses.

In the years that followed its initial establishment, the NCRP received funding from many other sources. Karl Morgan, a health physicist during the Manhattan Project and participant on the NCRP, was outspoken on the influence these sources had on the development of radiation protection standards:

> A cursory glance at the National Council on Radiation Protection (NCRP), which set radiation protection standards in the United States, sheds light on whose hand fed those who set levels of permissible exposure. Past sources of income for the NCRP included the DOE [Department of Energy], Defense Nuclear Agency, Nuclear Regulatory Commission, US Navy, American College of Radiology, Electric Power Institute, Institute of Nuclear Power Operations, NASA, and the Radiological Society of North America. In truth, the NCRP relies upon the nuclear-industrial complex for most of its funding other than income from publication sales. Trust me, this fact does not escape NCRP members when they set standards for radiation exposure (Caufield).

When the NCRP got down to work after the war, their first order of business was to establish new radiation standards and to formulate policies for the new nuclear industry, on such matters as safe handling of radioactive material, environmental monitoring, the disposal of radioactive waste, and so forth. To pursue the necessary lines of research, eight subcommittees were established. In this way, many former scientists of the Manhattan Project came on board as advisors to the establishment of safety standards. The most important of the subcommittees formed were Subcommittee One, charged with reevaluating the currently accepted standard for radiation received external to the body by x-ray and gamma ray exposure, and Subcommittee Two, whose agenda was to formulate new standards for internal contamination by the plethora of radionuclides that had been born into the world in the nuclear reactors of the Manhattan Project.

Subcommittee One was headed by Gioacchino Failla, a physicist at Memorial Hospital in New York. The work of this committee focused on the accumulating evidence that the 1934 tolerance dose of 0.1 roentgen (0.1 rem) of x-ray/gamma irradiation per day was too high. By the end of 1947, Failla's committee recommended that the dose for external exposure be cut in half to 0.05 rem per day, with the maximum permissible dose for a week readjusted to 0.3 rem. Before the official adoption of this new standard, Taylor

queried the nuclear industry as to whether or not the new standards would in any way impede their program. The answer they gave is most telling of the philosophy of the NCRP:

> Ultimately, the committee settled on a figure that the nascent nuclear industry would accept. "We found out from the atomic energy industry that they didn't care [if we lowered the limit to 0.3 rem per week]," explained Lauriston Taylor. "It wouldn't interfere with their operations, so we lowered it" (Caufield).

The problem of developing standards for isotopes undergoing radioactive decay inside the human body was an entirely different problem from merely revising the standards for external exposure and required much more time. Prior to the Manhattan Project, the possibility of internal contamination to humans was limited to select, small populations and only by a few radionuclides. Radium was used in medicine and industry. Uranium and radon were a hazard to miners. With the discovery of artificial radioactivity in 1934 and the development of the cyclotron, radionuclides that did not occur naturally on the earth began to be produced and used in biomedical research. The Berkeley cyclotron was the primary source of artificially produced radionuclides for civilian research prior to and during World War II. When the Manhattan Project was well under way, radionuclides for research were also being produced secretly in the nuclear reactor in Oak Ridge, Tennessee, and purified there at Clinton Laboratories. In order to maintain the secrecy of their origin, these radionuclides were shipped first to Berkeley and from there distributed to labs throughout the country. In 1946, the newly established Atomic Energy Commission initiated a program promoting peaceful applications of the atom and openly offered the radionuclides produced in Oak Ridge to interested scientists. As intended, easy availability rapidly accelerated research. In the first year, 1,100 shipments of radionuclides were shipped from Oak Ridge to 160 research centers. Two years later, Abbott Laboratories also began distributing radioisotopes. The ensuing research delineated the physical characteristics of each radionuclide and the behavior of each when introduced into animal and human subjects. Medical researchers sought for any clue in their studies that would indicate the possible usefulness of a radionuclide in tracer studies, diagnostics, or treatment. The sudden proliferation of novel radionuclides created an urgency for the establishment of safety standards for each internal contaminant. This was a major focus after the war for the advancement of radiation protection.

All the information furnished in this chapter up to this point has been required background material and preparation for understanding the work conducted by Subcommittee Two. This committee was charged with the setting of radiation protection standards for

radioactive material deposited in the interior of the human body through inhalation, ingestion, absorption, or uptake via skin lesions and wounds. Subcommittee Two pursued its work with the utmost integrity and succeeded in creating a system, expedient at the time, for establishing safety standards for internal contamination. Only many years later was their work subverted and transformed into a system of lies to cover up the true hazards to life produced by the release of radioactivity into the environment.

Subcommittee Two was chaired by Karl Morgan, who later presided for fourteen years over the committee on internal emitters for the ICRP. Morgan worked as a health physicist at Oak Ridge during the Manhattan Project and was employed there for twenty-nine years after the war. He cofounded the Health Physics Society and served as its first president. He is frequently referred to as the "father of health physics." In his later years, he became a controversial figure. He openly spoke out about the increased risks from unnecessary medical x-rays and advocated cutting the accepted standards for permissible radiation dosages by half. The nuclear establishment labeled him a "rogue physicist" and marginalized him. He is quoted as having said: "I feel like a father who is ashamed of his children."

When Subcommittee Two first met in September 1947, the challenge facing its members was daunting. Hundreds of novel radionuclides that had never before existed on the face of the earth, at all or in appreciable quantities, were being created en masse in the nuclear reactors that were producing fuel for atomic bombs. These same radionuclides were being created in the fireballs of atomic bomb detonations and scattered throughout the biosphere. Virtually nothing was known about their behavior once they gained access to the interior of the human body. Each possessed its own unique half-life. Each decayed in a unique manner. Each emitted different combinations of alpha, beta, and gamma radiation, and the energies transmitted by these radiations varied from one radioisotope to another. Each demonstrated a unique pattern of distribution throughout the body. Each showed a preference for an organ or tissue where it tended to accumulate. Each had its own rate of absorption, retention, and elimination. As a consequence of these factors and many others, each radionuclide presented its own unique toxicological and radiological hazard. What further complicated understanding was the problem of how to assess the combined hazard to a victim when more than one radioisotope was incorporated into the interior of the body at the same time. The major conundrum facing Subcommittee Two was how to proceed.

As a model for success in their endeavor, the committee had before them the example of radium. But therein lay the problem. The first standard for a permissible body burden of radium was not formulated with any scientific accuracy until well over forty years

after that radionuclide's initial discovery. This successful standard was based primarily on direct observation of internally contaminated individuals who later developed overt symptoms of disease or signs of injury. Once such a person was identified, the quantity of radionuclide taken up within their body was established and then compared to that of other individuals who lived or worked in a similar situation but who had internalized less and remained unharmed. By this means, estimates could be derived as to what levels of internal contamination were presumably safe. As further data accumulated, these initial judgments could be adjusted as required. This same approach worked for establishing the first standards for uranium and radon inhalation in mines. There was also reliable information, again derived from direct experience, about radium-224, used for therapeutic purposes in Germany between 1944 and 1951, and thorium-232, known as Thorotrast, used between 1930 and 1950 in patients to produce better contrast in x-rays. In addition, there were the human radiation experiments involving plutonium.

The members of Subcommittee Two recognized that standards for all the new radionuclides created by nuclear fission could not possibly be derived by direct observation. Data on the physiological effects in humans of many of these radionuclides was completely lacking. Sufficient animal studies had not yet been performed. Comparison of effects to known radioisotopes was possible only in a limited number of cases. Years, if not decades, of research would be required to generate the vast amount of required information on the physical, chemical, and biological behavior of each radioisotope. Such a task would be monumental. Yet standards were needed quickly to offer guidelines for protection of workers in the nuclear industry. Some other approach was required for zeroing in on what constituted permissible levels for internal contaminants.

During the war, Karl Morgan and other physicists and medical personnel of the Manhattan Project had made first steps in developing a new methodology for calculating dosages for internal emitters. By the war's end, they had succeeded in calculating the dose of radiation for seventeen radioisotopes in various chemical forms that would be delivered to the tissues they were likely to be deposited in once internalized. The methodology for these calculations was further developed after the War at three conferences on internal dosimetry held in 1949, 1950, and 1953. These meetings came to be known as the Tri-Partite Conferences in reference to the attending representatives who came from the three countries that had worked closely during the war in the study of radionuclides, namely Canada, the United Kingdom, and the United States. Many who attended these conferences were former participants in the Health Division of the Manhattan Project and later were members of Subcommittee Two. This is both interesting and important. The foundation of today's approach to internal contamination by radionuclides was forged by the subculture of physicists and medical personnel who built the first atomic bomb. Their men-

tality and orientation toward radiation safety evolved while they were immersed in fabricating weapons of mass destruction. While supporting the development of a weapon for the annihilation of masses of humanity, they simultaneously occupied themselves with developing safety standards to protect the world from the menace they were creating. In the postwar world, these same individuals entrusted themselves with becoming the guardians for all of humanity in their prescription of what constituted a permissible dose of radiation. This is an excellent example of the genocidal mentality referred to elsewhere in this book. To a healthy mind, true radiation safety would entail refraining from building weapons of mass destruction altogether.

The scientists participating in the Tri-Partite Conferences built upon the existing methodology for calculating the dosages for internal emitters and carried it further. What they created was a "computational system" based on mathematical modeling. This computational approach allowed them to calculate dosages from internal emitters and permissible levels of exposure without having to rely on direct observation and experimentation. In ensuing years, as new experimental findings and data from direct observation became available, this information was fed into the system to further refine and improve it. The methodology relied upon today by the agencies setting standards for internal emitters use this same computational approach, with updated modifications, to determine for the public what constitutes a permissible dosage of radiation emitted by radioactive atoms gaining entrance into the human body.

Many of the participants of the Tri-Partite Conferences later served on Subcommittee Two of the NCRP. These same people sat on a similar subcommittee studying internal emitters for the ICRP which Lauriston Taylor was instrumental in resurrecting in 1953. This is how the computational approach took root in these two agencies. The results of the Tri-Partite Conferences were transplanted into the NCRP and then into the ICRP, and these organizations became a clearing-house from which information about radiation safety was distributed throughout the world.

For the computational system to be effectively applied, a great deal of background data had to be assembled. First, the physical properties of each radionuclide had to be determined. The most important of these was the rate of decay, the type of radiation each emitted (alpha or beta plus the gamma ray that frequently accompanied each decay), and the energy this radiation would transfer to the organ of retention. As mentioned earlier, each type of radiation created different degrees of biological effect, and this information was included in establishing the quantity of energy each decaying atom would transmit to its surroundings. Also necessary was knowledge of the behavior of each radionuclide once introduced into the body. Of particular importance was the retention kinetics of each:

where did it go, how long did it stay, and over what period was it released. Numbers were also needed to represent the fraction of the radionuclide that passed from the gastrointestinal tract or lung into the blood, the fraction in the blood transferred to the critical organ, the fraction passing into the critical organ compared to the remaining fraction in the total body, and the fraction of that taken into the body that actually was retained in the critical organ. By knowing such patterns of distribution, calculations could be made to determine the dose delivered by each radionuclide to each organ or tissue and its maximum permissible body burden.

For the computational approach developed by the Tri-Partite Conferences to be applicable for all radioisotopes in all human beings, it was necessary to formulate a conceptual model of the human body that would be representative of all people. This model became known as "Reference Man", or more commonly, "Standard Man". This ideal human was "regarded as weighing 70 kg, being 170 cm high, between twenty and thirty years old, a Caucasian of Western European habit or custom and living in a climate with an average temperature of 10º to 20º" (Stannard). The inclusion of information on custom and climate was to set parameters for average water intake and typical diet. The tissues of the body of Standard Man were considered to have an average density equivalent to that of water. Basically, Standard Man was conceptualized as a 70 kg mass of water. An average mass for each organ in the body was derived mathematically and conceptualized as a smaller mass of water residing within the larger mass of water.

The successful application of the computational system for deriving safety standards hinged on a knowledge of how much radiation each organ or the body as a whole could be exposed to without causing any ill effect. With no prior knowledge of the behavior of the majority of radionuclides once inside the body, how was determination of a permissible dose possible? Members of Subcommittee Two were forced to rely on the vast body of knowledge that had accumulated over previous decades of the body's response to x-rays, i.e., EXTERNAL RADIATION. To quote *Radioactivity and Health: A History*:

> It should be noted that no cognizance is given in the system [computational system] to the nature of the biological effect being protected against. The limiting dose rate was determined by groups espousing basic radiation protection criteria. They arrived at their conclusions largely on the basis of work with *external radiation sources* [italics added], except for the bone seekers. They applied their best judgment to the biological data and set exposure levels for the most sensitive functions (Stannard).

The phenomenon of electromagnetic energy interacting with matter is what

Manhattan Project scientists used for formulating a general model of what transpires when *any type* of radiation interacts with matter. So effective was their conceptualization in explaining the impact of x-rays and gamma rays on the body that they did not hesitate to apply the same model for explaining the biological impact of alpha and beta particles plus gamma rays released in the interior of the body by decaying radionuclides. They carried this thinking into the Tri-Partite Conferences after the war and made it a cornerstone of the computational approach for determining dosages of radiation delivered by internal emitters. The validity of the entire model of radiation effects in man that they were constructing hinged on the validity of the foundational assumption that the biological effect of internal radioactive decay could be modeled on the biological effect of external irradiation.

After a half century of radiology, a substantial body of knowledge had accumulated about the effects to different organs, and the body as a whole, from different quantities and intensities of x-rays delivered at different rates from the exterior of the body. Based on this experience with external radiation sources, those working on the problem of internal emitters assigned a maximum permissible dose and dose rate to each organ of the body of Standard Man. The assumption was then made that each organ could safely absorb the same quantity of energy delivered from decaying radioisotopes embedded in the organ as it could safely absorb from x-rays delivered from outside the body. To the thinking of the time, what was important was the amount of energy delivered. For the computational system to work, what was required was a knowledge of how much energy was being deposited per unit mass of tissue under consideration. It was this point of view that allowed members of Subcommittee Two to base their work on internal emitters upon the previous research on external irradiation.

A simplified, hypothetical example will suffice to illustrate the type of calculations being performed in the absence of direct observation and research on the behavior of each radionuclide once inside the body. Suppose the permissible dose from exposure to x-rays has been established for an organ. This quantity represents the amount of energy that can be transferred to the atomic structure of that organ with no manifestation of any ill effect. That knowledge is then used as a baseline for calculating what quantity of a particular radionuclide could be taken up by the organ without manifesting any signs of injury. *To simplify the kinetics involved, the assumption was made that the internal contaminants were distributing the energy emitted from radioactive decay throughout the entire organ.* In this way, an equivalency was visualized between external and internal radiation. Each form of radiation was delivering the same quantity of energy to the same mass of tissue. Consequently, there was no reason not to apply what was known of external irradiation to the problem of internal radiation. Although in time a host of modifying factors were introduced to account for differences in the way the different types of radiation were delivered and the type of biological

effect each produced, these had no effect in displacing the fundamental assumptions that the transfer of energy was the essential characteristic of the interaction of radiation with the human body and that the energy delivered to an organ could be treated as if it were evenly distributed throughout the mass of that organ.

To return to the work of Subcommittee Two, once permissible dosages were calculated for each radionuclide, secondary standards were mathematically derived for the maximum permissible concentration of each radionuclide in air and water. The need for these safety standards was based on the idea that the only way to prevent a person from accumulating a hazardous dosage of internal emitters was to control the environment in which the person worked or dwelt in so as to limit hazardous accumulation of the radionuclide(s) in the air being breathed and in the food/water being ingested. A person dwelling in an environment where air and water did not exceed the maximum permissible concentrations would not accumulate levels of the radioisotope that would deliver a dose of radiation greater than the permissible dose. A working lifetime was considered to be 50 years. Intake for each radionuclide was presumed to happen continuously, either for a work week of 40 hours or continuously throughout a week's 168 hours. Limits were then established for the maximum permissible concentration for each radionuclide in water and air so that a worker exposed to these levels would never accumulate the maximum permissible dose to an organ over his working lifetime or at a rate that presumably would be hazardous.

In a nutshell, this is the computational method developed at the Tri-Partite Conferences and used by Subcommittee Two in establishing permissible limits for internal emitters. Although undergoing extensive revision over the years as new information became available, this mathematical approach to calculating permissible dosages still forms the backbone of radiation safety today. It is Health Physics 101. It is unquestioned orthodoxy in regards to the proper way of calculating the radiation transmitted to biological structures from internalized radioactivity.

For the non-specialist struggling to make sense of the technical material just presented, a single image is all that is required to follow the essence of the discussion. Visualize a person inhaling some quantity of a radioisotope. Microscopic particles of that radioisotope pass into his bloodstream and by metabolic processes within the body are transferred to the critical organ where they subsequently become lodged for a period of time within the cells of that organ. While retained there, some of the atoms undergo radioactive decay and radiate alpha or beta particles, depending on the isotope, and usually an accompanying gamma ray which can be visualized as a photon, a massless packet of energy. The energy transmitted by the nuclear particles and the photon for each radioisotope are known physical quantities as is the rate of decay for each radionuclide. Standard Man provides a ref-

erence for the mass of each organ. As the energy of radioactive decay is emitted, that energy is transferred to the electrons of the atoms making up the cells of the organ of deposition. If an estimate can be made of the amount of the radioisotope initially inhaled, the computational method can be used to calculate the amount of energy transmitted to the molecular structures making up the organ. The assumption is made that that energy is uniformly distributed to the mass of the organ, and by this means, the organ dose can be determined.

The original intention of Subcommittee Two, formulated in 1947, was to recommend maximum permissible concentrations in air, water, and the human body for twenty biologically significant radioisotopes. When their final report was published in 1953, and a similar report published by the ICRP in 1955, values had been calculated for 96 radioisotopes. Work continued throughout the decade, and both committees published comprehensive reports in 1959 which included information on approximately 215 radionuclides and 255 values for maximum permissible concentrations.

The work of Subcommittee Two was a milestone in human understanding. It provided a relatively simple methodology for quantifying dosages of radiation delivered to the interior of the body by radioisotopes. Further, it established urgently needed standards of what might constitute nonhazardous levels for a variety of radioisotopes. The new guidelines provided the framework for all future animal and human studies into the toxicology of radioactive materials. Subsequent study began to demarcate what dosages of each radioisotope were necessary to produce detectable alterations at every level of biological systems from the molecular to the cellular to the histological to the systemic. With protection standards in place, researchers could work in apparent safety in the development of such disciplines as nuclear medicine, radiation therapy, and radiobiology. Then as now, what remained a fundamental priority was to validate the accuracy of the computational system to determine whether or not it successfully modeled the actual biological impact of internalized radioactivity.

Before concluding this brief history of the development of radiation protection standards for internal emitters, one final point needs emphasis. Every living creature on the earth requires protection from mankind's experimentation with radiation. Without debate, this responsibility was assumed by the NCRP and the ICRP. These institutions were never truly separate or independent, and the membership of both heavily overlapped. Lauriston Taylor was deeply involved in the establishment of both organizations. Gioacchino Failla and Karl Morgan were chairmen for the subcommittees on external and internal radiation for both the NCRP and the ICRP. Other US representatives to the ICRP were also members of the NCRP. As a result of this cross-pollination, no opportunity ever existed for an

alternative point of view to evolve in regards to what constituted radiation safety and what was judged to be permissible exposure.

> The Chair of the NCRP, Lauriston Taylor, was instrumental in setting up an international version of the NCRP, perhaps to divert attention from the clear evidence that the NCRP was associated with the development of nuclear technology in the USA and also perhaps to suggest that there was some independent international agreement over the risk factors for radiation (ECRR).
>
> Taylor was a member of the ICRP committee and the NCRP Chairman at the same time. The NCRP committees One and Two were duplicated on the ICRP with the identical chairmen, Failla and Morgan. The interpenetration of personnel between these two bodies was a precedent to a similar movement of personnel between the risk agencies of the present day. The present Chair of the ICRP is also the Director of the UK National Radiological Protection Board (NRPB). The two organizations have other personnel in common and there are also overlaps between them and UNSCEAR [United Nations Scientific Committee on the Effects of Atomic Radiation] and the BEIR VII committee [Biological Effects of Ionizing Radiation Committee, originally funded by the Rockefeller Foundation in 1955, and now organized under the auspices of the National Research Council of the National Academy of Sciences.] This has not prevented the NRPB from telling the UK's regulator, the Environment Agency, that UNSCEAR and ICRP are 'constituted entirely separately', a statement which the Environment Agency accepted. Thus credibility for statements on risk is spuriously acquired by organizations citing other organizations, but it can be seen as a consequence of the fact that they all have their origins in the same development and the same model: the NCRP/ICRP postwar process. This black box has never been properly opened and examined (ECRR).

The NCRP/ICRP black box is impenetrable. The public has no access into the hearts of those who have served on these committees, the discussions that have gone on behind closed doors, the compromises that may have been made in radiation safety for the benefit of government nuclear programs and the nuclear industry. However, the international radiation protection agencies have left within the public domain a penetrable artifact of their true intentions and their true allegiances, i.e., their system of evaluating the risks of radiation exposure and their standards of what constitutes a "permissible" dose of radia-

tion. As the gospel of this book loudly proclaims, "By their deeds you will know them." You will know them by the fruits of their deeds. The reach of the Cult of Nuclearists and the services performed on their behalf by the radiation protection community is unmistakably written within the system currently relied upon to evaluate the hazards of internal contamination. Through a study of this system, glaring flaws become evident, intentionally left uncorrected to serve the political agenda of covering up the true impact to health from radiation released into the environment.

6

The Most Heinous Crime in History: The Betrayal of Mankind by the Radiation Protection Agencies

You can't underestimate the importance of public relations when you are trying to dump radioactive material on people [the transcript noted laughter at this point], and we worked at it strenuously.[1]

Oliver R. Placak

Science is a dynamic human enterprise. Achievements in understanding are frequently tentative advances which require reformulation as further knowledge is acquired. In fact, this is one of the distinguishing characteristics of science that separate it from all forms of dogmatism. The scientific method, when applied with integrity, invites evolution in understanding as new discoveries are made. This should have been the case with the computational model based on a transfer of energy from internalized radionuclides to whole organ masses. But the process was subverted. Like physics during the early part of the twentieth century, biology underwent a dramatic revolution beginning in the 1950s. The new realities which emerged underscored fundamental errors in some of the basic

[1] This quote appears in *Fallout: An American Nuclear Tragedy* by P.L. Fradkin. Oliver R. Placak was a radiation monitor for the Public Health Service who worked offsite of the Nevada Test Site during the period of atmospheric nuclear weapon testing. He made this statement in 1980 during a meeting convened by the Department of Energy to gain information to refute allegations in the lawsuit *Irene Allen v. The United States of America* (filed August 30, 1979) that fallout was responsible for producing cancer in people living downwind of the tests.

assumptions underlying the computational approach. Nevertheless, regulatory agencies have made no effort to correct the inherent flaws in their system which they continue to rely upon in gauging the biological impact of internal emitters and which remains the basis of internationally accepted standards of what constitutes permissible radiation exposure.

In most other scientific matters, a debate over safety would be entrusted to specialists in the field. Experimentation and the scientific method would be the final arbitrator between any rivalry of opinions. But this can no longer be the case with the study of internal contamination. The field of radiation protection has been heavily infiltrated and compromised by those with a vested interest in ensuring the proliferation of nuclear and radiological weapons and commercial nuclear reactors. A politically motivated international system of standard setting agencies, upholding antiquated models of the biological effects of ionizing radiation, has asserted itself as the voice of authority in the field of radiation protection. Governments, in turn, depend on the flaws within these models to legitimize the safety of their nuclear programs and conceal the detrimental biological effects these programs impart to unsuspecting populations. Under these circumstances, it would be foolish to believe that objective, disinterested science is representing the best interest of humanity. As long as the trained professionals remain remiss in their duty to counter the misdeeds of regulatory agencies and government, no alternative remains but to open to the public forum the ever so important issue of radiation safety.

The Trial of the Cult of Nuclearists

Hear Ye! Hear Ye! At long last, the time has come to convene the court of public opinion to try the Cult of Nuclearists for their crimes against humanity. They are charged with the crime of fraud, momentous fraud, which has been a shield for an unprecedented degradation of the earth and a creeping debilitation in the health of all people and all living things. What follows is the case for the prosecution. Let the people judge.

Exhibit A

The entire system that has evolved to safeguard the welfare of humanity is ultimately grounded on one fundamental idea: The essential feature of the interaction of radiation with biological systems is the transfer of energy from its source to the medium in which it is absorbed, and the degree of injury is proportional to the amount of energy transferred. This idea was advanced by physicists attempting to conceptualize biological realities, reali-

ties of which they had very little knowledge. Biology, however, is governed by its own laws, laws different from those falling within the province of physics. When now queried by current understanding, biology responds that this central idea is erroneous. **The neat concept of energy transfer is largely irrelevant to the biological response to ionizing radiation**.

Before proceeding, be forewarned. What follows is heresy. It is an unwelcome intrusion on the tyrannical paradigm that dictates how human beings are supposed to understand the interaction of radiation with living systems. Within the modern knowledge base, this paradigm is not only archaic but false, artificially propped up and perpetuated by the nuclear establishment. Although what follows defies orthodoxy, this does not equate with an absence of scientific merit. It is soundly grounded in modern research. It is gaining popularity as courageous and outspoken scientists step out of the shadows and forthrightly question why rates of cancer and mortality associated with internal exposure to radioisotopes are so much greater than that predicted by the currently accepted models of risk upheld by the ICRP models.[2]

To fire a shot across the bow of the Cult of Nuclearists, let the discussion begin with a quotation from *Radiation Protection Dosimetry: A Radical Reappraisal*: "**the amount of kinetic energy transferred in each collision** [between a charged particle and the molecular components of a cell] **plays no role in the production of radiation effects in mammalian cells**[1] **.**

Flawed thinking is the foundation upon which current models of radiation protection are built. The essential problem dates back to the first attempts to come to terms with the meaning of dosage as it applies to radiation. The roentgen was adopted as the unit of measure of exposure. It represented the quantity of ionization produced in air by photons emitted by an x-ray machine. At issue was how to translate this quantity of effect in air into a meaningful concept of biological effect once that energy penetrated into the human body. The model that was eventually adopted by physicists was analogous to the model adopted to explain the radiation of heat. When ionizing radiation penetrates a mass, the incident energy is conceptualized as being uniformly distributed throughout the entire mass. The unit of absorbed dose gave expression to this view of incident energy as averaged throughout the absorbing mass. The rad is an expression of ergs *per* gram. This concept seems suitable for thinking about the absorption of radiation by inanimate objects. However,

[2] Good background material for this discussion can be found at the following websites:
Committee Examining Radiation Risks from Internal Emitters - www.cerrie.org.
European Committee on Radiation Risk - www.euradcom.org.
Low Level Radiation Campaign - www.llrc.org.

when applied to ionizing radiation's interaction with living systems, the model shows its flaws:

> One need only consider the common fever in order to ponder the very high probability that the biological potency of ionizing radiation is related to its spatial concentration along tracks, rather than to its meager addition of energy to cells. A dose of 400 cGy (400 rads) is equivalent in heat to only 4.184×10^{-3} joules per gram of tissue — enough to provoke a mini-fever of 0.001 degree Centigrade — yet 400 cGy of ionizing radiation to the whole body, acutely delivered, will kill about half the humans exposed to it. (Gofman 1990)

In this example, the biological effects of ionizing radiation cannot be adequately modeled by simply dividing the quantity of energy by the mass into which it is deposited. That mode of thinking blinds one to the reality of how biological damage is actually induced by radiation. A living system is made up of cells. Impact on the functioning of these cells depends on how the energy is distributed in relationship to critical cellular structures:

> Generally, ionizations are not produced singly, but as double or triple events, known as clusters. Based on the assumption that an average of three ionizations occur per cluster, the figure of 100 eV/primary ionization is often used when discussing energy transfer. Even though the amount of energy involved in ionization appears very small, it tends to be very efficient and extremely lethal. If 100 eV/cluster were deposited in a sphere 30 angstroms in diameter, it would increase the temperature (locally) from 37°C to approximately 80°C. **Consequently, it is the distribution of the energy and not the total amount of deposited energy that is significant for cell inactivation** [emphasis added] (Holahan).

In his book *Wings of Death: Nuclear Pollution and Human Health*, Chris Busby totally destroys the reigning paradigm of energy transfer:

> Energy, however, can be transferred in a multitude of ways, and takes many forms; on its own, energy transfer is a totally useless measure of quality of effect. For example, one cup of boiling water at 100 degrees centigrade contains the same energy, the same number of Joules, as some ten times this quantity of water at the temperature of ten degrees. An energy transfer to a person of one waterthrow unit could encompass either a cupful of boiling water in the face or a buck-

> et of cold water: more information is needed before the health consequences can be assessed (Busby 1995).

This simple illustration highlights the shortcomings of the physics-based model of the biological effects of radiation. Energy can be transferred in many different ways. And equal quantities of energy can produce dramatically different effects depending upon *how they are delivered*. Acknowledgment of this simple fact necessitates a revision of the very foundation of current approaches to radiation protection:

> The last twenty years of developments in knowledge of cell biology have rendered obsolete the primitive understanding of radiation effects which is still used to underpin present laws of radiation safety. It is now apparent that we cannot continue to lump all radiation together and talk of "dose" as some physical quantity of transferred energy, as if sitting in front of a hot fire and absorbing the warmth of so many joules were equivalent to the same number of joules absorbed if we were to reach into the fire, withdraw a red-hot coal, and swallow it. The effects of radiation depend on the quality of that radiation and how it is delivered in space and time (Busby 1995).

> The energy transfer model for determining the effects of ionizing radiation starts out by postulating that so much energy transfer of ionizing radiation should produce proportional effect on living tissue. The shortcomings of such a facile hypothesis soon became apparent. The first obvious weakness was its inability to distinguish between the biological effect of different types of radiation: alpha, beta, gamma.

> Experiments in cell cultures made it clear that the effects of these three types of radiation [alpha, beta, gamma] were different: it was not the quantity of the radiation that explained the results, but its quality. Although the three types of radiation had been distinguished in theoretical physics, pioneers of radiation assumed that their harmful effects would be relative to the amount of energy each carried, rather than the nature of its irradiation effect (Busby 1995).

Radiation delivered to the body externally in the form of x-rays and gamma rays and radiation delivered to the body internally by the emission of alpha and beta particles from decaying radioisotopes are fundamentally different phenomena. The attempt to liken them by focusing on the fact that they both transmit energy disguises the fact that they differ in terms of the biological effects they produce. The model of energy transfer arose to explain the effects of x-rays impinging on the body from the outside. This model was ade-

quate for explaining relatively high doses of radiation. The large quantity of photons involved in the interaction are distributed throughout the mass that absorbs them. The primary ionizations created when the photons interact with orbital electrons throughout the target and the secondary ionizations caused when these liberated electrons go on to ionize other atoms tend to be spatially removed from each other in a sparse pattern of molecular disruption. As an abstraction, the idea of a uniform distribution of effect throughout the absorbing mass is not unreasonable. Alpha and beta particles from internal emitters not uniformly distributed, however, produce a different pattern of molecular damage within cells or within tissue. Their range of travel is minute, and they deposit all of their energy in a dense pattern of ionization in a small volume of cells. A "hot particle", a particle composed of a huge number of radioactive atoms, acts as a point source or hotspot, perpetually emanating radiation to the same critical cellular molecular structures in their immediate vicinity throughout the time they are retained within the body. This is the rationale for the hot coal analogy mentioned above. Being warmed by a fire is different from swallowing a hot coal, though the same amount of energy might be transferred. The two phenomena create different patterns of biological effect.

The model for external radiation that came to dominate thinking does in fact approximate reality to a certain degree. This is not because the essence of the phenomenon is, as visualized in the model, a transfer of energy throughout the target mass, but because at relatively high doses individual cells begin receiving multiple hits in critical structures and become increasingly vulnerable to functional alteration. A dense pattern of ionization in proximity to critical cellular structures is created which mirrors that created by alpha particles, and to a lesser degree beta particles, released by internal emitters. The key phenomenon is the location of ionizing events within the cell, not simply the amount of energy transferred. At high doses of external radiation, the differences between irradiation from the outside and internal exposure become blurred. Dense patterns of ionization within individual cells are created by both types of exposure. Biological damage becomes proportional to the dosage and the quantity of energy is predictive of the damage. Thus, the apparent triumph of the physics-based model. **The fundamental problem with the model is that it breaks down at low doses of radiation.** When the dosage delivered by photons external to the body is so low than each cell fails to be hit at least once, the idea of uniform distribution of energy within the target mass falters. At these low doses, the pattern of ionization created by external radiation and the hazard this poses cannot be likened to that produced by decaying radionuclides which are creating dense patterns of ionization and extensive local chemical disruption in individual cells. At low doses, the equivalent energy delivered by x-rays or gamma rays externally and that delivered by alpha and beta particles internally produce different patterns of chemical disruption to individual cells. As a consequence, low dose effects from external irradiation cannot be used to pre-

dict effects from internal contamination. The simple conclusion that, dose for dose, internal emitters may produce more negative biological effect than external irradiation is a calamitous conclusion for the nuclear establishment and will ignite vehement rebuttal. The whole basis for discounting the hazards from radionuclides emitted from nuclear installations or the detrimental effects of depleted uranium weapons is grounded on the purported equivalency between external and internal radiation based on the amount of energy they deliver. The qualitative difference in their capacity for promoting harmful effects to individual cells is conveniently ignored.

The current model attempts to account for the differences between the various types of radiation and their biological effects. Modifying factors have been introduced to shore up the reigning paradigm that energy transfer is the central phenomenon in radiation's interaction with living systems. For instance, the concept of *linear energy transfer* (LET) was formulated to account for the density of ionization produced by different types of radiation along their path of travel and the amount of electron-volts deposited per micrometer. The *relative biological effectiveness* (RBE) of different types of radiation, later replaced by the *quality factor* (QF), was a modifying factor added to calculations to account for the varying degrees of biological effect created by equal quantities of energy when delivered by different types of radiation. A *distribution factor* (DF) was another modifying factor introduced into calculations to account for the biological effect created by internally incorporated radioisotopes distributed nonuniformly throughout the target organ. It is essential to understand that these kinds of modifying factors were patched on to the prevailing model of energy transfer to rescue it from irrelevance by bringing it more into line with observed biological effects. These quick-fix measures, however, never addressed one central underlying flaw in the reigning paradigm. It is not grounded in biology, in the way cells actually respond to radiation!

The reigning paradigm is out of step with the current knowledge base. It is completely inadequate for modeling the effects of low-level radiation on the cellular level. The problem is that it is grounded on an "unsound premise." As mentioned in *Radiation Protection Dosimetry: A Radical Reappraisal*: "In the present context, the unsound premise is that absorbed dose is a fundamental concept that can be used as an effective predicator of radiation effects." Simmons and Watt then continue:

> Criticisms of the use of absorbed dose as a basis for assessing the effects of low levels of radiation are not new. At the 17th meeting of the NCRP in 1981, V. Bond, the Head of the Medical Department of

> the Brookhaven National Laboratory, observed that for stochastic[3] processes such as the induction of cancer at low levels of radiation, it is the effect within a cell (or a small number of cells) that is important. However, because at low levels of radiation (i.e., those of significance in radiation protection) a large proportion of the cells will have received no radiation, the mean dose per cell represented by the average tissue dose is not the same as the mean dose per dosed cell. A better quantity to use in this context is the fluence of charged particles through the critical volumes. Only when all the cells have received at least one hit (i.e., at "doses" of ~ 10 cGy [10 rad] for low-LET radiation and ~ 1 Gy [100 rad] for high-LET radiation) does dose become a suitable surrogate for charged-particle fluence.

To translate, the current model is adequate to explain radiation effects as long as the radiation dose received is great enough that the critical volume of each cell of the target [i.e., the cell nucleus] receives at least one hit by tracks of ionization laid down by alpha, beta, or gamma radiation. In doses smaller than this, a better predictor of biological effects is the fluence[4] of charged particles passing through the nuclei of the cells actually hit. Why is this? When low levels of radiation traverse tissue, not all cells are hit. Thus, the averaging of energy over large volumes is an erroneous concept. Biological effect is only induced in cells that are actually hit. Of those cells that are hit, the greater the number of tracks of ionization passing through the nucleus, the greater the likelihood for irreparable damage to critical cellular structures such as the DNA molecules. Thus, the fluence of charged particles is the fundamental phenomenon in gauging radiation effects. As Simmons and Watt explain, "Energy deposited is not the cause of an interaction; it is a secondary effect. The interaction is best described by fluence and cross section." From this point of view, dose "can be expressed as 'hits per unit volume or mass' or 'passage of particles per unit area'" (Simmons and Watt). Here physics and biology merge in a successful model that accurately depicts what takes place when radiation interacts with living systems composed of individual cells.

In the opinion of many radiobiologists, the most critical lesion created in a cell traversed by radiation is a double-strand break (dsb) in the DNA molecule. Single-strand breaks along one half of the double-helix molecule are effectively repaired by cellular mechanisms. Two breaks, each occurring along each half of the double helix, are much less likely to be accurately repaired. Such a lesion either goes unrepaired or is misrepaired.

[3] The outcome of stochastic processes involve chance or probability. Their end result is not fixed or causally determined.

[4] The term "fluence" refers to the number of charged particles traversing a given target volume per unit time..

This can lead to cell death or various types of mutation that may or may not be lethal to the cell. Mutations within cells that do survive may be the precursor to a cancer. The distance between the two strands of a DNA molecule is approximately 2 nanometers (2 billionths of a meter). There are a number of patterns of radiation fluence that can be responsible for creating successive ionizations within this critical 2 nm distance. At high doses of gamma irradiation, a number of tracks may intersect the same cell nucleus and successfully cause breakage in the two arms of the same DNA molecule. As dosage decreases, the likelihood of double-strand breaks diminishes. It is at this point that the current model of energy effects begins to break down. (Although the dose delivered by photons makes dsbs unlikely, an equivalent dose delivered by marauding alpha particles still retains the capacity for creating dsbs.) A second possible initiator of a double-strand break is a decelerating electron coming to the end of its track and ionizing both strands of a DNA molecule. The geometry of this type of event makes the probability of its occurring relatively low. A third and very effective cause of double-strand breaks is a heavy particle such as an alpha particle. Its dense pattern of ionization permits it to breach, at a single blow, both strands of the double helix. This is what makes alpha-emitting radionuclides so potentially hazardous. Just one alpha particle has the capacity of creating a dsb.

So far, what has been mentioned are double-strand breaks created by direct hits to the DNA molecule. Indirect hits can also contribute to double-strand breaks. The most frequent type of molecule to be ionized in a cell from radiation is water. This can lead to the formation of free radicals which can diffuse up to a distance of about 15 nm from the particle path that created it. Created in close enough proximity to the DNA molecule, the free radical can induce rupture along one of the strands, creating a point mutation. Similarly, the hydroxyl radical (OH) produced from the ionization of water can diffuse 2 to 3 nm and promote chemical rupture in a DNA strand. Thus, it is the combination of both direct and indirect hits to the nucleus that combine to create double-strand breaks.

> The radiation track must, so to speak, match the 'template' of the strands of the DNA for an effective interaction to occur. Those interactions which occur at positions not so matched will have no effects, a situation that accounts for the irrelevance of energy transfer. There are on average ~15 pairs of strands at risk across the cell nucleus. The observed saturation cross section depends on the number of target DNA segments penetrated (determined by the particle's projected range) and the interaction spacing along the relevant track (Simmons and Watt).

Under this scheme, the probability of hits created by the respective fluences of variously charged particles delivered at different rates becomes a basis for establishing relative

hazard.

> The conclusion to be drawn is that the basic mechanism of radiation damage to normal mammalian cells is the correlation of two ionizations, which are spaced at about 1.5 to 2 nm along single-particle tracks in the relevant charged-particle spectrum, with the similarly spaced strands of the intranuclear DNA. The biological effects discussed are found to depend on the number of such paired interaction events, which are independent of the energy transfer (Simmons and Watt).

Within this new paradigm, it is the breakage of the chemical bonds of the two strands of a DNA molecule that is critical, AND, for this to occur, no more energy is required than the binding energy of these two bonds. Thus, the old paradigm, in which radiation effects were pegged to total energy absorbed, mistakes the fundamental phenomenon in the interaction of radiation with living systems.

> If one accepts the argument, based on experimental evidence, that the amount of energy transfer in excess of bond energies is irrelevant to the induction of radiation effects, then it is fundamentally wrong to use energy deposition as a quantifying parameter.
>
> Two ionizations, if appropriately placed, are sufficient to break two single strands of the DNA whether the energy transfer is 10 eV or 1 MeV. All the evidence obtained here points to the conclusion that it is the *number* of events (double-strand breaks in the DNA) caused by correlated pairs of ionizations that matter, not the energy transfer. Thus, two ionizations produced in the critical volume of a DNA segment need not induce a dsb. To do this the ionizations produced by the track must be correlated with the strands of DNA, like a template. If this is correct, then it would invalidate, on conceptual grounds, the use of volume quantities such as absorbed dose; the quality parameters ionization density and restricted LET; and the microdose quantities, linear energy and specific energy density, because these quantities include the interactions of low-energy delta electrons (Simmons and Watt).

Simmons and Watt title their book *Radiation Protection Dosimetry: A Radical Reappraisal.* Their proposal for a new paradigm in understanding radiation effects is both unorthodox

and revolutionary. It challenges the very foundation of current thinking on how to best conceptualize what transpires when radiation interacts with life. It has been presented here in order to highlight the inadequacies of the reigning paradigm. It is evidence that the knowledge base has expanded tremendously since the Tri-Partite Conferences. Further, it is evidence of how antiquated the currently accepted model of radiation effects has become. The puzzle that must be unraveled is why such an outdated, inaccurate model continues to be used to protect mankind from exposure to low levels to ionizing radiation. The answer to this question will be addressed in Exhibit E.

Exhibit B

Dosages are calculated on the basis of the amount of energy transferred to a biological system. The risk to normal function posed by those dosages are similarly pegged to the amount of energy absorbed. From Exhibit A, it should have become obvious that this system is in need of revision. However, even within the currently adopted paradigm, a fundamental problem exists in the accepted methodology for calculating how much radiation a person receives from radioactive material deposited within the human body. As mentioned earlier in this chapter, the dose delivered to an organ is derived by averaging the amount of radiation emitted by internal contaminants over the entire mass of the organ in which they are deposited. Using external irradiation as a model, the physicists of the Manhattan Project postulated that internal emitters would produce the same biological effect for the same amount of energy deposited by radioactive decay (with consideration given to the quality factor of each type of radiation). To capture this energy transfer in their mathematical calculations, the energy transmitted by alpha and beta particles during radioactive decay was averaged over the entire mass of the target organ to yield an organ dose. **The ICRP continues to this day to insist that this is the proper way of calculating dosages from internal emitters!**

Alpha and beta particles emitted by radioactive contaminants create dense, localized patterns of ionization within a microscopic volume of tissue. To treat these emissions as somehow impacting and transmitting an effect to the entire mass of an organ is a gross conceptual blunder that totally distorts the reality of what actually transpires on the cellular and molecular levels. As mentioned previously, alpha particles on average traverse no more than 30 to 40 microns, approximately 3 to 4 cell diameters. Beta particles can travel as far as millimeters, depending on their energy and the density of the tissue, traversing the distance of approximately one hundred cell diameters. When emitted from an atom undergoing radioactive decay, these particles travel along discrete tracks within a small volume of cells. Biological damage is produced within individual cells along these particle tracks. While in transit, they initiate the ionization of molecules only along their path of travel,

either hitting vital molecular cellular structures, such as the DNA molecule, or missing them altogether. Not all cells within the range of the particle are affected. Biological alteration occurs only in those cells that are hit by the particle. Cells that are missed by the particle suffer no injury. *With internal emitters, the unit of interest for gauging biological effects is individual cells, not whole masses of tissue*. This is particularly true for the induction of a cancer. Cancers arise from mutations within a single cell. This being the case, averaging the effect of a particle over an entire mass is ludicrous. Being a hit or miss phenomenon involving individual cells, how can the effect of an alpha or beta particle be averaged over the entire organ?

Chris Busby has been instrumental in highlighting the shortcomings of this physics-based averaging model which he speaks about at length in his book *Wings of Death* and in numerous other writings. On the website of the Low Level Radiation Campaign, a simple but effective illustration can be found that pinpoints the inadequacy of current practices for calculating the biological impact of internal emitters:

> The conventional approach of averaging the energy transfer from radioactive decay events across a whole organ or the entire body is like emptying a Colt 45 into a football stadium and averaging the effects of the 6 bullets across all the 25,000 spectators. The assumption that between them 25,000 people should be able to stop six bullets without any of them feeling more than a tap on the arm will not console the six grieving families.[5]

In this example, the 25,000 spectators are the cells of an organ. The six bullets are six alpha particles. By the averaging model, the energy from the velocity of the bullets is treated as equally distributed to all who feel no more than a tap as a result. But this model simply does not reflect the phenomenon. In reality, the full energy is absorbed by only six spectators with catastrophic consequences. In terms of biological effect, it makes no sense to speak of the impact of six alpha particles distributed over 25,000 cells. Only the individual cells hit will suffer biological damage. The remainder will escape unscathed. The dose is not received by the whole organ. It is absorbed completely by only a handful of cells.

For the incredulous readers, shaking their heads in disbelief that the international radiation protection community calculates biological impact of internal emitters by such hocus pocus averaging, rest assured that this is the way things are done.

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[5] Extract from Low Level Radiation Campaign response to DETR consultation on the recycling of contaminated materials arising from Clearance of nuclear sites. This document plus hundreds of pages of instructive information can be found on the website of the Low Level Radiation Campaign at www.llrc.org.

But why? And what's the big deal anyway?

A single example will suffice to reveal the nature of the carny game being exposed. Imagine a soldier on a battlefield maneuvering downwind of a burning tank recently destroyed by a depleted uranium penetrator. Inhaling smoke from the fire, the soldier draws deep into his lungs a single particle of uranium oxide, UO_2.[6] (It's important to keep in mind that this is an ideal example. A victim so exposed to depleted uranium may inhale hundreds of thousands of particles.) The particle is small in diameter, 2.5 microns or 2.5 millionths of a meter, which is equivalent to one ten-thousandth of an inch. (Particles this small are considered respirable. They are capable of reaching the non-ciliated portion of the respiratory airways and can remain lodged in the lung for years or even an entire lifetime.) A depleted uranium particle of this dimension is estimated to consist of 2.10×10^{11} (210,000,000,000) atoms of the uranium isotope U-238. While lodged in the lung, the uranium atoms undergo radioactive decay at a rate determined by that isotope's unique half-life, the time required for one half the atoms in a sample to spontaneously decay by emitting particles and/or energy from their nuclei. Due to the long half-life of uranium, 4.5 billion years, on average only 32.3 atoms making up the particle will decay each year. To complicate the scenario, depleted uranium is not pure uranium-238. Present are atoms of other uranium isotopes with their own unique half-lives and energy emissions: uranium-234, uranium-235, and uranium-236. Together, these three uranium isotopes undergo an additional 5.3 atomic disintegrations per year. So, all tolled, approximately 38 atoms within the particle trapped in the lung of the soldier undergo radioactive decay each year. Taking into account the density of the tissue and the energy of the emitted alpha particles, the alphas will travel no more than a distance of 0.00331 centimeters. If the depleted uranium particle is visualized as residing at the center of a sphere with a radius equal to the maximum distance capable of being traversed by the alphas, the volume of cells potentially affected by the radiation will be 1.519×10^{-7} (0.0000001519) cubic centimeters. When the total energy delivered by the alphas in one year to this microscopic volume is calculated, the dose is **17 rads**. Taking into account the relative biological effectiveness of alpha particles, the dose to the vulnerable population of cells is **170 rem per year**. In the microscopic domain, this is a tremendous amount of energy radiating through a very confined volume.

In discussing the results of this calculation, Leonard Dietz offers the following observation:

> The Code of Federal Regulations dealing with energy specifies per-

[6] The figures presented in this scenario are drawn from an article by Leonard A. Dietz entitled "Estimate of Radiation Dose from a Depleted Uranium Oxide Particle." http://www.xs4all.nl/~stgvisie/VISIE/Dietz-L/Dietz-du-3.html

> missible radiation doses. Occupational doses (for radiation workers) shall not exceed 5 rem/yr., except in unusual circumstances. For the general population, the annual limit is 170 millirem (0.17 rem) and a specific limit of 500 millirem (0.5 rem) for any individual in the general population.
>
> If the above estimate of radiation dose (170 rem/yr.) received by lung tissue surrounding the depleted uranium oxide particle is correct, then it is 34 times the maximum dose that radiation workers are permitted to receive and 100 times higher than the maximum acceptable dose for the general population. For a 5 micrometer diameter depleted uranium oxide particle (8 times the volume), the estimated dose is 1,360 rem, or 272 times the maximum permissible dose to a radiation worker. Until these doses can be related to a cancer risk factor, they must be viewed as qualitative indicators of danger, as red flags.

Quite obviously, the currently accepted model "cannot deal with small volumes and inhomogeneities of dose, and for this reason is unsafe to apply to internal radiation" (ECRR). According to current statutes, a member of the public is permitted in any one year to receive no more than a dose of radiation *to the whole body* of 0.5 rem. It is thought that the organism can absorb the energy of 0.5 rem, and undergo the amount of ionization produced by this energy throughout its molecular structure without causing any significant health detriment. And yet, the single particle of depleted uranium transfers in one year 170 rem to the tiny cluster of cells in its immediate vicinity. This small conglomerate of vulnerable cells is driven into extreme chemical chaos by this single alpha-emitting particle. Until the risk to the hit cells is determined by experimentation, it is scientifically unwarranted to conclude that an inhaled depleted uranium particle is benign. This example highlights an important principle: **It is at the level of the cell where radiation effects become significant, not over large masses of tissue.** An honest approach to radiation safety would be grounded on this fundamental fact.

Busby has performed similar calculations to the one presented above. In his example, a particle with a diameter of 2 microns is lodged in the lymphatic system. As with the previous example, the dose to the cells in the immediate vicinity of the particle is 150 rem (1500 mSv) per year. By comparison, Busby provides a calculation of how the ICRP would calculate the dose ***averaged over the whole lymphatic system*** which is considered to be a mass of 800 grams. By this method of calculation, the yearly dose to the lymphatic system is only a meager 0.0000021 rem (2.1×10^{-7} mSv).

Pause right here. Observe the crafty sleight of hand that is taking place as a card gets sloughed under the table. The International Commission on Radiation Protection is mesmerizing the world into believing the decay of depleted uranium atoms within the body is insignificant. By a system of smoke and mirrors, they take the energy transmitted by a few alpha particles to a small volume of cells and treat is *as if* this energy is distributed through 800 grams of tissue. Totally false to the reality of the situation, their system DILUTES the impact by suggesting that it is spread over a large volume. In calculating dosage by this manner, the biological effects of imbedded uranium particles is made to appear inconsequential. When the phenomenon is viewed in its true light, the dosage is distributed only to those cells that are actually hit by the marauding alpha particles. A whopping dose of radiation is deposited in a small volume creating significant chemical alterations in the affected cells and setting the stage for mutations and the possible induction of a cancer. When government spokesmen proclaim that depleted uranium does not present a radiation hazard, what method of calculating dosage do you think they are relying upon to substantiate their conclusion?

From these examples, a disturbing truth emerges: The calculation of dosages of radiation from internal emitters based on the averaging of energy over large masses of tissue is a scam. It's charlatanism. It's flimflam. It's a racket of juggling numbers to get them to say whatever the juggler wants them to say. By mathematical prestidigitation, biologically hazardous quantities of radiation can be made to appear innocuous. The august scientific bodies around the world are fabricating lies based on models that do not accurately reflect the reality of the phenomenon. They have erected a monumental intellectual edifice designed to quell the concerns of the public while giving reign to the nuclear establishment to scatter with abandon dangerous quantities of radioactivity over the earth.

Exhibit C

Quite obviously, a major problem exists in the way dosages from internal emitters are calculated. But this is only half the picture. So what if the *theoretical* framework is corrupt? Surely, as a fallback, there must exist a body of research to validate the safety of the levels of internal contamination permitted to the public. But herein lies a startling revelation. The studies upon which the risks to health from low doses of internalized alpha and beta emitters are based are primarily studies of *acute doses of* ***external*** *irradiation by x-rays and gamma rays delivered at a high dose rate*!

Now hold it right there! How can this possibly be? The case was previously made that, from a biological point of view, external irradiation and internal contamination are

qualitatively different phenomena. How can standards of safety for internally incorporated radioactive contaminants be based on photons impinging on the body from the outside? *The assumption made so long ago that external and internal radiation produce the same biological effects has never been validated*. Extrapolating from known effects of external irradiation to predict suspected effects from internal emitters is scientifically without merit:

> With regard to internal radiation doses, the committee [European Committee on Radiation Risk] identifies a serious misuse of scientific method in the extension and application of the ICRP external model. Such a process involves deductive reasoning. It falsely uses data from one set of conditions — high-level, acute, external exposure — to model low-level, chronic, internal exposure. The procedure is scientifically bankrupt, and were it not for political consideration, would have been rejected long ago (ECRR).

In our age of purported scientific enlightenment, this is what the 'guardians of humanity' have been doing behind our backs: They have derived risk factors for internal exposure to radioactivity from a number of studies conducted on external exposure. Justification for the validity of this extrapolation is based on the fallacious model of energy transfer and the averaging of dosages over large volumes of tissue. Mankind's safety from internalized radioactivity is based on the erroneous assumption that there is no physiological difference in how energy is delivered to the body. External irradiation and particulate emission from internalized radionuclides are regarded as being identical phenomena in terms of the physiological effects they induce.

To elucidate the source upon which current standards for permissible levels of internal contamination are based, we can turn to "BEIR V", a 1990 publication by the Committee on the Biological Effects of Ionizing Radiation. According to this document, the Committee's risk factors for radiation exposure were derived from the following studies:

I. <u>The Life Span Study of the Japanese Atomic Bomb Survivors.</u>

The National Census conducted in Japan in 1950 identified approximately 284,000 people who had survived the bombings of Hiroshima and Nagasaki. From this population, 91,231 people enrolled in a study to have their health monitored over their lifetime. In addition, 27,000 people who were located a minimum of 10 km from the hypocenters of the explosions were selected for the study to serve as a control population. An elevated incidence of leukemia and solid tumors were observed in the study population. **The data from this study has become the primary source for assessing the risks from exposure to ionizing radiation.**

II. The Study of British Patients Irradiated for Ankylosing Spondylitis.

Ankylosing Spondylitis is a form of rheumatoid arthritis affecting the spine. In Great Britain between 1935 and 1954, patients with this condition were treated with spinal irradiation. This procedure had the unintended side effect of irradiating a large fraction of the body with substantial doses of radiation. Long-term medical follow-up of 14,106 of these patients revealed an elevated incidence of various cancers and leukemias when compared to a control population.

III. Radiation Dose and Leukemia Risk in Patients Treated for Cancer of the Cervix

This study followed the health consequences to 150,000 women who received radiotherapy for treatment of cervical cancer. Approximately 70% were treated with radium implants or external radiotherapy. The administered radiation delivered substantial radiation doses to organs close to the cervix and moderate doses to organs located more distally in the body. Doses to bone marrow — and consequently, rates of leukemia — were higher than those found in an unexposed population. The radiation dose to the active bone marrow was estimated by medical physicists who had access to the original radiotherapy records.

IV. The Canadian Fluoroscopy Series.

This study followed the health of 31,710 Canadian women for fifty years. Between 1930 and 1952, they were examined and treated for tuberculosis with x-ray doses to the chest. As a result, an elevated incidence of breast cancer was observed. The study divided the women into age groups based on when treatment was received and succeeded in establishing a relationship between the rates of cancer and the cumulative dose of x-rays.

V. The Rochester Acute Mastitis Therapy Series.

This study followed the health of 601 women treated with x-rays for acute postpartum mastitis. The incidence rate of breast cancer within this cohort was in excess of the rate found in a number of different control groups. The radiation dose varied from 60 to 1,400 rads.

VI. The Massachusetts Fluoroscopy Studies.

This research followed the health of 1,742 women who received x-ray treatments for tuberculosis. These women received repeated, low-dose exposures over a period of time. Estimated dosage per treatment was 1.5 rads. The accumulated breast dose was approximately 150 rems. Breast cancer rates were elevated in all age groups above the control population.

These six studies all share one thing in common. **They all involve acute, high-**

dose exposure from external radiation sources. Via mathematical modeling of the computational system, the data from these studies was manipulated to derive the risk posed by radionuclides *delivering chronic, low doses of radiation internally with the total energy delivered averaged over large masses of tissue*. This process is what the European Committee on Radiation Risk refers to as "serious misuse of the scientific method."

By far, the most important of the six studies listed above is the Life Span Study (LSS) of the Japanese survivors of the bombing of Hiroshima and Nagasaki. If you open any textbook on radiation safety, what you will find is a statement saying that what is known about the effects of ionizing radiation on populations is largely based on the data from Japan. The results of this study carry tremendous weight in the field of radiation protection. Currently accepted ideas of the risks to health from radiation exposure are based primarily on the results of this study. Consequently, the health of all of mankind is at stake, grounded on the reliability of this one study. Needless to say, the accuracy, validity and reliability of the Life Span Study is open to question.

The country that dropped the atomic bomb is the same country that funds and controls the Life Span Study. In 1950, five years after the bombing of Hiroshima, an excessive incidence of leukemia began appearing in the exposed population. In response, the Government of the United States established the Atomic Bomb Casualty Commission (ABCC) with the mandate of monitoring the health of the surviving population. In 1975, control of the study was passed to the Radiation Effects Research Foundation (RERF) in Japan. Continued funding is divided between the government of Japan and the government of the United States through the National Academy of Sciences under contract with the Department of Energy.

To fully appreciate the controversy that has arisen over the Life Span Study, it is necessary to revisit the horrific events of Hiroshima and its aftermath. At 8:16:02 AM on the morning of August 6, 1945, the "Little Boy" atomic bomb exploded over Hiroshima. At the moment of detonation, a flash of gamma radiation and neutrons showered the target area and irradiated the entire population. In a microsecond, a thermal pulse baked the city and ignited a conflagration, and a pressure wave smashed most structures to smithereens. Exact casualty figures are not known. Perhaps 100,000 people died from combined injuries from the direct effects of the blast: immense quantities of irradiation, burns, and a vast array of trauma injuries. It is estimated that by the end of 1945, total casualties had climbed to 140,000 people. By 1950, the death toll had reached over 200,000. What had once been Hiroshima was left in radioactive ruin. Radiation contaminated the soil and the water. This created an environment where internal contamination became possible for all who entered the area for years afterward. In the immediate after-

math of the bombing, people who had either lived outside the city or who had left the city center prior to the detonation reentered the city looking for family and friends. These people, not exposed to the detonation, subsequently became contaminated by internal emitters. Nevertheless, they were later included in the control group of the Life Span Study representing people who were not exposed to radiation.

This brief portrait provides all the information the reader needs in order to understand the overwhelming number of errors inherent in the atomic bomb survivor study. Never lose sight of the fact that, in the hands of the ICRP, this study provides the foundation for current models of the risks to health from radiation exposure, and via extrapolation, the hazards of low-dose exposure to internally emitting radionuclides. At a meeting of the European Parliament in February 1998, a number of attendees expressed criticism of the ICRP and the Hiroshima data on radiation effects. These were summarized in the first publication of the European Committee on Radiation Risk (ECRR).

1. Professor Alice Stewart faulted the Hiroshima research on the grounds that the study and control groups were not representative of a normal population. Those included in the study were survivors of the stresses of war who had endured an overwhelming atrocity. Between the end of the war and the establishment of the Life Span Study, as many as 100,000 people succumbed as a result of blast injuries, irradiation, conventional illnesses, and internal contamination from fallout and tainted food and water. As a consequence, **the study omits tens of thousands of radiation-induced deaths that took place in the first seven years after the dropping of the bomb**. Thus, any results of the LSS will inevitably underestimate the hazards of radiation exposure. Due to the multiple stressors of the bombing and its aftermath, a natural selection process was set in motion whereby unfit people, the physically and psychologically weak, succumbed and were weeded out of the study population. A "healthy survivor effect" thus biased the study. By the time the Life Span Study got underway, those studied made up an atypical population that could not adequately represent the delayed effects of radiation exposure for the entirety of mankind.

2. Several participants at the meeting of the European Parliament criticized the ICRP for failing to adequately address the subject of internal contamination. The surviving Hiroshima population was modeled on the basis of everyone receiving an instantaneous barrage of gamma and neutron irradiation at the moment of detonation of the bomb. Completely ignored by the study is the fact that the surviving population was exposed to fallout that compounded external radiation from beta and gamma emitters. Further, soil and water were contaminated by radionuclides creating the opportunity for the ongoing accumulation of internal emitters through the diet. As a consequence, dose estimates, upon which the whole study rests, are meaningless. To make matters worse, when those outside

the city during the time of the bombing entered the city to see what had happened and to look for families and friends, they likely received internal contamination. Thus, the "control" population was also contaminated with radioactivity. What effect does this have on the Life Span Study if both the study population and the control population were exposed to radiation? It will make the incidence of cancer among the study population appear much lower than if a valid comparison were made between those exposed and another suitable control population totally unexposed. By basing the study on an inappropriate control population, radiation is made to appear less hazardous than it actually is.

3. Dr. Chris Busby argued, as has been revealed previously in this chapter, that the model used by the ICRP to model the physiological impact of high levels of external radiation is totally inappropriate for accurately predicting the effects of internal contamination delivered in low doses at a low dose rate. And yet, this is exactly how the Japanese data is used to estimate health risks and derive permissible levels of exposure from internal emitters. According to Busby, by relying on faulty models to assess the risk of internal emitters, the ICRP has failed to accurately determine the true hazards of internal contamination.

4. Dr. David Sumner criticized the ICRP for utilizing the Sievert (equivalent to 100 rem) as a unit of measure. According to his argument, the quality factors introduced into equations to account for differences in the physiological impact of different types of radiation are value judgments and not physical units. To say, for instance, that alpha radiation produces ten times as much biological effect as electromagnetic radiation is not sufficiently rigorous to be used to evaluate the risk from different types of exposure.

5. Dr. Rosalie Bertell challenged the very legitimacy of the ICRP to represent before all mankind the hazards to health of ionizing radiation. "The ICRP is profoundly undemocratic and unprofessionally constituted. It is self-appointed and self-perpetuated" (Bertell, February 1998). Since its inception with some original members drawn from the Manhattan Project, the ICRP has been filled with people who are biased in favor of the nuclear establishment. "ICRP is organized by its By-Laws to include only users and national regulators (usually coming from the ranks of users) of radiation" (Bertell, February 1998). Membership has remained balanced between 50% physicists and 50% medical doctors. About 25% of the doctors have been medical administrators in countries possessing nuclear weapons who set radiation protection standards in their respective countries and another 15% have been radiologists. The remaining 10% of doctors has consisted of one pathologist, two geneticists, and a biophysicist. Women have been completely excluded. The rules of the main committee responsible for making decisions explicitly exclude participation of an epidemiologist, occupational health specialist, public health specialist, oncologist or pediatrician. According to their own mandate, the job of the ICRP is not to protect workers

or public health. Rather, their self-appointed purpose is solely to make recommendations as to what represents a sensible — i.e., "permissible" — tradeoff between the benefits and risks to society of pursuing technologies that result in people receiving exposure to ionizing radiation. Thus, the standards set by the ICRP for what constitutes acceptable exposure are infused with value judgments made by a select few with ties to nuclear weapons and other nuclear technologies.

> In terms of its own claims, ICRP does not offer recommendations of exposure limits based on worker and public health criteria. Rather, it offers its own risk/benefit tradeoff suggestion, containing value judgments with respect to the "acceptability" of risk estimates, and decisions as to what is "acceptable" to the individual and to society, for what it sees as the "benefits" of the activities. Since the thirteen members of the Main Committee of ICRP, the decision makers, are either users of ionizing radiation in their employment, or are government regulators, primarily from countries with nuclear weapon programs, the vested interests are clear. In the entire history of the radiologist association formed in 1928, and ICRP, formed when the physicists were added in 1952, this organization has never taken a public stand on behalf of the public health. It never even protested atmospheric nuclear weapon testing, the deliberate exposure of atomic soldiers, the lack of ventilation in uranium mines, or unnecessary uses of medical X-ray.
>
> The ICRP assumes no responsibility for the consequences attributable to a country following its recommendations. They stress that the Regulations are made and adopted by each National Regulatory Agency, and it merely recommends. However, on the National level, governments say they cannot afford to do the research to set radiation regulations, therefore they accept the ICRP recommendations. In the real world, this makes no one responsible for the deaths and disabilities caused! (Bertell, February 1998).

In reference to the Hiroshima research, Dr. Bertell made similar observations as the other presenters to the European Parliament:

> It [the LSS] has focused on cancer deaths, is uncorrected for healthy survivor effect, and is not inclusive of all of the radiation exposures of cases and controls (dose calculations omit fallout, residual ground radiation, contamination of the food and water, and individual medical X-ray), and fails to include all relevant biological mechanisms and

endpoints of concern.

> It is normally claimed that the biological basis of the cancer death risk estimates used by ICRP is the atomic bomb studies. However, these studies are not studies of radiation health effects, but of the effects of an atomic bomb. For example, the radiation dose received by the Hiroshima and Nagasaki survivors from fallout, contamination of food, water and air, has never even been calculated. Only the initial bomb blast, modified by personal shielding, is included in the US Oak Ridge National Laboratory assigned "dose." This methodology is carried to an extreme. For example, one survivor I know lived within the three kilometer radius of the hypocenter, but was just beyond the three kilometer zone, at work, when the bomb dropped. As soon as she could, she returned home after the bombing and found her parents and brother dead. Then she stayed in her family home for the three following days, not knowing where to go and filled with grief. Although she suffered radiation sickness and many subsequent forms of ill health, she is counted as an "unexposed control" in the atomic bomb data base. By using the "not in the city" population which entered after the bombing as "controls", many of the cancers attributable to the radiation exposure in both cases and controls are eliminated from the outcomes considered related to the bomb (Bertell, February 1998).

Testifying before the United States Senate Committee on Veterans' Affairs in 1998, Dr. Bertell dropped a bombshell. The team that had assigned dosages in 1986 to Japanese survivors assigned a dose of ZERO to anyone with a calculated dose less than 10 mGy (1 rad). This represented a total of 34,043 participants in the study: 37.3 percent. These people, purely by definition, were assigned to the "not exposed" control group. This decision effectively destroyed the possibility of any detection of heightened incidences of illnesses from those who actually received low-level exposure. Further, by lumping those exposed into the unexposed control group, the LSS is weighted to underestimate the health effects of radiation due to an unsuitable control population. These irreparable errors invalidate any possible conclusions of the LSS as they pertain to low-level exposure. Radiation protection standards are grounded on the research from Japan. What is thought to be the effects of low doses of radiation are extrapolated mathematically from the observed high dose effects discovered by the Life Span Study. As a result of Dr. Bertell's revelation, however, it is clear that the *Atomic Bomb research can have no relevance to any discussion about the health effects of low doses of radiation*. Those who supposedly received low doses had their exposure nullified. If honesty prevailed, this fact alone would shake the radiation protection community. A cornerstone of current approaches to radiation safety holds that the hazards posed

by low doses of radiation can be inferred from the effects observed in Japan from high doses.

> The atomic bomb researchers assumed (but did not demonstrate or prove) that below 1 rem exposure from the original bomb blast no radiation related cancer deaths would occur. Therefore this data base can tell us nothing about such low-dose exposures because the researchers assumed their exposure was "safe" and did not test for an effect. In philosophy, we call this "begging the question" and it results in an invalid "proof" (Bertell, April 1998).

There is other evidence available in the public domain that seriously questions the structure of the Life Span Study in regards to the assignment of dosages received by Japanese survivors:

> Detection of radiation risks depends upon the ability of an epidemiological study to classify persons according to their exposure levels. A-bomb survivors were not wearing radiation badges, therefore their exposures had to be estimated by asking survivors about their locations and shielding at the time of detonation. In addition to the typical types of recall bias that occur in surveys, stigmatization of survivors made some reluctant to admit their proximity [Lindee]. Acute radiation injuries such as hair loss and burns among survivors who reported they were at great distances from the blasts [Nerishi 1991, Nerishi 1995] suggests the magnitude of these errors, which would lead to underestimation of radiation risks (Wing).

In his book *Wolves of Water*, Chris Busby recounts information gathered by Kate Dewes who visited Hiroshima and Nagasaki in 2001 and interviewed a number of female *Hibakushas*, the "explosion-affected people." As a woman relating to other women, Dewes gained firsthand knowledge of significant flaws in the Life Span Study. In Japan, the *Hibakushas* are stigmatized. As a consequence, many carry with them feelings of shame. Further, many attempt to hide their experience, or if second generation, the experience of their parents, for fear that association with the bombing will interfere with their opportunity for employment, marriage, and having children. These obstacles to forthright communication are compounded by the fact that as women, they are reticent to speak with male researchers or doctors on "sensitive issues" regarding their health. With this said, a number of women reported to Dewes that they knew of women who had given birth to deformed and intellectually handicapped children who then hid them away so as not to be discovered. More importantly, women reported that researchers frequently did not inquire about their menstruation, fertility, history of miscarriages, and birth outcomes. These rev-

elations are astounding. To an unknown degree, the data from Japan is incomplete. Radiation effects occurred which were hidden from researchers. This would have skewed the results of the Life Span Study toward underestimating the true risks from radiation exposure.

While in Japan, Dewes became privy to other information regarding gross birth abnormalities. These effects are absent from the Life Span Study. **According to the Atomic Bomb Casualty Commission, there was no increase in the incidence of birth defects among children whose parents were exposed to the blasts (Nakamura).** Dewes reports differently:

> After the bombings, midwives in Hiroshima and Nagasaki became very concerned about the number of deformed babies being born. In the September 1954 issue of *Health and Midwifery*, it was reported that about 30,150 births were observed in Nagasaki from 1 January 1950 to 31 December 1953:
>
> "Before the bomb was dropped the proportion of abnormal children to those born healthy was very low, but in the nine years since the bomb was dropped this proportion has changed enormously. Of 30,150 babies born, 471 were stillborn and 181 were abortions. Of those born alive, 3,630 were abnormal and the abnormality was divided as follows:
>
> * 1046 children suffered from degeneration of the bone, muscle, skin or nervous system
> * 429 from deformation of organs of smell and hearing
> * 254 from malformation of lip and tongue
> * 59 had a cleft palate
> * 243 suffered from malformation of the inner organs
> * 47 from deformation of the brain
> * 25 children were born without a brain
> * 8 without eyes and sockets of the eyes.

While traveling with women who were visiting Japan from the Marshall Islands, Dewes heard stories of women who, after being exposed to fallout from the Bravo nuclear test in 1954, gave birth to "jellyfish babies" and "bunches of purple grapes." During her travels, Dewes heard stories of identical types of birth outcomes experienced by the *Hibakushas*. For those who have the stomach for it, images of these hideously deformed types of babies, if that's the right word for them, can be found on the internet, born to women in Iraq after that country was contaminated with depleted uranium.

An interesting historical fact is worth interjecting at this point which gives some perspective on the political forces at work behind the Hiroshima Life Span Study. Many of the Japanese researchers conducting the study were pardoned war criminals who did research in biological warfare and conducted hideous experiments on captured Chinese in Manchuria. They were granted immunity by the US Army in exchange for the results of their experiments. Rosalie Bertell has briefly recounted this history (Bertell, February 1998):

> Interestingly, the Atomic Bomb Casualty Commission (ABCC) and its successor organization, the Radiation Effects Research Foundation (RERF), has, since the beginning, collaborated with the Japanese National Institute of Health (JNIH). ABCC was set up by the occupying force in September 1945. Their Japanese partner was responsible for hiring and firing all Japanese scientists who worked on the A-bomb data, although the US assumed singular control of all of the dose assignments once they were available.
>
> The JNIH was actually established by the order of the US Forces (Lindee), staffed with scientists from the Institute of Infectious Disease (IID) attached to the University of Tokyo, and containing most of the leading medical scientists from the Japanese Biological Warfare (BW) Institutions and the infamous Unit 731, which was responsible for the gross experimentations with humans in Manchuria during World War II (Williams and Wallace). The Japanese scientists who engaged in biological warfare experiments on live human beings, allegedly including allied prisoners of war, were granted immunity by the US Army from investigation for war crimes in return for the results of their experiments.
>
> Kobayashi Rokuzo, advisor to the IID laboratory was attached to the Japanese Army's Medical College headquarters of the BW network, was Director of JNIH from 5/47 to 3/55. His Vice-Director for the same term was Kojima Saburo, who had intensively cooperated with BW Unit 1644 in the vivisection of humans at Nanking, and with the IID unit during the occupation of China. The Director of the JNIH from 3/55 to 4/58 was Komiya Yoshitaka, who was a member of the Institute of Health in Central China during the occupation, part of the BW network of hospitals run by the Military Police. Yanagisawa Ken, Vice-Director from 10/58 to 3/70, conducted experiments on Chinese youths during the occupation, through BW Unit 731. It was through these human experiments that he developed dried BCG,

> becoming "eminent" in medical circles. The list is much longer, including Directors and Vice-Directors up until 1990, scientists known to have conducted military experiments on humans (Shingo).

Returning to the subject at hand, the European Committee on Radiation Risk has compiled its own list as to why the Hiroshima research is totally incapable of providing relevant information on the effects of low levels of internal contamination:

1. The Hiroshima study includes an inappropriate control population. Both the study group and controls were internally contaminated.

2. Mathematical extrapolation from high doses to low doses fails to account for known cellular processes. The ECRR is highly critical of the methodology of mathematically deriving risks to health created by low doses of radiation from data on high doses. According to their rationale, this process fails to address well-established biological phenomena that have been observed at low doses. To offer just one example here (others will be offered in Exhibit D), at high doses there is a greater likelihood of cell killing among targeted cells while at low doses delivered at a low rate, which occurs from internalized radioactivity, there is a greater likelihood that cells injured by radiation will survive but in a mutated form. As a consequence, cancer incidence from internal exposure to low levels of radiation would be greater than that predicted from a simple linear extrapolation from acute dosages of external radiation.

3. In making extrapolations from an acute one-time exposure, as in the case of Hiroshima, to chronic repetitive low-dose exposures that occur from particles of internally embedded radionuclides undergoing radioactive decay, the ICRP model fails to address the fact that a variation in cell sensitivity is introduced into a cell population after initial exposure. Cells once exposed to radiation exhibit increased sensitivity to alteration following subsequent exposure.

4. The ECRR mentions another major flaw in extrapolating from external to internal exposure. When the bomb detonated over Hiroshima, an enormous barrage of photons was ejected in all directions. Those photons passing through human bodies delivered a homogeneous, whole-body dose of radiation to each victim. While traversing through body cells, each photon followed a single track, creating molecular disruption along its path until its energy was expended. Photons are said to have low LET, linear energy transfer. Along their path, they transfer, "on average," less energy per micrometer than alpha or beta particles. This has the effect of creating a sparse pattern of ionization through a cell, i.e., ionizing events are spaced further apart along a track compared to the more dense patterns

of ionization created by alphas and betas. Consequently, the photons released from the bomb possessed a relatively low probability of multiple tracks intersecting at the same critical structures within the same cell, i.e., the DNA molecules. In contrast, radionuclides within the body's interior represent a different phenomenon. Cells in close proximity to embedded particles are vulnerable to being repeatedly hit by the tracks of alpha and beta particles ejected during radioactive decay. Further, these particles have high LET. They create a denser pattern of molecular disruption within a cell. Depending on the radionuclide involved, the nuclei of neighboring cells are more likely to be hit by multiple tracks created during critical times in the cell's life cycle either as a result of multiple hits from atoms of the same radionuclide or from sequential decays of the same atom. As a consequence, internal emitters are more likely to create multiple tracks through the same cell's nucleus and create more molecular damage in and about the DNA. For this reason, internal radiation will have a much greater chance of altering cell function and inducing mutation than that caused by external radiation. Under this scenario, low doses from internal emitters are vastly more hazardous to cellular well-being than higher doses delivered to cells externally.

5. Currently, the ICRP embraces the model in which biological damage is directly proportional to dosage. Once again this assumption is based on extrapolation from high doses. This is what is called the Linear No-Threshold Hypothesis. Based on the biological response of cells to low doses of radiation, the ECRR holds that this assumption is "patently not true."

6. The ECRR maintains that the Life Span Study is not representative of other populations of people all over the world. It is an incorrect extrapolation to assume that the findings from Hiroshima are equally valid for all human beings since research has established that different populations manifest different levels of susceptibility to radiation injury.

7. The ECRR also faults the Hiroshima study because the study group is made up of war survivors. This, once again, is an expression of the healthy survivor effect. The Japanese survivors were selected by the pressures of war and the bombing due to their increased resistance, and thus, cannot be suitably compared to populations that have not endured similar stresses.

8. The Life Span Study has built-in inaccuracies due to the fact that it was started too late and missed many of the early deaths caused by radiation. This has had the effect of skewing the statistics to making radiation appear less hazardous than it in fact actually is.

9. The Life Span Study confines itself to the study of radiation-induced "fatal" can-

cers. Confining itself to this focus, the total health detriment induced in the surviving population is completely ignored. Once again, this misrepresents the true impact of ionizing radiation on human health. In addition to fatal cancers, inheritable damage, and IQ retardation which is considered by the ICRP and other risk agencies, the ECRR advocates inclusion of other health effects including nonfatal cancers, benign neoplasms, infant mortality, birthrate reduction, and low birthweights. General reduction in the quality of life and nonspecific life shortening are further consequences that must be included when evaluating the health effects of radiation exposure.

10. Genetic damage created by the bombing in Japan is modeled on gross abnormalities manifested in births of subsequent generations. The study overlooks more subtle genetic effects that nevertheless may have profound impact on the health of progeny over time.

As if these criticisms were not enough to convince anyone that the results of the Life Span Study are seriously corrupted, two further objections have been raised. One is mentioned by Busby in *Wings of Death*. He observed a large discrepancy between the cancer statistics published by the Atomic Bomb Casualty Commission for the period 1957-8 and those released by the Hiroshima Cancer Registry. According to the ABCC, the incidence of non-leukemia cancers among those survivors who were located within 1,500 meters of the hypocenter of the atomic bomb detonations was 338. In contrast, the Hiroshima Cancer Registry, for the twenty-month period between May of 1957 and December of 1958, reported that the same population had developed 1502 non-leukemia cancers. Adjusting this data for a twelve month period to offer a basis of comparison, Busby derived a figure of 90 non-leukemia cancers. When the incidence of these cancers was compared to the control population, the results were striking:

> Comparison of these two sets of results for the same population, for the same period makes for a curious sense of having fallen through the looking-glass. This feeling is one which is often experienced when attempting to follow published reports relating to the health effects of radiation. The Hiroshima Cancer Registry shows a 400 per cent increase in non-leukemia for the highly exposed group; the ABCC finds only a 30 per cent increase in the highly exposed group. It was the ABCC figures that were used as the basis of risk assessment: no one has ever explained the discrepancy.

An even more disturbing problem with the A-Bomb study has been unveiled by John Gofman in his book *Radiation-Induced Cancer from Low-Dose Exposure: An Independent Analysis, 1990*. In the fifth chapter of this book, Gofman provides a detailed history of the Life Span

Study. Wading through technical minutia to explain the study's structure and how it has been managed over the years, Gofman reveals highly disturbing practices in the conduct of the study that may have well destroyed the usefulness of the study for providing "objective" information about the effects of ionizing radiation on human health. What has taken place is major manipulation of the data in ways contrary to the standard and acceptable practices for conducting epidemiological studies.

Gofman relates four fundamental rules followed by epidemiologists all over the world to prevent bias from contaminating and ruining their studies.

Rule One: Once a study begins, the original input cannot be altered. The importance of this rule is to ensure that, as the outcome of a study becomes known, those who might not be pleased with the findings cannot change the original input to produce a more desirable result.

Rule Two: To further ensure that no bias creeps into an epidemiological study, those investigators in a position to ignore rule one and alter the original input should not have access to the results of the study as these begin to accumulate. Only those who are blind to the outcome are in a position to fairly alter the input once it has been established.

Rule Three: If retroactive alteration of the input is required part-way through a study, the credibility of results can only be safeguarded if investigators meticulously justify the scientific need for any changes and prove unequivocally that bias has not been introduced into the final results.

Rule Four: The original cohorts of a study must be kept intact. Continuity of the original structure of a study is the strongest defense against the insinuation of bias into a study's outcome. Shuffling people from one cohort to another as the results of the study begin to be tallied totally destroys the study's integrity and credibility and invites doubts as to the accuracy of the results.

While reviewing the chronology of the A-Bomb Study and the changes introduced to it over time, Gofman evidences major violations of these rules. One disturbing trend throughout the course of the study has been a continual shifting of the input by changing the make-up of the study population. At one time, thousands of new survivors were added to the study population. At another time, thousands of others were suspended. As Gofman comments:

> It seems as if RERF has been conducting one public study, with 80,000 survivors on view, plus another study with over 34,000 addi-

tional A-bomb survivors in reserve, who are followed-up and selectively added to the public study as needed.

Simultaneously there has been an ongoing process of reassigning dosages of radiation received by each survivor. The revision in dose estimates have ostensibly been introduced for the purpose of improving accuracy to the study. Unfortunately, those involved in this process have not been blind to the emerging incidence rates of leukemias and cancers and to the make-up of the shifting cohorts.

The Life Span Study is plagued by ongoing, fatal problems. As time passes and the population of Japanese bomb survivors ages and dies, the incidence of cancers is being recorded. While this is occurring, an ongoing process of retroactive altering of the study is being undertaken, changing the make-up of the study population and the dosages these people received. This is a high stakes game. The conclusions of this study will be referred to for generations as the definitive study of the relationship between ionizing radiation and cancer hazard. Mankind's trust in the safety of nuclear enterprises way into the future will be heavily influenced by the outcome of this single study. Unfortunately, those who uphold disinterested science as the final arbitrator in the quest for truth will be hard pressed to believe that bias has not hopelessly infected the A-Bomb Study to produce a predetermined outcome which makes radiation appear less hazardous than it actually is.

It does not take an epidemiologist to recognize that the Life Span Study is hopelessly flawed and unable to provide any definitive conclusion on radiation effects to the human body. Yet, it continues to serve as the foundation for regulatory agencies with regard to what constitutes permissible levels of exposure to ionizing radiation. Why? By this time, the answer should be obvious. It fulfills a political agenda. It is an instrument of an intentionally crafted disinformation campaign designed to keep the public unaware of the long-term health effects of nuclear weapons, nuclear power plants, radioactive waste, depleted uranium munitions, and so on. That the worldwide radiation "protection" community adheres to the validity of this plagued study is self-damning, raising legitimate questions about the impartiality and objectivity of its members. With so many "authoritative" bodies upholding this deeply flawed scientific work as the ultimate revealer of truth about radiation effects, the public is condemned to be submerged in lies, herded in ignorance, and deterred from formulating informed opinions about the genuine health effects of nuclear and radiological weapon programs. Think to the political ramifications of the corrupted Hiroshima data. It's all about people who ***survived*** a nuclear weapon. It is fabricated so as to offer testimony that the survivors of Hiroshima and Nagasaki were not subjected to undue suffering or catastrophic health consequences as a result of exposure to ionizing radiation. If these people emerged unscathed by radiation, what basis does anyone have to

complain about emissions from nuclear power plants or depleted uranium scattered over people's homelands? Further, the A-Bomb Study, focusing on fatal cancers to the exclusion of all other health effects, makes the aftermath of atomic warfare appear relatively benign. With high rates of cancer already in existence, what's the big deal if cancer rates creep imperceptibly higher? The mentality that sponsors and endorses the Life Span Study is the same mentality that advocates that nuclear war is winnable, tactical nuclear weapons are useable, and radiological weapons have a place on today's battlefield. This dogma is dangerous, a product of corrupted thinking perpetrated by the Cult of Nuclearists, that may very well draw the entire world over the edge into limited or total thermonuclear war.

Exhibit D

The astute reader may have asked at some point why the history of radiation safety provided earlier in this chapter stopped where it did in the 1950s following publication by the ICRP and NCRP of the first standards of safety for internal contamination. What happened to the second half of the Twentieth Century? This is the million-dollar question. The model used today by international agencies formulating safety for internal contamination by radionuclides is essentially the same model, with updated modifications, developed during the Manhattan Project, the Tri-Partite Conferences, and the meetings of the committees on internal emitters of the NCRP and the ICRP. **This model was developed prior to the discovery of DNA!** Since the 1950s, a revolution has taken place in biology. Entire vistas of cellular and molecular biology, totally unsuspected by World War II physicists, have opened up for scientific exploration. The rapid advancement in technology has created powerful tools for imaging cellular structures and probing the mysteries of the molecular chemistry that orchestrates cellular processes. Advances have been so profound that, today, microbeams can deliver individual alpha particles to cells *in vitro* and the altered morphology of cellular structures can be determined by DNA sequencing and correlated with functional aberrations. Over this amazing new world of microscopic wonders and the deepening understanding of the cellular and molecular basis of life, the ICRP, NCRP, NRPB, UNSCEAR, and BEIR, like Fascist dictators, inflexibly demand that their archaic model of radiation effects be the basis for radiation protection. They tyrannize all discussions on the biological effects of ionizing radiation, and are rigidly intolerant of allowing other points of view from gaining a footing. Despite the fact that cellular response to radiation can now be studied as never before, these "august" bodies of self-declared experts insist that radiation effects can only be properly modeled as they were modeled in the early 1950s. This state of affairs is despotic. The ruling paradigm on radiation effects maintains its supremacy by ignoring a half-century of research in the biological sciences.

A review of a half-century of radiation biology is beyond the purview of this book. The purpose of Exhibit D is to introduce to the reader a small number of fascinating, well-established, scientific facts pertaining to how cells respond to ionizing radiation. What is significant is that these phenomena cannot be adequately taken into account by the current methods used by the radiation protection agencies for determining the health risks from internal, low-level radiation exposure. Their models cannot accommodate these facts. Exhibit E will then offer an explanation for why an antiquated system of radiation safety is being propped up in defiance of advancing knowledge.

According to conventional wisdom, when the DNA of a cell's nucleus is "hit" by radiation, one of three outcomes is possible: (1) The DNA lesion is readily repaired and the cell emerges from the event unharmed. (2) The damage is of such a nature that it brings about death to the cell. (3) The cell survives in an altered form with radiation-induced mutation(s) to its DNA which are subsequently passed on to daughter cells during cell replication. These inheritable mutations may produce alteration in function within the cell. These in turn may instigate a cancer. It was not until the 1990s that a number of studies confirmed that a fourth avenue was possible for cells hit by radiation. At the moment of exposure, instability to the genome of a cell can be introduced which is not immediately apparent. The cell emerges from the event seemingly unscathed. No detectable aberrations are observable. Only with the passage of time, after a number of generations of cell division, does an instability begin to manifest itself as "abnormally high rates (possibly accelerating rates) of genetic change occurring serially and spontaneously in cell-populations, as they descend from the same ancestral cell [originally hit by the radiation]" (Gofman 1998). What is of interest is that the descendant cells that begin to manifest genetic abnormalities are not the original cells that received the radiation exposure. Moreover, after the first manifestation of chromosomal aberrations, continued cell division introduces yet further aberrations and DNA lesions which have no apparent relationship to the aberrations appearing first. The tentative conclusion at this point is that the initial radiation exposure damages the whole genome of the cell in such a way as to render it incapable of maintaining its stability over time.

Within the nucleus of each of the approximately ten trillion cells in the body of a human being, an exact copy of that individual's genetic code can be found. The integrity of this operating system is maintained by the ordered sequence of nucleotides along the length of the DNA molecules. DNA is not inherently stable. Agents from both within and outside the cell can induce changes to its structure. To counter these influences and ensure stability to the genome, an elaborate molecular system continually monitors the accuracy of the sequencing along the DNA and repairs any deviations. As a consequence, when a cell undergoes division, each progeny cell contains a faithful reproduction of the genetic

sequences present in the parent cell.

Exposure to radiation can adversely affect this system of stabilization of the genome. This can be induced by even the removal of a single nucleotide in the DNA sequence.

> The nature of the genetic code is such that mutations need not be gross in order to have gross biological consequences. For instance, permanent removal of a single nucleotide (a micro-deletion) can totally garble much of a gene's code, by causing what is called a "frame-shift." Then this nonfunctional gene can be the phenomenon which wrecks part of the system which would otherwise maintain genetic stability.
>
> In the mass media, some writers have expressed astonishment that radiation-induced genomic instability is not detected until several cell-divisions have occurred after the radiation exposure. They seem to imagine that the delay reflects a mysterious discontinuity between cause and effect. There is no discontinuity, of course. With current techniques, and with uncertainties about where to search closely among a billion nucleotides, it is just not possible to detect every intermediate step.
>
> The induction of genomic instability in a cell does not guarantee that it will become malignant. Genomic instability increases the rate of mutation in that cell and its descendants, and with this higher rate, the cells each have a higher probability that at least one of them will accumulate all the genetic powers of a killer-cancer. These powers include the ability to thrive better than normal cells, to invade inappropriate tissue, to adapt to the new conditions there, to recruit a blood supply, to fool the immune system, and many other properties (Gofman 1998).

The exact mechanism responsible for the initiation of genomic instability has yet to be identified. Perhaps more than one mechanism exists. Or, perhaps a chorus of combined mechanisms needs to be activated to induce the phenomenon. To date, no identifiable single lesion in a gene or chromosome has been identified as the trigger for genomic instability. A more pervasive intrusion on the cell's regulatory functions is hypothesized. A possible explanation is that a radiation-induced interference disrupts the system governing DNA repair, the system responsible for the accurate duplication and distribution of DNA to progeny cells, or the system that regulates gene expression. Further, it may be the case that some individuals carry a genetic predisposition to these destabilizing influences. If such variation

exists in human beings, standards of radiation safety presumed to be applicable to *all* human beings may be very shortsighted. It is important to note in passing that observations of mammals has confirmed that genomic instability can be induced in germ cells and be passed on to the genome of developing offspring. Thus, it is plausible that inherited genomic instability plays a part in the initiation of developmental abnormalities, stillbirths, birth defects, and infant mortality. In light of this, the finding that depleted uranium has been found in the semen of Gulf War veterans, when added to the accumulating anecdotal evidence of an increased frequency of birth defects in the population of Iraq, makes the indiscriminate scattering of depleted uranium in the environment truly alarming.

One of the landmark studies on genomic instability was published in 1992 by Eric Wright, Munira Kadhim, and colleagues (Kadhim *et al.*). In the course of their research, they exposed stem cells from the bone marrow of mice to plutonium-238, giving them a dose of from 0 to 5 grays of alpha radiation.

> The cells were kept in Petri dishes for 11 days until they had divided between 10 and 13 times, each producing between 10,000 and 100,000 daughter cells. Wright found that the progeny of the irradiated cells contained three and a half times as many chromosome aberrations as the descendants of cells that were not irradiated. In a letter to *Nature*, he concluded that **the "relative biological effectiveness" — a measure of how damaging low-level radiation can be in the body — for isotopes that emit alpha particles is "effectively infinite"** [emphasis added] (Edwards).

In the fall of 1995, more than thirty radiation biologists and health specialists attended a workshop in Helsinki to discuss the health consequences to the public of radiation-induced genomic instability. When compiling the available published information on genomic instability, attendees cited twenty-six studies that suggested that the "accepted rules for calculating the biological impact of radiation should be rewritten" (Edwards). According to Jack Little, professor of radiobiology at the Harvard School of Public Health and an attendee of the workshop: "Genomic instability changes our way of thinking about how radiation damages cells and produces mutations." After the workshop, participants prepared a report for the World Health Organization. This report was never published. However, the magazine *New Scientist* acquired a copy and published excerpts. Included in the report was the observation that genomic instability is a key event not only in the process leading to cancer but to the development of other diseases as well. This insight is revolutionary. If confirmed, it will effectively destroy current concepts of radiation safety.

> Instability is also a "plausible mechanism" for explaining illnesses

> other than cancer, the report says. "It would seem likely that if genomic instability led to health effects these would not be specific but may include developmental deficiencies in the fetus, cancer, hereditary disease, accelerated aging and such nonspecific effects as loss of immune competence." Epidemiology would be "powerless" to detect any relationship between the incidence of such diseases and exposure to radiation, the report says, because the number of people who would suffer any single disease would be too low. [Keith] Baverstock, who was the main organizer of the Helsinki workshop, and Wright believe that the world should be more wary of low-level radiation. If genomic instability is causing unpredicted disease, and if some people are genetically predisposed to it, the regulatory system starts to look inadequate. Existing measures meant to protect people, argue Wright and Baverstock, are less than reassuring (New Scientist).

In response to these observations, people who support the reigning ICRP paradigm will argue that any illness induced by genomic instability will already be accounted for within existing safety limits. This position is untenable. It is based on the unfounded assumption that the frequency of *all* possible endpoints of radiation damage (not just cancer) are linearly related to dose and valid extrapolations about low internal doses of radiation can be made from high doses of radiation delivered exterior to the body. According to the model of radiation effects upheld by the nuclear establishment, cancer is the fundamental endpoint of concern following radiation exposure. Further, the frequency of cancer expressed in a population after exposure is directly related to the dose of radiation received by that population. In sharp contrast, as illustrated in the quotation above, radiation-induced genomic instability may produce "developmental deficiencies in the fetus, cancer, hereditary disease, accelerated aging and such nonspecific effects as loss of immune competence." This hypothesis is revolutionary and in direct conflict with mainstream adherence to the belief that radiation damage to the human organism is confined to cancer. If this proves to be the case, it is totally without justification at this point in time to assume that these results are similarly in a linear relationship to dose and that current standards of safety protect the population from these endpoints. As has already been discussed, dosage is too imprecise a concept to account for radiation-induced changes on the cellular level from low levels of radiation. The number and rate of charged particles passing through the cell is a more fundamental phenomenon. This shift of perspective is essential for explaining newly discovered cellular effects of radiation.

The subject of depleted uranium will be explored in depth in subsequent chapters. But one observation is relevant at this point. Within the currently accepted framework for understanding radiation effects, battlefield dispersal of depleted uranium cannot possibly

pose a radiological hazard. The "dose" of radiation is just too small. But in the light of current research, this point of view is no longer defensible. Two *in vitro* studies were recently conducted involving exposure of human osteoblast cells to depleted uranium. Both studies demonstrated that depleted uranium induces genomic instability in the progeny of cells receiving exposure. One study exposed cells to uranyl nitrate created from various isotopes of uranium and compared their toxic effects to cells exposed to the heavy metals nickel and tungsten (Miller *et al.*, 2002). Those cells exposed to DU evidenced an increased frequency of dicentric chromosomes — chromosomes with two centromeres — when compared to the nonradioactive metals. Further, the frequency of dicentric abnormalities was dependent on the specific radioactivity of the different isotopes. The conclusion was that it was alpha radiation emitted by uranium that induced the chromosomal aberrations. According to Miller and her colleagues, "Published data from our laboratory have demonstrated that DU exposure in vitro to immortalized human osteoblast cells (HOS) is both neoplastically transforming and genotoxic." A second study conducted by the same research team exposed osteoblast cells to gamma radiation and alpha radiation from depleted uranium and compared the effects to nickel exposure (Miller *et al.*, 2003). Cell lethality and micronuclei formation were measured at various times after exposure. (Micronuclei arise from DNA double-strand breaks that are not rejoined. These have been implicated in carcinogenesis.) It was found that DU stimulates delayed reproductive death and the production of micronuclei up to thirty-six days (thirty population doublings) after exposure. This is evidence of induced destabilization in the genome. In contrast, the cell populations exposed to gamma radiation returned to normal after a period of twelve days. Further, micronuclei formation from DU exposure occurred at a greater frequency than for equal doses delivered by gamma irradiation. The authors summarized their results as follows: "These studies demonstrate that DU exposure results in genomic instability manifested as delayed reproductive death and micronuclei formation." Together these two studies demonstrate that the alpha radiation emitted from depleted uranium can damage DNA and that DU can induce instability to the genome that initiates abnormal growth in progeny cells. Only in political defiance of these observed phenomenon can propagandists continue to affirm that depleted uranium poses no radiological hazard.

In the cold, mechanistic, clockwork universe of the physical scientist, the phenomena of love, compassion and empathy are driven into exile. There is no mechanism that can account for these experiences. When I am hit, I suffer alone. You standing beside me remain untouched by my misery. This state of affairs, however, is not true to the human experience. In the world of relatedness and relationship, when I am hit, you beside me bleed. Reclaiming mechanistic science from out-of-touch abstraction is biology, the study of life. This is the metaphorical significance of the recently discovered "bystander effect," a second intriguing biological phenomenon that calls into question current assessments of

risk from exposure to low doses of radiation.

Up until the closing years of the twentieth century, research in radiation biology was guided by the foundational assumption that radiation-induced damage to cells was a *direct consequence* of the transfer of energy to cellular molecular structures, DNA being the primary target. Those cells "hit" by radiation were damaged at the instant of exposure or shortly thereafter, and the consequences were expressed within one or two cell generations. Those cells not hit by radiation escaped damage altogether. Within the physicist's paradigm, there was no mechanism by which non-targeted cells could receive injury from radiation. Discovery of the bystander effect dashed this shortsighted, unfounded assumption. In the realm of the living, cells hit by radiation communicate the assault to cells in their immediate vicinity, and the non-targeted cells respond by undergoing similar destructive transformations as if they had actually received the blow themselves.

The 'bystander effect' is the name given to a cell-to-cell communication process by which the damage created in cells hit by radiation is communicated to non-hit cells. These cells in turn manifest damage — often very extensive damage — similar in kind to that received by the targeted cells. "The radiation-induced bystander effect is a phenomenon whereby cellular damage (sister chromatid exchanges, chromosome aberrations, micronucleation, transformation, gene expression) is expressed in unirradiated neighboring cells near to an irradiated cell or cells" (Belyakov *et al.*). Besides immediately observable genetic damage and mutations, bystander damage may also include genomic instability which manifests only after many generations of cell divisions among populations of non-targeted cells. The mechanisms responsible for the bystander effect are not currently known. Two separate pathways seem to be involved. In cells which are in direct contact with each other, chemical communication from the irradiated cell to unirradiated neighbors occurs through channels called gap junctions. For communication with more distant cells, the prevailing hypothesis is that the hit cell releases damage-response chemical signals into the intercellular medium which are then absorbed by cells not directly targeted by the radiation.

The bystander effect shakes the foundation of orthodox dogma as to how radiation interacts with living systems and calls into question the adequacy of current models of radiation risk. Although as yet unproven, it suggests that internal exposure to low doses of radiation may be more hazardous than currently assumed. Further, it poses a serious challenge to the reigning assumption that the effects of low doses of radiation can be determined by a simple linear extrapolation from high doses:

> [The bystander effect] would have significant consequences in terms of radiation risk extrapolation to low doses, implying that the relevant

> target for radiation oncogenesis is larger than an individual cell, and that the risk of carcinogenesis would increase more slowly, if at all, at higher doses. Thus a simple linear extrapolation of radiation risk from high doses (where they can be measured) to lower doses (where they must be inferred) would be of questionable validity (Hall).
>
> The bystander effect does not demonstrate a linear relationship to dose. It is maximally induced by very low doses, suggesting a switch on/off mechanism for its activation (Belyakov *et al.*).
>
> On the basis of this [bystander] effect and its possible contribution to cancer induction in body tissues via the induction of DNA damage, the authors question the assumed linearity of low dose carcinogenic response for alpha particles; this assumption is an important element in radiological protection (Zhou).
>
> The main report [CERRIE Majority Report] notes that the existence of genomic instability together with the bystander effect draws attention to the existence of organization levels for cell communication midway between the cell and the organ. Sonnenschein and Soto have recently suggested that such cell communities are pivotal in the development of cancer as it is cell communication from local cells that tends to prevent any cells in a community from running away from growth control. They see replication as a default state and quiescence as a response to control by local cells. This suggests that damage to such a cell community results in transformation and may be critical in the ultimate expression of cancer. For this reason sublethal damage from multiple decays from hot or warm particles would confer risks not accommodated within presently accepted paradigms (CERRIE Minority Report).

It is interesting to note that the existence of the bystander effect lends support to the idea put forth in Exhibit A that radiation effects cannot be adequately modeled by the simple concept of a transfer of energy. "**Because of bystander effects, the distribution of energy in cells is not related to the distribution of cellular damage"** (Brooks).

The bystander effect introduces an entirely new type of effect produced by ionizing radiation, namely a disruption of intracellular and intercellular communication pathways. The study of this phenomenon is in it infancy and may lead to a revolution in understanding radiation effects. Rosalie Bertell has provided a few insights into this fascinating avenue

of research:

> In addition to these general affects on the whole organism, there are micro-biological effects and biomarkers of exposure which have been neglected by the ICRP because of their focus on cancer death and only one mechanism, namely, direct damage to the DNA molecule initiating a malignant growth. Professor Michael Vicker, University of Bremen, has documented the acute radiosensitivity of blood to micro-Gray doses of radiation, causing the arachidonic acid cascade (Vicker). Rather than trying to extrapolate the DNA damage hypothesis from the high dose exposures to radiation into theoretical happenings in the low dose range, researchers would do better to expand the mechanisms studied to include those which actually occur at the low dose and their sequelae.
>
> With all of the sweeping changes which have occurred in biology and microbiology since the 1952 discovery of DNA by Watson and Crick, radiobiology has stayed focused on cancer and direct damage to DNA. Other branches of biology have expanded to consider the entire cell, systems influencing cellular behavior including functional levels and coupled feedback reactions of networks of inter- and intracellular responses regulating cell communication. Without a holistic view of biology and physiology, radiobiology has been consumed with detail and elaborate mathematical picture of the small world which was delimited by the very first administrative decisions of the nuclear bomb era.
>
> In an organism, cells communicate with one another through the exchange of specific information, for example through a hormone, and the translation of this signal into intracellular messages. Paracrine (hormones secreted from tissues other than endocrine glands) and endocrine hormones are unable to pass through cell membranes. Therefore their information (the hormone) requires a cellular receptor on the outside surface of the cell, a transmembrane signaling that is connected to the receptor, called a "second messenger-generating enzyme", and a correct interpretation of the second messenger system. Various second messengers are released into the cell after stimulation of a particular receptor enzyme system, and which systems may be activated depends on the genetically determined receptors possessed by the cell. This communication system between cells in complex systems, can be modified, for example by phosphorylating particular proteins, and two second messengers can

interact through feedback and cross talk. Ionizing radiation causes many interferences and disruption in this delicately balanced intercellular communication system. In radiobiology, these problems are dismissed and assume to be either trivial or perfectly repaired. Ionizing radiation induces oxidative stress, something admitted by radiobiology but discussed only in terms of its thermal effects. This same oxidative stress induces measurable inflammation, including a massive cascade of fatty acids in various states of oxidation. These mediate inflammatory reactions in the blood and other tissues, such as blood vessel endothelium, and function as second messengers, even controlling such things as pain and chemiluminescence.

The perturbation of cellular communication, regulation and homeostasis by low doses has major consequences for human health and development. It is irrational, as the physicists are now doing, to count on the failure to observe high dose effects at low doses as "proof" that such doses are "safe". DNA damage is a statistical phenomena, called stochastic by the physicists, while the inflammatory response is non-stochastic, or deterministic as it is now called. Unlike skin burns, these internal inflammatory responses occur at microGray doses. The ICRP assumes that deterministic effects do not occur below 500 mGy doses.

The ionizing radiation stimulations are "illicit" in the sense that there is no equivalent stimulation of the arachidonic pathway after non-radiological physiological stimulation, making it pathogenic in character, difficult for the body to regulate and return to homeostasis. This response activates the monocytes, which kill themselves by the oxidants they produce, often ending up as pus along with their digested cellular victims. They can endanger the host by killing other tissue, for example, transplants or infarcted heart tissue.

Activated monocytes are carcinogenic, provoking hitherto latent oncogenic systems and genomic errors to replicate. This may well be one of the mechanisms by which cancers were increased within the first ten years after the Chernobyl disaster. These cancers were dismissed by the IAEA as not radiation related because the ICRP required latency period of ten years had not been completed. These were radiation promoted or accelerated cancers, not radiation induced cancers. Again, we see ICRP recognizing only radiation induced cancers, whereas the victim will experience both mechanisms as due to the disaster (Bertell, February 1998).

In addition to genomic instability and the bystander effect, there are other biological phenomena not adequately represented in the ICRP model of the health effects of radiation. For instance, cells vary in their sensitivity to radiation at different times throughout their lifespan. In an experiment conducted in 1966 on Chinese hamster cells, a 600-fold variation was observed in cell radiation sensitivity throughout the entire cell cycle (Sinclair and Morton). At any one time during the life of an organism, most cells inhabit a phase commonly referred to as Gap 0 (G0). In this phase, the cell is in a non-replication mode of stasis. It is living out its life while contributing to the normal living processes of the system of which it is a part. While in this phase, the cell is *relatively* insensitive to radiation damage. At some point, as a result of such factors as tissue growth, damage, or senescence, a signal is generated to initiate cell replication and the cell moves into Gap 1 (G1) phase. At this point in the cell cycle, preparations are initiated for the replication of the chromosomes. The cell increases in size, produces RNA, and synthesizes proteins. Also, an important cell-cycle control mechanism is activated. A process of proofreading of the integrity of the DNA gets underway where complementary strands are compared and damage is repaired. During G1, the cell is in an intermediate state of sensitivity. If the cell is damaged at this point by radiation, a period of delay is introduced into the process of cell replication while any newly incurred damage is repaired. In this controlled sequence of preprogrammed operations, the cell then moves on to Synthesis (S) phase where the chromosomes replicate. From there, Gap 2 (G2) phase follows. During this gap between DNA synthesis and cell division, the cell continues to grow and produce new proteins. Late in G2, a last checkpoint is reached in the cell cycle to verify that the cell is ready to enter mitosis and divide. Once this transition point (TP) is passed, the cell has reached a point of no return in the sequence of events and it will undergo mitosis. At this transition point, the cell is at its most sensitive point for radiation damage. If a sublethal hit is incurred at this time and damage is introduced into a chromosome, repair is not possible. The damage will be copied and replicated in the two daughter cells regardless of the amount of damage.

The ICRP model makes no allowance for the varied sensitivity of cells throughout their lifetime. Yet again ignoring radiation effects on the cellular level, the model is out of touch with basic biological realities. This gross inconsistency, however, does serve one important purpose. It bolsters the archaic and inappropriate concept of dose which averages energy over large volumes of undifferentiated, noncellular, masses. By this means, low-level radiation effects to individual cells is afforded no room for consideration within the current paradigm of radiation safety. The hazard posed by internal emitters is thus conveniently sidestepped. The enhanced sensitivity of cells to radiation damage at the time of replication suggests that the energy/particle flux from internal emitters, even at low doses, may represent an enhanced hazard to radiation injury when compared to photons impinging on the body from the outside from naturally occurring background radiation due to dif-

ferences in ionization density. It has been determined that, as a result of the natural radiation from the environment impinging on the body externally, each cell receives on average one hit per year. In contrast to this low-level external radiation, low-level radiation emitted by radioactive particles embedded within the body have a greater likelihood (dependent, of course, on quantity and activity) of hitting cells in their immediate proximity during the period of heightened sensitivity of cell replication.

The varying sensitivity of the cell to radiation throughout its life cycle is a central feature of Dr. Chris Busby's Second Event Theory. According to this theory, particular radionuclides that undergo sequential radioactive decay and "hot particles" (particles made up of a number of radioactive atoms) represent a unique hazard when immobilized in the body as compared to random hits delivered by natural background radiation. Central to Second Event Theory is the concept of time between hits to a cell, a factor not taken into account by current assessments of risk from radiation. According to Busby's theory, certain types of sublethal radiation damage created by a single track through a cell can stimulate the cell to undergo a repair and replication sequence. This lasts for a period of between eight and fifteen hours. If the cell is hit again — the second event — while it is at the point of heightened sensitivity in the repair cycle, irreparable sublethal damage may occur in the form of a mutation that will be passed on to daughter cells. Given that natural background radiation is responsible for but one hit per year per cell, on average, only a remotely small probability exists that this source will produce two hits to the same cell within the timeframe of heightened vulnerability to irreversible genetic damage during cell replication. However, the same cannot be said for some types of internal emitters. For instance, strontium-90 has a half-life of twenty-eight years. When it undergoes radioactive decay inside the body, it will hit nearby cell(s) with its emitted beta particle. Having decayed, the atom will have been transformed into yttrium-90. Yttrium-90 has a short half-life of sixty-four hours. The possibility thus exists that this yttrium atom will undergo radioactive decay within the period of maximum susceptibility of the nearby previously hit cell and strike it a second time with its emitted beta particle. In this way, an internalized sequential emitter can be responsible for two hits to the same cell during the window of opportunity of non-reparable genetic damage. A number of other sequential emitters can be similarly hazardous. For instance, tellurium-132 has a half-life of seventy-eight hours. By beta decay, it transforms into iodine-132 that has a half-life of 2.28 hours. Similarly, barium-140 possesses a half-life of 12.8 days and decays into lanthanum-140 with a half-life of forty hours. It is crucial to emphasize that sequential emitters are not the sole source of second-event processes. A "hot" particle can produce the same effect. A particle of plutonium entering into the lung can be made up of billions of atoms. Once lodged in place, it will continue, on an ongoing basis, to shower nearby cells with alpha particles. Two hits to the same cell within the proper time period can be responsible for inducing mutations in hit cells that will

be passed on to daughter cells. This is a plausible pathway for the initiation of a cancer. Not to be forgotten in the latter portion of this book is this important fact: A particle of depleted uranium has the capacity of inducing multiple hits to the same cell during that cell's period of maximum vulnerability. Depleted uranium is quite capable of causing genetic damage and inducing mutations within cells in its immediate vicinity. Once again the propagandists are shown up as liars. Depleted uranium internalized into the human body does pose a radiological hazard.

When one takes into account the differences in cell sensitivity to radiation at different times in the cell life cycle, the hazards of low doses of radiation may be much greater than that supposed by ICRP models. According to the ICRP, radiation effects are proportional to dose. This linear relationship is well-documented at high doses, and via mathematical extrapolation, it is assumed to be equally true at low doses. However, when taking cell sensitivity into account, the dose-response relationship at low doses takes on a different picture. It is not unreasonable to assume that throughout an organ or throughout the whole body, some portion of cells at any one time are undergoing replication. Normal replacement of dead or aging cells can account for this turnover. When this subgroup of sensitive cells is factored into consideration, the concept of averaging a dose over an undifferentiated mass to derive an organ dose once again seems out of touch with reality and the linear dose-response model breaks down at low doses. A biphasic dose-response relationship would offer a more accurate model of low-dose effects to cell populations that include among them cells in a state of hypersensitivity to radiation damage. Such a response has been observed by Burlakova (Burlakova 1995, 1996). To explain, let's assume that one percent of a cell population is actively dividing and in repair replication sequences, and for argument's sake, that these cells are 200 to 600 times more sensitive to a hit from a radiation track. What would the dose-response look like?

> Well, as the dose was increased from zero, the sensitive cells would begin to be damaged and a proportion of these hits would result in fixing a mutation and increasing the possibility of cancer. As the dose increased further, eventually this rise in response would peak as these sensitive cells were killed. The mutation yield would then begin to fall. However, at some point, the insensitive G0 cells would begin to be damaged and the whole process would begin again, with a rise in cancer (Busby 2000).

It can be seen from this model that the lowest doses of radiation can induce mutations in the most sensitive cells. Thus, the likelihood of developing cancer may be enhanced at low doses. As the dose rises, these most sensitive of cells are killed preventing cancer expression. This has the effect of masking the low-dose mutagenic effect. As the dose

increases further, the cells in G0 begin to be damaged and the dose response begins to take on the linear appearance that is currently assumed to be true for all doses. Within this theoretical framework, the possibility emerges yet again that internal emitters releasing low doses of radiation may pose a greater hazard than currently assumed by a simple linear extrapolation from high doses of radiation delivered external to the body.

It is reasonable to hypothesize that in the case of fetal injury, dose-response cannot be linear, but must be biphasic. This point is clearly addressed within the Minority Report of CERRIE, the Committee Examining Radiation Risk in the Environment:

> The Committee [CERRIE] considered the effect that the assumption of a continuous linear dose response relationship would have on the interpretation of findings in epidemiological studies. We [those who authored the Minority Report] argued that this (assumption that increasing dose would consistently produce increasing effect) was biologically implausible — for example, increasing dose to the fetus would ultimately result in its death. As a consequence, if an analysis of any endpoint in infants were expressed in terms of increasing dose it would show a maximum followed by a reduction. If there were sub populations of cells or people of different sensitivity, there could then be a subsequent increase (a biphasic dose response) (CERRIE Minority Report).

The biphasic dose response to low-dose/slow-dose rate exposure was proven by Burlakova and her colleagues after extensive research on animals and humans. This work was summarized in an article by Rosalie Bertell entitled *Gulf War Syndrome, Depleted Uranium and the Dangers of Low-Level Radiation*:

> They [Burlakova and fourteen other scientists] examined carefully the following biological phenomena under ionizing radiation exposure situations:
>
> * alkaline elution of DNA of lymphocytes and liver
> * neutral elution and adsorption of spleen DNA on nitro cellulose filters
> * restriction of spleen DNA by EcoRI endonuclease
> * structural characteristics (using the ESR spin probe technique) of nuclear, mitochondrial, synaptical, erythrocyte and leukocyte membranes
> * activity and isoforms of aldolase and lactate hydrogenase enzymes
> * activity of acetycholine esterase, superoxide dismutase, and glutathione

peroxidase
* the rate of formation of superoxide anion radicals
* the composition and antioxidizing activity of lipids of the above mentioned membranes
* the sensitivity of cells, membranes, DNA, and organisms to the action of additional damaging factors.

For all of the parameters a bimodal dose-effect dependence was discovered, i.e. the effect increased at low doses, reached its [low-dose] maximum, and then decreased (in some cases, the sign of the effect changed to the opposite, or "benefit" effect) and increased again as the dose was increased. Dr. Burlakova has speculated that at the lowest experimental doses used in this research, the repair mechanism of the cells was not triggered. It became activated at the point of the low-dose maximum, providing a "benefit"[7] until it was overwhelmed and the damage began again to increase with dose. This may well be the case.

There are numerous other examples of biological effects not adequately considered by ICRP risk assessments. For instance, some people are genetically predisposed to a heightened sensitivity to radiation damage. Are these people adequately protected by current radiation standards developed in the one-size-fits-all model of the ICRP?

> Animal and human studies have identified genetic subgroups with enhanced sensitivity to radiation e.g. Japanese LSS study and women developing early breast cancer. In the extreme cases of those carrying the ATM gene for *ataxia telangiectasia*[8], there is extreme radiosensitivity and tendency to leukemia, lymphoma, and some solid tumors (ECRR).

Take another example of biological variations among people outside the purview of ICRP models. Not everyone's immune system functions identically. Immune response to radiation insult may differ significantly from person to person. Models ignoring the variations may put segments of the population at greater risk to radiation injury. Further, the

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[7] It is important to note that it is only within this narrow dose range, where cell repair mechanisms begin to kick in, that the concept of hormesis makes sense. The concept, however, is abused when cited to prove that low-dose exposure is "beneficial" to the organism. Burlakova has demonstrated that numerous detrimental effects occur at lower doses before this seeming "benefit" appears.

[8] A rare, inherited, progressive, degenerative disease of childhood that causes loss of muscle control, a weakened immune system, and an increased risk of cancer.
http://www.cancer.gov/dictionary/db_alpha.aspx?expand=A#ataxia-telangiectasia

immune system performs defensive surveillance on behalf of the body and can mitigate the effects of mutation or tumor progression induced by radiation. However, the effectiveness of this system can be suppressed by exposure to certain stressors such as ultraviolet light. This suppression of immune system response may, under some circumstances, be another factor involved in the enhancement of hazard from low doses of radiation.

Take a third example. It is a well-established fact that different radioisotopes, due to their chemistry, have an affinity for different organs of the body. This fact is acknowledged in ICRP models, and the hazard posed by different radioisotopes to different organs is adequately taken into account. But the same consideration is not given to radioisotope affinity on the molecular level. For example, it has been proven that Uranyl UO_2^{++} ions bind strongly to DNA (Wu). This suggests that internalized depleted uranium may have an affinity for DNA molecules. Thus, depleted uranium may pose an enhanced hazard to genetic damage out of all proportion to its "dose." The same is true for strontium isotopes which have affinity for the phosphate backbone of DNA. It is essential that such molecular affinities be incorporated into assessments of risk from radiation because molecular effects at extremely low doses may nonetheless induce serious consequences to health in the form of mutations.

Another phenomenon ignored by ICRP models is the chemical transmutation radioisotopes undergo upon radioactive decay. When an atom undergoes transformation from one element to another, the chemical bonds which it has formed can be broken leading to significant alteration of the molecular structure of which it was a part. The impact of this chemical change is mentioned in the publication of the European Committee on Radiation Risk.

The macromolecules which are the operators of living systems — proteins, enzymes, DNA and RNA — depend upon their tertiary structure, or shape, for their activity and biological integrity. Alteration of this shape results in inactivity of the macromolecule. This inactivation could in principle be effected by the sudden transmutation or alteration of one atom in the macromolecule. Since the molecular weight of these macromolecules is usually greater than 100,000, it is clear that incorporation of one atom (of e.g. Carbon-14 which decays to Nitrogen) may result in an enhancement of effect of many thousand-fold (ECRR 2003).

When radioisotopes enter the internal environment of the body, they are available to become incorporated into the structure of significant macromolecules. Upon radioactive decay of just one atom in such a molecule, the function of the entire molecule may be altered or destroyed. A question yet to be addressed in risk assessment is the impact to

health on individual cells, organs, and the whole organism of such altered molecular junk flooding the human body.

The ECRR mentions another interesting biological phenomenon that may in time prove important in risk assessment. In a recent theory of cancer expression hypothesized by Sonnenschein and Soto, a communication field exists between cells, and a threshold number of genetically damaged cells must come into existence before cancer can develop (Sonnenschein and Soto). This idea is based on the theory that cell proliferation is the default state in multicellular organisms and that some permanent inhibitory signal must exist to deter proliferation. It is postulated that this inhibitory signal is carried by cell-to-cell communication and is perpetuated in the field of this communication network. "If this is found to be generally so then the effects of high local doses, as occur in the region near hot particles, may be particularly effective in causing cancer, since the damaged cells are all close to one another" (ECRR). By this theory, hot particles can create sufficient local damage to disrupt the inhibitory signal generated between cells and lead to cancerous proliferation.

One last biological phenomenon mentioned by ECRR that has yet to enter into consideration by ICRP models is the transfer of radioisotopes to the developing fetus in a woman who is internally contaminated. Once again, alpha emitters released at extremely minute concentrations may have consequences out of all proportion to the "dose" as currently calculated by ICRP models.

> For early developing fetuses, the local dose from particles of plutonium oxide or other actinide alpha emitters will be massively high and may result in a range of effects from fetal death and early miscarriage to effects in childhood. This is a case where the biological end-point may result from a very low probability, high risk event (ECRR).

To conclude Exhibit D, it is necessary to reiterate that the computational system developed during the Tri-Partite Conferences and carried into the NCRP and ICRP was an outstanding achievement in mankind's quest to manage the hazards to health posed by internal contamination by radionuclides. The system reduced to manageable abstractions the complex array of variables that were involved in the biological behavior of radionuclides. This permitted reasonable first approximations to be derived of what might constitute a nonhazardous dosage of radiation. To quote Rosalie Bertell:

> There are many administrative decisions embedded into the elaborate (artificial) methodology for calculating effective whole-body dose and for calculating the expected number of radiation-induced fatal can-

> cers. The strengths of the ICRP approach rest primarily on its ability to quickly convert a multidimensional problem, that is, a mixture of radionuclides, having a variety of energies and types of emissions, multiple pathways to humans, and a variety of target human organs, into a linear system amenable to management decisions. This is a recognized mathematical achievement. However, in risk assessments, long-term chronic exposure, the aftermath of a disaster, or in worker compensation hearings, these same techniques cloud reality and work effectively against justice for the victims. The elegant mathematics must not be allowed to cover up the injustices (Bertell, February 1998).

For all its strengths, the ICRP model is deeply flawed in one significant respect. It breaks down when it is applied to low-dose effects produced by internal emitters. The effort to prop this model up where it cannot adequately account for observed biological phenomena and to force reality to conform to the model is the source of the injustices alluded to by Rosalie Bertell. As outlined in this Exhibit, there exists a wide range of biological phenomena capable of being produced by low doses of internal emitters that cannot be addressed by current models of risk as propounded by the radiation protection agencies. These agencies represent their models as the definitive statement of how radiation affects the human organism, but this is, at best, a half-truth. Vast regions of uncertainty exist which are currently ignored in risk assessment. This is not without consequence for the welfare of humanity. Governments exploit the flaws in the current model to rationalize the safety of their nuclear/radiological agendas. Under these circumstances, there is no mechanism in place to constrain their deeds. With science rendered impotent to testify before humanity the crimes of governments, and with scientists incapacitated by falsehood to stand up for the health and welfare of humanity, governments are in effect carrying out radiation experiments on the entire human race. Rather than respecting the biological phenomena coming to light through modern research and curtailing their activities in the name of caution and respect for life, governments are ignoring biology in pursuit of their nuclear programs. Under such circumstances, the ICRP, NCRP, NRPB, UNSCEAR, and BEIR are ineffectual pawns at best, complicit criminals at worst, supporting the reckless endangerment of all life on planet Earth by offering no force to counter the misdeeds of governments. The results of their flawed methodologies legitimize these misdeeds. These organizations never intercede on behalf of humanity by sending the message to government, "Wait! There are biological phenomena that are not sufficiently taken into account in our current understanding to justify the scattering of radioactivity throughout the environment!" Although they stand before humanity as agencies of protection to the human race, they are complicit in the furtherance of policies that are contaminating, and will continue to contaminate,

populations with radioactivity.

By ignoring the biological implications of their nuclear/radiological policies, governments have forced a scientific issue, which would normally be settled by trained professionals guided by the scientific method, into a political issue. By casting caution aside and flouting biological truths in their pursuit of unlimited power, governments have left citizens with no recourse but to enter into a political struggle to curb government abuses and rescue the biological domain. If the radiation protection community is unwilling to restrain imprudent government and military policy, there is no other way.

EXHIBIT E

In Exhibits A through D, we have examined glaring shortcomings in the current approach to radiation safety as it applies to low doses of internal emitters. We have pinpointed major flaws in the reigning paradigm of how radiation interacts with living cellular structure, the way dosage is calculated, the research used to justify and perpetuate these errors, and the biological effects that the current system cannot adequately address. With this groundwork prepared, we can carry a torch into the heart of darkness of the nuclear age. Egregious malfeasance crouches silently within the answer to a single question: *Why do radiation protection agencies continue to uphold an antiquated model of how internal emitters interact with living systems when assessing the hazards to health of ionizing radiation?*

In their book *Radiation Protection Dosimetry: A Radical Reappraisal*, Jack Simmons and David Watt are very generous in their assessment of the current state of affairs within the radiation protection community. They liken the continued reliance on "absorbed dose" for assessing low-level radiation effects to the planetary system developed by Ptolemy that perpetuated the false notion for 1,400 years that the Earth was the center of the universe. In the *Almagest*, published in the middle of the 2nd century A.D., Ptolemy presented a mathematical theory for the motions of the Sun, the Moon, and the planets. According to the theory he proposed, the Earth was suspended in the center of the universe. The stars were fixed points of light on the inside of the celestial sphere. The alternation of the day and the night resulted from the rotation of the entire celestial system around the Earth. To account for the motion of the Moon, Mercury, Venus, Sun, Mars, Jupiter, and Saturn, Ptolemy proposed that the planets moved on small circular paths, the epicycles. The centers of these epicycles, the imaginary points around which the planets circled, in turn orbited the Earth along great circular paths called deferents. To fully account for the ongoing accumulation of astronomical measurements, including the peculiar retrograde motion of

some of the planets, a number of correction factors were periodically introduced into the system that compounded its complexity. Although unwieldy, the model was adhered to for fourteen centuries for its apparent accuracy in explaining observations and its ability to forecast future movements of the planets across the heavens. However, as the centuries passed, astronomical measurements accumulated that produced increasing discrepancies between observation and theory. By about 1500, many investigators doubted the correctness of the Ptolemaic system. This growing lack of confidence in established doctrine provided fertile ground for the conceptual revolution introduced by Copernicus. To account for all available observations, Copernicus inaugurated a paradigm shift, proclaiming that the Sun was the center of the universe, and the Earth, spinning on its axis, circled the Sun along with the other planets.

Simmons and Watt argue that the current system for calculating dosages of radiation and relating these dosages to observed biological effects is analogous to the Ptolemaic system. Over the last half century, an enormous amount of data has accumulated on the biological effects of radiation. This expanded knowledge base has forced the introduction of multiple correction factors into the models for calculating dosage and dose effects developed during and after the Manhattan Project in order to rescue these models from obsolescence and irrelevance. At this point, according to Simmons and Watt, the current methodology is unwieldy and incapable of accounting for the full range of confirmed observations. The time has arrived for a paradigm shift to bring theory more into line with observed phenomena.

This explanation for the continued embrace of an outdated model of radiation effects is naive. It fails to acknowledge and address the political interests that are so faithfully served by the perpetuation of the timeworn model that the radiation protection agencies insist on clinging to. Given that the current system for determining dosages of radiation and calculating biological effects does such an excellent job of protecting government and commercial nuclear programs from liability and criticism by the public, it is legitimate to ask whether another explanation exists as to why faulty models, out of synchronization with modern research, are allowed to dictate radiation safety.

The thesis to be developed here is straightforward. The faultless work of the Tri-Partite Conferences and Subcommittee Two underwent a sinister metamorphosis in the years subsequent to its development at the hands of government scientists and administrators who were sympathetic to nuclear weapon development and the proliferation of commercial nuclear power. In response to the government initiative to impose nuclearism on its citizenry, sectors of the public, beginning in the mid-1950s and continuing up to today, began to acquire a rudimentary understanding of radiation effects and embarked upon a

path of vocal opposition and protest against the government agenda. Simultaneously, research conducted by independent scientists began appearing with increasing frequency in scientific journals that revealed that catastrophic health effects were being created by the radioactivity which was routinely jettisoned into the environment. Amidst growing social unrest, the Atomic Energy Commission and its successor agencies, the Energy Research and Development Agency and the Department of Energy, were forced to pursue increasingly sophisticated methods of controlling the *perception of hazard* of the radioactivity being spewed over the population and infiltrating the food supply. Each radiation release, as it became known to the public, required a state-sponsored public relations campaign crafted to keep the citizenry ignorant of the potential medical consequences accompanying that release. Within this charged political climate, the information officers and radiation physicists who were sympathetic to the government's nuclear agenda discovered an unintended consequence of the work perfected by Subcommittee Two: **The computational system developed for computing dosages from internal emitters contained within it all the makings for an instrument of deception**. While struggling to portray each radiation release in the most benign light by repeatedly running numbers through their equations until they produced the desired results, the propagandists chanced upon the discovery that the computational system could be re-engineered into a political device for masking the medical significance of radioactivity delivered into the human body in low doses from internal emitters. By this conversion, the dosages delivered to exposed populations and the medical implications of these dosages could forever be manipulated so as to give the appearance of being of no consequence. Servants of the nuclear agenda realized they were heirs to a masterful propaganda tool. In their hands, the accepted methodology for calculating dosages from internal emitters, and thus how the public perceived the hazards thrust upon them, could be mathematically manipulated so as to trivialize the quite real threats to health. By computational abracadabra, all dosages to vulnerable populations downwind of liberated plumes of radioactivity could be made to appear within the permissible limits upheld by the international radiation protection community. What started out in Subcommittee Two as an effort to protect people from radiation was transformed into a vehicle of fraud for masking the potential health consequences of government-sponsored nuclear programs.

Although paying lip service to the hazards of fallout throughout the era of aboveground weapon testing and in the aftermath of radiation releases from nuclear facilities, the government's entire nuclear program since Hiroshima has hinged on the public remaining ignorant about the phenomenon of internal contamination. The cover-up began in earnest in the years immediately after the Second World War. In 1946, the United States demonstrated to the world its nuclear might by detonating two atomic bombs in the Bikini Atoll of the Marshall Islands. In 1947, and again in 1949, teams of researchers from the

Laboratory of Radiation Biology of the University of Washington traveled to Bikini to study the ecological impact of the radiation releases. For the first time, it was observed that plants and animals incorporated environmentally deposited radioactivity into their internal structures. Investigating the local food chains, they discovered that radioactivity accumulated in ever-increasing concentrations within organisms along each step of the food chain with the highest internal concentrations found in the feeders at the top of each chain. From then onward, internal contamination by fallout could not be honestly denied. But that is exactly what the Atomic Energy Commission did habitually when weapon testing commenced in 1951 at the Nevada Test Site and the Pacific Proving Grounds.

There is no need to dwell at length on the cover-ups and deceptions perpetrated by the Atomic Energy Commission against the American people in regard to the hazards of nuclear pollution. It is an ugly, undeniable fact, substantially documented in the historical record.[9] (The problem we are chasing here is that essentially nothing has changed today from the time when the AEC was in charge of radiation protection except for the fact that the lies and deceptions have become more sophisticated.) To protect the nation's weapons program and the monied interests' investment in commercial nuclear power, the AEC was forced onto a precipitous tightrope act between managing the hazards of fallout and the need to cause as little alarm as possible throughout the population. Success in this balancing act required the pretense of absolute safety to the population from low-level exposure to fallout.[9] Despite the fact that the NCRP had adopted the position in 1948 that no-threshold dose existed for the onset of radiation injury, "for several decades, AEC officials continued to publicly assert that there was a threshold of safety and that its exposure limits [the dosages deemed permissible to the public] were below that threshold" (Caufield). In harmony with this deception, the AEC published in a pamphlet in 1953 that argued that "low-level exposure can be continued indefinitely without any detectable bodily change When publishing information on the offsite drift of radiocontaminants from the Nevada Test Site, the hazard of fallout was routinely trivialized and always explained in terms of

[9] For those interested in researching this travesty, a number of popular histories appeared in the 1980s documenting the AEC's coverup of radioactive contamination of the American public. Although not currently in print, copies can still be found in libraries and used bookstores. A few titles follow:
Fallout: An American Nuclear Tragedy by Philip L. Fradkin
Justice Downwind: America's Atomic Testing Program in the 1950s by Howard Ball
Multiple Exposures: Chronicles of the Radiation Age by Catherine Caufield
The Cult of the Atom by Daniel Ford
The Day We Bombed Utah: America's Most Lethal Secret by John G. Fuller
Under the Cloud: The Decades of Nuclear Testing by Richard L. Miller
Killing Our Own by Harvey Wasserman, Norman Solomon, Robert Alvarez, and Eleanor Walters. This volume can be downloaded from the internet in its entirety at www.ratical.com/radiation/KillingOurOwn/KOO.pdf - 1035k.

potential external exposure. Thus, news releases from the AEC were forthright as to the intense burst of gamma rays at the moment of detonation and the hazards of gamma emitters in fallout. But to minimize the perception of hazard, reassurances quickly followed, informing people that the gamma burst was geographically limited to the immediate vicinity of a blast and that radionuclides in fallout rapidly decayed and were quickly dispersed throughout the environment in harmless concentrations. The possibility of internal contamination was left totally unmentioned or downplayed as insignificant. The AEC was fully cognizant of the hazards of internal contamination but kept the subject out of the public domain. Robert Minogue, a research director for the Nuclear Regulatory Commission once said, "High AEC officials knew very well the biological effects of low-level radiation in the 1950s. They can't use ignorance as an excuse" (Wasserman *et al.*). The fallback position on internal contamination repeatedly professed by the AEC was that, if external gamma radiation was within the established safety limits, the internal buildup of dangerous levels of radionuclides was unlikely. When queried, the AEC rationalized its position with a number of flagrant lies and ill-conceived notions about internal contamination, claiming that released radionuclides were characterized by

> (1) a short half-life so the radiation would not persist long enough to deliver a harmful dose; (2) the lack of similarity to normal body constituents so that retention would be very small; (3) if passed through the metabolic processes of the human food chain, decay and insignificant retention would appreciably diminish any potential hazard; (4) that normal food preparation would be expected to remove most of the deposited radionuclides; and (5) that wind-borne fallout clouds at distances far from the NTS would not maintain atmospheric concentrations long enough for inhalation to be a significant route of exposure. Therefore the emphasis was placed on minimizing the external exposure of the offsite population (Black and Potter).

With the passage of time, the lies told by the AEC were exposed. Today, the agency's legacy is the monumental betrayal of the American people that included the following misdeeds:

1. Failure to provide adequate warning to people living downwind of weapon tests.
2. Failure to develop an adequate radiation monitoring system.
3. Failure to explain to exposed populations the increased health risk confronting children.
4. Failure to warn of the hazard to livestock grazing on contaminated land.

5. Failure to inform about food-chain contamination.
6. Failure to inform those at risk about what steps could be taken to minimize their exposure.
7. Failure to disclose the results of research on the health effects of fallout.

Despite every effort by the AEC to downplay the danger of the inhalation, ingestion, and absorption of radionuclides liberated into the environment, evidence began accumulating throughout the 1950s that ignited widespread concern. Reports from downwinders began to appear in the press documenting hair loss and skin burns, poisoned wells and dead livestock. Fission products, particularly strontium-90 and cesium-137, began to be detected in the nation's food supply. High concentrations of iodine-131 were discovered in dairy products of communities downwind of the Nevada Test Site and in the thyroid glands of the children consuming these dairy-based foodstuffs. The Baby Tooth Survey provided unmistakable evidence that strontium-90 was accumulating in the teeth of children in all areas of the country. Suspicion and fear began to surge about the possibility that radionuclides released from weapon tests were causing increased incidences of infant mortality, leukemia, thyroid disorders, and cancers. These combined revelations erupted in a crescendo of vocal protest, both in this country and abroad, that was a key factor in bringing the United States and the Soviet Union together for the signing of the Limited Test Ban Treaty in 1963. But the end of atmospheric testing did not put an end to the public's distrust of the Government. In the decades that followed, waves of protest rolled across the country over such issues as the siting and safety of commercial nuclear power plants; the siting of nuclear waste repositories; proposed production of the neutron bomb; government refusal to provide financial and medical compensation to atomic veterans, nuclear workers, and downwinders; the health hazards of living in proximity to weapon production facilities and nuclear reactors; Three Mile Island; and today, depleted uranium.

Against this backdrop of ongoing civil unrest, guardians of the government's nuclear agenda were threatened by an even more formidable onslaught. Scientists not under the thumb of the nuclear establishment began publishing research that cast serious doubts on the adequacy of the government's safety guidelines. One tactic the AEC routinely turned to was to offer reassurance that radiation exposure received from fallout was no greater than that routinely received by a diagnostic x-ray. [Here again, attention is focused on external exposure to the exclusion of internal contamination.] This stratagem started backfiring during the second half of the 1950s. In 1955, while collecting data on the effects of x-rays on unborn children, David Hewitt of Oxford University noticed a trend toward a 50% increase in the number of British children dying of leukemia. His statistics encouraged Dr. Alice Stewart of Oxford's Department of Preventative Medicine to search for the reason. Dr. Stewart discovered that the death rate from cancer among chil-

dren under the age of ten was double among children whose mothers received x-rays while pregnant. X-ray exams conducted during the first trimester created a 10-fold increase in risk that the child would develop cancer. Further, multiple x-ray exams had a cumulative effect, with the risk of cancer increasing with each x-ray performed. These quite revolutionary findings on the effects of low doses of radiation had a profound impact on the propaganda campaign on behalf of the militarized atom. Science testified before all mankind that levels of radiation previously considered harmless were responsible for inducing cancer.

In May 1957, E.B. Lewis published an article in *Science* demonstrating that the incidence of leukemia was directly proportional to the dose of radiation received and that there was no safe level of exposure. The following month, Linus Pauling, who twice won the Nobel Prize, published an article in *Foreign Policy Bulletin* announcing his belief that 10,000 people were dead or dying from leukemia as a result of nuclear weapon testing. The following year, Pauling published estimates of the public health impact from the massive release of carbon-14. According to his calculations, the bomb tests "will ultimately produce about one million seriously defective children and about two million embryonic and neonatal deaths and will cause many millions of people to suffer from minor heredity defects" (Pauling). Also in 1958, Andrei Sakharov, the "father" of Russia's hydrogen bomb, added credibility to Pauling's estimates by declaring that every megaton of nuclear explosive detonated in the atmosphere would create 10,000 deaths from the uptake of carbon-14. Based on the rate of weapon testing, he estimated that half a million people had already died by the mid-1950s and each following year the number would increase by two to three hundred thousand.

In 1963, Dr. Ernest Sternglass, a professor at the University of Pittsburgh Medical School published an extremely controversial article in *Science*. He calculated that, as a result of fallout over the previous two years, everyone living in the northern hemisphere received a radiation dose of 200 to 400 millirads, *roughly equivalent to a pelvic x-ray*. Testifying before the Joint Committee on Atomic Energy that same year, Sternglass cited Stewart's research on x-rays and the incidence of childhood cancer and estimated that the atomic tests of 1961 and 1962 would create an extra 800 childhood cancer deaths.

Sternglass profoundly rankled the nuclear establishment in 1969 with publication of the article "Infant Mortality and Nuclear Tests" in the *Bulletin of the Atomic Scientists* (Sternglass). [The magazine's managing editor, Richard S. Lewis, informed Sternglass that, both before and after publication of the article, he received calls from Washington informing him that publication of the article was a "grave mistake."] According to Sternglass's article, rates of infant mortality between 1935 and 1950 had been declining by 4% per year. With the advent of atmospheric bomb testing in 1951, the rate of decline slowed. When

bomb testing came to an end in 1963, rates of infant mortality resumed their downward trend. Sternglass calculated that the interruption in decline of infant mortality during the era of atmospheric testing represented a death toll in the United States of 375,000 infants before their first birthdays.

Up to the present, Sternglass has continued publishing data on the health hazards of low doses of radiation. But his work has been marginalized by the mainstream nuclear establishment.

> BEIR V [the 1990 publication of the Committee on the Biological Effects of Ionizing Radiation] does not list Sternglass in its index and astonishingly has no section on the infant-mortality effects of radiation. As far as the reader of this standard work on low-level radiation is concerned, Sternglass never existed and radiation has no effects on infant mortality (Busby 1995).

Dr. John Gofman was another scientist that began to express his doubts that the population remained unharmed by fallout. Gofman had been a staunch supporter of the nation's nuclear programs. He was a co-discoverer of the fissionability of uranium-233, and during the Manhattan Project, he had helped to isolate the first milligram of plutonium. He went on to become head of the biomedical section of the Lawrence Livermore Radiation Laboratory. In May 1963, the AEC had announced the initiation of a "comprehensive, long-range program exploring in greater breadth and depth . . . man-made environmental radioactivity and [its] effects upon plants, animals and human beings" (AEC). Gofman was selected to oversee the program, and he worked closely with Arthur Tamplin, a former graduate student. It was during this work that Gofman began to undergo a conversion. He became convinced that public health and safety were not top priorities during weapon testing or in the Government drive to develop commercial nuclear reactors. In May of 1966, Gofman and Tamplin published a report entitled "Estimation of Dosage to Thyroids of Children in the US From Nuclear Tests Conducted in Nevada During 1952 Through 1957." It contained a realistic picture of the spread of radioactive iodine across the country and dose estimates to children's thyroid glands from the ingestion of contaminated dairy products. Some original dose estimates had to be scaled down after consultation with the AEC. In 1969, Gofman and Tamplin made headlines that further aggrieved the AEC. Up until that time, the scientific community and the public had received repeated assurances that routine leakages and discharges of radionuclides from nuclear reactors would pose no threat to health. During the course of their research, Gofman and Tamplin came to the opposite conclusion. At a science symposium in San Francisco in October 1969, they reported that levels of radioactive effluent from nuclear reactors which were deemed safe would in truth kill large numbers of people:

> "If the average exposure of the US population were to reach the allowable 0.17 rads per year average," they warned, "there would in time be an excess of 32,000 cases of fatal cancer plus leukemia per year." And the deaths would occur "year after year." Thus they recommended an immediate lowering of the legal exposure limit by a factor of ten, to 0.017 rads (Wasserman 1982).

Gofman and Tamplin made other waves during 1969. After Sternglass published his article on infant mortality and weapon testing, the AEC approached Gofman to refute the findings. Gofman handed the assignment to Tamplin, who reviewed Sternglass's research. The opinion he arrived at was that the number of cases of infant mortality had been overstated. At most, fallout from atmospheric testing was responsible for only 4,000 infant deaths. Pleased by this, the AEC encouraged Tamplin to publish his findings in *Science*. But they urged him to omit all mention of infant deaths caused by fallout from nuclear weapon tests.

For their ongoing opposition to the nation's nuclear agenda, both Gofman and Tamplin were forced out of their jobs. "In 1973, as a casualty of his integrity, Dr Gofman lost his position in his laboratory" (Durakovic 2003). In 1975, having lost his staff and budget in a thinly disguised act of blackballing, Tamplin resigned his position with Lawrence Livermore Laboratory.

For his involvement in the nation's nuclear program, Gofman has made the following confession:

> I feel that at least several hundred scientists trained in the biomedical aspect of atomic energy — myself definitely included — are candidates for Nuremberg-type trials for crimes against humanity for our gross negligence and irresponsibility. Now that we know the hazard of low-dose radiation, the crime is not experimentation — it's murder" (Gould 1990).

The issue that refused to be buried was that low levels of radiation were a threat to health. The subject repeatedly surfaced in the scientific journals. It represented the gravest threat to the nation's nuclear programs. Nuclear weapon testing released radiation into the environment. Commercial nuclear power plants could not operate without venting radioactivity into the surroundings. If low levels of radiation were confirmed as dangerous, the public would be outraged. The government was cornered. To safeguard its nuclear programs, the government had to deny the hazard of low-level radiation. The government's position on low-level radiation was aptly summarized by Lieutenant General

Harry A. Griffith, the director of the Defense Nuclear Agency during the Reagan administration, when he testified in the early 1980s before Congress on the subject of compensation to victims injured by the nation's nuclear weapons initiative:

> [Griffith] recited a litany of possible horrors should compensation be granted. Griffith testified that relief measures for the offsite population would result in a lowering of current radiation health standards, thus endangering the continued operation of academic research programs, medical and dental procedures, nuclear power plants, industrial radiology, nuclear ships, and the nuclear weapons program.
>
> General Griffith also said that to encourage "the erroneous impression" that low levels of radiation were a health hazard would disrupt these programs in four ways. First, claims would be filed against the government and private industry that would place "a heavy burden" on these entities to disprove. Second, nuclear workers would become more difficult to recruit, and 'the potential loss of manpower would stagnate the nuclear program." Third, compensation under existing health standards would result in those standards being lowered and "essential activities could be continued only with greatly increased cost while others could not be continued at all." And fourth, legislative and judicial recognition that low levels of radiation were hazardous "would increase the anxiety of the general public — itself an undesirable phenomenon — and thereby increase resistance to productive and necessary programs" (Fradkin).

It is beyond the scope of this book to offer an exhaustive review of the popular and scientific opposition that arose in the second half of the twentieth century to the nuclear agenda. The point has been to provide just a sketch of the social context in which the government's efforts to coerce the nation into hosting nuclear weapons and reactors took place. Controversial and dangerous programs were thrust upon the American people. Many perceived these as reckless endangerment to public health. Research by scientists with impeccable credentials confirmed the perceptions of many citizens that the risks from radiation exposure were cause for legitimate concern. Waves of opposition from throughout the heartland repeatedly swept over Washington. Nuclear programs were under a perpetual state of siege. The government was forced to adopt a defensive posture in opposition to the very citizens it was supposed to represent. Much money and manpower was expended devising new tactics to dissuade the public from raising further opposition. When evidence began accumulating of the hazard to health from low doses of radiation, members of the nuclear establishment recognized that a point of crisis had been reached. A endgame had to be devised. Unmistakable proof of endangerment from low doses of radiation would

render all state-sponsored nuclear programs indefensible. The government would be exposed as culpable for injuring tens of millions of its citizens. Financial reparations would be demanded for the ill and families of the dead. Accusations of crimes against humanity might be lodged. The line in the sand had been drawn. At whatever cost, by whatever means, mainstream science could not be permitted to establish a link between low levels of radiation and ill health. This was the unprotected flank of the entire nuclear enterprise. Renegades to the nuclear agenda could mount a successful scientific attack over this ground and ruin the plans of the Cult of Nuclearists. To forestall this prospect, radiation science as it applies to public health was preemptively infiltrated and subverted. A system of radiation safety was implemented that successfully masked low-level radiation effects and the threat to health of internal contamination. Worldwide acceptance of the bureaucratic infrastructure that upheld this defective methodology enabled mainstream science to testify before all mankind that government-sponsored nuclear programs and commercial nuclear power plants were safe and posed no hazard to health of the general population. With this accomplished, the Cult of Nuclearists had erected an impregnable and unassailable fortress by which to protect all future uses of radioactive material. Effective opposition would be forever muted. To challenge government on the safety of any of its programs involving radioactive material would first require a successful challenge to the entire edifice of radiation protection guidelines and the orthodox methodology for calculating dosage and assessing risk. As long as this infrastructure maintained the facade of scientific impeccability, all antagonists would be cut off at the knees, unable to challenge on "scientific" grounds that nuclear and radiological programs were ruining the health of life on planet Earth.

As outlined earlier in this chapter, the development of units of measurement for dosages of radiation was a profound intellectual achievement. It enabled scientists to quantify the interaction of radiation with matter. Likewise, the work of the Tri-Partite Conferences and Subcommittee Two was a milestone in radiation safety, allowing scientists to make significant inroads into determining what might constitute hazardous levels of internal contamination. In the hands of unscrupulous scientists, however, these scientific achievements were redirected to serve a political purpose. Hiding within established scientific theory and legitimate protocol, these scientists transformed the science of radiation protection into a masterpiece of trickery and beguilement. As currently crafted, the methodology for calculating dosages of radiation to exposed populations and determining health risks from these dosages is weighted against ever establishing definitive proof of hazard from low-dose exposure from internal emitters. This is by design. The reigning paradigm dictating the current approach to radiation protection has been artfully constructed to mask low-level radiation effects. This faithfully serves the Cult of Nuclearists which has been scattering radiation over the Earth for half a century. Science has been kidnapped to

intentionally hide the destructive health consequences to all life on Earth by the nuclear programs of the government.

It is alleged that the Cult of Nuclearists perpetrates a conspiracy against the people of the Earth so as to pursue its unquenchable thirst for developing nuclear/radiological weapons and procuring centralized control of the production of electricity through nuclear power. They hide the poisoned fruit of their nefarious deeds, radioactive pollution of Nature and the people of the Earth, behind inaccessible and fraudulent scientific models. They depend upon the international radiation protection agencies to enshrine these models and make them unassailable. With this infrastructure in place, every radiation release can be made to appear as inconsequential to health. Numbers are generated to "scientifically" verify the harmlessness of each release and demonstrate that dosages fall within limits accepted as permissible by the standard setting agencies. With no recourse to any other point of view, the public is forced to accept the opinion of the "experts." Most insidious is the fact that a whole generation of health physicists has been indoctrinated into the prevailing paradigm so as to unquestionably uphold the instrument of deception used to validate and protect the Cult of Nuclearists. Occasionally, scientists sufficiently trained in the radiation sciences to appreciate the fraud being perpetrated emerge to offer testimony against the corrupted paradigm. The defenders of the status quo then work to have these "rogue" scientists spurned and have their scientific work marginalized. The science of radiation protection, once conducted under the spirit of the search for truth, has been transformed by governments into an instrument of intellectual enslavement and the perpetuation of ignorance. The victim of this crime is ultimately Life itself. The viability of all life forms to survive in an increasingly contaminated environment is being eroded and will continue to erode throughout the generations until an end is brought to this villainy.

The accusations materializing across these pages are momentous. Where, it will be asked, is the proof?

Admittedly, within the public domain, no smoking gun exists for these crimes. There are no confessions from the principals involved, no documents unearthed revealing an international conspiracy. But it is the major thesis of this book that proof of this nature is not required. To know the Cult of Nuclearists and their crimes, all that is required is to look to their deeds. By their deeds you will know them. Left in the wake of their efforts to cover-up the radioactive pollution of the Earth is unmistakable evidence of their lies and deceptions.

Radiation protection, when applied to the public's exposure to nuclear/radiological weapons and the effluent from commercial nuclear reactors, is an elaborate show of smoke

and mirrors. It has been constructed to make an elephant, radioactive contamination of the Earth, disappear. Betraying the magicians' craft, secrets of the trade will now be revealed.

Contained within each new deck of cards are two jokers. In many types of card games, the rules allow for these jokers to take on changing identities for the benefit of those who hold them. In the game of radiation protection, these two jokers are *DOSE* and *RISK*. These are extremely slippery characters, chameleons, continually metamorphosing to lend the appearance to any radiation release that nothing hazardous to human health has transpired. When a radiation release occurs, the two most important pieces of information members of the public who might have been exposed want to know is their level of exposure (dose) and the risk this dose poses to their health. Clever manipulation of these two key pieces of information can transform any radiation insult, no matter how extreme, into a seemingly benign event.

Let's start unmasking the fraud by looking at the concept of dose. At its simplest, a dose of radiation represents a quantity of energy absorbed by the human body. As we saw earlier, the first unit of absorbed dose was the *rad*. It is calculated by dividing the total energy absorbed, measured in ergs, by the mass that absorbs it, measured in grams. Dose = energy *divided by* mass (d = e/m). According to current radiation protection guidelines, adults employed in industries where exposure to radiation may occur are permitted an annual dose of 5 rem (0.05 Sv). Members of the general public are permitted 0.1 rem (1 mSv) per year.

Now let's play a little game. Suppose, purely as a thought experiment, that the current system of radiation protection is not about protecting the public from the ill effects of radiation, but rather about protecting the nuclear establishment from criticism and covering up the casualties suffered by the public by the deeds of the Cult of Nuclearists. In order to insure that this racket continues indefinitely, doses to the public must be made to appear below the permissible dose. Given this prerequisite, how many ways can we manipulate the joker called dose so as to hoodwink a naive and trusting public into believing that they are safe from harm?

SCAM NUMBER ONE: According to the equation, dose = energy/mass, a dose of radiation can be reduced (and made to appear within the guidelines of safety) by increasing the mass that absorbs it.

One of the secret incantations recited by those charged with managing radioactive waste goes like this: *DILUTION is the SOLUTION to the POLLUTION*. An example of how

this maxim can be implemented to the benefit of the nuclear industry is illustrated by Karl Morgan in his book *The Angry Genie*. While employed at Oak Ridge during the 1940s, Morgan shared the responsibility of safely disposing of the radioactive waste generated as a byproduct of the nuclear weapons program. Broaching the subject with members of the Atomic Energy Commission, Morgan received a striking response: "Why not just dilute the radioactive waste to the occupational maximum permissible concentration, discharge it into White Oak Creek where it will seep into the Clinch River, and forget it?" (Morgan 1999) The implications of following this advice must be amplified. Regardless of whether or not the radioactivity being alluded to was diluted prior to discharge, the same quantity of radioactivity would be released into the waterway. Diluting it first, however, gives the appearance of being in compliance with legal statutes while not diluting it is a criminal violation. Presto! A magical way of transforming hazardous concentrations of radioactive waste into benign levels below regulatory concern. This is a routine method of complying with environmental regulation. For instance, hospitals, universities and research centers are permitted to routinely flush limited concentrations of low-level radioactive waste into sewers. By diluting the quantity of radiation in a volume of water, the perception is altered as to what is going on without actually changing the end result of how much radioactivity is being dumped into the environment.

This same sleight of hand has been applied to dosages received from internal emitters. In the United Kingdom, a major controversy has erupted concerning the health effects to the population from plutonium-239 released from the Sellafield nuclear fuel reprocessing facility. The Irish Sea is heavily contaminated with plutonium. Radioactivity is brought inland by sea spray and evidence exists that coastal communities are more heavily contaminated than those further inland. The winds also carry plutonium-laced effluent from Sellafield throughout much of the UK. Autopsies have confirmed that a proportional relationship exists between the amount of plutonium lodged in the tracheobronchial lymph nodes and how far the deceased lived from the facility (Popplewell). Further testifying to the extent of environmental contamination, plutonium has been detected in the feces of sheep grazing as far as 100 km from Sellafield and within the teeth of children living up to 200 km away. The plutonium escaping the plant primarily poses an inhalation hazard. Once deposited in the lungs, the insoluble particles of plutonium are available for scavenging by white blood cells which then ferry the pollutants to the tracheobronchial lymph nodes. *It is important to note that the combined mass of these tiny bodies of tissue is approximately* ***15 grams***.[10] (Inhaled particles of DU are likewise scavenged from the lungs and transported to the tracheobronchial lymph nodes.) In a contaminated individual, these lymph nodes can contain plutonium in concentrations between 100 to 10,000 times higher than in any

[10] The mass of the tracheobronchial lymph nodes in humans ranges between 10 and 30 grams. Average mass is 15 grams (Swinth, *et al.*).

other tissues of the body (Taylor; McKinroy *et al.*). Due to alpha emissions from the intensely radioactive plutonium, it can be assumed that a frighteningly high dosage of radiation is being deposited in these tiny tissue masses. As a consequence, there is an elevated risk for leukemia, induced by mutations to stem cells present within the nodes. As noted by Dr. Chris Busby: "Given that this organ [the tracheobronchial lymph nodes] has been identified as a source of lymphoma and leukemia in animals, this sounds very like the cause of the Sellafield leukemia cluster" (Busby 2001, Health Risks). For the nuclear establishment, such talk is heresy. If the public embraced the idea that pollution from a nuclear facility was causing leukemia, the weight of opinion might topple the government and force closure of Britain's nuclear program. The Cult of Nuclearists of that country cannot allow for such a possibility. As related by Busby (2003), the National Radiation Protection Board came to the rescue, armed with the prestidigitation of the corrupted computational system for calculating dosage. In NRPB R-276, *Risk of Leukemia and other Cancers in Seascale from All Sources of Radiation* (Simmonds *et al.*), plutonium dosage to the population was calculated by modeling the lymphatic system as consisting of a mass of **8,000 grams** that included the lymph nodes, liver, spleen, kidneys, pancreas, uterus, thymus, thyroid, stomach, both intestines, colon, red bone marrow, and cells on bone surfaces. The reader is challenged to find a single physiology book written anywhere in the world that offers such a definition for the "lymphatic system." Here, blatant criminality masquerading as science is indisputably apparent. In this publication, the dose actually deposited by plutonium to the tiny tracheobronchial lymph nodes is intentionally misrepresented as a dose to the whole "lymphatic system" following the conventional but sometimes questionable practice of stating exposure in terms of an organ dose. The lymphatic system, in turn, is modeled as consisting of a huge mass of tissue, a mass which for the most part is receiving no radiation. Only by this clever trick of mathematical dilution can the hazardous dose deposited in the tracheobronchial lymph nodes be made to appear as falling below regulatory concern as defined by the radiation protection community. While seriously contaminated people are becoming sick and dying from plutonium contamination, the National Radiation PROTECTION Board is covering up a public health tragedy with lies so as to run interference for that nation's nuclear programs.

SCAM NUMBER TWO: Rigidly adhere to the traditional concept of dose when evaluating the biological effects of radiation, even in instances where that concept of dose is rendered meaningless.

Earlier in this chapter, a description was given of how the science of radiation protection matured when the meaning of a dose of radiation was finally defined in terms of measurable and quantifiable phenomena. The rad represents a quantity of energy absorbed by a gram of matter. In keeping with many other concepts in physics, the rad is

an idealization, an abstraction, from physical events. Embodied within the concept is the assumption that the absorbed energy is evenly distributed (averaged) throughout the mass that absorbs it. This concept evolved from the study of x-rays and it accurately modeled the phenomenon *at relatively high dosages*. From an external source, a barrage of x-ray photons penetrates a mass and can be conceptualized as being uniformly distributed throughout that mass. Interacting with orbital electrons, the photons eject the electrons from their atoms. These liberated electrons create tracks of ionization through the material that, for all practical purposes, can be considered to cause uniform disturbance to the molecular makeup of the entire mass. This is a successful and powerful model. The degree of molecular disruption is directly proportional to the amount of energy absorbed. This has been experimentally validated in a wide range of applications and has become an extremely useful concept for predicating radiation effects. For instance, acute radiation syndrome is a medical condition initiated by dosages of approximately 100 rem (1 Sv) and above. The severity of the biological response to exposure and the course of the illness is directly related to the amount of radiation absorbed. The phenomenon has been so extensively studied that the likely outcome to a patient can be predicted on the basis of the absorbed dosage alone. The same holds true for cancer effects among exposed populations, again at relatively high doses. The number of cancers induced is directly proportional to the collective dose.

The success of this model demands a uniform distribution of energy throughout the mass that absorbs it. Conceptual problems arise within this model, however, when doses become so low that the entire mass is not uniformly disturbed. At this point the model breaks down. It no longer accurately describes what is taking place in the mass absorbing the radiation. To quote the European Committee on Radiation Risk, the energy units of rad and rem, gray and sievert "and the energy per unit volume approach are not applicable unless the system being irradiated is truly uniform. The model cannot deal with small volumes and inhomogeneities of dose, and for this reason, is unsafe to apply to internal irradiation."

To illustrate the problem, let us return to an example given earlier in the chapter. Busby explored the hypothetical situation of a single DU-containing particle, 2 microns in diameter, deposited in the lymphatic system. Using the ICRP method for calculating dosage, the amount of energy released by the particle in one year, considered as being evenly distributed throughout a lymphatic system defined as consisting of 800 grams, creates the insignificant dose of 0.0000021 rem (2.1×10^{-7} mSv). Now we have to ask ourselves, what is the actual meaning of this number? Is it really the case that if we were able to take a measurement at any point throughout the mass of the lymphatic system that we would get a reading of 0.0000021 rem? No, this is not true, because the actual energy of radioactive

decay is confined to the area around the point source of the single particle. Pure and simple, the purported organ dose in this instance is a mathematical fiction. It represents nothing in reality. It is a mathematical construction designed to create the erroneous idea that the energy of radiation emitted by the particle is uniformly distributed throughout the entire lymphatic system. But this is not the actuality of the situation. In reality, only a tiny volume of cells immediately surrounding the particle receives the entire dose. It is a major conceptual blunder to apply the traditional concept of dose to this dimension.

The shortcomings inherent in the concept of dose under these circumstances need no longer be an impediment to scientific accuracy. Advances in technology have given radiation biologists the power to witness, either directly or indirectly, radiation effects on both the cellular and molecular level. Microdosimetry allows for an accurate evaluation of the distribution of energy at this dimension of physical reality. And yet, radiation protection agencies rigidly adhere to the principle that the traditional concept of dosages to whole organs must be used to properly assess the biological impact of low levels of internal exposure. Why?

Because it deceives. Dosage, as misapplied to low levels of radiation, is a perfect instrument of camouflage, and is relied upon because it so successfully disguises the underlying biological effects. The successful model for calculating dosage and dose effects for high doses of external photon irradiation, by sleight of hand, is overlaid on a dimension of reality for which it doesn't apply. The science that supports the nuclear establishment forces this fit. It is the basis for the unfounded assumption, rigorously defended, that low-dose effects can be accurately extrapolated from verifiable high-dose effects. This abuse of the concept of dosage is one of the cornerstones of the conspiracy to mask the significance of low doses of radiation. It is an intentional misrepresentation of the phenomenon, upheld by the radiation protection community, to confuse people and distract intellectual inquiry into the safety of exposure to low levels of radiation.

As a front for the American war machine, a number of organizations have issued scientific opinions that uranium/depleted uranium weapons cannot possibly pose a radiological hazard to health. They base this claim on the fact that the *dose* uranium delivers to the lung is too small. They estimate the energy released by a hypothetical quantity of inhaled DU dust and average it over the mass of the lungs. Calculated in this way, the dose does appear insignificant, below regulatory concern. But let's shift paradigms for a moment. Let's dispense with the traditional concept of dose and view the contamination as a number of *discrete* alpha particles producing tracks of densely packed ionizing events that pass through the nuclei of nearby cells. All of a sudden, the shroud of deception created by the concept of dose drops away. On the cellular level, uranium/depleted uranium,

even in "insignificant" quantities, is clearly seen to be quite capable of producing double-strand breaks, mutation, genomic instability, and bystander effects. These are radiological hazards. The defenders of DU weapons innocently proclaim that these weapons pose absolutely no hazard to health because of the low doses they impart to tissue. This is nothing but a nasty deception, an out-and-out lie.

SCAM NUMBER THREE: Continue to calculate organ doses from internal emitters by averaging the emitted energy over the entire mass of the organ.

This is basically a rewording and summation of Scams One and Two. The work of the Tri-Partite Conferences and Subcommittee Two developed the method for calculating an organ dose from internal emitters by averaging the emitted energy over the mass of the organ. Deceivers use this science to mask the physiological impact of embedded hot particles. They dilute the emitted energy by smearing it over a mass of tissue, as in the Busby example above, and then declare how the dose is too low to be hazardous. *This is the centerpiece of the cover-up to forever assure that the medical effects of low levels of radiation produced by internal contamination will* ***never*** *be determined.* Earlier in this chapter, we cited the example of Dietz, who calculated that a particle of depleted uranium, 2.5 microns in diameter, transmits to the cells in its immediate vicinity in one year a dose of 170 rems. He concluded his article by saying, "until these doses can be related to a cancer risk factor, they must be viewed as qualitative indicators of danger, as red flags." This point unveils another element of this scam. The risk of developing a cancer from internal emitters is calculated from doses delivered to whole organs. The risk posed by localized point sources of hot particles has not been scientifically determined. Thus again, the assertion that uranium/depleted uranium weapons are without risk is premature and lacks scientific validation.

SCAM NUMBER FOUR: To ensure that the radiation protection community develops standards of safety acceptable to the nuclear establishment, make sure important staff appointments are filled by scientists sympathetic to the nuclear agenda.

The subject of "hot particles" dispensing huge quantities of radiation into small volumes of cells has haunted the nuclear establishment since the Manhattan Project. In the book *The Angry Genie* (Morgan and Peterson), Karl Morgan relates a telling anecdote of how the politicized radiation community dealt with this problem in the past:

> An early example of our profession's prostitution occurred with the 'hot particle problem' (HPP), which arose during the first five years of operations at the Hanford plutonium-producing facility (1944-49).

> Small radioactive particles released into the environment caused a substantial health risk to the surrounding population.
>
> Since the dose from a small, radioactively contaminated dust particle varies inversely as the square of the distance from the particle, simple calculation indicates that extremely high local tissue doses of thousands of roentgens will be received by the lung cells close to one of these small particles. Such large doses not only kill most of the cells close to one of these small particles but also cause surviving cells farther away to change into primordial cancer cells, the precursors of malignant tumors.
>
> These hot particles contained a mixture of radionuclides, such as Sr-90, Cs-134, Cs-137, Ru-106, and I-131, and undoubtedly some of the particles contained plutonium. Apparently no one conducted Pu-239 measurement at Hanford, but alpha measurements made elsewhere indicated large amounts of Pu-239, U-238, and U-235 on some of those particles.
>
> The AEC 'solved' the HPP when it formed an Advisory Committee of Competent Authority to investigate the matter.

After providing this background information, Morgan goes on to disclose how members of the committee for studying the HPP were chosen. A declassified letter is reproduced, originally written on September 25, 1962. It was authored by Paul Tompkins, deputy director of the Division of Radiation Protection Standards of the Federal Radiation Council. It was sent to Commissioner Haworth of the AEC. A portion of this letter reads as follows:

> Memorandum for Commissioner Haworth through Director of Regulation.
> Subject: Status Report on Current Activities of the Federal Radiation Council Working Group
>
> 1. It was agreed that current levels of radiation from fallout were too low to impose a practical problem in public health. It was suggested that the Public Health Service come up with its views as to what levels would correspond to enough of a health risk to justify diversion of resources in order to provide protection. If any reasonable agreement on this subject can be reached among the agencies, the basic approach to the report would be to start with a simple, straightforward statement of conclusions. We would then identify the major questions that

> could be expected to be asked in connection with these conclusions. It would then be a straightforward matter to select the key scientific consultants whose opinions should be sought in order to substantiate the validity of the conclusions or recommend appropriate modifications [italics added].

Bluntly stated, this is an ass-backward method of doing science. Start with the conclusions you want to arrive at. Determine the questions that may arise when putting forth these conclusions. Then acquire "scientific confirmation" of your predetermined conclusions by enlisting support from scientists sympathetic to your political agenda. This stain on the scientific enterprise is sobering. It testifies that science as a purely objective path for disclosing the nature of physical reality is a myth.

Morgan continues:

> The Advisory Committee proclaimed that the HPP presented no problem after all. In reaching this conclusion, they accepted the meager data they could find that supported what I believe was their foregone conclusion.
>
> The Advisory Committee disregarded early studies of high incidence of in-situ tumors when Sr-89, Sr-90, Y-91, Ce-144, Ra-226, and Pu-239 were injected subcutaneously or intramuscularly into mice, rats, and rabbits, such as the results reported by H. Lisco *et al.* in 1946 (Lisco *et al.*). Minute amounts of plutonium produced cancers at the site of injection and bone tumors occurred frequently in mice, rats, and rabbits injected with plutonium at levels ranging from 0.05 to 5 millionths of a curie per gram of injection — the majority of the plutonium-induced tumors occurring in the spine. One microgram of Pu-239 (0.061 microcurie) injected locally under the skin would induce fibrosarcomas even though much of the injection dispersed from the site. This frightening and sobering news caused us to increase our efforts to reduce plutonium exposure, but the decision of the advisory committee still stood: the HPP did not exist.
>
> For the cause of justice, the HPP cannot be covered up. Hundreds of thousands of years will pass before all the evidence can be destroyed. Some of these particles remain in attic heating ducts and furnaces. Some are certainly in the remains of those unfortunates who unknowingly inhaled these radioactively contaminated dust particles. These hot particles will remain in geologic formations for millennia, where future generations of scientists may obtain evidence on the foolhardiness

of their ancestors.

Stacking different scientific committees with the same people is a way of giving the impression that a broader consensus exists on a particular issue than actually is the case. This gimmick has been put to good effect by those organizations which have issued reports on the harmlessness of depleted uranium. Keith Baverstock substantiated this fact in June of 2005 during a presentation to the European Parliament:

> A number of organizations, including the World Health Organization, the International Atomic Energy Agency, the UK Royal Society, the International Commission on Radiological Protection and the European Commission Article 31 Group have, since 2001, published advice relating to the health consequences of exposure to DU. You may wonder, as I do, how such authoritative and independent organizations, making ostensibly "independent" assessments of the situation can all ignore the evidence that exists in the scientific literature.
>
> It is worth noting that these assessments may not in fact be truly independent. For example, staff of the UK National Radiological Protection Board (NRPB) are acknowledged as contributing to the WHO and RS reports, the Chairman of the ICRP was recently the Director of the NRPB. Staff members of the NRPB collaborate with the IAEA and have been members of the Article 31 Group. It is, therefore, possible that a few individuals have influenced the outcome of these so called independent assessments (Baverstock).

SCAM NUMBER FIVE: In the aftermath of a radiation release into the environment, the perception of hazard to the exposed population can be managed by controlling information of the quantity of radiation involved, and thus, the dosages.

Returning to our simple equation of dose = energy/mass, it is readily observed that dose can be made to appear smaller by reducing the amount of energy involved. The energy emitted by radioactive atoms is a known physical quantity. If you know which radioisotopes are released in an event and in what quantities, you know their manner of radioactive decay, their half-life, the amount of energy emitted by each decaying atom, and so forth. This knowledge can be combined to derive estimates of the maximum dose to the entire exposed population. Under these circumstances, the only way to manipulate knowledge of the dose people may have received is to control knowledge of the total amount of radioactivity actually released. If you are in a position to do this, no one will be able to

accurately assess the doses received, whether these doses are within the range deemed "permissible," and what illnesses appearing later in the population might be attributable to radiation exposure. Examples of this scam are too numerous to mention here within these pages. Repeatedly over the decades has long-suppressed information come to light of once-secret radiation releases from such nuclear installations as Sellafield in the UK, the Chelyabinsk-40 complex in the USSR, and in the US at the Hanford Reservation in Washington State, Rocky Flats in Colorado, the Savannah River Plant in South Carolina, the now-closed Feed Materials Production Center in Fernald, Ohio, and the nuclear facilities in Paducah, Kentucky.

This scam was the major tool involved in covering up the commercial nuclear reactor accident in 1979 at Three Mile Island. To this day, the public has been denied access to accurate information on what radionuclides were released and in what quantities. Without this key piece of information, "dose" to members of the exposed population is incalculable. The number of people made sick by the event, the number of people that will die because of the event, can never be gauged as long as information on dosage is manipulated or withheld. This protects the nuclear establishment from culpability and ensures ongoing support for the wide range of nuclear programs. The big losers at Three Mile Island were those dwelling downwind of the event. With no knowledge of the dosages they may have received, they are unable to assess the risk they incurred to their health. Their lives are forever haunted by the prospect of radiation-induced cancer waiting to ambush them 25 to 40 years down the road. If disease strikes, their anguish may be intensified by not knowing the reason. People ask, "Why is this happening to me?" Victimization is hard to bear, particularly when it robs you of your health and shortens your life. Cover-ups of radiation accidents carry in their wake many different types of human misery.

Three Mile Island was not an isolated event. The catastrophe at Chernobyl in 1986 was variously reported by different organizations with diverse interests in nuclear technology. These reports differed by their estimates as to how much radioactivity was released from the destroyed reactor core. At the time of the accident, the core contained approximately 192 tons of radioactive material consisting of approximately nine billion curies of radioactivity. In the immediate aftermath of the event, the Soviet government declared that 50 million curies of radionuclides and 50 million curies of chemically inert radioactive gases escaped into the biosphere. This overly conservative estimate was challenged from many quarters. The Nuclear Agency Committee of the Organization for Economic Cooperation and Development estimated that the maximum release from a group of the 20 most important radionuclides totaled 340 million curies. Estimates made at the Argonne National Laboratory in the United States suggested that 30% of the core's radioactivity, nearly three billion curies were released in the accident. The Lawrence Livermore National

Laboratory's estimate was even higher, suggesting that half of the core's radioactivity, 4.5 billion curies, were spewed out of the breached reactor. Finally, Vladimir Chernousenko, Scientific Director of the Ukrainian Academy of Sciences Institute of Physics in Kiev's Task Force for the Rectification of the Consequences of the Chernobyl Accident published an estimate that fully 80% of the core's contents were liberated into the environment (Chernousenko). These varying estimates are not just of academic interest. Each represents a political statement. Each implicitly carries a statement of the possible health effects that will be distributed throughout the contaminated populations. What is the true health legacy of Chernobyl? No one really knows. The lethality of the accident can only be gauged on the basis of the quantity of radioactivity liberated. The uncertainty of this critical piece of information renders all estimates questionable.

When one reviews the history of radiation accidents, one repeatedly discovers that the public has been kept in ignorance of the potential medical impact from events because they have been denied access to knowledge of the quantity of radioactivity released into populations. Operating under the veil of national security, governments can escape accountability for their deeds. How many tragedies have been covered up? How much radiation was released by the weapons labs of the nation? How much radiation has been released by commercial nuclear reactors? How much radioactivity has escaped into the environment? If you control this information, you control the thinking of the people. You cover up medical effects by covering up dosage.

Again, the discussion comes around to uranium weapons. The United States currently pursues a policy of preventing information of its weapon systems from reaching the public domain. No one knows how many types of weapons contain uranium, how much uranium is contained in each weapon, and the tonnage of weapons discharged in each campaign. This cover-up serves an important political purpose. *It prevents dosages of radioactivity from being calculated.* If an Afghan family lives immediately downwind of a building destroyed by a bomb containing 1,000 pounds of uranium, and if they inhale aerosolized uranium dust from the plume, their radiation dosage may be medically significant. It is fraudulent science, hocus pocus mumbo-jumbo, to sell the world on the corrupt idea that uranium weapons are not radiological weapons, and these weapons are not capable of producing indiscriminate health effects. The United States of America is perpetrating crimes against humanity and covering up its deeds by covering up the radiation dosages of its victims.

SCAM NUMBER SIX: Beguile the public with inappropriate comparisons between external irradiation and internal contamination.

The proliferation of nuclear weapons and commercial nuclear power plants has succeeded in deluding the public of the hazards of internal contamination. Covering up the danger of radioactivity within the body from human-generated radioisotopes is the bedrock upon which the entire nuclear behemoth is secured. A common tactic used to dupe critical thinking on issues of radiation safety is to liken the *dose* received from internal emitters to the *dose* received by natural background radiation. This is very sophisticated flimflam. To the uninformed, it appears perfectly logical that dose is dose; regardless of how the energy is delivered to the body, the end result will be the same. If we receive small doses of radiation naturally just from dwelling on planet Earth or while flying in an airplane, and if these are harmless, it seems quite reasonable to conclude that the same doses delivered by internal emitters will likewise be inconsequential. By now the reader knows the con hidden within this line of thinking. It was extensively explored in Exhibit A. The biological effect of a dose of radiation depends totally on how that dose is delivered to the body. By natural background radiation, ionizing events are widely distributed both in space and time throughout the mass of the body. By contrast, internal emitters have the capacity of repeatedly hitting the same cellular structures within a small volume of tissue. In instances where "doses" are comparable, the hazard posed by internal emitters will be greatly enhanced.

This swindle can be found in the literature penned to defend the harmlessness of uranium weapons. Claims are made that the dose from inhaled uranium is as insignificant as natural background radiation. Left unsaid is that the dose from uranium/depleted uranium weapons is delivered by densely ionizing alpha radiation to sensitive and critical components of a small volume of cells, while natural background radiation is deposited throughout the whole body. Research has confirmed that, like plutonium, a portion of depleted uranium deposited in the lung is scavenged by white blood cells and transported to the tracheobronchial lymph nodes. These tiny structures become the repositories of concentrated quantities of DU. This localization of dose poses an elevated hazard to the organism that is simply not comparable to the same dose delivered to the whole body by natural background radiation.

SCAM NUMBER SEVEN: Following a radiation release, avoid conducting adequate radiation monitoring.

First-year students of philosophy are invariably presented with this classic dilemma to ponder: If a tree falls in the forest and there is no one there to hear it, does it make a sound? An analogous conundrum is routinely posed by the Cult of Nuclearists: If radiation is released into the environment and no one is there to measure it, does a hazard exist? They would like the world to believe that the answer is no, no hazard exists. Each radia-

tion release and its health consequences evaporate when no adequate radiation-monitoring data testifies to the event. No causality can ever be established between radiation and illness if exposed individuals have no information on the doses of radiation they have received. Most people suppose that radiation monitoring of the population and the environment is carried out with diligence. This is an unwarranted assumption. As Caufield observes,

> Monitoring radiation in the environment and in humans is, in fact, so difficult that it is rarely done. Many people assume that radioactive releases are closely monitored and that government agencies know the radiation exposure of the local soil, water, plants, animals, and people. This is not the case. Some, but by no means all, radiation users are required to continuously monitor their own routine releases for gamma — through rarely for alpha — emissions. Water, soil, and food, however, are checked only sporadically and usually only for gamma radiation. Members of the public are not monitored for radiation exposure because of the expense, the inconvenience, and the fear that such monitoring would cause alarm.

Radiation released into the environment poses a challenging problem to public health. Once liberated from its source, radioactivity most often migrates in the form of individual atoms or small particles. The pathways that these particles follow are determined by environmental forces working in concert with natural chemical processes. The fate of this radiation and the biological effects it produces remain unknown until scrutinized by meticulous scientific investigation. If this research is not undertaken, the perfect crime has been committed. Forensic investigation falters when there is no weapon and no body. So daunting is the problem posed by radioactive atoms freely dispersed around the planet that science has yet to evolve to the level of sophistication necessary to assess the full spectrum of biological effects that mankind's nuclear experiment has produced. What the general public fails to appreciate is that the determination of levels of internal contamination is most often a costly, labor-intensive undertaking frequently requiring sophisticated detection equipment. The popular image in the public mind is of a radiation-safety officer dressed head to toe in protective clothing, a breathing apparatus strapped to his back, carrying a geiger-mueller counter that he swipes back and forth as he moves through the environment. This type of monitoring provides information about radiation in the environment. But it provides only indirect information about the potential hazards of internal contamination to those potentially exposed. Measurements of the actual levels of alpha and beta emitters trapped within a human body cannot be done by simply running a handheld detector over the body's external surface. Given the limits of the technology, internal contamination, except in instances of acute exposure, is rarely performed. As a substitute for

this, mathematical modeling is performed, based on environmental data, to provide estimates of probable dosages of those potentially exposed. Estimates? Probable? Potentially? Another dirty little secret of the Nuclear Age scurries out from the shadows. With widespread monitoring of internal contamination not possible, knowledge of the fate of radionuclides liberated into the environment and their ultimate biological impact as it pertains to human health is simply not known. Average levels of contamination absorbed by humans can be estimated, but these may fail to take into account anomalous situations which result in individuals accumulating medically significant levels of contamination. When radiation escapes into the environment, it is not always uniformly distributed. Modeling the distribution of escaped radioactivity and possible patterns of uptake by humans may not accurately reflect the reality of what is taking place. Radioactivity can accumulate in unidentified hotspots. Animals used as food may accumulate environmentally dispersed radioactivity in their tissues at unexpected levels that may be hazardous. People's patterns of consumption of contaminated food and water varies. People vary in the multiple exposures they receive from the full gamut of radiation-emitting sources. Formulating estimates of the "average" dosage for members making up a population can mask elevated and hazardous exposure to particular individuals. What we are doing to ourselves and to our planet is not known with sufficient precision to conclude that all is well.

The Cult of Nuclearists in the United Kingdom claims that plutonium released from the nuclear reprocessing plant at Sellafield is medically insignificant. The Pentagon declares that depleted uranium released amidst populations is harmless. Such claims are scientifically baseless. Unless dosages are measured for the entire exposed population, unconditional affirmations of safety of all those exposed are not credible. The alternative is to speak the truth. But this would entail admitting that some amongst us are being made sick and are dying from nuclear pollution.

The AEC successfully misled the nation on the health hazards emanating from the Nevada Test Site by not conducting adequate radiation monitoring. Who amongst the population were exposed and the dosages they received will remain forever unknown. These people make up an invisible cohort of silent victims, casualties of the Nuclear Age. This cohort is filled by other faceless victims as well. What was the fate of the sport-fisherman vacationing in Washington State who consumed gluttonous quantities of salmon drawn from the Columbia River, a river heavily contaminated by high-level radioactive waste discharged from the Hanford Reservation?[11] How much strontium-90 and cesium-137 did you or your parents ingest through the consumption of contaminated beef and dairy products during the era of aboveground weapon testing or after Chernobyl? How much depleted uranium did your son actually inhale during Operation Desert Storm?

[11] The Hanford Reservation in Richland, Washington was originally constructed to produce plutoni-

Estimates of dosage float around for these events, but really, they are nothing but guesses. They represent averages based on a number on unverified assumptions. Without precise monitoring of these seemingly innocuous events, ignorance prevails as to who the real victims of a radiation accident are. This suits the Cult of Nuclearists just fine.

The United States, with impunity, bombs foreign populations with uranium weapons and disguises its misdeeds by not monitoring radiation levels in the environment or within the bodies of contaminated victims. This casts a veil over the entire enterprise. Uranium/depleted uranium is deemed harmless because no efforts are being made to find out anything further about its effects. It falls to independent investigators to unearth the smoking gun. As this is being written, news is leaking out of Iraq that, in areas of downtown Baghdad, radiation has been measured at 1,000 times background levels. Why? How did that radiation get there? Who has been exposed? What were their dosages? Has anyone become ill? To these questions, no answers are forthcoming. A perfect crime.

SCAM NUMBER EIGHT: In instances where environmental monitoring is undertaken, avoid measuring the full spectrum of radiation emitted from the radioisotopes involved.

This scam has been repeatedly relied upon throughout the nuclear age to minimize the perception of hazard created in the aftermath of major radiation releases. As outlined in Exhibit C, the study of the survivors of Hiroshima has been fabricated as a study of exposure to external gamma irradiation. Conveniently overlooked is the internal contamination incurred by both the study and control populations which hopelessly obscures any relevant conclusions of risk borne by those directly exposed to the blast. The same cover-up occurred with contamination drifting from the Nevada Test Site. The AEC monitored gamma emissions from fallout and attempted to sell to the public the idea that this was where the only hazard resided. Only grudgingly, when cornered by independent scientists,

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um for the Manhattan Project and was a major production facility for nuclear material after the War. Today, 50 million gallons of high level liquid are stored underground in 177 storage tanks. In addition, the site is home to 2,300 tones of spent nuclear fuel, twelve tons of plutonium in various forms, 25 million cubic feet of buried or stored solid waste, and about 270 billion gallons of groundwater contaminated above drinking water standards.

In 2005, the Government Accountability Project and Boston Chemical Data Corporation released a study on contamination of the Columbia River. This study provided the first solid evidence of plutonium contamination in fish. Aquatic creatures were also found to be contaminated with elevated levels of strontium, mercury, beryllium, uranium and cesium.

The study also published data on strontium-90 contamination of mulberry plants offering proof that contaminated groundwater was being transfered into the biosphere. Rodent droppings bore evidence of a 13-fold increase in strontium-90 over similar specimens found downstream of Hanford. This provided direct evidence of strontium-90 contamination in the food chain of higher organisms.

did the AEC reluctantly admit that radioactive iodine was a hazard to thyroid health and childhood development and that dose reconstruction of this radionuclide to the downwind population was warranted. Often overlooked is the fact that the detonation of a nuclear weapon produces over 400 different radioisotopes. Many of these are extremely short-lived and many are biologically insignificant. Nevertheless, a complex of radioactive molecules created out of dozens of medium and long-lived radionuclides can assault health in ways that are not yet completely understood. Further, these may act synergistically to produce effects not anticipated when each radionuclide is modeled independently.

Currently, this scam is being used very effectively to minimize the perception of the health toll from the accident at Chernobyl. If one scours the literature on the aftermath of Chernobyl, the persistent investigator will find little information on adverse health effects from the accident other than thyroid disease and thyroid cancer. The nuclear establishment has reluctantly been forced to admit these types of pathologies result from nuclear pollution. Thyroid disease, induced by radioactive iodine, is relatively uncommon, easy to detect, and appears within a relatively short time after radiation exposure. Children are the most vulnerable, and increased incidence of thyroid abnormalities stand out in glaring relief in a population exposed to fission products. These illnesses cannot be made to disappear. But again, what of the medical impact of the other biologically significant radioisotopes? These are being passed over in silence. They are treated as if they don't exist and don't pose a detriment to health. Sufficient time has yet to pass before an epidemic of radiation-induced tumors and other diseases will begin to appear. Evidence of this is present in data collected by the national cancer registry of Belarus. According to the database of malignant tumors maintained at the Clinical Institute of Radiation Medicine and Endocrinology Research in Minsk, cancer incidence between 1990 and 2000 rose 40% over the incident rate prior to the Chernobyl disaster (Okeanov *et al.*). And this alarming trend is emerging just 18 years after the accident. Although organizations aligned with the Cult of Nuclearists are working overtime to deny it, other radioisotopes besides those of iodine are producing an epidemic of malignancies in addition to the epidemic of thyroid cancer.

Sometimes, learning of the blatant cronyism that prevails among nuclear apologists can make a person embarrassed to be a human being. That was the response of this author when reading in September 2005 of a newly published study entitled "Chernobyl's Legacy: Health, Environmental and Socio-Economic Impacts."" The three-volume, 600-page report was written by the Chernobyl Forum, a committee comprised of representatives of the International Atomic Energy Agency, World Health Organization, United Nations Development Program, Food and Agriculture Organization, United Nations Environment Program, United Nations Office for the Coordination of Humanitarian Affairs, United Nations Scientific Committee on the Effects of Atomic Radiation, and the World Bank, as

well as the governments of Belarus, the Russian Federation and Ukraine. Posturing as the new voice of authority on the Chernobyl accident, this coterie united behind the conclusion that the number of deaths that could be directly attributed to radiation was a mere 56. Of these, nine children died from thyroid cancer. The remaining victims, rescue workers who spent time in the immediate vicinity of the destroyed reactor, died from acute radiation syndrome. This death toll was in stark contradiction to previously published figures from the Ukraine where 4,400 deaths had been registered as attributable to radiation exposure. As reported by the Associated Press, the chairman of the Chernobyl Forum, Dr. Burton Bennet, said: "previous death tolls were inflated, perhaps 'to attract attention to the accident, to attract sympathy.' He said the majority of workers and residents around the plant received low doses of radiation, and that poverty and 'lifestyle diseases' posed a 'far greater threat' to local communities" (Loof). Countering previous predictions that the number of deaths caused by Chernobyl would climb to tens of thousands, the Forum concluded that the upper limit would reach no more than 4,000. These deaths would be from cancer and leukemia among the population of 200,000 emergency workers, 116,000 evacuees and 270,000 residents in the most contaminated areas. The total number of children that would eventually develop thyroid cancer was estimated at 4,000. A fitting response to conclusions of the Chernobyl Forum was made by Oleh Andreev, spokesman for the Ukraine Emergency Situations Ministry: "The one who says the devil is not as black as he is painted had better live here and see the problem from the inside" (Loof).

The conclusions of the Chernobyl Forum are comedic skullduggery, brought to you by representatives of the same organizations that proclaim that depleted uranium in the environment is harmless. It is meant to whitewash the hazard to health of low levels of radionuclides. In rebuttal, the reader is referred to an article by Alexey V. Yablokov entitled "The Chernobyl Catastrophe - 20 Years After (a meta-review)." This article contains an extensive review of Russian research into the health effects produced by the accident. Among the data presented are a number of statistics that put the conclusions of the Chernobyl Forum to shame:

> - Since 1986, there has been an increase in general mortality in the radioactively polluted areas of Ukraine, Belarus and Russia in comparison to neighboring areas (Grodzinsky 1999; Omelianetz *et al.*, 2001; Kashirina 2005; Sergeeva *et al.*, 2005).
>
> - A correlation exists between an increase in the number of stillbirths and the amount of radioactive pollution in the environment in some areas of Belarus (Kulakov *et al.*, 1993) and Ukraine (Golovko and Izhevsky 1996).
>
> - In some European countries, a correlation was revealed between

perinatal mortality rates and the Chernobyl meltdown (Korblein 2006).

- In the polluted areas of Ukraine (Omelianetz and Klement'eva 2001) and Russia (Utka *et al.*, 2005), an increase in infant and children's mortality was documented.

- Between 1987 and 1995 in the polluted areas of Belarus, there was an increase in the number of newborns who died with central nervous system congenital malformations (Dzykovich 1996).

- Between 1990 and 2000, the rate of cancer increased forty percent in Belarus. The increased incidence of cancer in different territories of the country was in direct proportion to the level of radioactivity measured in the environment of each territory (Okeanov *et al.*, 2004).

- The number of radiation-induced thyroid cancers recorded in Belarus alone totaled 4,400. The combined incidence rate for thyroid cancer in Belarus, Ukraine and Russia through 2001 was roughly 12,000 cases (Imanaka 2002). These numbers are expected to substantially increase over the next forty to fifty years.

- There is increased frequency of leukemia in all the polluted areas of Ukraine, Belarus and Russia (Prysyazhnyuk *et al.*, 1999; Ivanov *et al.*, 1996; UNSCEAR 2000).

- Among 32,000 people evacuated in Belarus, the incidence of lung cancer was four times greater than the national average (Marples 1996).

- Yablokov provides extensive documentation, citing scores of studies, that demonstrate a general overall decline in health among people from the contaminated territories when compared to pre-accident levels or when compared to populations not contaminated by Chernobyl fallout.

The medical effects from Chernobyl were not confined to the areas in immediate proximity to the stricken reactor. As an example, fallout from the accident produced congenital defects in babies born in Germany:

A recent study by a team of scientists from the official childhood can-

> cer registry in Mainz, Germany, reported a statistically significant increase in a very rare kind of tumor of the nerve cells in young children (neuroblastoma) for babies born in 1988, 2 years after the explosion of the Chernobyl reactor (Haaf *et al.*). For the 1988 birth cohort, in areas with more than 10^4 Bq/m^2 cesium-137 soil contamination, the number of cases recorded until mid-1992 was 1.96 times the expected number for Germany during the years 1980-1987 (22.5 cases per 10^6 live births); for areas with 6 x 10^3-10^4 Bq/m^2 contamination, the number of cases was 1.65 the expected number, and for areas with less than 6 x 10^3 Bq/m^2 radioactive cesium deposition the ratio was 0.98. Similar increases in neuroblastoma rates were found for babies born for the years after 1988. Given the clear association of relative risk for a rare congenital defect with levels of radioactive cesium contamination, a causal relationship is likely (Nussbaum and Kohnlein).

SCAM NUMBER NINE: Let the fox guard the henhouse; leave radiation monitoring and dose reconstruction in the hands of those who have a vested interest in minimizing the perception of hazard.

This scam recurs every time radiation is released into the environment. A clear, documented example from recent history will suffice to expose the deviousness at work when the government takes responsibility for determining dosages and their medical consequences. In 1979, during the Carter administration, a radiation study was undertaken by the Task Force on Compensation for Radiation-Related Illnesses. The purpose of this study was to explore the feasibility of compensating radiation victims living downwind of the Nevada Test Site. The Task Force was comprised of 13 members, six from the Departments of Energy and Defense, with the others drawn from the Veterans Administrations and from the Departments of Justice and Health. In their final report, they estimated that, within the 250 mile radius of the test site, 170,000 people received radiation exposure. Using the "available monitoring data," they "estimated" that

> "19 people had been exposed to more than 5 rems, 10,817 persons had been exposed to between 1 and 5 rems, and the remainder had received less than 1 rem."
>
> "Using dose-response statistics published in the controversial 1979 draft report of the National Academy of Science's Committee on the Biological Effects of Ionizing Radiation (the BEIR III report), the task force estimated that between 18 and 48 cancers above the expected

> number might occur, of which from 6 to 18 could be fatal. Applying an uncertainty factor of 2, the number of such cases could be as high as from 36 to 96, of which from 12 to 32 might be lethal. 'Thus, from an overall public health perspective,' the report stated, 'the added risk to the downwind population from fallout was very small'" (Fradkin).

By this time, the reader should be able to spot some of the elements of the game being played by poker-faced representatives of government. Monitoring data throughout the whole period was inadequate. Dose estimates were based entirely on external gamma irradiation. The medical impact of internal contamination by fission products was conveniently swept under the table and made to disappear from the mind of the casual reader not versed in issues of radiation. Missing entirely from the report was any mention of thyroid doses, knowledge that had been assembled thirteen years earlier by Gofman and Tamplin in *Estimation of Dosage to Thyroids of Children in the US From Nuclear Tests Conducted in Nevada During 1952 Through 1957*. In that report, the estimated dosages to the thyroid glands of children living in cities within 250 miles of the test site included St. George, 120 rads; Roswell, New Mexico, 57 rads; Salt Lake City, 46 rads (Fradkin). Only by ignoring the available evidence could the task force conclude: "*Thus, from an overall public health perspective, the added risk to the downwind population from fallout was very small.*"

In contrast to this politicized attempt to sanitize the misdeeds of the government, the National Cancer Institute published an interesting study in 1997. The study attempted to come up with a reasonable estimate of the number of cancers induced in the population from weapon testing from *internal contamination* by a **single** fission product, iodine-131. It's important to emphasize that only this one isotope was considered. Left out of consideration were the cancers induced by internally incorporated isotopes of strontium, cesium, plutonium, and the other radionuclides meriting attention. Their conclusion was sobering. They estimated that 150 million curies of iodine-131 were scattered over the United States in doses large enough to produce 10 to 75,000 cases of thyroid cancer, with 10% of these being fatal.

SCAM NUMBER TEN: Focus attention on dosage as the prime determiner of biological effect so as to divert thought from pioneering an appreciation of the biochemical chaos induced by the transmutation of atoms during radioactive decay.

Within the context of the reigning paradigm, radiation injury is proportional to the amount of energy absorbed by the body. Consequently, internal emitters that are widely dispersed throughout the body and which release small quantities of energy are deemed

inconsequential to the health of the organism. *The fallacy lurking in this line of thought is that certain radioisotopes can promote biological effects as a consequence of their chemistry that is independent of the amount of energy they release at the moment of radioactive decay*. The Low Level Radiation Campaign highlights this phenomenon on its website in an article on tritium.

Tritium is an isotope of hydrogen; its one proton shares the nucleus with two neutrons. Its half-life is 12.3 years. At the moment of radioactive decay, each atom of tritium transforms into an atom of helium while emitting a beta particle with an average energy of 5.7 thousand electron volts (keV.) Tritium is ubiquitous in the environment. It occurs naturally in very low concentrations, produced in the upper atmosphere by the interaction of cosmic rays with either nitrogen or deuterium in the air. It then falls to the ground as rain. Tritium is also produced in the fireball of nuclear weapons, and the earth's burden of tritium was substantially increased as a result of nuclear weapon testing. Commercial nuclear power plants produce tritium within their reactors, and this is routinely vented into the ecosphere. Tritium is found in nature as a gas and can gain entrance to the human body through the air we breathe. It can also be readily absorbed through the skin. More commonly, a tritium atom will replace a stable hydrogen atom in a molecule of water, and this tritiated water will then gain entrance into the interior of the body. Once internalized, tritium disperses quickly and is uniformly distributed throughout the body. The biological half-life of tritium is 9.4 days. However, residency time can be greatly extended to a number of years if, chemically bound into the structure of organic compounds, tritium enters the body via ingested foodstuffs.

Due to its uniform distribution throughout the body, the weakness of its emitted beta particle, its relatively long half-life and short biological half-life, tritium is considered, under normal levels of intake, to pose an insignificant health risk. The "dose" of radiation it transfers to any organ or to the body as a whole is too minute to be of much concern. This conclusion is hazardously deceptive. It would be true if the total energy absorbed by the body was the sole determiner of biological effect, but for at least some biologically significant isotopes, this notion woefully misrepresents what actually is transpiring on the molecular level.

Having gained entrance into the body, tritium, chemically identical to hydrogen, can become incorporated into the structure of essential biochemicals such as enzymes, proteins, RNA and DNA. Tritium can also participate in forming hydrogen bonds between molecules. Once incorporated into molecular structure, tritium behaves no differently from stable hydrogen until the instant of radioactive decay. At that moment, all bonds between the tritium atom and the atoms that bond to it are broken. Inert helium replaces the hydrogen atom and dissociates from all adjacent atoms. The result of this transmutation is chemical

chaos. Those atoms that were previously bonded to tritium become highly reactive and randomly reattach to available atoms in their vicinity. What started out as an ordered biological macromolecule is transformed into molecular garbage that may be useless, perhaps even toxic, to normal cellular physiology. In the case of enzymes and proteins, their spatial configuration can become so distorted that they stop functioning altogether or, perhaps worse, malfunction. In the case of DNA, an intricate series of events may be initiated with ramifications all out of proportion to the amount of radiation involved. At the moment of disintegration, the loss of the hydrogen atom may be responsible for significant damage to DNA structure. Simultaneously, the ejection of the low-energy beta particle may compound the damage with further ionizing events in the immediate vicinity. What is important to recognize is that the transmutation of a single tritium atom within a molecule consisting of thousands of other atoms represents a tremendous amplification of effect. A single radioactive disintegration can render an entire macromolecule useless. Occurring in DNA, it may contribute to genetic damage. Occurring within the embryo, developmental abnormalities may be induced. All of a sudden, innocent tritium doesn't look so innocent.

Transmutation is not confined to radioactive hydrogen. It can result from the disintegration of any radioisotope bound within organic molecules. It enhances the damage to an organism's biochemical structure and function produced by radiation. Those who chime in with the observation that this is a commonplace phenomenon occurring from naturally present radioisotopes in the environment and that cells are forced to manage molecular rubbish all the time fail to give transmutation the importance it deserves. The biochemical dance of life is not understood with sufficient precision. Perhaps transmutation that occurs at precise moments during common physiological processes, such as during DNA replication, will have amplified effect than when occurring at other moments. Perhaps increasing the body burden of radioisotopes throughout the world's population increases the frequency of certain genetically based diseases. Once again, we are at a loss to fully understand what we are doing to ourselves and all life forms by dumping radioisotopes into the biosphere and into ourselves in unnatural quantities.

SCAM NUMBER ELEVEN: Rely on the concept of "dose" to mislead the layman about the biological impact of low levels of radiation.

In Exhibit A, a pivotal issue was raised that requires reiteration. In *Radiation Protection Dosimetry*, Simmons and Watt make the following point: "The amount of kinetic energy transferred in each collision plays no role in the production of radiation effects in mammalian cells." To clarify this point by way of example, to irreparably disrupt the structural integrity of a DNA molecule in the nucleus of a cell nothing more is required than the addition of sufficient energy to produce simultaneous, or near-simultaneous, ionizing events

on each strand of the double helix, i.e., a double-strand break. The amount of energy needed to accomplish this may amount to no more than a few tens of electron-volts. Any additional energy to that required to break the two chemical bonds is irrelevant to the lesions produced. This simple idealization pinpoints the deceptiveness of the concept of dosage. The amount of energy absorbed by a mass of cells, the dose, is not what determines biological effect. Rather, biological effect is determined by the spatial concentration of ionizing events in relation to critical molecular components within each cell that is hit. From this point of view, the essential characteristic is "passage of particles per unit volume" or "hits per unit mass."

It is not difficult to see the importance of this shift in perspective when addressing the hazard posed by radiation exposure to the developing fetus. While in the womb, a catastrophic effect on the future health of the human being can potentially be induced by a single alteration to a DNA molecule. This modification is independent of the dose. Thus, extremely minute quantities of radiocontaminants in the vicinity of germ cells prior to conception or in the womb after conception can devastate a human life. (Thus, the discovery of depleted uranium in the semen of Gulf War Veterans is an alarming discovery!) **The genetic mutation induced by radiation need not manifest itself after birth as a visibly deformed child or a child plagued by debilitating illness.** (Such visible effects are the criteria for genetic defects produced by radiation used by the Hiroshima Life Span Study.) The altered cell, and all of its descendants, may be transformed into precursor cells of cancer, more vulnerable than unaffected cells to being tripped into uncontrolled cell replication by other random events at some future time in the person's life. As observed by the ECRR:

> In the event that an irradiated cell is altered rather than killed, the outcome is very different. Despite the existence of cell repair mechanisms and, in the whole organism, further surveillance systems for the elimination of such cells, the clone of cells which carry the modification induced by the radiation will have a higher probability than the original cell of acquiring the set of genetic changes necessary to cause uncontrolled replication. This may result in the manifestation of a malignant condition, a cancer. It may also result in a detrimental effect on the efficiency of the organ or system which the cell is a part of, with resultant ill health in the individual (ECRR).
>
> [Thus, cancer need not be the only health detriment produced by radiation!]

If "dose" is to have any meaning at low levels of exposure, the inaccurate concept of a quantity of energy averaged over a large volume of cells must be discarded. In its

place, the concept of dose must come to be seen as representing a probability of the number of particle tracks passing through cells within a specified volume and the likelihood that these will produce significant, irreparable lesions such as double-strand breaks. This shift in perspective, of conceptualizing dosage as *discrete* events rather than energy averaged over a mass, will be vehemently resisted by the regulatory bodies fronting for the Cult of Nuclearists. To acknowledge that the fluence of charged particles through a cell is the critical phenomenon for determining biological effect would necessitate admitting that internal emitters represent an enhanced hazard over external radiation and that the chemical form of the internal emitter must be taken into account when evaluating risk. The European Committee on Radiation Risk acknowledges the importance of these variables for biological effect and has added weighting factors to traditional dose calculations to take them into account. Why is this important? Take depleted uranium as an example. As we have seen, when the energy emitted by uranium is averaged over a large volume of tissue, the dose of energy it delivers appears insignificant, and DU weapons are made to appear harmless. However, when account is taken of the fact that uranium is an internal emitter of alpha particles, that each alpha emission violently disturbs only a small volume of cells in its immediate vicinity (increasing the probability of genetic damage to those cells actually hit or to bystander cells) and that certain compounds of uranium have an affinity for binding to DNA, the purported harmlessness of DU is unmasked as barefaced treachery.

Recent research confirms the enhanced hazard posed by the alpha emissions of depleted uranium. Scientists at the Radiation and Genome Stability Unit at Harwell in Oxfordshire, UK, working in conjunction with Mount Vernon Hospital in London, produced direct evidence that a single alpha particle emitted from DU can produce unrepaired genetic alterations in cells that are passed on to daughter cells during cell division. Groups of human blood cells were exposed to a single alpha particle and left to divide a dozen times or more. Study of this cell population revealed that 25% of the daughter cells had distinctive patterns of bent and broken chromosomes. Such damage can be a precursor to cancer expression. According to Professor Dudley Goodhead, the Harwell unit's director: "This work shows for the first time that even a single alpha particle can induce genomic instability in a cell" (Edwards 2001).

SCAM NUMBER TWELVE: Mislead the public into believing that science has definitively established that low doses of radiation present no risk to health.

In the article "Radiation Protection — Science in Crisis: Flaws in NRPB Modeling" on the website of the Low Level Radiation Campaign, the following quotation from UNSCEAR 2000 is reproduced:

> Risk estimates for the induction of human disease are obtained primarily from epidemiological studies. These studies can clearly distinguish radiation effects only at relatively high doses and dose rates. To gain information at low doses and dose rates, which are more relevant to typical human radiation exposures, it is necessary to extrapolate the results of these studies. To be valid, this extrapolation requires a detailed understanding of the mechanisms by which radiation induces cancer and genetic disorders [emphasis added].

The punch line of the article is sobering: "Nobody knows the mechanisms by which radiation induces cancer and genetic disorders. What more do we need to say?"

Their point, although simply stated, carries profound implications. As long as science remains ignorant of the mechanisms by which radiation is carcinogenic, the conclusion that low doses of radiation pose no hazard to health is crackbrained and indefensible. *In vitro* studies clearly demonstrate that the lowest conceivable dose of radiation, a single particle track through a cell, can produce irreparable genetic damage. Until the intermediary steps between this event and the onset of cancer are fully understood, it is reckless to discount the carcinogenic potential of low doses of radiation. Consequently, the assertion that uranium weapons pose no radiological hazard to health is groundless and without merit.

The dumping of DU on the homeland of our enemies is just part of a much larger campaign to economically dispose of radioactive waste by dispersing it haphazardly over the surface of the Earth. Rationalizing their deeds by their flawed theory of radiation effects, representatives of the US government are currently crafting policies of reckless lunacy. If these regulators and lawmakers have their way, disposal of significant portions of the low-level radioactive waste stream will be deregulated, allowing this material to be legally dumped into unlicensed sites such as local municipal garbage dumps, landfills and hazardous waste sites. Such disposal will create long-lived contamination of soils and groundwater, creating yet another channel for the internal contamination of unwitting citizens. To vastly compound the threat, provisions are being enacted to allow recyclers to acquire castoff radioactive material and convert it into construction materials and consumer goods. Deregulation will pave the way for 1,250,000,000 pounds of depleted uranium to be dumped into the marketplace. To compound the nightmare, radioactive scrap metal salvaged from nuclear weapons fuel-chain facilities and decommissioned power plants will be freely available for mixing and smelting with regular scrap metal and then distributed to industry. This practice is already permitted in Europe. Consumers will be oblivious to the fact that the ornaments of daily life will be the repository of radioactive waste. Cars, pots and pans, buckles, wristbands, jewelry, bicycles, playground equipment, and

potentially everything else made from recycled metal, will ferry radiation into human proximity.

In addition to metals, other materials that have acquired radioactivity are planned for release into the general environment. These include concrete, plastics, asphalt and soils. Once incorporated into the general recycling stream, this material will become invisible and ubiquitous. Consumers will be clueless as to which items they purchase contain radionuclides. Will this create a hazardous situation? The experts will spout the tired lies that the increased dose to the population will be minuscule, yet again trying to befuddle everyone into thinking that external radiation is the only avenue of harm. But bring to mind the workers and the do-it-yourselfers who will be unaware that some of the materials they use are contaminated. All operations which include milling, cutting, sanding, sawing, and burning will release radioactive particles into the air, making them available for internal contamination via ingestion and inhalation. Consider the following scenarios: a road worker sawing into concrete contaminated with radionuclides, a construction worker breathing in the dust of a demolished building built with contaminated materials, a fireman breathing in the smoke of a burning vehicle made from recycled scrap metal. Internal contamination by a wide variety of radioisotopes is being readied for large sections of unsuspecting humanity. The inevitable radiation-induced illnesses will again cause an invisible plague of untraceable origins.

The initiative to contaminate the Earth with increased levels of background radiation is broad-based and international. In the United States, its is supported by the Department of Energy, the Nuclear Regulatory Commission, the Department of Transportation, the Environmental Protection Agency, the Tennessee Department of Environment and Conservation, and the California Department of Health Services. Internationally, it is supported by the United Nations International Atomic Energy Agency (IAEA), the European Commission, Euratom (the European atomic energy agency), and the governments of nations that possess nuclear weapons and reactors. The same people responsible for initiating the globalization of trade, finance and government have included the universal contamination of the biosphere in their agenda. The IAEA, through its affiliation with the United Nations and its transport organizations, the International Maritime Organization and the International Civil Aeronautics Organization, is actively advocating to get all member countries of the UN to adopt the transport recommendations it developed with both industry and Euratom. Adoption of these measures will permit free, unregulated international commerce in contaminated materials and consumer goods.

A relatively recent event testifies to the type of mayhem these policies will lead to and the negative health consequences that will assuredly follow. In late May 1998, a steel

mill in Spain unknowingly vented a plume of cesium-137 into the atmosphere. The wind-blown contamination set off alarms in France, Switzerland, Italy, Austria, Germany, Bulgaria, the Czech Republic and Greece. The radioactivity was released during the smelting of scrapped metal equipment. According to Spain's Nuclear Security Council, the metal had been screened for radioactivity, but the specialized equipment had been lined with an absorbent material that prevented detection.

Depleted uranium munitions are a harbinger of a new world order, one characterized by ongoing radioactive contamination of the Earth. They are a forerunner, and they forewarn, of future devil-may-care practices of dispersing radioactive waste amidst populations and detonating nuclear/radiological weapons. The clarion call has sounded, and we have been warned.

SCAM NUMBER THIRTEEN: Promote simplistic, all-encompassing hypotheses of the relationship between dosage and physiological response to spellbind the public into believing that more is known about the effect of low doses of radiation than is actually the case.

Resolution of the debate over the hazards of low doses of radiation is hampered by the difficulty of designing and carrying out conclusive, indisputable, epidemiological studies. Dr. Alice Stewart succinctly diagnosed the problems confronting such research:

> Studies of the health effects of very small doses of radiation face three design problems: how to accurately measure the radiation doses large numbers of persons have received (the dosimetry problem), how to prevent comparisons between exposed and unexposed groups from being bedeviled by other differences (the selection problem), and how to cope with the varying lengths of cancer latency (the follow-up problem). These technical problems lie at the center of the current debate about the cancer effects of low levels of radiation, and the cancer issue is central to the controversy about nuclear technology.

The absence of firm data on population effects from low-dose exposure has forced various interest groups to field their own mutually exclusive hypotheses of what the actual hazard *might* be. All such attempts to date have been overly reductionistic. All rely on an oversimplification of the complex processes that biological systems undergo in response to radiation exposure. All fail to account for all the available data. The dose-response models proposed have been derived by extrapolation from known high-dose effects down into a region of heightened uncertainty. Confirmation of the accuracy of such modeling has been frustrated by a paucity of incontrovertible evidence. As noted by the ECRR: "In the

case of external irradiation studies, the small populations studied result in wide confidence intervals and a number of different curves can be drawn through the data." This arcane subject of postulating the shape of the curve on a graph is the battlefield where pro- and anti-nuclear gladiators collide. "The disagreement concerns how to extrapolate from higher dose rates to the non-measurable range. The rancorous discord among scientists concerning the low-dose cancer danger is over hypotheses — not observable fact" (Ball).

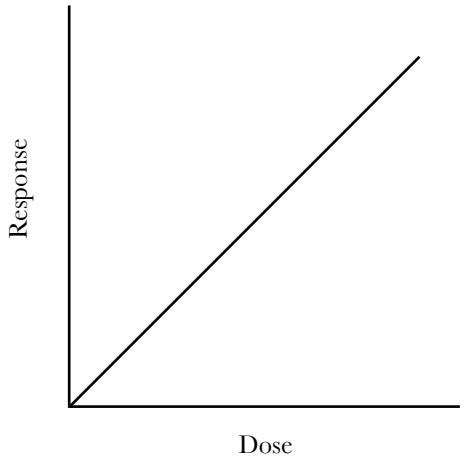
The central question in the field of radiation safety is this: What is the relationship between a dose of radiation and the biological effect produced by that dose? At relatively high doses, answers to this question are straightforward. Some biological effects are nonstochastic, i.e., deterministic. A threshold dose must occur for these effects to be produced and the severity of the effects are directly proportional to the size of the dose. Examples of nonstochastic effects are acute radiation syndrome, cataract formation and skin burns. As the dose of radiation decreases, *apparent* deterministic effects disappear. In addition to these types of effects, radiation produces stochastic effects. These effects are produced by chance. Within current orthodox thinking, the stochastic effects of concern are cancer and genetic defects. At relatively high doses, as the dose increases the *probability* of stochastic effects likewise increases. Similarly, a decrease in dosage is accompanied by a reduced *probability* of a stochastic effect occurring.

Because of such problems as those mentioned by Alice Stewart for conducting epidemiological studies that will produce unequivocal results, various models have been proposed to capture the *true* relationship, as dosages decrease, between the dose received and the probability of a stochastic effect occurring. Since at relatively high dosages, the likelihood of stochastic effects is directly proportional to the dose, one model proposes that this proportional relationship exists down to the lowest possible dose. Another model postulates that at low doses more health detriment per unit dose is produced than that predicted by the linear relationship. A third prominent model proposes the opposite, that less health detriment per unit dose occurs. The Holy Grail in radiation research is to determine which model successfully captures the reality of what is actually going on.

Radiation protection agencies throughout the world have embraced the premise that biological damage from radiation exposure is directly proportional to the dose. This is called the Linear No-Threshold Hypothesis (LNTH). According to this model, the probability of an individual developing cancer is linearly related to the amount of radiation he/she receives. Applied to populations, the LNTH posits that as the radiation dose to members of the population increases, the number of cancers induced in that populations increases at the same rate. This hypothesis is supported by a great deal of empirical data based on relatively high levels of exposure to external irradiation. The problem is that suf-

ficient data is not available to determine definitively that this relationship continues to hold as doses become smaller and smaller. For regulatory purposes, radiation protection agencies have adopted the LNTH "as if" it were true. They believe that this stance is overly conservative in estimating the hazard of low doses and offers the greatest measure of safety to radiation workers and the general public. Embedded in this model is the idea that the incidence of cancer is the same whether the radiation is delivered as a high dose in a short period of time or as a low dose over an extended period of time. Small doses are cumulative and each exposure increases the risk to the individual. According to the LNTH, there is no such thing as a threshold dose below which there are no adverse effects to health. Regardless of how small the dose, some probability always exists that a cancer will be induced.

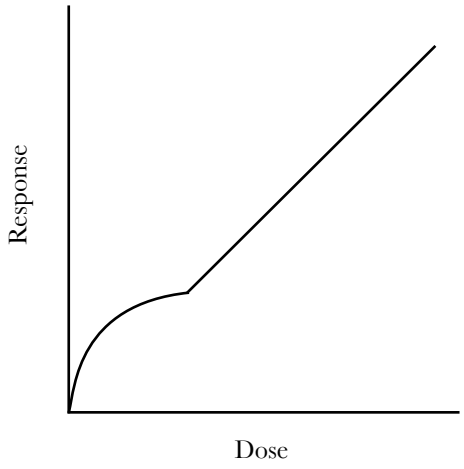
The Linear No-Threshold Hypothesis



The Supralinear Hypothesis represents a direct attack to the status quo of the nuclear establishment. According to a small number of dissenters, the LNTH dangerously underestimates the hazards to health of low doses of radiation. In their view, the existing data provides ample evidence that in the low dose range, 10 rem (0.1 Sievert) or less, more damage is created per unit dose than that predicted by a simple linear relationship. This counterintuitive conclusion is supported by a number of observations cited by the ECRR. For instance, the genetic instability and bystander effects induced in cell cultures by very low doses demonstrate a supralinear response. *In vitro* studies also provide evidence

that free radicals, produced from the ionization of water molecules, have a tumor-promoting effect that enhances the hazard of low-dose radiation and alters the shape of the dose-response curve to one of supralinearity. Increased health detriment at low doses has also been attributed to the Petkau effect, described later in this chapter, whereby sparse free radical production can promote cell death through cell-membrane destruction. This phenomenon has been postulated as having a debilitating effect on the immune system, causing an elevated rate of cancer in the low-dose range. The hypothesis that the risk of cancer death per rad increases as the dose decreases was demonstrated by Gofman in his reanalysis of the Hiroshima Life Span Study. He showed that this data exhibited a supralinear relationship for breast cancer, leukemia, and overall deaths. The ECRR has concluded that sufficient evidence exists to reject the LNTH as inaccurate in the low dose range and favors relationships which show much greater effects per unit dose.

The Supralinear Hypothesis



A third competing model for low-dose effects is the Linear Quadratic Hypothesis. According to this viewpoint, hazard at low doses is even less than that postulated by the LNTH, the risk of cancer death per rad decreases as the dose decreases. This conclusion is supported by data that shows that the body has numerous mechanisms for mitigating the effects of radiation damage. These mechanisms kick in at different dosages, and thus, simple extrapolation from high doses down to low doses cannot be made accurately.

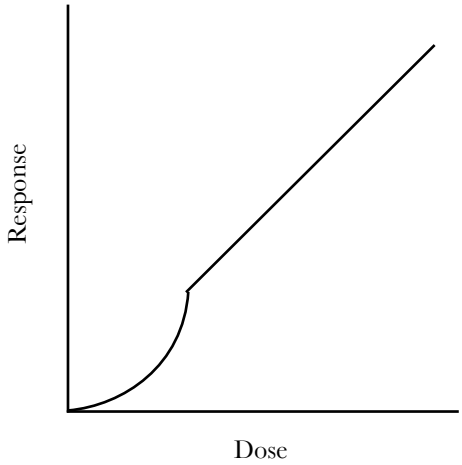
The ECRR have postulated an explanation for effects manifesting a linear quadrat-

ic dose response:

> There are sound theoretical reasons for interpreting this [a Linear Quadratic response] as due to independent track action in the linear range with a much increased effect when the dose is so great that two tracks impinge on a cell at the same time. These two tracks (or correlated tracks) are thought by most to have a high probability of inducing a mutation because they can cause damage to both DNA strands in such a way that there is a 'double-strand break,' an event which is difficult for the cell to repair. This may not be the true reason for the increased mutation efficiency but the observation that two hits have a very much larger chance of causing mutation is now well accepted. Recent work with alpha particles and cell cultures has confirmed this empirically (ECRR).

What this means is that at the lowest possible dosages, not all cells within a population are hit, and those that are hit are extremely unlikely to be sufficiently damaged by a single hit to cause irreparable mutation or to be hit twice to produce a double-strand break.

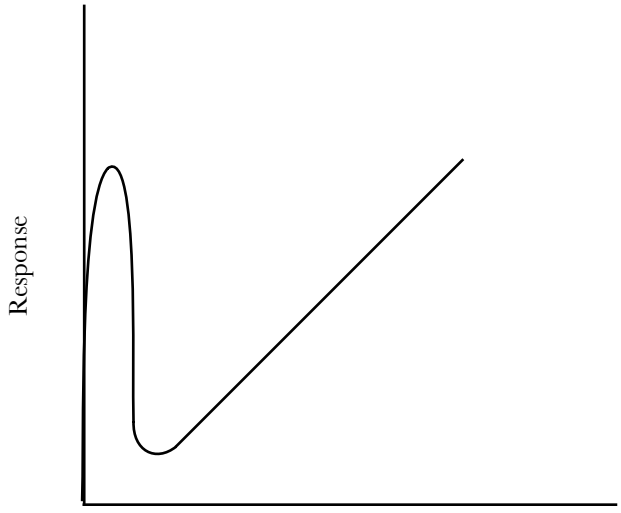
The Linear Quadratic Hypothesis



As the dose increases, the percentage of cells in the population that are hit increases as well as those receiving two or more hits. Finally, when a sufficient percentage of the cells receives two or more hits, the likelihood of irreparable mutation becomes directly related to the dosage. The dose-response curve then becomes linear.

The ECRR has drawn attention to research which displays a fourth dose-response curve. This curve displays a biphasic relationship. In some cell culture experiments, as the dose increases from zero, the effect increases to a maximum point. With further increase in dose, the effect falls back to a minimum. As the dose increases still further, a second rise in effect is witnessed. Busby has proposed an interesting explanation for this phenomenon. Within the body, different types of cells have different sensitivity to radiation. Further, at any one moment in time, a percentage of cells throughout the organism is undergoing replication. During this time, they are in a heightened state of sensitivity to radiation damage. As the dose increases from zero, the first cells to sustain damage are among those that are the most sensitive. They will be exposed to a greater likelihood of irreparable mutation and cancer induction. As the dose increases still further, these most sensitive cells will be killed rather than survive in a mutated form. This cell death cancels out the potential deleterious effects to the organism from the oncogenic events at lower doses. Thus, potential detriment to the organism decreases. At still greater doses, the less sensitive cells will begin to respond and the effect will once again increase and continue to do so with increasing doses until expression of a cancer or death to the organism from radiation illness.

Biphasic Dose-Response Curve



The quest for a universal hypothesis to encompass and explain all responses of the

organism to all doses harkens back to the time when physicists dominated the discussion on the health effects of radiation. What was sought was a tidy, all-inclusive model of how radiation affects the human organism, from the tiniest of exposures up through to a lethal dose. However, no evidence has ever been presented that biology is amenable to such oversimplification. As far as we know, it is nothing more than wishful thinking to hope that a single, universal dose-response relationship can be found to account for all types of exposure to all types of cells in all individuals and for all possible effects. It is conceivable that each of the dose-response models that have been proposed hold true under various circumstances or for different medical endpoints under consideration.

The health of humanity is being jeopardized by the reductionistic thinking embodied in the dose-response models embraced by the radiation protection agencies. Often, epidemiological evidence is rejected as being invalid because it fails to conform to what the models predict *should* be observable. A case in point is the cancer clusters found in proximity to nuclear installations. Another is the debilitated health of those exposed to uranium weaponry. Rather than calling the models into question, such evidence is rejected by those in authority as being invalid and unscientific because it is at odds with the accepted models. Once again this is a distortion of the scientific method. As noted by the ECRR:

> There is not sufficient evidence to show that there is a universal dose-response relation for all types of exposure and all endpoints, and to assume such a function is an example of a fatal reductionism. However, there are good reasons for assuming that effects in the low dose range from zero dose to about 10 mSv are likely to follow some kind of supralinear or fractional exponent function. Since there is good theoretical and empirical evidence for the existence of biphasic dose response relationships, the committee strongly recommends that no epidemiological findings should be dismissed on the basis that it does not conform to a continuously increasing dose response relation of any form.

The reader is cautioned not to get sucked into the vortex of confusion created by the academic debate over how to extrapolate known high-dose effects to low levels of exposure. The Cult of Nuclearists profits from the irresolution of this controversy and has a vested interest in keeping it alive. While academicians argue over the shape of the dose-response curve, the United States military is saturating other peoples' homelands with just those levels of radiation that are being argued over. As long as consensus among the experts remains unachieved, the United States can disguise itself in pristine innocence and escape accountability for its crimes.

SCAM NUMBER FOURTEEN: Deviously initiate a propaganda campaign to overturn conventional wisdom on dose-response relationships in order to achieve a political objective.

Uranium weapons are being used by the US military in each new overseas conflict. The government is proposing the development of a new generation of nuclear weapons and a possible resumption of testing at the Nevada Test Site. Worldwide, articles are appearing with increasing regularity describing the next incarnation of nuclear power reactors that are destined to solve all our energy needs. Proposed deregulation of the disposal of low-level radioactive waste (see Scam Twelve) is paving the way for a flood of radioactive material to enter the marketplace. Against this backdrop, a pregnant, rhetorical question needs to be posed: Isn't it a remarkable coincidence that, just now when these advances in the proliferation of nuclear technologies are underway and waste disposal policies are changing, a concerted attempt is afoot to demolish the Linear No-Threshold Hypothesis currently embraced by the radiation protection agencies and replace it with a dose-response model that will justify increased low-dose exposure to the public?

For the Cult of Nuclearists, the Supralinear Hypothesis has always been an enemy. It predicts greater health detriment to the population from low doses of radiation than admitted by the radiation protection agencies. But the Linear No-Threshold Hypothesis is falling into increasing disfavor as well. Regulatory constraints based on this model are an interference to practices that release increased levels of radiation into the environment and elevate human exposure. Looser waste disposal policies or new weapon development may be stymied if regulatory agencies don't loosen up a little bit with regard to the amount of exposure allowed to the public. Cleanup of nuclear waste sites will eat up gargantuan amounts of money if current guidelines continue to be enforced. In addition to these inconveniences, the LNTH is undermining the nuclear establishment because it reinforces the public's fear of radiation. Embodied within its premises is the idea that no dose of radiation is safe, that even the lowest doses are creating a health detriment to a small portion of the population. This leads in an unfortunate direction. Uranium weapons *are* inducing cancer in some number of those exposed. With the LNTH causing such problems, the Cult of Nuclearists has hatched a brilliant new public relations strategy within the last decade to convince the world that exposure to low levels of radiation is without risk. The public needs to be versed in this latest tactic so as to spot representatives of the Cult of Nuclearists and understand the reason for the current push not only to refute all evidence of detrimental low-level effects but to completely dismantle a century of study in radiotoxicology and radiation protection. What follows is a summary of the various arguments that are appearing with increasing frequency in the media and the scientific journals, implanted there to reassure the public that exposure to low doses of radiation should no longer be a concern.

(The flaws in these arguments will be addressed in later scams.)

1. In this clever public relations campaign, the Cult of Nuclearists borrows tactics from its critics and attacks the ICRP. The argument is made that the ICRP has perpetrated a fraud against humanity by basing radiation protection standards on the Linear No-Threshold Hypothesis. The validity of this hypothesis for postulating the detrimental health effects of low doses of radiation, so the argument goes, has never been confirmed by experimentation. The only reason the radiation protection agencies adopted this hypothesis was that it was assumed to be overly conservative. The nuclear industry raised no objection because it could easily operate within the safety standards developed on the basis of the LNTH.

2. The LNTH is now entrenched and will be difficult to change. Beginning in the mid-1960s, the anti-nuclear movement gained tremendous momentum. Under its tutelage, the scientific hypothesis that small amounts of radiation **MAY** be hazardous was corrupted into the political agenda that a small amount of radiation **IS** hazardous. Spurred by anti-nuclear activists, the public has developed an unreasonable fear of any amount of radiation exposure. If the LNTH is scrapped for a more scientifically sound basis of radiation protection, anti-nuclear organizations will accuse regulatory agencies of jeopardizing public health. The public's radiophobia unduly hampers the nuclear industry from providing to society the enormous benefits promised by radioactive materials.

3. Research has revealed that the human body has numerous mechanisms for repairing radiation damage or inducing cell death in damaged cells before they have the opportunity to undergo replication. Consequently, some as yet unidentified threshold dose or threshold mechanism must exist before the onset of cancer expression.

4. The DNA in each cell is subject to tens of thousands of damaging events each day from oxidative metabolism and other normal physiological processes. This damage is successfully corrected by normal repair mechanisms. Compared to this normal level of damage, the amount of DNA damage induced by low-level radiation is insignificant. Whatever damage is produced in DNA by low-level radiation will be lost amid the other assaults to DNA and will likely be effectively repaired. Further, since numerous carcinogens are attempting to assault the integrity of DNA in modern humans, there is no way to isolate radiation-induced damage and award it special significance as being more hazardous.

5. The modern understanding of the etiology of cancer testifies against the simple model of carcinogenesis embraced by the radiation protection agencies. Cancer induction is not a straightforward process following inexorably from radiation-induced DNA damage

within single cells. The initiation of malignancy is a complex, multistage process requiring several key changes in different parts of the genome. Low doses of radiation cannot produce all the necessary alterations simultaneously. Thus, cells suffering genetic mutation from low-dose radiation must undergo further genetic alterations from other events and/or other sources before evolving into a malignant genotype. Further, carcinogenesis is intercellular. Innumerable iterative steps which are unpredictable in their effect to the overall process take place between the malignant transformation of a single cell and the proliferation of a cancer consisting of billions of cells. Such complexity precludes postulating a simple linear relationship between dose and response.

6. The phenomenon of hormesis testifies to the fact that exposure to low levels of radiation are beneficial to the human body. Hormesis refers to the stimulating and apparently protective effect conferred on living systems by exposure to low doses of radiation and low doses of other toxic substances. A wealth of experimental evidence exists that demonstrate that low levels of radiation can act as a stimulant to a variety of cellular functions, enhancing repair mechanisms and immunological responses.

7. Natural background radiation varies at different points on the Earth by a factor of 10 or more. Populations living in areas of high levels of natural background radiation show no evidence of increased adverse health effects when compared to populations living in areas of lower levels of natural background radiation. Quite obviously, humans possess adaptive mechanisms allowing them to handle increased amounts of radiation with no ill effects. Thus, the addition of a little more human-generated radiation above background levels cannot reasonably be deemed harmful.

8. Low levels of radiation stimulate adaptive mechanisms at both the cellular level and the level of the whole organism. A cell exposed to a high challenging dose evidences less radiation damage if it was previously exposed to a low conditioning dose. The initial dose stimulates adaptive mechanisms that enable the cell to manage greater radiation insult at a later date. Some evidence has been gathered demonstrating that the same phenomenon is manifested in people who live in areas of high natural background radiation. Having adapted to higher-than-average levels of radiation, they give signs of increased resistance to radiation exposure above familiar background levels.

9. The radiation protection agencies throughout the world need to be faulted for ignoring the beneficial effects of low doses of radiation (hormesis) or the zero (nonexistent) effects. By such a one-sided outlook, their recommendations are unbalanced and biased. They emphasize the bad potentialities of radiation exposure and ignore the good. This bias

is out of sync with today's scientific climate, and it serves to prejudice the people against the nuclear industry.

10. Enormous sums of money are being unnecessarily spent annually to assure dosages to the public are below those wrongfully hypothesized as harmful by the Linear No-Threshold Hypothesis. Cleanup and decommissioning of nuclear sites worldwide are projected to cost close to $2 trillion. Due to the low levels of radiation involved in many instances, this expenditure will produce negligible public health and safety benefits. The money can be better spent elsewhere.

These 10 points summarize the new paradigm on low-level radiation effects being promulgated by the Cult of Nuclearists. The implications of this paradigm shift, in regard to uranium weaponry, are troubling. Taken to its logical extreme, the people of Afghanistan and Iraq should offer thanks to United States for bombing them with uranium and exposing them to the health-enhancing benefits of low doses of radiation. In its beneficence, US weaponry is stimulating a variety of physiological functions, improving cellular repair mechanisms, and enhancing immunological responses.

The Cult of Nuclearists ardently desires to convince all listeners that it has assembled sufficient proof to warrant a significant overhaul of radiation protection standards as they apply to low-dose exposure. Their argument rests on three major premises which they promote as being thoroughly validated by experimentation. This is a gross misrepresentation, for their conjectures are still open to a wide range of interpretations and have yet to be shown to provide a realistic basis for protecting the population from radiation injury. The first premise: the phenomenon of hormesis testifies to the fact that cellular systems can remain unharmed by low doses of radiation and actually benefit from such exposure. Repair mechanisms within cells are stimulated and immune function is enhanced, conferring a protective benefit to the organism as a whole. The second premise: due to the remarkable efficiency of DNA repair mechanisms within cells, the immune system has the capacity of perfectly repairing every type of damage capable of being produced by low-dose radiation. The third premise: below some threshold dose, radiation causes no ill effect to the organism. The new paradigm reintroduces the concept of a threshold dose for the onset of radiation-induced malignancy. Based on the concepts of hormesis and perfect repair of radiation damage, the evident conclusion is that a yet unidentified dose is required to initiate a series of events that eventually trips some threshold mechanism before radiation-induced damage can escape repair and develop into uncontrolled cell proliferation.

A large body of evidence has accumulated to substantiate the existence of hormesis. But pro-nuclear lobbyists are making unwarranted extrapolations from the phenomenon,

claiming that it proves that all low-dose exposure is harmless. Is it not possible that, while some health benefits are conferred, *simultaneously* some subpopulation of the cells or organisms exposed suffer unrepaired or misrepaired genetic lesions which are precursors to cancer? In agreement with this line of reasoning, Dr. Rosalie Bertell offers the following observation on the subject of hormesis:

> What has been sorely neglected in this public relations battle is that low dose radiation at the cellular level must necessarily affect a large range of molecules in the cellular communication system in any particular cell type. In order to produce one "good" effect, one must endure many other unwanted "bad" effects which will in the long run claim a physiological price perhaps significant, although they evolve to a clinically observable level more slowly (Calabrese; Bertell 1998).

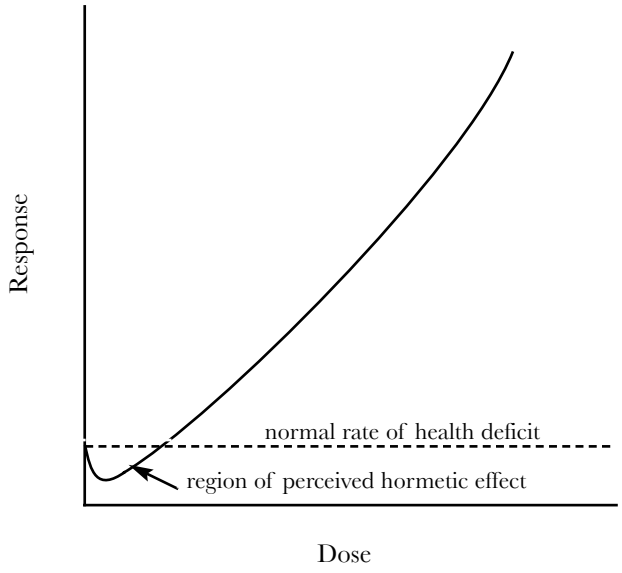
The phenomenon of hormesis, as interesting as it is, is really irrelevant to the topic of radiation protection and is sorely abused by those who reference it when attempting to dismiss the hazards of low-dose exposure. This is made clear by Makhijani, Smith and Thorne in *Science for the Vulnerable: Setting Radiation and Multiple Exposure Environmental Health Standards to Protect Those Most at Risk*:

> There are some who subscribe to the "hormesis" hypothesis, according to which a small amount of radiation could produce some beneficial health effects, by stimulating the immune system for instance. The main evidence put forward for this has been from experiments on mice. According to a summary of the evidence for the hormesis effect, compiled by Charles Waldren, a high dose of radiation produced fewer mutations in some circumstances if preceded by a dose in the 1 to 20 rem range. This supposed protective effect does not appear at lower or higher doses, however, and lasts only for about a day, after which it disappears (Waldren 1999). Such a hormesis effect, even if it exists in humans, has no public health significance, since the cancer risk of the exposure would be very high and any immune system stimulation would be very temporary. This issue has been extensively addressed by the BEIR VII panel and others. The conclusion of the BEIR VII panel was that "the assumption that any stimulatory hormetic effects from low doses of ionizing radiation will have a significant health benefit to humans that exceeds potential detrimental effects from the radiation exposure is unwarranted at this time" (NRC 2006).

The ECRR offers an interesting observation on the phenomenon of hormesis that

requires further investigation. If one plots the hormesis dose-response curve, one gets the following graph:

Hormesis Dose-Response Curve

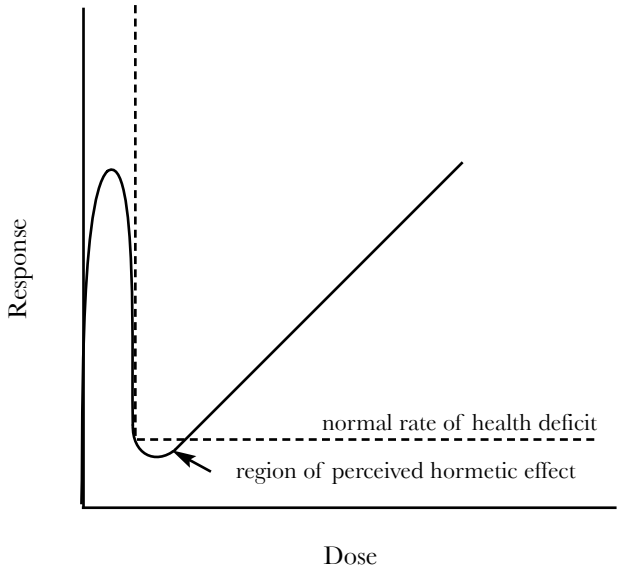


Reading this graph from left to right, one sees a dipping of effect, initially, as dose increases, before the line turns upward and begins to exhibit the more familiar curve of increasing effect with increasing doses. The region of the dip is the region where the beneficial effects of hormesis are observed. Less cancer is observed within that interval, and the assumed conclusion is that radiation is conferring a beneficial effect. Somehow the organism is deriving benefit from the dose. Interestingly, the curve resembles part of the graph reproduced earlier illustrating the biphasic dose-response model. As stated by the ECRR:

> It may be, however, that some of the hormesis evidence results from an artifact. If the dose response in the low range follows a biphasic curve, all that is needed to show an apparent hormetic effect is to leave out the zero dose/zero effect point. It may be that because deductive conclusions from high-dose experiments could not be squared with

the possibility of such variation in this low dose region, either the points were interpreted as scatter or they were forced into a hormesis dip by leaving out the lowest dose responses as outliers.

Postulated Origin of the Hormetic Dose-Response Curve



To translate: The apparent benefit of radiation in the low-dose region emerges as a result of failing to detect or account for evidence of the initial spike in the dose response curve. In this region the most sensitive cells initially undergo increased rates of mutation and cancer induction. With increasing dosage, these cells are killed off and health detriment lessens, and the graph descends vertically. The region of hormesis is misinterpreted as a region where the organism derives benefit. But this dip represents nothing more than a transition from one phase of damage to the system to the next. The same reasoning may explain certain epidemiological studies attempting to prove the beneficial nature of high background radiation because of a lower incidence of cancer. Perhaps a better explanation is that the background radiation has been responsible for selecting for radiation resistance in a population by culling out radiosensitive individuals. The apparent health benefit is nothing more than what remains when low-level radiation has eliminated the most sensitive.

In an attempt to acquit low-level radiation of doing harm, supporters of hormesis frequently cite studies which they claim show lower rates of cancer mortality in geographic areas with higher-than-average levels of natural background radiation. However, their interpretation of these studies is open to question. In the article "Altitude, Radiation, and Mortality from Cancer and Heart Disease," a number of such studies were analyzed. Under this scrutiny, the reality for hormesis became questionable. According to the authors of this review: "When we adjust linearly for altitude, the negative correlations between mortality and background radiation all disappear or become positive. We see no support here for the claim that ionizing radiation is beneficial at low doses" (Weinberg, Brown and Hoel). After an exhaustive analysis of confirmed low-dose health effects in "Inconsistencies and Open Questions Regarding Low-Dose Health Effects of Ionizing Radiation," authors Nussbaum and Kohnlein make the following observation:

> All of the low-dose studies of radiation effects in human populations reviewed above are inconsistent with hypothesized long-term cancer-reducing effects of such exposures in excess of unavoidable natural background of human populations (hormesis). One can only speculate about the continued popularity of this conjecture among some groups of radiation experts.

The call to permit higher levels of radiation exposure only makes sense if there is unmistakable proof that a threshold dose must exist for the onset of irreversible radiation injury. This means that the damage produced by doses below this threshold are flawlessly repaired. One hidden assumption in this conjecture is that all people in the population have equivalent immune systems and that there is not a range in immune response between people. If such a range is admitted, then radiation protection standards must address the most vulnerable among the population or the value judgment must be made explicit that these people should be put at heightened risk of radiation induced illness so that the rest of the population can benefit. But there is a deeper problem with the conjecture of perfect repair. Evidence exists that the immune system makes mistakes when repairing DNA lesions. In chapter 18 of his book *Radiation-Induced Cancer from Low-Dose Exposure*, Gofman presents a powerful argument for why irreversible genetic damage, and thus cancer induction, can occur at even the lowest levels of exposure. His argument is based on the fact that the cellular mechanisms for repairing carcinogenic injuries do not operate flawlessly. Thus, "repair" is at the heart of the threshold issue:

> The radiation-induced cancers arising from the unrepaired lesions at low doses do not wear a little flag identifying them as any different from cancers induced by higher doses of radiation, or induced by causes entirely unrelated to radiation. Therefore, threshold propo-

> nents cannot argue that the cancers arising from the lowest conceivable doses of radiation will somehow be eliminated by the immune system or any other bodily defenses against cancer. Such an argument would require the elimination of cancer in general by such defenses. Instead, we observe that cancer is a major killer (roughly 15-20% of many populations). So the proposition would lead to a non-credible consequence, and must be rejected. This means that repair is the key.

Gofman's analysis proceeds by first reviewing nine reputable low-dose studies: the Nova Scotia Fluoroscopy Study, the Israeli Scalp-Irradiation Study, the Massachusetts Fluoroscopy study, the Canadian Fluoroscopy Study, the Stewart In-Utero Series, the MacMahon In-Utero Series, the British Luminizer Study, the Harvey Twins In-Utero Series, and the Israeli Breast-Cancer in Scalp-Irradiation Study. These studies involved a range of exposures from 9.0 rads down to 0.1 rad which Gofman translates into 12 tracks per nucleus per exposure down to 0.29 tracks per nucleus. His argument is that if flawless repair exists at some threshold dose, every carcinogenic lesion will be successfully undone below that dose and no excess cancers will be induced. However, in every study an excess of cancers was in evidence. Gofman summarizes the conclusion of this line of reasoning as follows:

> 1. One primary ionization track is the least possible disturbance which can occur at the cellular level from ionizing radiation. Without a track, there is no dose at all.
>
> 2. Every primary ionization track has a chance of inducing cancer by inducing carcinogenic injuries; it needs no help from any other track.
>
> 3. This means that there is no conceivable dose or dose-rate which can be safe, unless (A) the repair system always successfully undoes every carcinogenic lesion, when the dose or dose-rate is sufficiently low, or (B) every failure of the repair system, at low doses, is always successfully eliminated by some post-repair defense system.
>
> 4. Human epidemiological evidence shows that the repair system for radiation-induced carcinogenic lesions has a failure rate even under minimal strain.
>
> 5. Observation and logic show that the post-repair defense systems (for instance, the immune system) cannot possibly be perfect with respect to providing a safe dose or dose-rate of ionizing radiation.

> It follows that there is no safe dose or dose-rate of ionizing radiation, with respect to induction of human cancer. The risk is related to dose, right down to zero dose.

SCAM NUMBER FIFTEEN : Rely on your models to create reality.

When radiation is liberated into the environment, either from an accident at a nuclear power plant or the incineration of a uranium weapon, where does the radiation go? Given sufficient motivation, time and money, radiation monitors can be dispatched into the field and laboriously map in what direction the radiation traveled, where it was deposited, and the number of people potentially exposed. Depending on the radioisotopes involved and the level of contamination drifting through the air or settling to contaminate potable water sources and agricultural products, *very fuzzy estimates* can be *manufactured* of what the *possible* external and internal dosages to the members of the exposed population *might* be. Assembling the picture of what has occurred is arduous and the outcome is, at best, an educated guess. Until an easy and rapid method is devised and implemented for measuring external exposure history and internal contamination among large numbers of people, actual dosages of an at-risk population are not ascertainable. Because we cannot/do not measure where all those radioactive atoms go and who accumulates them and in what concentrations, and because radiation biology is still in its infancy in determining the full range of biological effects produced in those contaminated, there is tremendous uncertainty as to the outcome of a radiation release on public health. The powers that be will adamantly deny this assessment.

As an alternative to actually going out to measure and map the full consequences of an environmental release of radiation, methods have been developed to "model" what *might actually* be taking place. For such a model to have any validity, a number must first be derived representing the dose of radiation received by each member of the exposed population. Once again, "averaging" is the relied upon methodology. An average dose is postulated for an average individual within the exposed group. Among the factors taken into account in deriving this number are the radioisotopes involved, the type of radiation these emit, the energy transmitted by the radiation, the external hazard from gamma emitters, the organ(s) of retention of internal emitters, and the residency time of the internal emitters within the various organs of the body. The total energy the average person is thought to have received is stated in a unit of measure called the "person-rem" or "person-Sievert." This number is then multiplied by the number of people in the exposed population to derive the "collective dose." By multiplying this number by the appropriate risk factor(s) [to be explained later], a quick estimate can be derived of how many cancers and of what type are likely to develop in the exposed population over their lifetime as a result of the collec-

tive exposure. This methodology has great utilitarian value because it can very rapidly provide a rough guess of the possible health consequences from routine or accidental emissions.

Needless to say, the concept of collective dose, similar to that of the concept of dose, is vulnerable to a range of abuses from mild massaging to gross misrepresentation. Scams, identical to the ones previously mentioned, can be applied to the concept of collective dose to paint the desired image of the consequences of a radiation release. The assumptions made by researchers in their determination of such variables as the amount of radiation released, the average dose, or number of people exposed can sculpt the derived collective dose into any number of different guises.

The idea of collective dose is grounded in the very abstract and dubious notion that such a thing as an average dose can be derived that faithfully represents the exposure received by each member of a population. Implicit in the concept is the assumption that radiation is uniformly distributed, that no hotspots develop that enhance exposure to local groups, that dietary habits are similar throughout the population and all members ingest similar diets that contain equivalent quantities of radiocontaminants. Perhaps more importantly, the concept of collective dose assumes uniform vulnerability to radiation injury, failing to take into account the heightened vulnerability of such subgroups as women, children, fetuses, those who are genetically predisposed to above average radiosensitivity and people with compromised immune systems. This is analogous to the hot particle problem where some cells in an organ receive no hits and a few receive huge numbers of hits, for many in a population may receive no exposure while some small fraction may receive a highly significant dose. Averaging the radiation over the whole population may have the effect of understating the health impact.

To predict the number of cancers likely to be induced in the exposed population, the collective dose is multiplied by the appropriate risk factor(s) published by the radiation protection agencies. These risk factors are derived from the rates of cancer observed in epidemiological studies that have achieved consensual acceptance by the radiation protection community, such as the corrupted Hiroshima study, and from the model of dose-response favored by whoever is doing the predicting. Radiation protection agencies currently rely on the Linear No-Threshold Hypothesis to develop risk factors and to predict the incidence of cancer in the aftermath of a radiation release.

The reason for the vehement clash over the shape of the dose-response curve in the low-dose range can now be readily understood. The model creates reality. The model chosen

to represent the human organism's response to radiation controls the prediction of the public health impact of a radiation release. The number of people *known* to develop cancer as the result of a radiation accident is largely determined by the model chosen to evaluate the event. Radiogenic cancers can take as long as decades to develop after exposure. These cancers become masked by normal incidence rates of the disease. Normal fluctuations from year to year in cancer deaths and the number of cases of new cancers can disguise the contribution played by a radiation event in sickening the population. Epidemiological studies have the potential of providing answers, but they are challenging to design and implement so as to deliver unambiguous results. To fill the knowledge void, researchers and public health officials turn to the currently accepted models to explain the health implications of an incident. Knowledge of the radioisotopes released, their quantities, and the number of people exposed are all that is necessary to do the math to determine the number of cancers likely to be produced. The answer may have little to do with what is actually but invisibly taking place in the population. But that doesn't matter. Here and now, all that matters is what people believe is happening. The truth, if it is rigorously pursued, won't be known for decades. The models relied upon to interpret events forge the perception.

To date, the collective dose from radiation incidents has been filtered through the Linear No-Threshold Hypothesis to derive the cancer consequences of the events. The Cult of Nuclearists can no longer allow this conservative and precautionary approach to craft the public's perception when it concerns mass exposure of populations to low doses of radiation. The LNTH produces the unwelcome prediction that cancers inevitably will be produced. This conclusion is repellent and an obstacle to the public acquiescing to the proliferation of uranium weapons, nuclear bunker-busters, small fourth-generation fusion weapons, and a resumption in nuclear testing at the Nevada Test Site. What can be done to alter public opinion? The answer is obvious. Change your model. And that is exactly what is being done through the current push to discredit the LNTH and replace it with a model that postulates that low-dose exposure is without hazard.

SCAM NUMBER SIXTEEN: Conduct spurious diagnostic tests on possible victims of internal contamination and then use the inevitable negative test results to falsely reassure the patients that their dose was nonexistent or inconsequential.

Despicable and unconscionable are adjectives too tame to adequately convey the gravity of this scam. Nevertheless, it is currently being used against ailing American veterans returning from combat duty. Due to the controversy over depleted uranium, many vets suffering from Gulf War Syndrome want to know whether DU contamination is a factor in their symptomatology. The standard diagnostic test administered by the military is to collect a 24-hour urine sample and measure the total concentration of uranium within the

sample so as to ascertain whether uranium levels are elevated above normal. This sounds perfectly reasonable. A veteran, not adequately informed, will greet the inevitable negative tests results with relief, assured that internal contamination with uranium is not a factor in his illness. A casualty of misplaced trust, he will remain ignorant that he has been a victim of a medical hoax intentionally perpetrated by the Pentagon to hide from the world the consequences of uranium weaponry. **Measurement of total uranium in urine is the wrong diagnostic test**. When a human being assimilates soluble uranium compounds into his body, almost all of that uranium remains mobilized within the body and is rapidly eliminated through the urine in a matter of days. Thus, the total concentration of uranium in the urine will quickly return to normal levels. The tiny percentage of uranium lodged in tissues of retention, such as bone, will slowly leach into the circulation and then into the urine. This uranium will mix with the naturally present uranium in the body and is unlikely to elevate total uranium concentrations beyond the normal range. Consequently, it is evident that unless a urine sample is collected within days of exposure, this test will provide no information as to whether or not the soldier has been internally contaminated. This, however, is not the whole story. It is quite possible that a GI on active duty will inhale a medically significant quantity of *insoluble* uranium compounds. These may become immobilized in the lungs or trapped within the tracheobronchial lymph nodes, irradiating surrounding tissue for years or decades. Slow to leach into the general circulation, this contamination may go undetected because it does not significantly elevate uranium levels in the urine above normal. Quite obviously, a different diagnostic test is required to prove contamination with battlefield uranium. The fact that the ratio of uranium isotopes is different in depleted uranium from that in the uranium naturally found in the body, the only legitimate test is one that measures the composition of the various isotopes of uranium being excreted in the urine. (A fuller description of this procedure appeared in the chapter, *A Primer in the Art of Deception*.)

This author, in full cognizance of the responsibility of his words, stands before all mankind and unhesitatingly declares that the Veterans Administration is perpetrating medical fraud on ailing military personnel. Further, the Department of Defense of the United States is endorsing this medical malpractice to deceive the entire world on the health implications of battlefield DU. Military physicians, if they keep abreast of the scientific advances in their field pertinent to their profession, know with certainty that they are prescribing the wrong diagnostic test. They cannot use ignorance as an excuse.

SCAM NUMBER SEVENTEEN: Disembowel the profession of health physics to such an extent that its members will turn a blind eye to the misdeeds of Government.

Of what use is the profession of health physics in protecting humanity from the haz-

ards of radiation if none of its practitioners has the courage to speak out against Government abuse of science as exemplified by any of the previously mentioned scams?

Up to this point in Exhibit E, we have scrutinized that pesky and dodgy character *dose*, and witnessed some of the antics it is called upon to perform in the highly politicized extravaganza of downplaying the hazards of exposure to ionizing radiation. The time has come to turn attention to the other prankster in the carnival: *risk*. Determining the risks to health that accompany exposure is a central objective of the science of radiation protection. No sane community of human beings is going to allow the dispersal of a toxin within its midst unless it is confident that it has correctly assessed that toxin's risk to health and found that risk to be acceptable. Analyzing ionizing radiation's impact on health is a labyrinthine exercise, and conventionally, the issue has been the province of experts in the field. Due to the complexity of the subject matter, laymen have been forced to surrender their well-being to the radiation protection community and government decision makers. In a world operating on the principle that truth is the fundamental priority, this delegation of authority to the experts and those in power would be adequate to guarantee public health and communal well-being. Unfortunately, those who control the assessment of risk simultaneously control the perception of risk, and too much evidence has accumulated bearing witness to the fact that the integrity of the radiation protection community has been compromised by proponents of nuclear/radiological weaponry and commercial nuclear power. When the experts and those who sponsor them have their own priorities that take precedence over truth, the public is vulnerable to abuse. The fabric of a free and democratic society is rent asunder when its guardian institutions traffic in mischief in matters of basic science and replace truth with falsehood for the benefit of vested interests.

To estimate the potential threat to an individual or a population following a radiation release, the first requirement is a determination of the probable dosages involved. The scams revealed up to this point amply illustrate that the seemingly straightforward process of establishing objective dose measurements is an opportunity for great rascality and devilment. In addition to dosages, a body of epidemiological studies must be available that demonstrate from previous instances of exposure the relationship that exists between the size of a radiation dose and the incidence of disease. Exhibit C reviewed some of the currently relied upon studies and demonstrated their limitations. In particular, it highlighted the prominent place awarded the corrupted Hiroshima study and detailed how this study has been purposely designed to skew risk assessment in favor of the nuclear industry for generations to come. A third essential element for evaluating the risks following a radiation event is a reliable model of dose-response into which new data can be plugged in to derive estimates of collective health detriment in an emergency. For scenarios of low-dose exposure, the favored method of extrapolation from high-dose effects is the fundamental deter-

minant of what risks are thought to exist. This explains the fierceness of the battle over the shape of the dose-response curve. The reigning model controls the perception of risk. From this point, a disturbing conclusion emerges: the objectivity of science is a myth. Those in power control the science, and they use their corrupted science to justify whatever programs they elect to sponsor.

When the human organism is exposed to ionizing radiation, deterministic effects and/or stochastic effects may be induced. A deterministic (nonstochastic) effect occurs when exposure exceeds some threshold dose and results directly from the effects of the killing of cells. It's a predictable outcome observed in most or all of those receiving the threshold level of exposure, and its severity is dose-related. Deterministic effects have yet to be identified as occurring at low dosages. In contrast, stochastic effects are those that depend upon chance or probability. In whole-body doses of less than one sievert (100 rems), stochastic effects are the predominant concern. In doses above one sievert, stochastic effects can be produced in addition to deterministic effects. Cancer and inheritable genetic damage are examples of stochastic effects. These effects arise from cells that are altered by radiation and that manage to survive. The *probability* of their occurrence increases as the dose increases, but their severity is independent of dosage. At present, the majority of radiation scientists operate on the assumption that there is no minimum threshold dose required to induce stochastic effects. Even a single track through a cell, the lowest possible dose, is thought capable of producing stochastic effects, though the probability of this occurring is extremely low. This point is a major source of contention due to the many uncertainties of effect in the low-dose range. When stochastic effects are produced, they are initiated at the moment of exposure, but years or decades might elapse before the whole-organism response to these changes manifest as altered functioning and ill health.

In harmony with the computational system for determining dosages, mathematical models have been developed to assess the risk of cancer in both individuals and whole populations following radiation exposure. A number of organizations involved in radiation protection, such as UNSCEAR, BEIR, ICRP, and the Environmental Protection Agency (EPA), have published estimates of risk. Although differing in minor ways, they all are in substantial agreement. These estimates are based on the study of survivors from the bombings of Hiroshima and Nagasaki, on groups who received radiation for diagnostic or therapeutic purposes, and workers who received occupational exposure. Successful modeling of the risk of cancer incidence demands consideration on a wide range of variables. According to BEIR V:

> The risk depends on the particular kind of cancer; on the age and sex of the person exposed; on the magnitude of the dose to a particular

> organ; on the quality of the radiation; on the nature of the exposure, whether brief or chronic; on the presence of factors such as exposure to other carcinogens and promoters that may interact with the radiation; and on individual characteristics that cannot be specified but which may help to explain why some persons do and others do not develop cancers when similarly exposed.

For the sake of simplicity, the mathematical model to assess risk can be reduced to its bare essentials. Only three numbers are required to estimate the increased risk of cancer to a population resulting from radiation exposure: the dose to the average individual, the number of people receiving that dose, and the risk factor applicable to the type of cancer under consideration. To give an example, if the average dose to a population of 10 people is 100 rems, the collective dose is 1,000 person-rems (10 x 100). Similarly, if the average dose received by a population of 10,000 people is 0.1 rem, the collective dose works out to be the same: 1,000 person-rems. In order to calculate the number of fatal cancers expected in the two populations, the collective dose is multiplied by the appropriate risk factor. The risk factors per sievert (per 100 rems) have been developed by the international radiation protection agencies to cover different scenarios of whole-body exposure and/or exposure to individual tissues and organs. Note that when the identical collective dose in the two examples mentioned above are multiplied by the same risk factor, the number of cancers anticipated in each population is the same. This conclusion is a consequence of the Linear No-Threshold Hypothesis. Cancer yield is proportional to the collective dose. The same numbers of cancers will be produced whether 1,000,000 people each receive a thousandth of a rem or 1,000 people each receive one rem. In the low-dose range, this assumption of linearity is under increasing fire for either under- or overestimating the cancer yield or for being woefully simplistic.

To appreciate the function played by risk factors in estimating cancer incidence, a simple example will suffice. The 1990 ICRP absolute risk value for fatal cancer probability in the high dose and high dose region was 8×10^{-2} (0.08) per sievert. To calculate the number of fatal cancers in an exposed population, this risk factor is multiplied by the average dose to each member of the population which in turn is multiplied by the number of people receiving that dose. Thus, if 10,000 people each receive a dose of 1 sievert, the probable number of fatal cancers will be 800. ($0.08 \times 1.0 \times 10{,}000 = 800$). The utilitarian value of this methodology is obvious. In the aftermath of a radiation release, an estimate can be quickly generated satisfying the intellectual desire to come to terms with the health consequences of what has taken place long before the actual pain and suffering becomes apparent within the population, if they ever become apparent at all. (Of course, the stricken victim will be aware of his own pain and suffering, but he may be handicapped by the long latency period of radiation-induced cancer of ever knowing if the origin of his

illness is radiation-related.)

Because it is difficult to observe low-dose effects in populations, attempts at estimation have extrapolated from relatively reliable high-dose effects. The data from Japan clearly shows an adverse health effect among adults who received a dose above 200 milliSieverts (20 rems) and children who received a dose about 100 milliSieverts (10 rems). The key question that draws daggers out from underneath lab coats is, what is the risk to health at levels of exposure below these dosages?

To gain an appreciation of the difficulties of determining cancer incidence at low doses, let's suppose that in a population of 10,000 people, each member received a dose of only 10 millisieverts (1 rem, i.e., one hundredth of the previous example.) The expected number of fatal cancers in this instance would be 8 (0.08 x 0.01 x 10,000 = 8). Normally, approximately 20% of the population dies of cancer. So rather than 2,000 cancer deaths, the expected number of cancer deaths in the exposed population would be 2,008. Due to statistical fluctuations and normal levels of uncertainty, there is no way to be sure that radiation caused excess cancers in this population. As Caufield observes:

> With such a large base of cancers, it may be statistically impossible to detect a relatively small number of extra cancer deaths. Some scientists argue that in order to get statistically reliable data on the effects of doses on the order of one rem, it would be necessary to study 10 million exposed people, and a matching group of ten million people who have not been exposed to radiation. Matters are further complicated by the need to continue a study from the first exposure until death.

Given these uncertainties, the radiation protection agencies rely on their risk factors for interpreting the health consequences of radiation accidents and planned radiation releases. These risk factors are the eyes for all human beings who wish to evaluate radiation effects, for they enable us to see what is invisible and unmeasurable. They inform us of the level of human suffering produced by nuclear weapons, nuclear reactors, radioactive waste, and now, non-nuclear weapons containing radioactive material.

At this juncture, the reader might reflect on a number of questions: What if the risk factors are wrong? What if they produce calculations that misrepresent, by underestimating, the actual health consequences of human exposure to radiation? Given that in the absence of direct observation, the risk factors are the central window through which we perceive the hazards of a radiation release, are they not the likely focal point for intentional malfeasance by the Cult of Nuclearists so as to keep the world ignorant of the breadth

of their misdeeds? And finally, isn't the *raison d'être* of the corrupted Hiroshima study now perfectly clear, since by it, the current risk factors are justified?

If the risk factors are wrong, humanity has been hoodwinked and rendered blind by artful lies. Crimes against humanity and crimes against life can be committed before our very eyes, and we will fail to see them for what they are. Could there be a more perfect crime than one committed before a world of blindfolded witnesses?

Exhibit F will testify to the falsehood of the current risk factors. But before we walk down that road, we must first explore the vagaries of that shifty character called "risk," and observe some of the many tricks its handlers can make it perform to alter the perception of hazard of ionizing radiation.

SCAM NUMBER EIGHTEEN: Base estimates of health risks from chronic exposure to internal emitters upon instances of acute flashes of external exposure.

This scam is the centerpiece for much of the current mischief perpetrated by the radiation protection agencies. It is the practical implementation of the falsehoods rehearsed in Exhibits A, B and C. It is grounded upon the dubious premise, which has gained ascendancy in the discipline of health physics, that *all* types of health detriment from *all* types of radiation exposure is simply related to the total amount of energy absorbed. No distinction is made between energy delivered to the body externally by photons and energy delivered internally by alpha and beta particles, despite the fact that these can create completely different spatial and temporal patterns of molecular damage to cells and organs. In the case of external irradiation, the total amount of energy deposited in the body is conceptualized as being uniformly distributed, or "averaged," over the target mass, be it the whole body or a particular organ. How risky this dose is for inducing cancer can then be estimated by consulting a handful of studies of acute external irradiation, the most prominent being the corrupted Hiroshima Life Span Study. The identical method, without question as to its legitimacy, is used for instances of internal contamination. First, the total energy emitted by embedded hot particles is calculated. This quantity is treated *as if* it were uniformly distributed throughout the target organ, even though in many circumstances this is certainly not the case. The likelihood of illness is then predicted according to the studies of external radiation. What is important to note is that the risk factors, the probability of cancer incidence, for the different types of exposure are derived from the same source: the corrupted Hiroshima study and the handful of other studies of external exposure. By this method, the radiation protection agencies pitch to the world their central, unverified hypothesis: that the biological response of chronic low-dose exposure to

internal emitters incorporated in the body from nuclear pollution in the environment in no way differs from that produced by an instantaneous flash of gamma irradiation at one moment in time. By the logic of this schema, the data from the highly politicized Life Span Study insinuates itself into forecasts about the health consequences of chronic, internal, low-dose exposure from such situations as Chernobyl, living downwind from a nuclear installation, and inhaling weaponized uranium. Exhibit F will bear witness that this methodology produces risk factors that repeatedly underestimate the number of radiation-induced illnesses inflicted on the innocent and unsuspecting throughout the world.

SCAM NUMBER NINETEEN: Mislead the world into believing that, below the dosages where deterministic effects begin to occur, the only health concern from radiation exposure is the risk of cancer.

To ensure the continuation of programs that contaminate the biosphere with radiation, the Cult of Nuclearists must downplay the detriment to public health that accompanies their deeds. A major tactic in this campaign is to fixate the attention of the public on the idea that the fundamental risk to health following radiation exposure is cancer. In living systems, the molecular damage produced by radiation injures the structure and function of cells. Vulnerable to harm are both the germ cells (the cells responsible for reproduction) and somatic cells (all the other types of cells making up the organism). For the individual receiving radiation exposure, the source of any health detriment is produced from damage to somatic cells. Damage to germ cells carries the additional risk of impacting on the health of offspring, from the moment of conception to birth and then onward through to old age until the final death of that individual. The central focus of radiobiology for the last half century has been the quest to understand how radiation can damage DNA and lead to cancer. Little research has been devoted to understanding non-cancerous processes induced by DNA damage, and the implications these have on cell function and the health of the organism as a whole. The entire biochemical structure and function of a cell or its descendants is vulnerable to radiation-induced alteration, depending on where along a chromosome damage is incurred. The science of radiation effects remains in its infancy.

Given that cancer is a recognized outcome of radiation exposure, the public health focus of the radiation protection agencies has been to assess the risk to the population from all types of exposure for all types of cancer. The probability of cancer is predicted by the risk factors embraced by the radiation protection agencies. In the high-dose range, these are based on the accepted epidemiological studies. In the low and intermediate dose ranges, extrapolations are made from known high-dose effects. For radiation protection purposes, a linear relationship is assumed between dose and cancer yield. According to the ECRR, for the ICRP, UNSCEAR, BEIR, NCRP, NRPB, and the state agencies of the

member nations of the European Union, the only health effects considered to be produced by low-level radiation are **"fatal"** cancers, heritable damage, and IQ retardation. Members of the public may find this disquieting. **What about nonfatal cancers and benign tumors?** The incidence of these are many times more frequent than fatal cancers, and if nothing else, they adversely affect quality of life and take a toll on psychological/emotional well-being. Damage to germ cells with resulting hereditary disorders is acknowledged by the radiation protection agencies as a possible outcome of low-level radiation exposure, but the claim is made that these have yet to be identified as occurring in man. (Evidence to prove that this position is incorrect will be presented in Exhibit F.) According to the ECRR, "the ICRP only considers heritable effects which are measurable in phenotype after birth, e.g., congenital defects and perhaps increases in clinically diagnosed heritable genetic diseases." However, there are other possible consequences of germ cell injury which are recognized by the ECRR but ignored by the radiation protection agencies that establish risk factors for radiation injury. Germ cell injury may produce developmental problems to the fetus from the moment of fertilization onward. These may result in spontaneous abortions or fetal deaths. Is the public informed that this is a possible outcome of low-level radiation exposure? No! Further, as a result of radiation-induced germ cell injury, a newborn child may carry in its mutated DNA non-apparent abnormalities that may cause or contribute to the full gamut of possible illnesses later in life. Is the public informed that this is a possible outcome of low-level radiation exposure? No! Aside from inherited damage, there are risks other than cancer to the developing fetus from low-level radiation exposure in the womb. These, also, are not adequately addressed by the radiation protection agencies. Given the vulnerability of the developing fetus for "low probability" events producing "high impact" effects, no consideration is given to the effect of low-level radiation on the birth rate within populations, the incidence of low birthweight babies, and the rate of infant mortality. Is the public informed that these are a possible outcome of low-level radiation exposure? No!

Epidemiological studies have produced evidence of a wide range of health effects other than cancer. These are not addressed by the radiation "protection" community. To avoid repetition, the reader is directed to a fuller discussion of this topic in the last section of the chapter *A Primer in the Art of Deception*.

SCAM NUMBER TWENTY: Entrust agencies of questionable objectivity with the power to establish the risk factors for low-level radiation exposure.

Historically, the radiation protection agencies and the committees that publish estimates of radiation risk have been staffed by people with close ties to government nuclear programs and the nuclear industry. When establishing guidelines for radiation safety, a fun-

damental consideration was the development of a system that enabled those with interests in nuclear technology to go about their business without undue interference. This clandestine alliance between regulators and users has introduced bias into the science of radiation protection and has ultimately been responsible for many of the scams unveiled in this Exhibit.

In the circle game of radiation protection, the ICRP earns its status and legitimacy from the regulatory bodies of governments that consult it for advice. Completing the circle, the radiation safety standards of a nation are deemed legitimate because they issue from such an authoritative and respected body as the ICRP. This incestuous relationship had its start at the beginning of the nuclear age, in 1946, when the AEC sought guidelines from the newly reformed NCRP, which it helped to establish through Lauriston Taylor. This, in turn, led to the formation of the ICRP. Today, the ICRP takes the position that its function is nothing more than to offer recommendations on radiation safety. In a meeting in Brussels in 1998, as recounted in the first publication of the ECRR, the scientific secretary of the ICRP, Dr. Valentin, told attendees that "the ICRP was an independent body which gave advice on radiation safety, but that those who considered this advice unsafe or questionable were entirely free to consult any other group or organization" (ECRR). As fair and open-minded as this may sound, the ruse in the matter is that governments consult only the ICRP and the other copycat agencies when authoring laws and regulatory policies for their nuclear programs. Any individual or group is free to author whatever dissenting opinion they wish on the current safety of radiation standards, but it won't make a damn bit of difference to the entrenched power structure and the nuclear programs it sponsors.

One would think that with the variety of international organizations involved in radiation safety, a number of different points of view on the hazards of low-level exposure would be represented. However, this is not the case. Except for minor differences, the various agencies base their work on the same assumptions and come up with similar risk assessments. They all embrace the flawed methodology outlined in Exhibits A, B, and D, and they all base their assessment of the risk of chronic, low-level internal radiation exposure primarily on the corrupted Hiroshima study or on other studies of acute, external exposure. All discount as inconsequential the health detriment posed by low doses of radiation. This unanimity of opinion can be interpreted in two different ways: either the science is so well understood that there is little room for disagreement, or a political agenda has taken hold of the various radiation protection agencies in order to control the perception of hazard posed by radiation exposure.

Control over what ideas occupy the minds of human beings are the stakes being

played for in the debate over radiation risk. Those organizations fronting for the nuclear establishment promote a single, unified, dogmatic point of view of what risks are imposed on humanity. Given the influence and power of this tyrannical system, a new organization such as the ECRR should be welcomed into the debate for it provides fresh ideas, allowing the public to weigh alternatives and engage in free thought. To gain an appreciation of the importance for alternative points of view, it is instructive to compare the predictions of ICRP models and those of the ECRR on the losses imposed on humanity by nuclear technology. For instance, ICRP models predict that the worldwide health detriment from all nuclear activities[12] up to the year 2000 is 1,173,606 extra cancer deaths and 2,350,000 total cancers. Under these models, no infant deaths or fetal deaths are predicted as having occurred. By contrast, the ECRR has calculated an alternative picture of reality by adding additional risk factors to the ICRP methodology to fill perceived inaccuracies in that system. The ECRR models estimate the worldwide health detriment as totaling 61,619,512 extra cancer deaths and a total of 123,239,024 induced cancers. Further, they estimate that the human nuclear experiment has produced 1,600,000 infant deaths and 1,880,000 fetal deaths. Similarly, the predicted mortality from the accident at Chernobyl differs widely. ICRP models predict an excess of 30,000 fatal cancers worldwide, a figure that will be statistically invisible within normal population incidences of the disease. By contrast, ECRR models predict that the overall 70 year yield of fatal cancers, in Belarus alone, will be 1,200,000. Global figures are predicted to be in excess of 6,000,000.

The reason for these wide discrepancies rests primarily on how the ICRP and ECRR models estimate the health detriment produced by internal emitters. This is the crux of the debate on low-level radiation effects. As we have seen throughout this chapter, the ICRP predicts health effects by calculating the total amount of energy absorbed by the body or organ from decaying radioisotopes external to the body and deposited internally, weights the contributions of alpha emitters within the body's interior, and then averages the total energy over the mass under consideration (whole body or organ) to derive a dose. In sharp contrast, the ECRR model partitions internal and external doses. The calculation of the internal dose, contrary to ICRP methodology, includes weighting factors that take into consideration the specific biophysical and biochemical behavior of each isotope within the body and, further, discriminates between whether the isotope(s) is distributed as individual molecules or as sub-micron or micron-sized hot particles.

The skirmish over dose-response is not simply some esoteric and theoretical controversy by the experts with no practical significance for the rest of humanity. The fate of the

[12] This includes global nuclear tests, weapons fabrication, nuclear power production, radioisotope production, and accidents.

whole human race may very well rest upon it. Our ideas of the anticipated effects of a nuclear exchange, the amount of wellness sacrificed to our continued reliance on nuclear power, the health detriment imposed on a population by uranium weapons, all rest on the model we choose for faithfully portraying reality.

SCAM NUMBER TWENTY-ONE: Alter population statistics to completely corrupt accurate risk assessments.

For those readers who have yet withheld judgment as to the malevolence of the Cult of Nuclearists and their ruthless determination to impose their deadly technology upon the world, the time has come to shine a light through the veils of their treachery and explore the true depths of their malfeasance. Epidemiology is an esteemed and precious tool in the hands of humanity for assessing trends in public health and identifying environmental hazards that are producing illness and ruining people's lives. The foundation of a successful epidemiological study is accurate information of normal trends of morbidity and mortality within a population. If this baseline is tampered with, the opportunity for discovering truth disappears. The inquiring mind is set adrift in misconceptions with no prospect of ever coming ashore to reality. The intentional manipulation of data to misdirect knowledge is nothing less than brainwashing and mind control. It is victimization of the human intellect, the implanting of an insurmountable obstacle in the minds of people who thirst for an accurate picture of what is transpiring in the world around them. The Cult of Nuclearists stands guilty of inflicting this havoc into the minds, into the lives, of an unsuspecting humanity.

Evidence for this crime is meticulously laid out by Jay Gould and Benjamin Goldman in their book *Deadly Deceit: Low Level Radiation, High Level Cover-Up*. The authors recount how, using mortality data collected from official death certificates, they set about to discover if evidence existed for excess deaths occurring in the wake of radiation releases from reactors at weapon production facilities and commercial nuclear power plants. In addition to confirming increased mortality to populations exposed to low-level radiation vented into the environment, the authors made the startling and disturbing discovery of "outright falsification of published data." Analyzing discrepancies in mortality data published by the government, the authors uncovered proof that official statistics on mortality and morbidity had been intentionally tampered with in an attempt to cover up deaths in the US population caused by radiation vented into the environment.

In the course of their research, Gould and Goldman mined data from three series of publications authored by the Public Health Service, a subsidiary of the Department of

Health, Education, and Welfare. One publication was *Radiation Data and Reports*, a monthly publication compiling radiation readings in the environment as reported by a network of recording stations throughout the United States. A second publication was *Monthly Vital Statistics Report*, a state-by-state tabulation of infant mortality and total deaths. The data recorded within these pages each month was referred to as mortality "by place of occurrence." It contained information on where deaths actually occurred, not necessarily where the deceased dwelt during their lifetime. In the following year, after new, revised data had been obtained, revisions to the monthly mortality information were published. This allowed for a comparison between the data as originally recorded and the data as it appeared after revision. The third publication consulted by the authors was *Vital Statistics of the United States*. This single volume contained a yearlong compilation of the data recorded in the monthly reports. It contained adjustments to the incidents of mortality by place of occurrence to provide an accurate picture of mortality "by place of residence." Each volume of this publication appeared in print a couple of years after the year of monthly reports it summarized. Among researchers from a wide variety of disciplines, *Vital Statistics of the United States* was considered the standard reference for US mortality data. It was easier to work with than the monthly copies reporting on a single year, and it was more widely available in public libraries.

Cross-referencing these three publications, Gould and Goldman made a number of disturbing discoveries.

1. One issue explored by the authors was the health consequences of a radiation accident that had received scant public attention. On October 1, 1988, news belatedly reached the public domain of two radiation accidents in November and December 1970 at the Savannah River nuclear weapons facility in South Carolina. In each of these months, nuclear fuel rods suffered a meltdown. There was an information blackout as to what quantities of radiation, if any, were released over the downwind population. The news that eventually reached the public was this: "E.I. du Pont de Nemours and Company, which operated the Savannah River Plant at the time of the accidents, ran a full-page advertisement in *The New York Times* that claimed 'the radioactivity given off was kept within the building' and 'no one, on or off site, was ever harmed.'" Exploring the veracity of this claim, Gould and Goldman compared published radiation measurements with published mortality data. What they uncovered put E.I. du Pont de Nemours and Company to shame. As reported by the researchers:

> Results of an examination of government databases were startling: after the two accidents in November and December 1970, radioactivity had increased significantly in the milk and rain of South Carolina

and throughout the Southeast. Peaks in infant and total mortality showed up immediately following the accidents and disturbing longer-term mortality trends appeared also in the region.

Radioactivity in South Carolina's rain, as measured for December 1970, jumped six-fold over the same month in the previous year. This jump in beta radiation occurred immediately after the accidents in November-December 1970. The rise was significantly above the local trend in the preceding 22 months and it was three times greater than the US rise. Also, in the Southeast as a whole, radioactivity in the rain doubled over the previous December (1.2 times greater than the US rise.) The average reading for the Southeast was higher than any other region in the country: five times higher than the Northeast and West and 70 times higher than the Midwest.

Milk was also contaminated. Radiation readings indicate that the level of strontium-90 found in South Carolina's pasteurized milk during the summer following the Savannah River Plant accident rose significantly over the previous summer. Whereas, the level declined in the milk in the rest of the country.

Immediately after the elevated radioactivity was found in the rain, South Carolina's infant mortality rate in January 1971 peaked at 24 percent above the previous January. In contrast, it declined in the US and Southeast during the same period.

Total deaths in South Carolina also diverged significantly from the rest of the country during the months immediately following the accidents, declining six percent slower than the US since the previous January.

Elevated peaks in both infant mortality and total deaths were recorded in *Monthly Vital Statistics Report* for January 1971. Revised figures corrected for errors from late filings, faulty death certificates, computer malfunctions and random mistakes appeared in the same publication a year later. These were in substantial agreement with the original data. But in the final bound volumes of *Vital Statistics of the United States* published in 1974, ***the peaks in infant and total mortality disappeared. The data had been altered completely.*** "In the final by-residence data, South Carolina's January change over the previous year became the same or less than the US change, whereas it had been significantly higher for both infant and total mortality in the revised by-occurrence data." In this instance, increased mortality was covered up through a substantial lowering of the numbers

of deaths that had previously been reported in the monthly statistics. Suspiciously, such wide discrepancies between mortality "by place of occurrence" and mortality "by place of residence" occurred **only** after significant radiation releases:

> Presumably, these deaths were now missing because all of these babies had travelled from out-of-state that month to die. The subtraction of 38 dead babies in South Carolina the month after the Savannah River Plant accidents can be compared to 59 missing infant deaths in Maryland during July 1980, right after a Three Mile Island venting, and eighty-six missing in Pennsylvania during July 1979, right after the Three Mile Island accident. In all three cases, peaks in infant mortality were eliminated as a result of the revisions.

2. Another type of suspicious tampering of population statistics appeared after the accident at Three Mile Island. In every month of 1979 after the accident, mortality data for California, Minnesota, and Illinois were missing from successive issues of *Monthly Vital Statistics Report*. "These highly irregular omissions made it impossible to evaluate the significance of mortality increases in areas near Three Mile Island, **because the baseline US mortality trend could not be calculated**" (emphasis added).

3. In 1986, after fallout from the Chernobyl catastrophe reached the United States, dramatic revisions appeared in the monthly mortality data. "Some states markedly increased their reported number of live births in *Monthly Vital Statistics Report*. Since the number of births is the denominator in an infant mortality rate, increasing this number lowers the rate." Small random fluctuations in the birth data are expected due to late filings as is the case for the filing of late death certificates. These changes then appear in the revised data published the following year. However, as the authors relate, preposterous tampering with the birth rate was in evidence.

> Revisions to the 1986 birth data for California and Massachusetts, however, were all positive and clearly nonrandom, adding nearly 45,000 live births to their original totals. Exactly 813 births were added for each of five successive months to Massachusetts' monthly data. The next three months, the changes were 703, 702, and 703. The nine upward revisions in California's birth data were all combinations of 5000, 4000, and 4415. At the same time, there were no major revisions in the reported number of infant deaths. The result was that Massachusett's June 1986 infant mortality rate was lowered by 76 percent and California's July infant mortality by over 25 percent. In this way, the large infant mortality peaks in the original data

for California and Massachusetts after Chernobyl were eliminated.

4. In January 1987, in the year following Chernobyl, the format of *Monthly Vital Statistics Report* was changed. Revisions made to data from the previous year were no longer marked. By this means, identification and analysis of changes were made significantly more difficult. Details of changes were replaced by a generic note at the bottom of each page which stated "figures for earlier years may differ from those previously published." As Gould and Goldman observe: "Now, the individual changes are not only unexplained, they are also no longer identified."

5. The authors identified a number of instances where crucial information from *Radiation Data and Reports* was omitted. Starting in 1967, the recording station 140 miles downwind of the Savannah River Plant ceased to publish any information on radiation levels in the environment. In 1975, the Environmental Protection Agency assumed the responsibility from HEW for collecting and publishing data about radiation in the environment. Monthly publication of *Radiation Data and Reports* was halted. A quarterly report with a much smaller circulation replaced it. Detailed information was no longer made available about radiation levels in the environs around government weapons facilities, radioactivity in the food supply, and strontium-90 in bone.

6. Starting in 1975, the Environmental Protection Agency centralized environmental monitoring by collecting milk samples, rain samples, and air filters from all over the country and shipping them for analysis to the laboratory of the Eastern Environmental Radiation Facility in Montgomery, Alabama. One of the practices introduced at this institution was the reporting of "negative" radiation values for milk. This is a curious adoption given the fact that a negative amount of radiation is about as real as a Heffalump. Gould and Goldman offer the following explanation for this procedure:

If the radiation in milk is lower than background levels that are due to cosmic rays, radon, and other natural sources, then small "negative" readings occur. Under this system, there are normally as many small positive as negative values for short-lived substances such as iodine-131 and barium-140 that decay in a matter of a few weeks. As statistically expected, the numbers are rarely larger than four or five units and average out to zero over a period of a few months to a year.

Not surprisingly, these negative values began to play a nefarious role in covering up radiation released into the environment. Contrary to the expectations expressed by Gould and Goldman for the frequency and magnitude of negative values, occasional reports were issued that contained many more negative values than positive values, and the negative values

were of unusually large magnitudes. One example is in the aftermath of an underground nuclear detonation at the Nevada Test Site in the summer of 1982 which was suspected of releasing radiation into the environment. As reported by Gould and Goldman:

> Large positive readings of barium-140 and iodine-131 in the milk would have been an unequivocal signature of leaks from the underground tests. Instead, barium-140 in Nevada milk reached the incredible value of negative 42 picocuries per liter in June 1982, the most significant negative reading in the nation. Out of a total of 62 barium-140 measurements reported for the US that month, an astounding 57 were negative! Eight western states neighboring Nevada also had negative barium-140 measurements that diminished in magnitude with distance away from the test site. In sharp contrast, no such clear-cut pattern existed for the month of March, when the magnitude of negative radioactivity in the milk was ten times less in Nevada than in June, and there only were small positive and negative fluctuations as expected under normal conditions.

The authors report other abuses of negative radiation readings. In June of 1982, there was a cluster of negative readings of iodine-131 in New England. That was the same month in which two serious radiation accidents occurred at the Pilgrim nuclear power plant in Massachusetts. As in Nevada, the peculiar and unexplainable pattern emerged of high negative readings of iodine-131 in proximity to a radiation source, in this case the nuclear reactor, surrounded by readings that diminished as distance from the plant increased.

So, was there a political purpose served by negative radiation readings? The authors write: "**These negative values would cancel the positive readings, so resulting national averages would never cause alarm**" (emphasis added). In the aftermath of a radiation release, high positive readings would be present in the environment. When these were averaged with high negative readings, the radiation in the environment could be made to magically disappear by beautiful, mathematical wizardry.

7. Key mortality data became unavailable in the aftermath of significant radiation releases. During the period of heavy fallout in the early 1960s, Massachusetts withheld information on live births, infant deaths, and total deaths. In 1970, the New York Department of State ceased its practice of publishing detailed annual listings of deaths by cause and location after evidence emerged that the incidence of leukemia had increased after fallout from the Nevada Test Site was deposited on Albany and Troy. The Connecticut Department of Health Services stopped publishing data on cancer mortality

by township, which it had done annually since the 1930s, after radiation releases from the Millstone nuclear reactor in 1975.

The few examples that have been provided do not exhaust the forgeries uncovered by Gould and Goldman. They are sufficient, however, to illustrate that mischief-makers have tampered with population statistics to befog understanding of the medical impact of radiation releases. The most disturbing implication of this revelation is that citizens are being injured unnecessarily by the government's refusal to acknowledge that low-level radiation in the environment is a hazard. In the aftermath of a radiation release, forthright disclosure of the hazards would empower people to take precautions to minimize their risk of injury. Denial and cover-up render the population vulnerable and cause otherwise preventable illnesses.

If *Deadly Deceit* were the sole source of information on these corrupted statistics, the reader might be justified in maintaining a certain skepticism. However, similar incidents have been documented by other researchers. In Wales, members of the Low Level Radiation Campaign (LLRC) forced front men in the UK nuclear industry to doctor cancer statistics in all too transparent a manner. In November of 1993, the LLRC had drawn attention to the fact that data included in the Wales Cancer Registry (WCR) showed a 300% increase in bone cancer incidence in Wales compared with the national rate throughout the UK. (Nuclear pollution in Wales and an increased incidence of cancer has been attributed to emissions of radioactivity from the Sellafield nuclear installation lying across the Irish Sea in England and to the nation's nuclear power stations. The Cult of Nuclearists in the UK hotly contests this conclusion.) The Cancer Registry responded by announcing that it would undertake a "validation" exercise of its data. In 1995, it published its revised figures. The total number of cancers were less than previously recorded, yet they still validated the conclusion of an excess incidence of bone cancer. Further, yearly variations in the Registry strongly correlated with variations in the deposition of strontium-90 released into the atmosphere twenty years earlier during the era of atmospheric weapon testing. In April 1996, amidst much publicity, LLRC convened a symposium in the House of Commons to debate the merit of Dr. Chris Busby's book *Wings of Death* and his Second Event Theory. During that meeting, a member of the National Radiological Protection Board announced that the excess incidence in bone cancers appearing in the Wales Cancer Registry no longer existed:

> By a remarkable coincidence, just two days before the Symposium, Wales Cancer Registry had announced that a second revision of the data had eliminated the excess entirely. The full report was not published for some months, fueling suspicions that the press announce-

> ment was issued to help NRPB attack Busby. By a further remarkable coincidence, on the very day of the Symposium the *Western Mail* (a Welsh daily newspaper) carried the news that WCR was to be closed amid allegations of incompetence, and its functions handed over to the Velindre NHS Trust" (LLRC 1999).

The WCR closed in 1995. In 1997, it reopened under the name of the Wales Cancer Intelligence and Surveillance Unit (WCISU). This new organization was headed by Dr. John Steward, who had written a paper exonerating the country's nuclear power stations of any blame in causing cancer. (Isn't it curious that a cancer registry is headed by a defender of nuclear power?) Soon after, it was discovered, 3,517 cases of cancer that had been included earlier in the WCR were dropped from the new database of WCISU. Missing were 18% of the total number of cases of childhood cancer among the 0-14 year olds in Wales. Further, 80% of the bone cancer cases had vanished. The alterations made in the WCISU database after their "revalidation" resulted in cancer numbers being reduced in both sexes for every year between 1974 and 1989. Mysteriously, the "revalidation", which included discovery of errors in coding and duplicate registrations, not once involved an *increase* in the number of cancers for a given year but only *decreases*. Further, the greatest revisions in any one year occurred in 1986, the year of the Chernobyl disaster. WCISU, in a feat of unparalleled prestidigitation, reconfigured the health picture of the entire population of Wales. After the third revalidation of the data of the Wales Cancer Registry within five years, the excess incidence of bone cancer in the nation miraculously disappeared along with the excess incidence of childhood cancer. Erased from the public record was evidence that Sellafield was causing excess cancers among the coastal population of Wales.

The European Committee on Radiation Risk, in its first publication, briefly cites other occurrences where data were intentionally tampered with. After Chernobyl, hundreds of thousands of people participated in cleanup operations in close proximity to the destroyed reactor and also built of a concrete sarcophagus around the reactor building to entomb the radiation for thousands of years. In subsequent years, this population of "liquidators" was reported as having a *lower* rate of leukemia than the general population. Only later did it come to light that Soviet doctors were forbidden to record this disease in their diagnoses. Scientific data was also meddled with after the fire in the reactor at Windscale in England in 1957. (This reactor was located on the site that is currently occupied by the Sellafield nuclear fuel reprocessing facility on the western coast of England.) The amount of radiation released from the fire and the incidence of cancer induced in the population of Ireland remain fiercely contentious issues. According to the ECRR, at some point after the fire, meteorological records were altered "with the apparent motive of con-

cealing the likely location of any effects." By disguising the path of the fallout plume, interested parties could minimize the perception of the risks to health in Ireland and the Isle of Man. A third example occurred in Germany after Chernobyl. Infant mortality figures were altered to mask the impact of the accident on public health.

How is the human community to discern truth from falsehood in the matter of human-generated radiation awash in the environment? How many other instances of data tampering have occurred in the last half century that have gone undetected? By its own mischief, the Cult of Nuclearists has destroyed its credibility and is ruining the trust of the people in their governing institutions. What does the public really know about the risks to health of radiation exposure? How safe are we? How accurate are the dose estimates of the survivors of Hiroshima and Nagasaki? How much radiation seeps from commercial nuclear power plants? Where does it go? Who absorbs it? How many people really became sick and died after the accident at Three Mile Island? What types of diseases in what frequency were instigated by the Chernobyl catastrophe? What impact will the detonation of nuclear weapons on the other side of the world have on the health of our children or the purity of our food supply here in the United States? How safe are depleted uranium weapons?

How will we ever be able to distinguish what is from what is not? Objective data has been falsified. Science has been compromised. Truth has been decapitated. At the hands of the Cult of Nuclearists, our minds have become the repositories of carefully crafted falsehoods and deceit. Our brains have been raped. Collectively, we have been the victims of an anthropoid ravish.

SCAM NUMBER TWENTY-TWO: Derive estimates of the risk to health from chronic internal contamination from research conducted on instances of acute external irradiation.

This point formed the basis of Exhibit C and need not be belabored. Radiation safety standards and the assessment of risk from radiation exposure are based primarily on the research of the survivors of the bombings in Japan and those who received x-ray exposure during medical treatment. In the incidents in Japan, populations were exposed to a flash, lasting a few milliseconds, of external gamma and neutron radiation. Based on the governing, *unverified* assumption that the quantity of energy delivered to tissue is the fundamental determiner of biological effect, the radiation protection agencies of the world fabricate risk estimates from these instances of acute external radiation and from them derive risk estimates for the entire gamut of possible patterns of chronic exposure from internal contamination by radionuclides. The whole basis of radiation safety is grounded on the

conjecture that there is no difference in the cellular response, the organ response, and the whole-body response between an instant of gamma exposure and chronic, repeated exposure from decaying radionuclides inside the body emitting alpha, beta, and gamma radiation. NO RESEARCH HAS EVER BEEN CONDUCTED TO CONFIRM THE VALIDITY OF THIS FUNDAMENTAL ASSUMPTION. In *Wings of Death*, Chris Busby relates an anecdote of his investigation into studies of the comparison between external and internal radiation. "When I wrote to the UK National Radiological Protection Board in 1986 asking about this, I received the reply that the board, 'knew of no studies where internal and external radiation had been compared.'"

The estimates of the risk to health from many types of chronic, low-level exposure from internal emitters is based on unwarranted assumptions. Mankind's safety from radionuclides awash in the environment is currently underwritten by fraudulent science. Risk factors may be substantially in error. Populations may be more endangered than currently believed. The radiation protection community has not done its homework.

SCAM NUMBER TWENTY-THREE: Derive the risks to health from exposure to ionizing radiation from corrupted epidemiological data.

It does not take an epidemiologist, when examining Exhibit C, to recognize that the Life Span Study of the survivors of the first atomic bombings in Japan is seriously and irreparably flawed. And yet, the radiation protection community throughout the world upholds this study as the most important source of information available to mankind on the health effects of ionizing radiation. What is going on? Something, somewhere is seriously amiss.

Of the numerous defects that compromise the Life Span Study, three stand out as fatal: 1. The dosages assigned to members of the study population are questionable guesses. 2. Between the time of the bombing and the time the study was initiated, tens of thousands of victims died of non-blast related, radiation-induced illnesses. Yet, these casualties conveniently play no part in this so-called definitive study, purported to provide reliable information of the relationship between dose and physiological response to radiation exposure. 3. The contamination of both the study and control populations with internalized radionuclides invalidates any meaningful conclusions of the incidence of disease in one population compared to the other. Clearly, by ignoring points 2 and 3, the Life Span Study is intentionally designed to deliver results that "prove" that radiation is less hazardous than it in fact is. Given its structure, it cannot help but underestimate radiation effects. It's a rigged game.

The Life Span Study is the doorway into the heart of darkness of the Nuclear Age. By it, one can catch a glimpse of the vast machinations of the Cult of Nuclearists to corrupt the science of radiation protection so it can go about its deeds unhindered. The LSS is deeply flawed science. Yet, it is lauded by the radiation protection community as a valid basis on which to erect standards of protection for all mankind. This state of affairs is appalling and remains completely nonsensical until one concedes that, yes, mischief is afoot in the science of radiation safety.

The Life Span Study has been strategically crafted as the keystone of the current myth of how the human organism responds to exposure to ionizing radiation. It is the lynchpin that holds together the corrupted paradigm of radiation effects that this chapter has been devoted to deconstructing. By the dictates of this myth, biological effect is directly proportional to the amount of energy absorbed. This energy can be treated as an abstract mathematical entity and averaged over a mass of tissue even when that tissue has not been uniformly disturbed by that energy. Whether delivered externally by x-rays or gamma rays, or internally by radioactive decay of radionuclides, dose for dose, weighting factors considered, the biological effects are the same under this model. Low-dose effects can be modelled, or extrapolated, from high-dose effects. Low doses of radiation represent no hazard to the health of the organism. And, cancer is the only endpoint of concern from radiation exposure.

The data from Japan has been erected as the "scientific" proof of this myth. It is what gives credence to current concepts of dose-response. Anointed with such legitimacy, the Life Span Study can be used to justify current emission standards from nuclear installations, the doses of radiation permitted to the public, current concepts of what risks to health accompany radiation exposure, and so forth. All of these become suspect when the results of Japan are called into question. The glaring shortcomings of the LSS testify before all humanity that the agencies setting radiation protection guidelines have been infiltrated, corrupted, and politicized and have had their scientific objectivity thoroughly compromised.

SCAM NUMBER TWENTY-FOUR: Cloak biased judgment in the guise of objectivity when selecting the data used to assess radiation risk.

When developing models of radiation risk, the radiation protection agencies use criteria that at first sight appears unassailable. They take into account only studies that have been published in peer reviewed scientific journals, and which include accurate dose-response data. How could one possibly find fault with such seemingly impeccable methodology? The concealed hoax lies buried in the words "accurate dose-response data." By

only considering instances where accurate dose information has been gathered, important avenues of investigation are precluded from consideration. For instance, many types of epidemiological studies that can offer insight on the effect of radiation releases on populations are banned from consideration when establishing risk factors because these studies do not provide data on the dosages of the exposed population. The work of Gould and Goldman, cited earlier, provides a good example. Their observation of trends in increased mortality after the arrival of Chernobyl fallout or after the accidents at the Savannah River Plant or Three Mile Island is not the type of data accepted by the ICRP for assessing radiation risk. These studies are excluded because they do not identify particular radiation victims, the dosages received by these victims, and the illnesses caused by these dosages. The same applies to the ever-increasing evidence of cancer clusters in the proximity of nuclear installations. If statistically marginal increases in cancer incidence happen in the vicinity of a single nuclear facility, this may be just an anomaly. But if marginal increases are observed around a number of installations, which is the case, the cumulative evidence becomes stronger that a link exists between the risk of developing cancer and living near a nuclear facility. Once again, this type of evidence is not considered as a basis for risk assessment. Causality must be established between an identifiable dose and an identifiable cancer victim or the work is not considered sufficiently rigorous or "scientific."

Part of the swindle of the corrupted Hiroshima data is that the dose assigned to each victim is promulgated as accurate. This is why the study is granted such importance. The problem is that, in fact, no one knows with sufficient precision the dose received by each member of the Life Span Study population. "Dose reconstruction" is based entirely on guesses and computer simulations of the geometry of the bomb, the efficiency of fission of the bomb's uranium fuel, the percentage of radiation reaching the ground, the relative contribution to dosage of gamma and neutron radiation, the degree of attenuation of the radiation field by roofs and walls that offered some margin of protection to the victims, the location and physical orientation of each victim at the instant of detonation, and so forth. All the numerous assumptions that have gone into *reconstructing* "accurate" dosages really make the data from Japan of questionable value. Yet, it is heralded as the definitive study for establishing dose-response in the human organism.

SCAM NUMBER TWENTY-FIVE: Deny that low doses of radiation pose a risk to health by ignoring studies that provide clear evidence that such a risk exists.

The ICRP and other agencies involved in assessing radiation risk conduct annual reviews of scientific papers published throughout the world on the biological effects of ionizing radiation. They then select from this body of work whatever data they judge as relevant to the setting of safety standards. By this means, the radiation protection agencies con-

trol the knowledge base upon which permissible levels of exposure are derived and the perception of the risks that accompany these levels. From this selective filtering, it would appear that no evidence exists for harmful effects to health caused by low levels of radiation released into the environment. But this is simply not true. The fact of the matter is that those who control the current paradigm just don't acknowledge research that intrudes into the worldview they are attempting to promulgate.

On the basis of accepted standards of safety, there was no risk to the health of the population of the United States from the fallout of Chernobyl. Similarly, releases from the accident at Three Mile Island presented no threat to the downwind population. The two previously cited accidents at the Savannah River Plant that resulted in melted fuel rods was covered up for 18 years but was no cause for alarm because, according to the Du Pont operators, "no one, on or off site, was ever harmed." Although the two reactors at the Peach Bottom nuclear power stations in Lancaster, Pennsylvania emitted fallout between the mid-1960s through 1987, these emissions were never reported as significant enough that people were warned to stop consuming dairy products from farms downwind of the facility. Similarly, the two reactors at Millstone near New London, Connecticut, were spewing inordinately large amounts of radiation into the surrounding countryside, yet the downwind population was never warned to take precautions. It is these five cases that are examined in depth by Gould and Goldman in *Deadly Deceit*. In spite of the mischief uncovered in Scam Number Nineteen, the authors found sufficient statistical data to confirm elevated incidences of infant mortality and total mortality in the exposed populations in the aftermath of these releases. The inexcusable tragedy is that a timely and forthright disclosure could have reduced mortality and cancer incidence among the unsuspecting populace. People could have taken precautions. But if these hazards had been admitted, the admission would have amounted to a confession of the danger of the technology and the inadequacy of current radiation standards to protect the public from low-level radiation-induced illness.

Gould and Goldman make an important observation in the conclusion of their book:

> Any individual case that passes a significance test may still reflect a random variation. But the cumulative significance of the five sets of correlations between low-level radiation and increased mortality, considered in Chapters Two, Four, Five, Eight, and Nine, means that the likelihood that they are all chance occurrences is remote.

This is a rebuttal to those nuclear apologists who insist that insufficient data exist to

demonstrate low-level radiation effects in populations. Although individual studies may be inconclusive, the cumulative significance of observed correlations across a number of studies strengthens statistical probability. Gould and Goldman provide an excellent example in data they collected in the aftermath of Chernobyl. The accident occurred on April 26, 1986. Starting on May 5, radiation-monitoring stations in Washington State began recording elevated levels in rainfall of iodine-131, a product of nuclear fission. Peak values were recorded between May 12 and May 19. This provided evidence that Chernobyl fallout had reached the United States. Starting on May 16, 50 EPA milk-monitoring stations in states that received rain mixed with fallout began recording elevated levels of iodine-131 in milk. "No warnings against drinking the milk were issued by public health authorities because the reported levels were regarded as safe" (Gould and Goldman). These elevated radiation readings correlated with government data of increased mortality throughout the United States for the month of May: "The higher the level of radioactive iodine found in milk in a region, the higher the percent increase in total deaths." Elaborating on these facts, Gould and Goldman offer this observation:

> These statistics showed a surprising 5.3 percent increase in the total number of deaths in the US in May 1986 over the same month in the previous year. This was not only statistically significant (with a probability of less than one in a thousand of being a chance event); it was, in fact, the highest annual increase in May deaths recorded in the US in 50 years. There were also high percentage increases in deaths in the three succeeding months.

A graph comparing levels of iodine-131 in milk with increases in mortality yield evidence for the Supralinear Hypothesis, namely, that increased risk occurs at low doses and the rate of mortality diminishes as doses increase. The graph "indicates that deaths increase rapidly with iodine-131 levels below 100 picocuries per liter, but the percentage increase flattens out at higher radiation levels." According to Gould and Goldman:

> If the Chernobyl fallout is responsible for these steep and highly unlikely mortality increases, then this is the first evidence using large populations that suggests the dose-response curve at very low dose rates of fallout radiation exposure is logarithmic and not linear, contrary to generally accepted assumptions. The medical and scientific community has long believed, on the basis of linear extrapolations from high doses, that low-level radiation from fallout and nuclear plant releases can be dismissed as posing a negligibly small danger. The Chernobyl experience indicates that this assumption may underestimate the effect of low radiation doses for the most sensitive members

of the population by a factor of about one thousand.

To strengthen their conclusion that Chernobyl fallout caused an increase in mortality, Gould and Goldman provide evidence of unprecedented levels of bird deaths reported by Dr. David DeSante, a researcher at the Point Reyes Bird Observatory in California. In a letter by Dr. DeSante, the following observation was made:

> We documented a massive and unprecedented reproductive failure of most species of landbirds at our Palomarian Field Station [located 25 miles north of San Francisco] during the summer of 1986. The number of young [newly hatched] birds captured in our standardized mist-netting program was only 37.7 percent of the previous ten-year mean. Interestingly, the reproductive failure did not begin at the start of the breeding season but only after about one month of the season had passed, that is, for birds hatched about mid-May. Furthermore, there seemed to be a slight recovery of reproductivity very late in the season. Might this implicate iodine-131? (Gould and Goldman)

To further strengthen apparent correlations between Chernobyl fallout and increased mortality, *Deadly Deceit* provides evidence of increased levels of infant mortality in West Germany during the same period in areas contaminated by fallout. The authors then conclude that "the probability that the simultaneous mortality peaks in the US, West Germany, and among birds are unrelated random events can be expressed mathematically as one out of 10^{30}"

Again, the reader must ponder why the radiation protection community continues to rely on the politically corrupted Hiroshima data to establish the risks of radiation exposure when other data is available. Gould and Goldman argue that the worldwide data from Chernobyl can provide accurate risk assessments for low-level radiation exposure for the following reasons:

1. It involves a much larger exposed population than any other study.

2. It involves a normal population, not hospital patients, workers of a limited age range of 18-65, or war survivors of a traumatic bombing.

3. It involves extremely low doses, cancelling the need for uncertain extrapolations from higher doses.

4. It involves accurately measured amounts of radioactivity in the diet over a wide range

of concentrations made by monitoring stations throughout the world. "No such accurate measures of dose were available in any earlier studies of environmental radiation exposures or direct radiation exposure at Hiroshima and Nagasaki."

5. It involves internal radiation exposure.

Gould and Goldman summarize their argument concisely: "Thus, the statistics emerging from the Chernobyl disaster permit, for the first time ever, the establishment of a dose-response relationship at extremely low doses in a normal human population." Those people who endorse programs that result in the liberation of radioactivity into the environment will violently argue against this conclusion. It flies in the face of their efforts to marginalize the disastrous public health consequences of Chernobyl. It intrudes on their claim that low-level radiation is without effect. It etches away at their prejudiced assumption that Hiroshima is the disaster of choice for understanding radiation effects in man.

SCAM NUMBER TWENTY-SIX: Underestimate the risk of damage to cells from low-level radiation by making the false comparison between normal free radical damage and damage caused by ionizing radiation.

Routinely, an enormous number of free radicals are produced in cells, and these induce molecular damage to DNA and other important cellular structures. Exposure to ionizing radiation creates a much smaller number of additional free radicals. Based on these facts, those who deny the hazard of low-dose radiation make the argument that since cellular mechanisms routinely repair naturally occurring free radical damage, they obviously have the capacity to repair damage induced by ionizing radiation. This is a seductive and seemingly convincing argument. However, as John Gofman points out, it is based on two false assumptions: "(1) that the nature of damage done by ionizing radiation is the same as the nature of damage done by routine metabolic free radicals, and (2) that damage therefore can be compared by comparing the relative numbers of free radicals" (Gofman 1997).

Gofman demolishes these two assumptions in his article, "The Free-Radical Fallacy about Ionizing Radiation: Demonstration that a Popular Claim is Senseless". His argument runs as follows: By some estimates, the DNA of each cell in the body is exposed to between 120,000 and 240,000 damage events per day from intrinsic metabolic processes. In response, cellular mechanisms are rapidly activated that repair this damage. If the damage caused by radiation is not qualitatively different from normal free radical damage, which is the basic assumption of the Free-Radical Fallacy, then repair mechanisms should have the capacity of undoing an equivalent amount of damage produced by ionizing radiation. Can this be the case? Gofman's response is as follows. Understanding exists as to

the repair capacity of the human organism. Estimates exist for the number of damaging events produced in each cell by each rad of absorbed dose. Further, experiments have confirmed that, in response to whole-body radiation of 100 rads delivered all at once, human cells mobilize a sufficient amount of repair enzymes to repair all genetic damage. In fact, repair capacity is not overwhelmed by the number of damaging events induced by 500 rads. Thus, the body has the capacity for perfect repair. However, a dose of many hundreds of rads is a lethal dose. Thus, perfect repair is not the central issue in the body's ability to withstand radiation injury. From this simple thought experiment, Gofman arrives at the conclusion that either the nature of the damage caused by ionizing radiation or the nature of the repair process cannot possibly be the same for the oxidative damage of normal cellular processes and that caused by ionizing radiation. Gofman continues with the argument that repair capacity is not the issue, but that radiation damages cellular structures in complex ways that resist perfect repair. [Double-strand breaks to DNA are an example of complex damage compared to the more usual single-strand breaks caused by normal free radical damage.] Gofman states:

> The difference between free-radical damage from routine metabolism and from ionizing radiation almost surely lies in repairability. If DNA damage is perfectly repaired by a cell, such damage has no health consequences. It is inconsequential. The consequences arise only from injuries which are non-repairable or mis-repaired.
>
> The power of ionizing radiation to induce particularly complex and unrepairable genetic injuries is surely related to a unique property of this agent. Ionizing radiation instantly unloads biologically abnormal amounts of energy at random in an irradiated cell. Biochemical reactions in a cell generally involve net energy-transfers in the ballpark of 10 electron-volts and below. By contrast, Ward reports that the average energy-deposit from low-LET ionizing radiation is thought to be about 60 electron-volts, all within an area having a diameter of only 4 nanometers. (The diameter of the DNA double-helix is 2 nanometers). In other words, ionizing radiation produces violent energy-transfers of a type simply absent in a cell's natural biochemistry.
>
> Because of its unique property, ionizing radiation is a unique menace to our DNA and chromosomes. This fact needs wide recognition, as mankind learns that far more health problems are mutation-based than anyone could prove 15 years ago.

SCAM NUMBER TWENTY-SEVEN: Underestimate the risks posed by low-level radiation by failing to take into account known physical and biological phenomena.

According to the model of risk assessment upheld by the ICRP, the density of ionization events within a target mass is the key determinant of biological effect. To account for the fact that the same quantity of energy will create different patterns of ionization depending on whether it is delivered by alpha, beta, or gamma radiation, the equations of the ICRP allow for the introduction of a weighting factor to make allowance for these differences, called the *radiation weighting factor*. As an example, if the equivalent dose of radiation is delivered to a tissue by x-rays and alpha particles, the biological effect of alpha particles is weighted as 20 times greater than that produced by the x-rays due to the denser pattern of ionization (more destruction per unit length along a track of alpha particles.) A second weighting factor is added to calculations: the *tissue weighting factor*. This mathematical expression is inserted into equations to capture the differing sensitivities of the various organs of the body, and to offer an expression for the contribution of each organ to total health detriment resulting from uniform external irradiation to the whole body. The addition of the two weighting factors into the complex modeling of the ICRP is an attempt to create a realistic model that connects the quantity and quality of radiation to the probable biological effects. Unfortunately, the model is archaic. It fails to take into account known physical and biological phenomena that add to the hazard of the organism. This conveniently leads to an underestimation of risk.

To address these shortcomings, the European Committee on Radiation Risk proposes that, to salvage the ICRP methodology from irrelevance, additional weighting factors need to be included in calculations to address current understanding. (It must be emphasized that the ECRR has absolutely no influence at this point in time over the methodology of the mainstream radiation protection community. Their suggestions can easily go unheeded, and the ICRP and related organizations can continue to ignore biological realities in their questionable risk assessments. Of course, such intransigence will only further weaken their credibility.) To fully capture the hazard to the organism posed by radiation, the ECRR sees the need for the addition of a *hazard enhancement weighting factor*. This would inject into calculations known physical and chemical effects that at this point in time are completely overlooked by the ICRP. A few examples will be given to illustrate current shortcomings in the accepted methodology that lead to an underestimation of the hazard to health from low-level radiation.

1. Radioisotopes which gain access to the interior of the human body behave in accordance with their chemical composition. Thus, different radioisotopes pose different hazards depending on how they migrate through the human body and where they are

retained. It has been proven that isotopes of strontium, barium, and plutonium have a propensity to bind to DNA. Due to their intimate proximity to DNA, the likelihood is increased that these radioisotopes will induce irreparable genetic damage. The ECRR recommends acknowledging this increased hazard in comparison to other radioisotopes that don't bind to DNA inside the body. This observation is important when discussing the hazards created by the inhalation of depleted uranium. It has been observed that uranyl UO_2^{++} ions bind strongly to DNA (Wu). As a consequence, internalized uranium poses enhanced hazards that are totally ignored by all agencies.

2. Cells have a range of sensitivity to radiation depending on where they are in the cell cycle, but this variation in sensitivity is not considered in risk assessment. Cells undergoing replication are more sensitive to radiation effects than cells which are not in the process of cell division. This can enhance radiation effects under certain circumstances. "For external low LET radiation there is a 600-fold variation in the sensitivity for cell killing over the whole cell cycle" (ECRR). Take the example of two separate doses of external radiation delivered in a 24-hour period. The first dose will induce some portion of the targeted cells to initiate cell repair and replication processes. Once these are underway, a second dose hitting them in this heightened phase of sensitivity will be more hazardous than if the second dose were delivered after the cell population had returned to stasis. Second Event theory postulates a similar phenomenon for certain types of internal emitters. For instance, an atom of strontium-90 may be bound to a chromosome. When it decays to the radioisotope yttrium-90, it will produce a track of ionization through the cell that may produce sublethal damage. This may signal the cell to enter a repair-replication sequence. Yttrium-90 has a half-life of 64 hours. Consequently, a probability exists that it will undergo decay during the phase of enhanced sensitivity of the reproducing cell, when DNA damage can no longer be repaired. Conditions at this point are ripe for irreparable mutations to be created that, if not lethal, will be passed on to all descendants of the daughter cells created from the original cell division. The ECRR recognizes increased hazard in the two scenarios mentioned here and proposes increased weighting factors in calculations of risk under these conditions.

3. Certain types of insoluble hot particles lodged in tissue represent a hazard that is not addressed by current estimates of risk. The biological effect of this type of contamination depends on the size of the embedded particle, the activity, and the dose. Being insoluble, these particles may remain lodged in their place of deposition for long periods of time. As such, they represent an enhanced hazard to surrounding cells when compared to single atoms of the radionuclide dispersed throughout greater volumes. The ECRR believes that this phenomenon warrants inclusion in determinations of risk from internal emitters.

The first publication of the ECRR contains a deep discussion of the ICRP model, its shortcomings and recommendations for bringing it into harmony with current knowledge of radiation effects. The work of the ECRR, however, sets it on a collision course with the nuclear establishment. When applying its risk factors to estimates of health detriment following exposure, radiation is revealed to be much more hazardous than currently assumed. For instance, the risk factors (the probability of injury) per sievert for whole populations for whole-body effects is double that of the ICRP for fatal and nonfatal cancers, severe hereditary defects, and cancer and severe retardation after in utero exposure.

SCAM NUMBER TWENTY-EIGHT: When establishing risks to health from ionizing radiation, ignore scientifically validated low-dose effects that inconveniently intrude on the reigning scientific paradigm.

The mainstream radiation protection community does not acknowledge that low-level radiation delivered at a slow rate poses a hazard to public health. They are only able to sustain this position by sacrificing objectivity and ignoring scientifically validated low-level effects. Their position is aptly summarized by Rosalie Bertell:

> In the official approach to radiobiology, only direct damage to DNA has been recognized as "of concern," and only high-dose/fast-dose rate experiments or observations have been accepted for use in estimating the dose-response rate. As was noted, it is the "common wisdom" that effects of low doses/slow-dose rates cannot be studied, but must be extrapolated from the officially accepted high dose/fast-dose rate studies. Basing one's theory on claims that it is impossible to study the phenomenon is certainly a peculiar way to do science! (Bertell 1999)

Actually, important low-dose effects involving other than DNA damage have been confirmed by repeated experimentation. One such biological mechanism that has received a great deal of attention is the Petkau Effect. This phenomenon was first discovered by Dr. Abram Petkau, a Canadian physician and biophysicist, who at one time managed the Medical Biophysics Branch of the Whiteshell Nuclear Research Establishment in Pinawa, Manitoba. In 1971, Dr. Petkau was studying the effects of radiation on model lipid membranes extracted from fresh beef brain. In an early series of experiments, he determined that when delivering an x-ray dose of 26 rads per minute, a total dose of 3,500 rads was required to destroy a cell membrane in an aqueous solution. Altering his procedure, he added to the water a small quantity of sodium-22, a commonly found radionuclide in fallout and releases from nuclear reactors. Under these new conditions, the cell membranes were receiving the minuscule dose of 0.001 rads per minute. Quite unexpectedly, the cell

membrane was destroyed by a total dose of only 0.7 rad. Dr. Petkau had unveiled some biological phenomenon that occurred when cell membranes were exposed to low doses of radiation delivered at a slow rate that was absent when the membranes were exposed to high doses delivered at a fast rate. Further experimentation explained what was happening. When exposed to x-rays or radioactive decay of sodium-22, electrons were liberated into the aqueous solution and captured by dissolved oxygen. The result was that free radicals were formed. These negatively charged free-radical molecules were then attracted to the electrically polarized cell membrane. On encountering the cell membrane, these molecules would initiate a chemical chain reaction that dissolved the lipid molecules of which the membrane was principally composed. The leaking, compromised cell membrane, if not repaired, would initiate cell death. What made the low numbers of free radicals created by the radioactive sodium so much more efficient in producing this effect than the large numbers created by the x-ray exposure was their unimpeded access to the cell membrane. They tended not to interfere with one another, and so had a much higher probability of reaching and interacting with the cell membrane. It had been discovered that the slight electrical charge of the cell membrane attracts free radicals when they are present in low concentrations. With more free radicals present, the attraction weakens. With the high dose x-ray exposure, the massive numbers of free radicals became so concentrated that they tended instead to interact with one another forming ordinary oxygen. Their abundance actually reduced their ability to reach the cell membrane. A simple analogy suffices to explain the phenomenon:

> Think of the free radicals as individuals in a crowded room. A fire starts and everyone tries to get out at the same time. As a result, everyone bumps into each other and very few escape. If only a few people are in the room when the fire occurs, however, everyone leaves easily through the door. The rate of escape is very high, and therefore, efficient (Gould and Goldman).

The Petkau Effect cannot just be swept under the table and ignored by those assessing the risks of radiation exposure. It is a verified phenomenon which may explain the hazards posed by low doses of internal emitters. Further, it provides evidence that DNA damage and cancer are not the only endpoints of concern from radiation exposure, that cell membrane damage may affect every cell line in the body. This drastically alters the current picture of how radiation exposure can compromise health:

> Chronic exposure to low-level radiation produces only a few free radicals at a time. These can reach and penetrate the membranes of blood cells with great efficiency, thus damaging the integrity of the entire immune system although very little radiation has been absorbed.

> The correlations of health effects with low-level radiation may thus be caused indirectly by chronic low-level exposures to ingested radiation through hormonal and immune system damage from free-radicals. Low levels of strontium-90 and iodine-131 ingested in food, milk, and water, and breathed in air, may damage the ability of the body to detect and destroy infected or malignant cells. Such damage may occur even if radiation is present at concentrations far below existing standards. These standards were set on the basis of a quite different biological mechanism: cancer cell production caused by the direct impact on genes of high doses of external radiation (Gould and Goldman).

In her writings, Rosalie Bertell has mentioned two other unexpected effects to low-dose/slow-dose rate exposure to ionizing radiation that can be attributed to other biological mechanisms than direct damage to DNA. These involved monocyte depletion and deformed red blood cells. According to Bertell (Gulf War Syndrome, 1999):

> Monocyte depletion: Nuclear fission produces radionuclides which tend to be stored by humans and animals in the bone tissue. In particular, strontium-90, plutonium and the transuranics have this property. Stored in bone, near the stem cells which produce the white blood cells, these radionuclides deliver a chronic low/slow dose of radiation which can interfere with normal blood-cell production. A few less neutrophils or lymphocytes (the white blood cells which are most numerous, and are usually "counted" by the radiophysicist) are not noticeable. In the normal adult, there are about 7,780 white cells per microlitre of blood. Of these, about 4,300 are neutrophils and 2,710 are lymphocytes. Only 500 are monocytes.
>
> If, for example, stem cells in the bone marrow are destroyed so as to reduce total white blood count by 400 cells per microlitre due to the slow irradiation by radionuclides stored in the bone, this would represent a depletion of only five percent in total white cells, an insignificant amount. If all of the depletion was of neutrophils, this would mean a reduction of only 9.3 percent, still leaving the blood count well in the normal range. The lymphocytes would also be still in the normal range, even though they were depleted by 400 cells per microlitre, or 14.8 percent. However, there would be a dramatic depletion of the monocytes by 80 percent. Therefore, at low doses of radiation, it is more important to observe the monocytes, than to wait for an effect on the lymphocytes or neutrophils (as is now usually done).

> The effects of serious reduction in monocytes are:
>
> - Iron deficient anemia, since it is the monocytes which recycle about 37-40 percent of the iron in the red blood cells when they die;
>
> - Depressed cellular immune system, since the monocyte secretes the substance which activates the lymphocyte immune system.
>
> Deformed red-blood cells: Dr. Les Simpson, of New Zealand, has identified deformed red-blood cells, as observed under an electron microscope, as causing symptoms ranging from severe fatigue to brain dysfunction leading to short-term memory loss. He has identified such cells in elevated number in chronic fatigue patients, and speculated that because of their bloated or swollen shape, they are obstructed from easily passing into the tiny capillaries, thus depriving muscles and the brain of adequate oxygen and nutrients. The chronic fatigue syndrome has been observed both at Hiroshima and Nagasaki, called bura bura disease, and at Chernobyl (Bertell 1993).

SCAM NUMBER TWENTY-NINE: Base estimates of risk to a population from exposure to radiation on the response of the average adult while ignoring the heightened sensitivity of subgroups within the population.

As currently crafted, risk estimates are inherently flawed. They are based on average exposures to average individuals. Permissible levels of exposure are then set on the presumption that these will protect the entire population from radiation injury. This approach fails to take into account the fact that populations are heterogeneous, and that subgroups exist within the population that have heightened sensitivity to radiation effects. We know from studies done on patients undergoing radiation therapy that individuals can differ considerably in their sensitivity to radiation. A number of genetic syndromes have been identified that predispose individuals to heightened risks of various forms of cancer. Enhanced radiosensitivity is frequently connected with two phenomena: 1) deficiencies or disturbances in DNA repair after radiation damage, and 2) an uncontrolled proliferation of cells due to faulty regulation of arrest of the cell cycle (Streffer). Currently, no accurate information exists as to the percentage of such genetically predisposed radiosensitive individuals within the general population. Published estimates vary from one to six percent.

The statistical studies of Gould and Goldman, as reported in *Deadly Deceit*, uncovered an interesting trend in the wake of the Chernobyl disaster. In the months immediately following the arrival of the fallout cloud over the United States, the increased mortality

that was recorded was not uniformly distributed throughout the US population. Rather, elevated rates of death were most in evidence among infants, young adults suffering infectious diseases, and the elderly. Their recorded causes of death were predominantly pneumonia, infectious diseases, and AIDS. The authors hypothesize that it was vulnerable immune systems further stressed by radiation that was the mechanism responsible for the increased mortality.

Radiation protection standards, if their purpose is to protect people, must be written so as to protect the most sensitive sector of the population from harm. This would then ensure the maximum level of protection for everyone. Most importantly, the health of developing fetuses must be protected by standards that restrict the level of internal contamination in pregnant women. If such a concern is disregarded and standards are written merely to protect the "average" citizen, whoever that might be, then the most sensitive segment of the population is being exposed to much greater risks than current estimates would have us believe. As the ECRR observes: "Once we take into account varying radiosensitivity in the population it is difficult to think of a morally acceptable alternative to developing risk models that are based on the health risks of the most susceptible citizens."

SCAM NUMBER THIRTY: Use current theories of cancer etiology as a multistage process to deny that exposure to low doses of radiation is hazardous.

In 1927, Hermann Muller published his research on x-ray induced mutations in populations of male fruit flies. In the course of his investigations, Muller observed that the frequency of mutations was directly proportional to the dose, and that no-threshold dose existed for the onset of genetic damage. With decreasing dosages, the frequency of mutations decreased, but they did not entirely cease to occur. No dose, however small, was found to be 100% risk-free for genetic damage. This discovery was the historical foundation for what later developed into the Linear No-Threshold Hypothesis for cancer induction. The rudiments of this hypothesis and its implications for the standards of radiation safety first appeared in Publication 1 of the ICRP in 1958. Further articulation of the hypothesis appeared in ICRP publications in 1962 and 1965. In 1991, for the purpose of radiation protection, the ICRP officially endorsed the LNT Hypothesis.

A vocal opposition has always questioned the validity of the LNT Hypothesis. Gunnar Walinder made the following observation in an article that ended with the remark, "the LNT hypothesis is one of the greatest scientific scandals of our time." As he went on to say:

> However, there were many people who were reluctant to accept the

> new idea of the LNT. Rolf Sievert found it difficult to reduce complex biological phenomena such as heredity and cancer to a straight line. He simply did not believe in stochastic, biological effects and his arguments were very similar to those later expressed by Lauriston Taylor. The same opposition could also be found among the oncologists at Radiumhemmet in Stockholm, of whom the perhaps most eloquent spokesman was Dr. Lars-Gunnar Larsson. They claimed that the drawing of straight lines has nothing to do with biology and such methods could never constitute a model of a biological process and, least of all, the complex kind of dysdifferentiation that we call cancer.

Walinder continues with an interesting observation about the shortcomings of a linear mathematical model for cancer rates within populations.

> The basic doctrine in the radiation protection is expressed (after low doses and dose-rates) by the simple formula: N = 0.05 x D where N is the number of radiogenic cancer cases and D is the collective dose (expressed in manSv). This formula is considered valid for all populations and independent of living habits and other factors that normally are considered of significance for tumor formation. Advocates of this equation cannot possibly have any knowledge of the generic category of disparate diseases which we have given the common name cancer. Nor can they have any idea about the epistemological prerequisites for using mathematical models. As a physicist, I have, of course, always applied mathematics to my problems. However this mathematics has to be adjusted to the specific task. To me, it is impossible to understand how one and the same formula can be used as a collective model for all disparate forms of cancer. How should we explain the fact that various forms of cancer have different dose-response relationships and that some tumors cannot, on the whole, be induced by ionizing radiation (for example, such common forms as the uterine cancer and those in the prostate). How can anyone believe that such extremely complex processes as the general carcinogenesis can be adequately described by an equation of the first degree? This model obviously does not fulfill any demands for consistence or generality. The formula is not only generally considered valid, it is also said to be applicable at "homeopathic" radiation doses. What an unbelievable pretension to knowledge: "We know everything and we are able to give quantitative figures of infinitesimally small radiation risks." It reminds me of Moliere's comedies. Could we not hope that, in a reasonably short future, such pretensions of knowledge will give rise to the same roar of laughter as is the case with the precious figures

> in Moliere's comedies? In no other scientific field have such deeply unscientific claims been made.

Today, the steps leading from radiation-induced genetic alteration to the expression of cancer in the organism are mired in controversy. Many researchers believe that the popular idea of a single cell being transformed into a malignant state in one step is overly simplistic. Evidence has accumulated that the initiation of cancer is most likely a multistage process. As the ECRR notes: "As a result of examining the variation of cancer rates with age, cancer is now believed to be the result of up to six separate genetic changes. These include acquisition of specific oncogenes and loss of tumor suppressor genes." The onset of uncontrolled cell proliferation is further impeded by a number of biological defense mechanisms that intercede at an early stage to repair radiation damage or prevent an altered cell from reproducing. These defense mechanisms include such things as immune system removal of cells with persistent DNA alterations, enzymatic reactions, apoptosis (suicidal elimination of altered cells), activation of tumor suppressor genes, cell cycle regulation, and various intercellular interactions. On the basis of this repair capacity and the complex, multistage process of cancer etiology, many researchers advocate that radiation protection standards need not be as stringent as they are today. They hypothesize that the human organism can tolerate greater levels of exposure than permitted today without undergoing ill effects. The body has a generous capacity for eliminating the effects of low-dose radiation before such effects induce cancer.

The conclusion of this line of reasoning is succinctly stated by Walinder:

> Modern oncology has also clearly shown that the transformation of a cell into a malignant phenotype is a multistep process that demands several changes in different parts of the genome. All these changes cannot be caused by a low radiation dose. Thus, here too, the malignant contribution of the radiation is dependent on the presence or future emergence of other, necessary genetic effects.

The complexity of cancer etiology is becoming an increasingly popular theme of nuclear apologists intent on loosening standards for radiation protection. However, those who advocate that low levels of radiation cannot possibly induce cancer and that regulation of low levels of exposure is unnecessary fail to see that their argument is deeply flawed and reckless. With cancer being a multistage process, it is reasonable to assume that some unknown percentage of a population carries within its cells precancerous genetic alterations from any number of environmental or hereditary sources. In these people, exposure to even low levels of radiation may be sufficient to induce that final genetic mutation neces-

sary to ignite a malignant proliferation of cells. Even with cancer understood as a complex, multistage process, low-level radiation, being a mutagen, must be considered hazardous. The ECRR makes this point perfectly clear:

> The outcome of radiation exposure in the exposed individual follows the effects of somatic damage to cells. In the case of cancer as an outcome, there is seen both an immediate effect and a delayed effect. This pattern of risk with time is a consequence of the multistage etiology of cancer. Cancer is now believed to result from the accumulation of genetic damage in cells or their descendants. The particular pattern of incidence of cancer with age is most easily explained by assuming that a geometric increase in the number of a damaged cell clone ultimately results in a high enough probability that one of the cell descendants will acquire a second or subsequent necessary genetic mutation for cancer to develop in that cell (or group of cells). It follows that an exposure episode may either cause initial genetic damage in cells which have none or add to genetic damage which is already present. For those cells which have already acquired the initial set of genetic damage, the exposure may produce the final requirement for cancer. For undamaged cells the episode will supply the initial damage and start the process [emphasis added].

In summarizing the current theory of the etiology of cancer, Lars Persson of the Swedish Radiation Protection Institute makes the same point:

> Neoplastic initiation encompasses the irreversible cellular damage, which provides the potential in cells for neoplastic development. There is good evidence that this initiation process results from damage to DNA leading to gene or chromosomal mutations in single cells in tissues. The critical event in relation to ionizing radiation is likely to be DNA double-strand breaks for which error-free repair is not likely at any dose.
>
> Once the necessary gene mutation is present in a cell, further neoplastic development is believed to be highly dependent upon the cellular environment. Promotional events, influenced by growth factors in cells, dietary constituents, hormones, or other environment agents, may increase cell proliferation and may, in some instances, interfere with communication processes between cells that act to maintain cellular stability in tissues.
>
> Conversion of these pre-neoplastic cells to a form in which they are committed to be malignant is believed to be driven by further gene

> mutations.
>
> Progression of the disease, once the potential for a malignancy has been established, may depend upon further cellular changes that allow for the invasion of adjacent normal tissues, the circulation of neoplastic cells in the blood and lymphatic systems and the establishment of metastases at other sites in the body.
>
> Radiation-induced mutations may influence all stages of the neoplastic process. Consequently, at the level of DNA damage, there is no basis for assuming that there is a dose threshold below which the risk of tumor induction is zero.

The bottom line is that radiation, at any level of exposure, poses a hazard to the health of some portion of the population. Arguments that try to deny this fact are ill-conceived and politically motivated. Low-level radiation can be responsible for initiating the first step of a multistage process or for tripping precancerous cells into the final stage where malignancy commences. This is a plausible mechanism for explaining elevated incidences of cancer among populations exposed to low levels of radiation released from nuclear installations. Our theories of cancer may change, but they cannot repudiate the capacity of ionizing radiation to structurally alter DNA, and thus, be a mechanism in the process of carcinogenesis.

SCAM NUMBER THIRTY-ONE: When assessing the health risks of particular radioisotopes, make invalid comparisons between the health effect of the isotope as it is found in nature with the health effect of the technologically enhanced form of the isotope.

The defenders of depleted uranium weapons are guilty of a gross scientific gaffe. They proclaim that these weapons pose no radiological hazard, and they substantiate their claims by citing research on the health effects of the uranium-found-in-nature on uranium miners, uranium millers, and other populations of workers in the uranium fuel cycle. What these proponents conveniently fail to mention is that no body of scientific research exists to prove that their comparison is valid. They presume, without proof, that inhaling the dust of ore in which uranium exists in low concentration has the same biological impact as inhaling minute particles of pure uranium metal contaminated with small quantities of fission products. (A fuller discussion of the make-up of DU weapons can be found in the chapter *Are Uranium Weapons Made of Uranium?*) It has never yet been proven that the physiological response of the human body to the two forms of uranium is the same. Thus, it is presumptuous and unscientific to proclaim that depleted uranium weapons pose no risk to health. Yet this fallacy of relying upon studies of the health effects of the uranium-found-in-nature

to acquit uranium munitions of being a radiological hazard has been used in reports authored by the National Research Council, the Rand Corporation, the Royal Society in the UK, the European Commission, the European Parliament, and the World Health Organization. How can all these institutions make the same simple procedural error in their research protocols? The debate over the safety of nuclear and radiological weapons has little to do with biology and everything to do with what you can get away with in the court of public opinion.

SCAM NUMBER THIRTY-TWO: When all else fails, simply lie.

Spokesmen for the US military profess tirelessly, to all who will give them ear, that depleted uranium weapons pose no radiological hazard to health. In making such statements, they contravene safety guidelines openly endorsed by other government agencies. The Federal Aviation Administration's Advisory Circular 20-123, written December 20, 1984, bears witness to this embarrassing contradiction. That memo, authored by M.C. Beard, Director of Airworthiness, is entitled "Avoiding or Minimizing Encounters With Aircraft Equipped With Depleted Uranium Balance Weights During Accident Investigations." The warning contained therein was directed to airline crash-site investigators who inadvertently might be exposed to depleted uranium amidst the wreckage of destroyed commercial airplanes. Caution was urged due to the fact that aircraft manufacturers had begun routinely to utilize depleted uranium coated with cadmium plating to balance ailerons, rudders and elevators on certain jet aircraft, and rotor blades on certain helicopters. The advisory contained the following warning:

> While the depleted uranium normally poses no danger, it is to be handled with caution. The main hazard associated with depleted uranium is the harmful effect the material could have if it enters the body. If particles are inhaled or digested, they can be chemically toxic and cause a significant and long-lasting irradiation of internal tissue (FAA).

Following this warning, the recommended precautions were delineated: .

> a. Avoid contact with balance weights using depleted uranium. On arrival at accident scenes of aircraft suspected of containing balance weights made of depleted uranium, determine if balance weights have been damaged or lost their cadmium plating coating. Request specialized assistance if balance weights have been damaged or lost their cadmium plating. No penetration of the plating is allowed.

> b. Avoid breathing or swallowing particles of balance weights found damaged or with cadmium plating damaged or lost.
>
> c. If it becomes necessary to handle balance weights, the following precautions should be observed.
>
> (1) Personnel handling the balance weight should wear gloves.
> (2) Industrial eye protection should be worn.
> (3) Respirator mask should be worn to ensure no radioactive dust particle ingestion.
>
> d. Gloves, wrapping material, wiping cloths, respirator filters, or any other articles used in the handling of damaged balance weights should be discarded and appropriately labeled as radioactive waste and disposed of accordingly.

Clearly, depleted uranium is identified in this circular as radioactive waste that poses a threat to health. And yet, this same radioactive waste is freely dispersed across the modern battlefield where our own soldiers and those of our allies, enemy combatants and civilians are left vulnerable to hazardous internal contamination. They are denied the luxury of calling for "specialized assistance." In most instances, they are not forewarned to protect themselves with gloves, eye protection and respirators or lack such specialized knowledge and equipment. They have no opportunity to regather the radioactive dust liberated from a tank kill and package it in red containers to identify it as radioactive waste. Rather, it is set free in the environs to be deposited in the tissues of living creatures where it will irradiate their cells. Circulating through the environment via wind and water, the DU dust will remain a hazard to life for billions of years.

While on the subject of lies and liars, it would be informative to rehearse some of the statements made in Kiev in 2001 at the second World Health Organization conference on the health effects of Chernobyl. Abel Gonzalez of the International Atomic Energy Agency, with shameless audacity, stood before a room of eminent Russian and Ukrainian scientists and spouted the following drivel:

> The known effects of the Chernobyl accident are 31 deaths in liquidators and 200 thyroid cancers in children. Whether any other effects have occurred is an epistemologically insoluble problem, we just don't know. There are no other internationally agreed effects (CERRIE Minority Report).

Lending two part harmony to this mockery to intelligence, Norman Genter of UNSCEAR stepped to the microphone and chimed in:

> The risk of leukemia does not seem to be elevated even in the liquidators. I agree with the IAEA, positive perspectives exist. For those who believe, no explanation is necessary; for those who do not believe, no explanation is possible. We use the most rigorous possible data so that the people and the decision makers can get the right information (CERRIE Minority Report).

Incensed by these malicious fairy tails, Professor Alexey Yablokov, a member of the Russian Academy of Sciences and an advisor to Presidents Gorbachov and Yeltsin on environmental issues, rose and bellowed the following admonition:

> This is Shocking, Shocking! An impudent presentation of nonobjective data. What scares me is it's said openly, presented as scientific conclusions. There were irremediable falsifications of official health data. Don't you know that the leaders of the State Committee for Statistics were arrested two years ago for falsifying data. UNSCEAR knows it. They know the data were falsified! They use these to say that the consequences of Chernobyl were not so serious. They say there are no genetic effects after Chernobyl, but the genetic effects are the most serious. Tens of papers in serious scientific journals show this. Bandashevsky shows the effects in children, sudden deaths, organ damage. Increases in mortality, cancers, congenital malformation, immune system disorders, exhaustion, slow growth. How is it possible to reject this? Silencing these facts is incorrect. It is science (CERRIE Minority Report).

SCAM NUMBER THIRTY-THREE: Cloud thinking on the biological effects of human-generated low-level radiation with the claim that populations living in areas of high Natural Background Radiation are no more at risk from radiation-induced injury than people living in areas of low Natural Background Radiation.

Those who claim that emissions of radiation into the environment are harmless hold in their hand one seemingly unbeatable trump card. If low doses of radiation are hazardous, they argue, then people living in areas of high Natural Background Radiation should suffer from higher rates of cancer than people living in areas where NBR is low. The central importance of this argument is highlighted by Chris Busby in his book *Wings of Death*:

> Finally, despite considerable evidence of low-level radiation effects from man-made pollutants, including cancer clusters near nuclear installations such as Sellafield, there has never been a plausible theory of how such effects can be produced at levels below those we are exposed to from Natural Background Radiation. This is the rock on which the nuclear castle is built: no progress in the crucial debate can be made without addressing the problem that cancer rates in populations exposed to widely different background radiation levels do not differ significantly.

In previous sections of this chapter, various aspects of this highly important issue have been addressed. We have noted that likening the effects of Natural Background Radiation, which contributes one hit per year to the nucleus of each cell in the body, to man-made hot particles, which can be responsible for repetitive hits to the nuclei of a small volume of cells, is a false analogy. We have further explored how man-made radioactive pollutants differ from Natural Background Radiation in their ability to exploit vulnerabilities in biological systems. Busby's Second Event theory and the Petkau Effect are examples of how low doses of certain types of internal emitters can cause harm to cells in ways that NBR cannot. What remains to be addressed are the epidemiological studies themselves. What evidence has led proponents of nuclear pollution to the conclusion that the risk of cancer is the same for people living in areas with different levels of Natural Background Radiation?

The ECRR cites 10 major epidemiological studies that have shaped current understanding of the consequences to health from living in areas of high NBR. Contrary to the claims of the Cult of Nuclearists, seven of these studies demonstrated increased incidence of chromosome defects in the study population. The remaining three studies didn't investigate this type of aberration. In addition, five of the studies revealed elevated rates of cancer. A study in Japan revealed increases in stomach and liver cancer. Of two studies in Iowa, one uncovered a 24% increase in bone cancer and the other demonstrated a 68% increase in lung cancer. A study in Brittany revealed a 132% increase in stomach cancer. Finally, a study from Scotland testified to a 60% higher rate of leukemia. Despite this evidence of increased cancer risk in areas of high Natural Background Radiation, the ECRR is cautious in interpreting the results.

> For a number of reasons, it is uncertain how the results of these studies can inform discussion about risk from radiation exposure. First, for many of these studies, the populations suffer stresses associated with living in the Third World where cancer is not a major cause of death owing to earlier competing causes and the generally shorter lifespan.

> In addition, population natural selection for radiation resistance over a long period may be expected to confound any attempt to find a suitable control group: thus the repair efficiency for cancer-inducing lesions in genes would be expected higher in the exposed populations than the controls. In addition, the considerable amount of evidence which shows that different populations have different genetic susceptibility to cancer of different sites makes it impossible to draw any universally applicable conclusions from background radiation studies.

The ECRR expresses skepticism that definitive conclusions can be reached on the effects of low-dose radiation from the comparison of people living in areas of high and low Natural Background Radiation. The reasons for this are as follows:

1. Disadvantaged populations occupy many of the areas of high NBR. Competing causes of death may claim lives prior to the advent of radiation-induced cancer. This would have the effect of lowering the cancer rate in a population and making high levels of NBR appear less hazardous.

2. Accurate health data is not available in many areas of high NBR. Thus, the true rates of cancer in the population are not ascertainable.

3. Valid epidemiological studies are hampered by an inability to find genetically comparable populations to serve as suitable control groups.

4. Over generations, increased radiation resistance will have been bred into members of a population exposed to high NBR due to natural selection. Consequently, cancer rates in these areas would be lower.

5. Global fallout from weapon testing must be factored into any consideration of the health effects of Natural Background Radiation. Different geographical locations have been contaminated by different levels of fallout. This complicates any attempt to discern the part played by NBR on cancer rates.

6. Due to the low levels of radiation being studied and the low cancer rates predicted for these dosages, the determination of cancer rates due to NBR relative to other possible causes is highly unlikely.

In the southern Indian state of Kerala, a population of several thousand people resides on a strip of land 10 km by 1 km that has some of the highest levels of natural

radioactivity of any place on Earth. This heightened radioactivity is caused by an abundance in the soil of the mineral monazite, which contains 10% thorium phosphate. As a consequence, the population receives an exposure to NBR that is two times the world average. In the article *Can ICRP Be Trusted to Set Radiation Exposure Standards?*, Rosalie Bertell (1995) speaks about Kerala and offers some important insights that challenge the nuclear industry's claim that high levels of NBR are not hazardous to health:

> Recently the BEIR Reports have used atomic bomb data to support their theory that humans have undetectable genetic damage from the atomic bombs. As early as 1957, the World Health Organization called together a Committee to study the genetic effects of radiation and to recommend protection of the human gene pool. In the publication by this committee, Kerala, India, was identified as the best place to study the genetic effects of chronic radiation exposure over several generations. To date, the nuclear establishment has not undertaken a serious study of this population, indicating their lack of concern for genetic damage. In one study, undertaken for another purpose, the authors noted that the exposed population of Kerala had an abnormally high rate of Down's Syndrome. Researchers also found significantly high levels of broken chromosomes in the exposed group. In 1988, with the help of Indian researchers, I agreed to act as scientific advisor to a study of the people of Kerala. Researchers found that they were the first group to interview and examine the population, although the nuclear industry often uses Kerala as its example to "prove" that low-level radiation is harmless.
>
> We now have measurements of the background radiation at grid points all through the contaminated area, detailed information on about 32,000 exposed households and matched control households not living on contaminated sand, and information on 92,000 pregnancies. Our preliminary findings are that the rate of Down's Syndrome is 3 to 4 times higher in families living on the radioactive sand than for control families. Other problems which were more than doubled for the radiation-exposed group were congenital blindness and deafness, epilepsy, malformation of long bones, childlessness (couples who wanted to have children but could not), and various kinds and degrees of mental retardation. In the communities living on the contaminated soil, every one of the so-called sentinel mutations, rare genetic damage, was found. This was not true for the matched controls.

There are radiobiologists who do not believe in the necessity of a threshold dose for

the onset of radiation injury and who recognize Natural Background Radiation as the source for a small percentage of the cancers suffered by the global population. From their point of view, the random hits from NBR occasionally spawn a cancer that escapes immune system surveillance. The inescapable conclusion is that some small number of cancers are the inevitable price paid by humanity for simply dwelling on planet Earth. From this perspective, any additional radiation liberated into the environment increases background levels and contributes to an increase in the cancer rate. Recent evidence for this concern was presented in the magazine *New Scientist* in an article entitled "Background Radiation Enough to Trigger Cancer". The article reviewed research conducted by Keith Baverstock of the World Health Organization's European Center for Environment and Health, in Bonn, and Paivi Kurttio of the Radiation and Nuclear Safety Authority, in Helsinki. Investigating the incidence of papillary thyroid cancer among the children of Europe as a result of the accident at Chernobyl and from medical x-rays, the researchers determined that the nine milligrays of natural radiation absorbed by the average child's thyroid during the first nine years of life would cause one or two cancers per million children each year. This predicted rate matches the incidence of the disease of children under the age of 15 in Finland, Norway, Sweden and Denmark. This study followed an earlier one conducted by Mark Little, a medical statistician at Imperial College in London. Using data from the A-bomb survivors, Little calculated that between six and sixteen percent of the cases of papillary thyroid cancer were caused by Natural Background Radiation. The cause(s) of the remaining cases was never determined.

Plenty of studies have been done that implicate exposure to background levels of radiation with increased incidence of cancer. Those who claim no such evidence exist are liars. In the article, "Inconsistencies and Open Questions Regarding Low-Dose Health Effects of Ionizing Radiation", Nussbaum and Kohnlein provide the following information:

> A Birmingham team of scientists was able to correlate the very large database on the geographical distribution of childhood cancers in Great Britain of the OSCC [Oxford Survey of Childhood Cancer] with accurate measurements of terrestrial gamma-ray dose rates over a 100 km grid covering England, Scotland and Wales (Knox *et al.*). The terrestrial doses for that area vary by up to a factor of five, between about 15 nGy/hr and 80 nGy/hr (0.013-0.070 cGy annually). This study suggests that "background radiation might be an element of the causal chain of the majority of childhood cancers" (Knox *et al.*). It is noteworthy that a simple regression analysis of childhood cancers found a negative correlation with dose, in qualitative agreement with the above-mentioned studies with inadequate controls for confounding factors that continue to be cited in support of radiation

> hormesis. When confounding socioeconomic factors, identified as being strongly correlated with childhood cancer mortality, were included in the OSCC analysis, the association with background dose turned significantly positive.
>
> Consistent with the British OSCC results, a recent US study also found a significant association between childhood cancer incidence and a variation in annual external background gamma-ray dose rate by nearly a factor of two (0.05-0.092 cGy per year) over an area within a radius of approximately 10 miles from the Three Mile Island nuclear plant. On the basis of risk factors derived from the A-bomb survivor study, no detectable trend in cancer among children should have been found from variations in background exposures of such small magnitude. This study, however, found a 50% increase in risk of cancer for children under 15 years with every 0.01 cGy increase in estimated annual background gamma-ray dose (Hatch and Susser). As in the British background study above, the high sensitivity to radiation is most likely related to exposures during the earliest fetal stages of development.

SCAM NUMBER THIRTY-FOUR: Compromise your position as a respected scientific organization and voice of authority to advance a veiled political agenda and skew the debate over the risks to health of low-dose exposure.

Health physicists are experts in the field of occupational and environmental radiation safety. Over and above any other group of professionals, they should provide unbiased, objective information to the public on the effects to health from radiation exposure. If political intrigue compromises their impartiality, the layman is set adrift without a compass, unable to evaluate in the midst of a radiation emergency what information is trustworthy and potentially lifesaving. The Health Physics Society, the organization that represents the profession, thus did a disservice to the field of health physics and to the public when, in January 1996, its Scientific and Public Issues committee published a position paper entitled "Radiation Risk in Perspective". The paper addressed the risk to health from exposure to radiation below five to 10 rem. Their position was reaffirmed in 2001 and underwent minor alterations in 2004. The paper is remarkable for the way it exploits uncertainty in matters of science and produces an authoritative, decisive, unconditional position bearing momentous political benefits for the nuclear industry. This was not lost on members of the profession. In the Society's newsletter of May 1996, one member pointed out that the position sounded "more political than scientific" and another wrote in predicting that the statement would "harm the credibility of the [Society] as a radiation protection organization" (Fairlie and Resnikoff).

The argument set forth in the position paper starts out with a debunking of the Linear No-Threshold Hypothesis. It reiterates the familiar refrain, that current radiation protection standards and practices have come to rely on the premises of the LNTH only because "insurmountable intrinsic and methodological difficulties exist for determining if the health effects that are demonstrated at high radiation doses are also present at low doses." The argument then goes on to assert that evidence exists that this model is an oversimplification, that it is not applicable for a number of specific cancers, and that heritable genetic damage has yet to be observed in human studies. Further, the role played in the induction of cancers and genetic mutations by such biological mechanisms as DNA repair, bystander effect, and adaptive response "are not well understood and are not accounted for by the linear, no-threshold model."

Having established the unreliability of the LNTH, the paper then mentions the limitations of the current knowledge base:

> Radiogenic health effects (primarily cancer) have been demonstrated in humans through epidemiological studies only at doses exceeding 5–10 rem delivered at high dose rates. Below this dose, estimation of adverse health effect remains speculative.
>
> Epidemiological studies have not demonstrated adverse health effects in individuals exposed to small doses (less than 10 rem) delivered in a period of many years.
>
> Below 5-10 rem (which includes occupational and environmental exposures), risks of health effects are either too small to be observed or are nonexistent.

The political punch line is then delivered as if it is the only reasonable deduction to be made from the above observations:

> In view of the above, the Society has concluded that estimates of risk should be limited to individuals receiving a dose of 5 rem in one year or a lifetime dose of 10 rem in addition to natural background. In making risk estimates, specific organ doses and age-adjusted and gender-adjusted organ risk factors should be used. Below these doses, risk estimates should not be used. Expressions of risk should only be qualitative, that is, a range based on the uncertainties in estimating risk

> (NCRP 1997) **emphasizing the inability to detect any increased health detriment (that is, zero health effects is a probable outcome)** [emphasis added].

The policy paper concludes by stating the implications of its position on the assessment of risk as it pertains to radiation protection:

> (a) The possibility that health effects might occur at small doses should not be entirely discounted. The Health Physics Society also recognizes the practical advantages of the linear, no-threshold hypothesis to the practice of radiation protection. Nonetheless, risk assessment at low doses should focus on establishing a range of health outcomes in the dose range of interest and acknowledge the possibility of zero health effects. **These assessments can be used to inform decision-making with respect to cleanup of sites contaminated with radioactive material, disposition of slightly radioactive material, transport of radioactive material, etc.** [emphasis added].
>
> (b) Dose (the sum of individual doses in a defined exposed population expressed as person-rem) has been a useful index for quantifying dose in large populations and in comparing the magnitude of exposures from different radiation sources. However, collective dose may aggregate information excessively, for example, a large dose to a small number of people is not equivalent to a small dose to many people, even if the collective doses are the same. Thus, for populations in which almost all individuals are estimated to receive a lifetime dose of less than 10 rem above background, collective dose is a highly speculative and uncertain measure of risk and should not be used for the purpose of estimating population health risks.

For the uninitiated, the following interpretation is provided: The Health Physics Society decrees that science has yet to produce unequivocal epidemiological evidence on the effects to health of low-dose exposure. It will ignore the fact that this is perhaps symptomatic of the limits of epidemiology or of the way epidemiology has so far been applied to studying the problem. Further, the Society will ignore the fact that evidence of low-dose effects has not been produced because science currently lacks other means besides epidemiological ones for measuring the biological consequences to populations from releases of radiation into the environment. Rather, we are going to declare that low-dose effects are unobservable, which we take to mean inconsequential or nonexistent. Consequently, consistency demands that we abandon all models that provide a quantitative estimate of what

might be happening to the health of populations from low-dose exposure. The profession of health physics advocates that it is illegitimate to posit that because "x" amount of radiation is released amidst a population, that "y" amount of health detriment will result within the dose limits mentioned. Estimating the likelihood of an individual developing cancer or the number of cancers expected throughout the population is an invalid and fruitless exercise. Policy makers need only be advised of the range of possible health outcomes in the dose range of interest. What can this possibly mean other than zero health effects? (Recalling Exhibit B and the dubious mainstream practice of averaging energy over masses of tissue, the reader might notice how the official party line is reaffirmed by the Health Physics Society, that risk estimates are only *bona fide* if they are based on organ doses. This position effectively discredits all epidemiological studies, as exemplified by the studies of Gould and Goldman, that demonstrate a cancer risk from low-dose exposure but which do not have available organ dose estimates. This is a very tricky and sophisticated ruse, repeatedly pulled out and dusted off to prevent useful types of information from gaining "scientific" credibility. This point will be elucidated further in the next chapter, *The Chicanery of the US Radiation Accident Registry*.)

The political motivations of those who crafted the Health Physics Society policy statement are all too transparent. They manifest their political bias by ignoring convincing evidence that demonstrate health detriment following low-dose exposure. By fiat, the Health Physics Society has usurped the scientific method. It has decreed that uncertainty in low-dose effects warrants the abandonment of all tools that enable us to come to terms with the possible public health impact of our deeds. Risk factors for low-dose exposure are invalid. Risk estimates are impermissible. Population effects are not to be predicted. Such conclusions free us from constraint and give us permission to fly blind. In one fell swoop, the Health Physics Society has decreed that we need not fret over how many people are being sickened by depleted uranium weaponry, that many sites contaminated by radioactivity need not be cleaned up, that caution may be abandoned in the disposal of low-level radioactive waste. Emissions from nuclear installations and commercial nuclear power plants are without hazard. We can resume nuclear testing without concern. These are outdated issues. Decision-makers can be freed of such petty concerns because we haven't figured out how to measure the effects and a possibility exists that there aren't any at all. The regulatory handcuffs can be taken off the nuclear industry. And think of the money we'll save. Dismissing the Linear No-Threshold Hypothesis gives absolution to the Cult of Nuclearists.

Although his critics will abhor it, the words of John Gofman will prove to be the conscience of this whole nasty business:

> **It is true, of course, that radiation-induced cancers in a population from very low doses will rarely if ever be detectable epidemiologically, because of the signal-to-noise ratio. But it does not follow (from the lack of direct observation) that the cancers are therefore unreal, hypothetical, speculative, theoretical, nonexistent, or imaginary. No rational person will deny that one of the most commonplace (and important) functions of science is to let people know what is really happening when direct observation is impossible** [emphasis added] (Gofman, 1990).

SCAM NUMBER THIRTY-FIVE: When promoting the benefits of nuclear technology to the layman, rely on half-truths and incomplete information to disguise costs to the environment which ultimately become risks to health.

The Cult of Nuclearists is dedicated to fulfilling its vision of the centralized control of electricity production through nuclear power. Having botched this plan the first time around with poor reactor design, exorbitant cost overruns, harrowing accidents and the massive loss of public support, they have been patiently waiting in the wings for an opportune moment to resume their campaign. Recent concerns over global warming and greenhouse gas emissions from coal-burning power plants have served as a pretext for touting nuclear fission as a promising "green" energy source. Since former vice-president Al Gore began stumping for an international commitment to combat global warming, a nuclear renaissance has blossomed. Orders for new nuclear power plants are in the works in numerous countries throughout the world. Admittedly, commercial nuclear reactors do not discharge greenhouse gases into the atmosphere. And it's just possible that next-generation reactor design may indeed guarantee the impossibility of catastrophic core meltdown. Nonetheless, nuclear power will never be green or clean.

When nuclear power is hyped as the solution to global warming, many important facts go quietly unmentioned. For starters, worldwide production of electricity releases only nine percent of the annual emissions of human-generated greenhouse gases. Although a nine-percent reduction would be significant, this goal could not be achieved even if all the coal-burning facilities in the world were shut down and replaced by nuclear ones. The reason for this is that uranium mining, milling, conversion, enrichment and separation; reactor-fuel fabrication; the building and decommissioning of nuclear power plants, and the storage of radioactive waste all require huge amounts of energy which is generated by the burning of fossil fuels. Thus, contrary to nuclear industry propaganda, nuclear power is responsible for emitting large quantities of greenhouse gases. Dr. Helen Caldicott has cited examples of this atmospheric pollution in her article "Nuclear Power Is The Problem, Not

A Solution':

> In the US, where much of the world's uranium is enriched, including Australia's, the enrichment facility at Paducah, Kentucky, requires the electrical output of two 1,000-megawatt coal-fired plants, which emit large quantities of carbon dioxide, the gas responsible for 50 per cent of global warming.
>
> Also, this enrichment facility and another at Portsmouth, Ohio, release from leaky pipes 93 per cent of the chlorofluorocarbon gas emitted yearly in the US. The production and release of CFC gas is now banned internationally by the Montreal Protocol because it is the main culprit responsible for stratospheric ozone depletion. But CFC is also a global warmer, 10,000 to 20,000 times more potent than carbon dioxide (Caldicott).

Any short-term benefit to be derived from nuclear power in reducing CO_2 emissions will quickly disappear as high-quality uranium ore reserves become depleted. This is made clear in the treatise "Can Nuclear Power Provide Energy For The Future; Would It Solve the CO_2-Emission Problem?":

> If the known uranium resources were used to exhaustion the total electrical energy produced would only amount to the present-day worldwide electrical energy use in three years.
>
> If all of the contributions are taken into account [i.e., burning of fossil fuels throughout the uranium fuel cycle], a nuclear plant causes the emission of about one-third of the CO_2 produced by a gas-burning plant. But this relatively favorable ratio only holds as long as there are rich uranium ores available. When these are exhausted, the use of leaner ores will lead to the production of more CO_2 by the operation of a nuclear plant than by a gas-burning plant. In the long run, nuclear power is therefore not a solution to the CO_2 emission problem.
>
> The reason for this little-recognized problem of nuclear energy is that it costs energy from other sources (principally produced by burning fossil fuels) to produce nuclear energy. More disturbing is that many of these energy costs will have to be paid generations after a nuclear power station has stopped producing electricity. These are thus energy debts: debts incurred during its production lifetime, which our yet unborn descendants will have to pay (van Leeuwen and Smith).

In the process of generating electricity for immediate consumption, commercial nuclear power plants produce massive quantities of radioactive waste that will remain hazardous for millennia. The energy debt borne by the future will be paid by the greenhouse gas emissions produced to handle this radioactive waste. Currently, there are more than 80,000 tonnes of high-level radioactive waste stored on site at the nation's 103 nuclear power plants, in either indoor wet pools or outdoor dry casks. An additional 33 tonnes are produced annually at a typical 1000-megawatt facility. Fossil fuel consumption will eventually be required to transport this dangerous dross to permanent waste repositories. According to current plans proposed by the Department of Energy, tens of thousands of shipments by truck, train, and barge will be required to transport irradiated nuclear fuel and high-level radioactive waste through 45 states and the District of Columbia to the sequestration facility being readied at Yucca Mountain in Nevada. The construction of this facility required the burning of fossil fuels. Future facilities will likewise result in greenhouse gas emissions. The long-term maintenance and monitoring of these facilities, for the incomprehensible tens of millennia that will be required, will also require ongoing fuel consumption. A third source of the energy debt bequeathed to the future that will be paid by fossil-fuel emissions is the energy expended to dismantle each nuclear facility at the end of its life-cycle. During the course of a reactor's operation, the reactor vessel, piping and valves, and construction materials making up the containment building will have been made radioactive through neutron activation. This huge mass of radioactive debris will require disassembly, removal and burial — once again, all provided by fossil fuels.

Moreover, due to its high lethality, radioactive waste presents an attractive target to terrorists. Since 9/11, the once remote possibility of an attack on a nuclear facility has become more real. Any accident or terrorist attack resulting in a breach of containment of the reactor vessel, an interruption in core cooling, or the liberation of stored radioactive waste would produce an unimaginable catastrophe. Using Chernobyl as the template, what can be imagined is an environmental catastrophe, an epidemic of radiation-induced diseases, the forced relocation of large segments of the population, major economic disruption and so forth. Regardless of how clean the technology is, even one such event would negate any derived benefit of boiling water by nuclear fission to generate steam.

Shortsighted human beings fail to learn lessons from history. Wars break out. Social disruption engulfs whole societies. Economies collapse. In the event of these remote but not unimaginable misfortunes, the radioactive waste scattered around the country may be neglected or abandoned. Interruption in the guarding of this nuclear detritus or its proper cooling and storage may lead to environmental releases that would create uninhabitable zones for hundreds of human generations. Anyone unwittingly entering one of these areas in the remote future will be vulnerable to radiation-induced disease and death. This is a

possible legacy of the "clean" technology being ballyhooed today.

When nuclear power is promoted as a clean technology, scant mention is made of the biologically significant quantities of radionuclides routinely liberated into the environment at each reactor site. Gaseous effluents contain fission-created or neutron-activated noble gases, iodine-131, particulates, and tritium. Liquid effluents include fission/activation products, dissolved and entrained gases, and tritium (Harris and Miller). This radioactivity is not credited with producing illness in the population despite numerous cases of cancer clusters in the proximity of nuclear installations. The operators of commercial nuclear power plants repeatedly assure the public that they operate within the safety guidelines issued by the federal government and that their emissions are strictly regulated. But how do members of the public really know what is being dumped into the environment from nuclear installations? The following will illustrate that radioactive pollution contaminates the environment to a greater extent than is admitted, that doses to the population are consequently higher than acknowledged and that the risks and incidence of radiation-induced cancer are greater than anyone cares to admit.

Beginning in 1990, citizens independent of the nuclear industry established the C-10 Radiological Monitoring Network in proximity to the Seabrook Nuclear Power Plant in New Hampshire. Within the 10-Mile Emergency Planning Zone in southern New Hampshire and northeastern Massachusetts, 25 monitoring stations were set up, mounted on the homes of volunteers. Each station included a beta/gamma detector, a gamma-only detector and a weather station. These instruments continually fed data into a computer for later retrieval. The data was periodically collected and analyzed in the Network's Newburyport office. Early on the morning of November 29, 1995, three stations southwest of Seabrook registered the passage of a radioactive cloud. The beta/gamma detector readings jumped as high as eight times normal background levels and remained there for several hours. The gamma-only detectors recorded levels 15 times normal background. The weather stations measured wind blowing steadily from the northeast, strongly suggesting the source of the cloud was Seabrook Station. According to a report of the incident:

> We occasionally register elevated readings (though never before as high as those on November 29) at one or more C-10/RMN stations, and follow up by checking with plant spokespeople or the Nuclear Regulatory Commission's (NRC's) on-site inspector. Usually we have an answer in 2 or 3 days, and it often turns out that the high readings coincide with various "evolutions" within the reactor complex. This time our inquiries went unanswered for weeks. Only after we announced that we were going to the press did Seabrook's spokespeople get back to us.

> Their story was that the plant had indeed been venting radioactive material at the time of our high readings. They claimed that the material was tritium — a form of heavy hydrogen — which had been vented at rates so low that our sensors should not have picked it up. Furthermore, they acknowledged that the plant's Wide Range Gas Monitor had been inoperative since about 30 minutes before the venting began, and that "periodic sampling" of the outflow was performed as a back-up.
>
> There were two problems with this. The first was with the specific radioisotope involved. Tritium does not emit gamma photons, but the highest C-10/RMN sensor response was from our gamma-only detectors, indicating that the cloud could not have consisted of tritium alone. The second problem was with the rate at which Seabrook admitted venting. We have our own computer model for simulating the dispersion of radioactive clouds. It's based on the same mathematics and references as the models used by the nuclear industry and the NRC, and was developed with the assistance of several scientists. Using this computer model, which accounts for factors of weather and plant construction, we found that the rate at which Seabrook admitted venting could not have caused a cloud of the magnitude we observed. Instead, we found that a release rate about 50,000 times greater than Seabrook admitted was required to reproduce our cloud (S. Miller 1996).

In response to the press conference that eventually took place, the Citizens' Radiological Monitoring Network came under heavy fire. Lobbyists for Seabrook worked to have state funding of the organization rescinded. Public relations personnel tried to discredit the Network in the press, attacking their data and instrumentation and offering a number of alternative explanations for the high radiation readings. What was the truth? As in many other such confrontations, the issue was wrestled into ambiguity so that potential outrage was smothered and the public's concerns pacified. This gambit is another scam in its own right, a proven method of quelling opposition and of disarming a wary citizenry.

Before moving on, it is important to mention the benefits bestowed on the commercial nuclear industry from inaccurate models of risk. Nuclear power plants are licensed to release radioisotopes into the environment based on current models of radiation effects and the assumption that the permitted levels will not create illness in the population. Because risk factors have been inaccurately assessed, nuclear facilities have been given latitude to legally discharge hazardous levels of radioisotopes, while simultaneously covering up the

price paid in the eroded health of unsuspecting citizens. Here is a case in point provided by Rosalie Bertell:

> If it is decided that fatal cancer incidence rate should be the biological endpoint on which the regulations are based, and I do not accept this as the best indicators of problems, then the radiation industry needs to conform to the same standards of injury as is used for regulating the chemical industry.
>
> The State of Minnesota, in the USA, decided that a nuclear waste dump should not be able to cause more than one cancer (fatal of non-fatal) over the lifetime (70 years) of an exposed person. This is the standard which the State used for chemical polluters. Based on this, a criteria of no exposure of the public above 0.0005 mSv per year was derived by the State Department of Health. This Standard is being enforced in that State, although it is ten thousand times lower than the current permissible dose to the public per year under US Federal Law, namely 5 mSv per year.
>
> In Ontario, the Advisory Committee on Environmental Standards (ACES) expressed astonishment that the nuclear industry was permitting itself to pollute the drinking water with up to 40,000 Bq of tritium per liter, under the 5 mSv per year federal radiation dose limit for members of the public. When the ICRP reduced the recommendation to 1 mSv per year, the industry agreed to lower the permissible level of tritium in water to 7,000 Bq per liter. When the ACES used the industry risk estimates for calculating the expected number of fatal cancers considered to be "permissible" under this Standard, they called for an immediate reduction in permissible levels to 100 Bq per liter, with a further reduction to 20 Bq per liter within five years. This was based of the standard setting used for toxic chemicals. This means the radiation protection guide line allows 350 times more fatal cancers than chemical standards would allow.
>
> While I understand mathematically why the nuclear industry, dealing with a mixture of radionuclides sets such unreasonably high permissible values, I see also that these high values are used for public relations reasons to assure the trusting public when there is a spill or abnormal incident at a reactor. Stating that the exposure was less than 10% of the permissible dose, sounds reassuring! Yet if one knew that the permissible dose was 350 times too high based on cancer deaths caused, 10% would be seen as 35 times too high. It is in the

> interest of the nuclear industry, hiding behind ICRP, to carry on the subterfuge that "permissible" implies "no harm" (Bertell, February 1998).

SCAM NUMBER THIRTY-SIX: Violate people's innate process of evaluating and assuming risk in their daily lives by imposing highly risky technology upon them and then falsely underrate the risks that accompany that technology.

In 1953, President Eisenhower initiated the Atoms for Peace Program. A major unstated goal of this initiative was to assuage the terror that had settled into the hearts of a large segment of the population as a result of the development of nuclear weapons. These monstrosities did tremendous violence to people's sense of personal security and trust in the uninterrupted continuity of life. The possibility of instantaneous demise by forces beyond one's control was routinely on peoples' minds. Images of brutal victimization were deeply disturbing to the psychological equilibrium of many. Responding to this unease, the government crafted a propaganda campaign to transform the menacing atom into the beneficent atom. This well-orchestrated crusade was intended to pave the way for the public's embrace of nuclear power. However, despite the best efforts of government PR, the majority of the population remained wary of the new technology. In people's minds, nuclear power was incestuously intertwined with nuclear weapons, and the possibility of radiation-induced disease, regardless of how remote, was terrifying. This mindset, an obstacle to the plans of the empowered, became an area of academic interest and was studied by experts in the field of risk analysis.

According to the website of Argonne National Laboratory, risk analysis can be defined as follows:

> The systematic study of uncertainties and potential harm that may be encountered in such areas as the environment, business, engineering, and public policy. Risk denotes a potential negative impact to an asset or some characteristic of value that may arise from some process or future event. Risk analysis seeks to (1) identify the probability of loss, or risk, faced by an institution or business unit; (2) understand how and when risks arise; and (3) estimate the impact of adverse outcomes. Once evaluated, risks can be managed by implementing actions to mitigate or control them.

Basically, risk analysis is a study of systems. After defining the successful operation of a system, efforts are made to identify the factors that might disrupt the operation of the system, the consequences of this disruption and ways to minimize the likelihood that such

disruptions might occur. An adjunct to this study, one relevant to the nascent nuclear industry, was the study of the likelihood of events that would lead to the release of radiation into the environment and what risks such releases might pose to the health of the surrounding population. When the infinitesimally small projections of risk predicted by the nuclear industry failed to quell opposition to nuclear power, social psychologists began investigating risk assessment: how do human beings evaluate risks in their daily lives, and how do they prioritize which risks they are more or less willing to expose themselves to in exchange for the benefits derived?

This field of inquiry delivered novel insights into human behavior. It revealed that all modern human beings share similar criteria for evaluating potential hazards. These patterns of thought act as filters that color people's perception as to what risks are acceptable or unacceptable. The table below summarizes these perception factors.

Risk Perception

Acceptable	**Unacceptable**
Voluntary	Involuntary
Individual Control	Others Control
Clear Benefits	Unclear Benefits
Trustworthy Sources	Untrustworthy Sources
Ethically Neutral	Ethically Objectionable
Natural	Artificial
Familiar	Exotic
No Historical Associations	Memorable Associations
Less Dread	High Dread
Visible	Undetectable
Immediate Effect	Delayed Effect
Known, Understood	Uncertainty, Variability
Little Media Attention	High Media Attention

To illustrate the utility of this material, a simple example will suffice. If asked, a majority of people will say that they feel a lot safer driving their car than flying in an airplane. They cling to this belief even after being apprised of the fact that driving is statistically much more hazardous than flying, and the likelihood of being in a fatal accident on

the highway greatly exceeds that of being in one while airborne. That people feel safer in the more dangerous situation is not so enigmatic when the thinking behind such an assessment is understood. People know that driving a car is a risky venture. But while driving, they feel in control of their vehicle and are in a familiar situation. They are on terra firma rather than up above the clouds. This not only produces less dread, but it seems to offer more options in the event that the situation turns unpredictable. Further, car accidents are rather humdrum whereas fiery air crashes make front page news. And bumping into another car and being forced off the road is, on reflection, less fear-inducing than being trapped in a terrifying descent that will surely lead to a fiery crash that burns hundreds of bodies beyond recognition.

The vehement opposition to nuclear power is no mystery once the mechanisms of risk perception are understood. Nuclear power has been imposed on populations throughout the world without recourse to referenda. Due to the complex nature of the technology, others are in control of it, and this increases feelings of vulnerability. The benefits are unclear, given that other methods of generating electricity are available, and the safe disposal of radioactive waste is an unsolvable dilemma. Originating from government and big business, and with a long history of cover-ups, nuclear power is perceived as coming from an untrustworthy source. Being intertwined with the production of nuclear and radiological weapons, the technology is perceived as ethically objectionable. Being extremely high-tech, it is viewed as artificial and exotic. It has memorable associations with Three Mile Island and Chernobyl. The idea of a catastrophic nuclear accident instills extreme dread. Released radiation is undetectable and health effects from exposure are delayed, uncertain, and variable. And reportage in the media of accidents, shutdowns, protests, cost overruns and so forth has furthered people's suspicions of the technology. In a nutshell, the majority of people, due to their inborn psychological processes that come into play when assessing risks, perceive nuclear power as hazardous and unacceptable.

The nuclear industry found itself behind the eight ball as the process of risk assessment began to be delineated. In response, they devised a brilliant gambit to woo public opinion and make nuclear power appear less risky. The PR strategy they adopted went something like this: *The study of risk perception provides concrete evidence that people can be irrational when assessing risks in their daily lives. When assessing alternatives, they give themselves over to emotion and make choices based on fear that are not in their best interest. When a number of people do this simultaneously, they develop unwise social policy that is not for the common good. To prove this, let's apply statistical analysis to the host of risks people confront daily. When we do this, we discover that nuclear power is less risky than a whole host of risks that people voluntarily assume without hesitation.*

This appeal to rationality over what is painted as spontaneous, unreflective prejudice

is a highly seductive argument. And it was supported with a number of interesting, and sometimes humorous, observations. For instance, Mettler and Moseley in their book *Medical Effects of Ionizing Radiation* provide information on how various conditions are statistically associated with lifespan shortening. For instance, a male who remains unmarried can expect for his life to be shortened, on average, by 3,500 days. A male cigarette smoker will lose approximately 2,250 days from his life. Being 30 percent overweight will reduce lifespan by 1,300 days. Having cancer robs its victims, on average, of 980 days, and a stroke diminishes life span by 700 days. Compared with these life-shortening factors, radiation appears downright innocuous. Natural background radiation, according to BEIR 1972, shortens life by eight days, medical x-rays by six days, and reactor accidents between 0.02 and 2.0 days.

Following a different track, *Medical Effects of Ionizing Radiation* reports the risks confronted in daily life that increase the chance of death by one chance in a million. Data from this line of reasoning is presented in the table on the following page.

This data is intended by the nuclear establishment to awaken people to their inherent foolishness, which by implication is the basis for their resistance to nuclear power. The peanut butter eaters and the bicycle riders are silly to object to nuclear power. In the course of their daily lives, they choose activities that carry similar or greater risks than those posed by nuclear power. The routine pleasures of life put people in jeopardy. If they saw clearly, they could not possibly find fault with nuclear power.

This line of reasoning leads to a disturbing conclusion: basically, people are dummies. They don't understand themselves, and they don't understand the world they live in. They must be rescued from their follies by science and rationality. An elite body of enlightened policy makers must arise to lead humanity out of ignorance to a new golden age. This perspective is typified in an article that appeared in the *Washington Post*, entitled "Let's Get Real About Risk." It was written by David Ropeik, director of risk communication at the Harvard Center for Risk Analysis. Although not mentioning nuclear power directly, it could easily be used in its defense. The author begins by illustrating how much human effort is misdirected:

> Hundreds of thousands of Americans will die this year, deaths that can be prevented. Millions will get sick with preventable illnesses. Billions of dollars and countless hours of human effort will be wasted unnecessarily — all because we are afraid of the wrong things.
>
> In a frenzy of fear we are pouring millions this summer into protecting ourselves from the West Nile virus, and spending only a fraction of

Activity	***Cause of Death***
Smoking 1 cigarette	*Cancer, heart disease*
Drinking 1/2 liter of wine	*Cirrhosis of the liver*
Living 2 days in New York or Boston	*Air pollution*
Rock climbing for 1 1/2 minutes	*Accident*
Traveling 6 minutes in a canoe	*Accident*
Traveling 10 miles by bicycle	*Accident*
Traveling 30-60 miles by car	*Accident*
Flying 1000 miles by jet	*Accident*
Flying 6000 miles by jet	*Cancer caused by cosmic radiation*
Living 2 months in Denver	*Cancer caused by cosmic radiation*
Being a man age 60 for 20 minutes	*Illness*
Eating 40 tsp of peanut butter	*Liver cancer caused by alfatoxin B*
Eating 100 charcoal-broiled steaks	*Cancer from benzopyrene*
Living 5 years at site boundary of a typical nuclear power plant in the open	*Cancer caused by radiation*
Living 150 years within 20 miles of a nuclear power plant	*Cancer caused by radiation*
Risk of accident by living within 5 miles of a nuclear reactor for 50 years	*Cancer caused by radiation*

that sum on public education encouraging people to wash their hands, which would eliminate far more disease transmission than killing every mosquito in America.

Public and private spending on the cleanup of hazardous waste in America is estimated at $30 billion a year. Hazardous waste is a real problem, but the number of people whose health is at risk because of it is actually quite low. Compare that $30 billion with only $500 million

> a year on programs to reduce smoking, one of the leading preventable causes of death in America.

After illustrating the folly in current decision-making, the cause of this folly is diagnosed: fear.

> We could make decisions that are more rational and informed. In many areas, science can identify the physical hazards, tell us how many people are likely to be affected by each one, what various mitigations will cost and how effective we can expect them to be. We can rank risks and remedies and put things in perspective. But we don't. Instead, we make policy based more on fear than fact.
>
> Let's be blunt. This irrational response kills people. In a world of finite resources, we can only protect ourselves from so many things. If we overspend on risks such as pesticides or asbestos, which are real but of relatively low magnitude, we have less to spend on greater threats such as bacterial food poisoning or fossil fuel emissions. As a result, thousands of the people exposed to those higher risks will die.
>
> The usual suspects blamed for bad policy are politics, greed, the media, even the open, manipulatable nature of democracy itself. True, these are all factors in a process that often becomes a battle between competing private agendas rather than an informed search for policies that will serve the greatest common good. But the principal underlying cause of wasteful choices that seek protection from the wrong bogeymen is fear.

Ropeik then identifies how irrational fear, when embraced by large groups of people, can lead to adoption of irrational public policy:

> But society, with limited resources, must be more rational than that. When individual fears become group fears, and when those groups, organized or not, become big enough or visible enough to put pressure on the government to provide protection from less dangerous threats, we can end up with policies that leave a lot of people in the way of harm from higher risks that we're doing less about.

For the greater good, the solution to this dilemma is deference to the wisdom of a body of independent experts for the rational assessment of societal risks. Ropeik proposes the creation of a nongovernmental agency to "provide us with credible, trustworthy guidance on risks." His Risk Analysis Institute would rank hazards according to their likelihood

and consequences, and oversee cost-benefit analysis to outline possible solutions and maximize resources to protect the greatest number of people. To assure the objectivity of the institute in promoting rational policymaking, the utopian ideal is presented that funding would have no strings attached, and that the "scientific work would have to be carried out by professionals who are chosen for their education and training, their expertise and reputations for integrity, neutrality and open-mindedness, not for who their political friends are."

Without question, there is tremendous merit in the idea of injecting rationality and objectivity into the process of risk assessment in order to create effective social policies. However, in the hands of an empowered clique such as the Cult of Nuclearists, risk analysis has been transformed, yet again, into a mesmerizing display of smoke and mirrors. As such, it has become a tool to confound the better judgment of people and do violence to their deep-seated impulse to arrange their lives for the maximum degree of safety, security, and tranquility. The attempt to manipulate the perception of the risks posed by nuclear power is readily understood within the context of how this technology initially evolved. Nuclear weapons were imposed on society by government without any form of democratic debate. As the implications of Hiroshima and Nagasaki burrowed deeply into the collective consciousness, people responded appropriately to these weapons from their inborn processes of risk assessment, and by all criteria, judged them to be unacceptable. However, they lacked the political strength to demand limits to the technology or the foresight to realize that, left to its own devices, the Cult of Nuclearists would assemble before everyone's eyes the arsenal of Armageddon. For a large sector of humanity, the normal process of managing risk was forever upset. They were victimized and traumatized by this reconfiguration of their familiar landscape. Impotent to change this external menace, people's psychology was forced to undergo modification. They had to integrate into their lives increased feelings of dread and insecurity, fear for the future welfare of their children, anxiety about the precarious fragility of all that made life worth living. People had for the first time in history to face the horrible possibility that the continuity of life into the future might be irrevocably interrupted. When nuclear power appeared on the landscape, these same feelings became associated with the threat of the accidental release of radiation. By the way people normally go about assessing risk, this attitude was not unjustified.

The crux of the problem of nuclear weapons and nuclear reactors is that the Cult of Nuclearists has always prized these technologies above the psychological well-being of the people of the Earth. They introduced a technology that by all measures was inappropriate to human happiness and safety and remained unmoved by the average person's response to this technology, i.e., that it was unacceptably risky. Rather than respect this instinctive judgment and work to create a new world order more friendly to the inhabitants

of the Earth, the Cult of Nuclearists advanced its own agenda. To this end, they fabricated elaborate deceptions to beguile people's natural inclinations. This was the motivating impulse for much of the lying and deceit revealed within these pages. When the process of human risk perception began to be clarified, proponents of nuclear weapons and reactors manufactured a strategic response for the purpose of demonstrating how misguided human beings can be when relying upon their native instincts for assessing risk. A new social-psychological paradigm was promoted, centered upon the idea that humans are essentially irrational when assessing certain types of risk. To save them from their folly and guide them to seeing the world in its "true" light, social scientists needed to present the risks of daily life in the cold logic of statistical analysis. By this method, humanity could be freed from its "irrational" fears, limited funds could be apportioned more wisely for addressing "real" hazards, more lives could be saved and the greatest good could be achieved for the greatest number.

At the risk of offending the reader, there is no word in the English language that comes close to characterizing this line of reasoning other than "mind-fuck." It is a cheap trick designed to belittle and invalidate humanity's collective perception of the nuclear hazard. Rather than admit to the inappropriateness of their technology, inappropriate to the pervasive human desire for safety, security, and a sense of well-being, the Cult of Nuclearists is attempting to beguile humans into accepting that they, the people themselves, are inappropriate to the technology. According to their argument, human nature as it applies to risk assessment is imprisoning the species in fear and shortsightedness, thus holding society back from progress. People are repelled by nuclear technology only because they don't see the world aright. The cure for this pervasive nuclear phobia is reeducation by the enlightened perspective of "objectivity." Once this is accomplished, people will awaken to the realization that nuclear power presents no greater risk to their welfare than a short trip in a canoe or a brief ride on a bicycle.

This argument is hogwash. It is based on the fallacy that the perspective of the social scientist and that of the risk-taker are freely interchangeable. Social scientists use statistical analysis as one window on life in their attempt to discern patterns in human behavior. They objectify life in order to study it. They abstract from all the nuances that are involved in individuals formulating preferences of one course of action over another in order to draw certain generalizations about population dynamics. The perspective of the risk-taker, the one who is at risk, is entirely different. For this person, the assessment of risk is a multifaceted process which takes into account past history, knowledge of the world, expectations, preferences, aspirations, intuitions, physical sensations, appetites, emotions, desires, and so forth. If making choices were an entirely rational process and if knowledge of statistics were sufficient to alter behavior, no one would smoke, no one would be over-

weight and everyone would wear a seat belt. Obviously, this is not the case.

For the moment, let's assume that the foregoing statistics are accurate, even though they are based on the lies uncovered in this book, and that there is no difference in the risk to life-shortening between eating 40 teaspoons of peanut butter and living for five years at the perimeter of a nuclear power plant. Knowledge of this fact is not sufficient to change most people's attitude or behavior. Peanut-butter eaters will continue to eat peanut butter with abandon and real estate values around nuclear power plants will remain in a slump. Why? Because personal risk assessment involves more than simply selecting the objectively safest alternative. It involves the very subjective process of creating within oneself a sense of security and safety. All of us are gamblers in the casino of life. We are constantly exposed to a vast matrix of risks, any one of which could ruin or end our lives. To manage this, we push many risks out of our awareness. Others that are more within our control, we may choose to address so as to reduce the hazard they *may* produce in our life. We choose to better our odds of avoiding certain types of catastrophe by electing to wear seat belts, stop smoking, or go on a diet. However, these efforts offer no complete assurance that we will not die in a car accident, contract lung cancer, or suffer a heart attack. Constant vulnerability to chance and the unexpected is the reality of life. The psychological cushion to this state of precariousness is the sense of security derived from one's personal process of risk assessment and management regardless of how accurate it may be objectively.

If statistical knowledge of relative risk lacks the power to supplant most people's inborn processes of risk assessment, what alternative remains for those intent on creating social policy at odds with the public's perceptions? The only option is to circumvent these perceptions by ignoring and overriding them. This is the ultimate purpose of the proposed Risk Analysis Institute. "Experts" are to be enlisted to apply their "superior" wisdom and purported "objectivity" to contravene what is characterized as the passions and ignorance of the masses. Sidestepping the annoying pitfalls of having to deal with public opinion, these experts will work directly with policy makers and lawmakers to create a society reflecting their own values and interests. Undisguised, this is social engineering of a new world order by an elite class not accountable to the people who will have to live under the social policies imposed upon them without consensus. The Risk Analysis Institute is a utopian ideal fraught with peril for humanity. This is most clearly illustrated by a living embodiment of such an organization, the ICRP. To all external appearances, this body of experts provides lawmakers throughout the world with objective information on radiation risk. But as we have revealed, behind their facade of purported objectivity, this organization is a servant of the Cult of Nuclearists, bolstering and legitimizing its misdeeds while ruining the health of untold numbers of victims.

The safety of commercial nuclear power plants is a subject besmeared with obfuscation. Consequently, a legitimate avenue of investigation is to question how the statistics of relative risk listed above were derived. If they are based on the "presumed" dosages to the population from the "assumed" levels of radioactive effluents routinely vented into the environment, and if the risk factors of the ICRP are then applied to these dosages, it should be apparent by this point in the discourse that the hazard to health will be greatly understated. As we shall explore in the following chapter, if the statistics of risk are based on the casualty data recorded in the US Radiation Accident Registry, the conclusions reached as to the hazards of nuclear power plants will be nothing less than a mockery to intelligence. Not everyone in the population is equally at risk from discharges of radioactive pollutants from nuclear installations. If the total amount of radiation released into the environment is treated as if it were distributed to the entire population, the presumed risk is vastly underrated. It would be more accurate to examine the risk incurred by those individuals living immediately downwind of nuclear power plants. As will be revealed in Exhibit F, this type of investigation will reveal elevated risks of breast cancer to people living downwind compared to those living upwind of these facilities. Inclusion of this data in comparisons of relative risks would forever tarnish the myth of the harmlessness of nuclear power.

Statistics can be easily manipulated to create this or that false impression. For instance, statistical analysis may be used to demonstrate the low risk of life-shortening posed by nuclear weapons, the improbability of another Chernobyl-type accident, or the minuscule hazard posed by the planet's accumulated radioactive waste. But such fine number-crunching would be brought to naught by the single improbable occurrence of a nuclear war that decimated 90 percent of the population of the Earth. The safety record of commercial nuclear reactors can be touted *ad infinitum*, but the low-probability event of a simultaneous breach of containment and loss of coolant to a reactor core would contaminate the entire population of a large metropolis. Stored nuclear waste has yet to cause catastrophic loss of life, but the safety record of today may fail to account for hazards facing an unsuspecting humanity thousands of years in the future. Mathematical probabilities may predict that nuclear accidents are far-fetched and unlikely, but far-fetched and unlikely things happen all the time. The question is not how improbable the risk, but whether or not we can afford to have such a risk in our midst at all. Is the technology worth the risk of the mass casualties that seem so implausible? Rather than go to the statistical tables for answers, we should travel to Belarus and ask people there if another Chernobyl is worth the risk. We should travel to Hiroshima and ask the survivors what they think of America's defense policy. We should ask sick veterans returning from Iraq whether they think the ICRP's risk factors for inhaled uranium are accurate.

Contrary to the beliefs of the pundits within the Cult of Nuclearists, the people of

the Earth are not dummies. We recognize the lies for what they are. We are acutely aware that we are living on the brink of nuclear catastrophe. We have witnessed calamitous radiation accidents, and there is nothing that can convince us that these will not happen yet again. Where before we used to protect our children from discovering about the birds and bees, today the horrific secret to be kept from tender ears is that their lives can be incinerated in a microsecond by some deluded idiot. We long to live in a world where we can ride bikes and go canoeing and eat peanut butter sandwiches without being burdened by the thought of having our world ruined by radioactive contamination. We recognize that the Cult of Nuclearists and their policies are an embedded cancer in the body politic. Excising them from our midst may be treacherous because such an operation may kill the host as well. But the people do not have unlimited patience with threat, injustice and deception. Let us hope that Cult of Nuclearists will quantify that risk as well.

SCAM NUMBER THIRTY-SEVEN: Block the dissemination of all information that raises questions as to the validity of the current estimates of risk from internal contamination by radionuclides.

Governments and the nuclear industry derive a tremendous boon from the flawed model of radiation effects as it applies to low-level internal contamination. It gives them license to contaminate populations with radionuclides and escape accountability for their deeds. Their minions, availing themselves of the types of scams elucidated within these pages, can demonstrate within the wake of even the most catastrophic releases that dosages to the exposed populations fall within the safety guidelines set by the radiation protection agencies, and thus, that the resulting risks to public health are relatively insignificant. To maintain this facade, the Cult of Nuclearists is heavily invested in creating the impression that the science of radiation effects is more advanced than it in fact is, and that a worldwide consensus exists in the understanding of how radiation affects human health. To give the impression that current models are impeccable, extreme pressure is brought to bear on dissidents who refuse to toe the line and who, in defiance of the status quo, voice unorthodox viewpoints. Routinely, these whistleblowers are marginalized and their work discredited. Among the tactics used to silence those promoting dissenting points of view: threats and intimidation, loss of employment, demotion, salary cuts, funding cuts, refusal of employers to allow publication of research, rejection of publication by the scientific journals and so forth. A common rationale for such retribution is that conclusions in defiance of current models are illegitimate because they fall outside the mainstream of accepted scientific thought. What escapes due consideration is the possibility that the mainstream itself is hopelessly polluted and in need of cleanup.

Given this tyrannical suppression of independent thought, it is not surprising that

experts in the radiation sciences have been silenced when attempting to warn the world of the hazards of depleted uranium. A recent example came to light in February 2004, with the publication of an article in the UK's *Sunday Herald* which reported that the World Health Organization had kept secret a report warning that Iraq's civilian population faced a long-term threat of increasing rates of cancer from inhaling DU dust from weapons fired by British and US forces. Dr. Keith Baverstock, who had been employed by WHO for 11 years as a senior advisor on radiation and health, authored the 2001 study in collaboration with Professor Carmel Mothersill of Canada's McMaster University and Dr. Mike Thorne, a radiation consultant. Baverstock told the *Sunday Herald*: "Our study suggests that the widespread use of depleted uranium weapons in Iraq could pose a unique health hazard to the civilian population. There is increasing scientific evidence that the radioactivity and the chemical toxicity of DU could cause more damage to human cells than is assumed." As reported by the newspaper which had attained a copy of the research:

> Baverstock's study pointed out that Iraq's arid climate meant that tiny particles of DU were likely to be blown around and inhaled by civilians for years to come. It warned that, when inside the body, their radiation and toxicity could trigger the growth of malignant tumors. The study suggested that the low-level radiation from DU could harm cells adjacent to those that are directly irradiated, a phenomenon known as "the bystander effect." This undermines the stability of the body's genetic system, and is thought by many scientists to be linked to cancers and possibly other illnesses (Edwards 2004).

Baverstock offered the following observation:

> I believe our study was censored and suppressed by the WHO because they didn't like its conclusions. Previous experience suggests that WHO officials were bowing to pressure from the IAEA, whose remit is to promote nuclear power. That is more than unfortunate, as publishing the study would have helped forewarn the authorities of the risks of using DU weapons in Iraq.

The WHO was quick to dismiss these allegations as totally unfounded. "The IAEA role was very minor," said Dr Mike Repacholi, the WHO coordinator of radiation and environmental health in Geneva. "The article was not approved for publication because parts of it did not reflect accurately what a WHO-convened group of international experts considered the best science in the area of depleted uranium," he added.

As an aside, the *Sunday Herald* article concluded by offering observations by Pekka

Haavisto, chairman of the UN Environment Program's Post-Conflict Assessment Unit in Geneva:

> Haavisto's greatest worry is when buildings hit by DU shells have been repaired and reoccupied without having been properly cleaned up. Photographic evidence suggests that this is exactly what has happened to the Ministry of Planning building in Baghdad.
>
> He also highlighted evidence that DU from weapons had been collected and recycled as scrap in Iraq. "It could end up in a fork or a knife," he warned.
>
> "It is ridiculous to leave the material lying around and not to clear it up where adults are working and children are playing. If DU is not taken care of, instead of decreasing the risk you are increasing it. It is absolutely wrong."

The suppression of the Baverstock study is not an isolated phenomenon. Investigating the medical effects of depleted uranium can lead to termination of employment. After 19 years of service to the US government, Dr. Asaf Durakovic, Chief of Nuclear Medicine at the Veterans Administration hospital in Wilmington, Delaware, was fired after undertaking investigations into the medical effects of depleted uranium on sickened veterans from the first Gulf War. Although he had served in the Gulf himself, Durakovic was unaware until he returned to the US that depleted uranium munitions had been deployed in the Gulf. Says Durakovic:

> I only discovered indirectly in September 1991 that depleted uranium had been used on the battlefield. I was horrified. When scientists conduct experiments using this material, we dress like astronauts. Our soldiers had no protection. And this attack could have potentially exposed the entire population of the Gulf region. Soil samples from Iraq show radiation levels more than 17 times the acceptable level (Arbuthnot).

Dr. Durakovic's story of the obstacles he encountered while attempting to treat contaminated veterans is interesting and well worth repeating. It is a textbook case of the types of intrigue that can be waged against honest scientific investigation.

> In 1991, 24 soldiers from the 144th Transportation and Supply Co., New Jersey, were referred to me by Ventnor Clinic in my capacity of

Chief of Nuclear Medicine, VA Medical Facility, Wilmington, DE. All of the veterans were referred to me for the opinion and diagnostic assessment of their DU body burden. My expertise is in the internal contamination of radioisotopes and I was the only published researcher in the federal VA system with research on transuranic elements at the time these soldiers were referred to me. Although I personally served in Operation Desert Shield as Unit Commander, my expertise of internal contamination was never used because we were never informed of the intended use of DU prior to or during the war.

The research on the effects of transuranic elements in the human system is not well known as prior accidents have dealt with many isotopes (Chernobyl) and the Persian Gulf War deals with one actinide, i.e., uranium.

From January 1991 until August 1991, these soldiers were on a tour of active duty in Saudi Arabia and after the ground war started were located at the KKMC, King Khalid Military Camp, where it was their duty to unload battle-damaged M1A1 tanks, Bradleys, and M113 tanks destroyed by DU armor-piercing shells from friendly fire of helicopters, airplanes, and other tanks.

The soldiers worked on these tanks. During this time, soldiers had constant contact with these vehicles. Those that were required to receive the vehicles actually lived very near them, ate lunch on top of them, and cooled themselves inside of them. They had been told not to let anyone photograph or take souvenirs from them so they kept the tanks close at hand.

On March 10, 1991, a Battle Damage Assessment Team dressed in full radioprotective clothing arrived, stating that they were from Washington to assess the radioactivity of specific tanks. They reviewed the tanks for four days, fully dressed in the 90 degree temperatures.

At the conclusion of the assessment, the soldier in charge of the crew required to move the equipment, was told that the tanks were "hot," to mark them with the atomic symbol and not to let people go near them. The Assessment Team had detected .26 to 1.0 rad inside the tanks. [With an RBE (Relative Biological Effectiveness) factor of 10, the dose rate is 2.6 to 10.0 rem/year for the surrounding body tissue.

In the US, the Code of Federal Regulations regarding energy specifies an annual limit of 0.17 rem/year and a specific limit of 0.5 rem/year for an individual in the general population.]

After that evaluation, the soldiers were told to cover the tanks with tarps and not to photograph them. The Team stated that the tanks were not dangerous to those required to work in their environment. One soldier was given an outdated dosimeter which began to detect radiation right away despite the fact that it was long past its expiration date.

My diagnostic strategy consisted of their referral to the VAMC [Veterans Administration Medical Center] of Boston to the internationally known expert on low energy detection of internal contamination, Dr. Belton Burroughs who with Dr. David Slingerland performed whole body count of uranium-238 on several of the referred veterans. It was found by a rather insensitive and outdated whole body count that 14 of the 24 patients referred contained decay products of radioactive uranium. On the basis of this, more sensitive equipment, specifically a Germanim crystal, was applied for the project which was then terminated. All work that was conducted on behalf of DU contamination was coordinated through the Persian Gulf Registry of the Wilmington VA hospital. All records were subsequently lost.

The urine samples of these same patients were sent to the US Army Radiochemistry Lab in Aberdeen, Maryland. Again, some samples never reached the lab and the results of those that did were supposedly lost.

According to my experimental research on lab animals and extensive review of the literature, uranium can hardly be detected by the external methods including whole body counting and urine analysis. Therefore I recommended that the veterans should be sent to the SANDIA National Labs in Albuquerque, NM which specializes in the pulmonary pathways of contamination with transuranic elements.

Furthermore, an objective analysis in the main site of uranium incorporation which is the skeletal system, should be performed by an autoradiographic analysis of the skeletal deposition of uranium by the bone necropsy specimens.

> Neither of the above recommendations were followed because no one took the veterans' illnesses seriously. Two of the 14 soldiers have died since returning from the Persian Gulf. A recommendation for autopsy which should have included autoradiographic analysis of the skeletal deposition of uranium, was ignored.
>
> The 144th Transportation and Supply Company has since been scattered all around the United States, making it impossible for unified testing and analysis.
>
> Due to the current proliferation of DU weaponry, the battlefields of the future will be unlike any battlefields in history. Since the effects of contamination by uranium cannot be directed or contained, uranium's chemical and radiological toxicity will create environments that are hostile not only to the health of enemy forces but of one's own forces as well.
>
> When released, DU aerosol particles are carried on the winds, their range as fallout virtually unlimited and as they migrate they contaminate air, soil, and water. So released, it is available for uptake by humans via inhalation, ingestion, or absorption. In such a toxic environment, fighting personnel will find themselves victims of their own weapons as well as those of the enemy. Due to the delayed health effects from internal contamination of uranium, injury and death will not always be immediate to the battle, but will remain lingering threats to "survivors" of the battle for years and decades into the future. The battle field will remain a killing zone long after the cessation of hostilities. Environmental contamination will linger for centuries posing an ongoing health threat to the civilians who reclaim the land and subsequent generations (Durakovic, Statement).

In one interview, Durakovic offered an opinion as to way the US government was actively engaged in hiding the effects of depleted uranium:

> Was there a reason officials didn't want information on DU victims of the Gulf War to become public? According to Dr Durakovic there are two main reasons - and they both involve money. By the year 2000 the bill to clean up waste uranium from the US nuclear industry would have amounted to more than $200 billion. So a lot of cash could be saved if the uranium was recycled in the arms industry. And of course there is the issue of compensation. The US Government would have to pay out billions if it could be conclusively proven that

> DU-coated weapons were causing illness in returned American troops (Arbuthnot).

In February 1997, Dr. Durakovic, on behalf of Gulf War veterans, wrote a letter to President Clinton asking for an inquiry into DU contamination. Two months later, he was fired. In an interview on the radio show *Democracy Now*, Durakovic spoke of his termination:

> I was fired in the year 1997. Because after the Persian Gulf War I, I was approached by the officials of the different departments of the US government who asked me to stop my work on the depleted uranium, which I obviously could not agree with, because I was mandated by the government of the US to take care of my patients, and I was the head of Nuclear Medicine Department of the V.A. Hospital in Wilmington, Delaware. So when I discovered a high percentage of contamination with the DU in Gulf War I veterans, every effort was made to stop my work. Which I obviously couldn't. I'm a medical doctor, and my responsibility is for the well-being of my patients. So, in 1997, I was fired (Broadcast Exclusive).

Dr. Durakovic has offered a sobering thought in regard to the misapplication of uranium for military purposes:

> Uranium is dangerous, it does cause cancer, uranium does cause mutation, and uranium does kill. If we continue with the irresponsible contamination of the biosphere, and denial of the fact that human life is endangered by the deadly isotope uranium, then we are doing disservice to ourselves, disservice to the truth, disservice to God and to all generations who follow (Catalinotto).

The Cult of Nuclearists will use any means to silence its critics of the currently accepted model of radiation effects. Free minds and unbiased intellectual inquiry are its most potent enemies, and it is these that must be silenced. Its raging intolerance was recently in evidence on a seemingly inconsequential battlefield, the meeting table of CERRIE, the Committee Examining Radiation Risk from Internal Emitters. In 2001, Michael Meacher, then Environment Minister in the UK, established CERRIE. Due to the controversial nature of its subject matter, CERRIE was structured along novel lines for a panel offering scientific advice to policymakers. Members of the committee were selected from three different camps. Some came from the National Radiation Protection Board and British Nuclear Fuels, a government-owned company which produces nuclear fuel, runs reactors, generates and sells electricity and reprocesses spent reactor fuel. Other members

of the committee represented the Green movement or were people whose scientific views challenged those of the NRPB. The remainder were supposedly neutral academics. The mandate of the committee was to undertake a review of the health risks posed by internal emitters and produce a final report which adequately presented the views of all parties. Topics for which a consensus was reached were to be identified. For subjects on which differences of opinion were irreconcilable, the reasons for the disagreements were to be elucidated in accessible language and suggestions were to be made for avenues of future research which might help resolve the conflicting points of view. All committee members were to agree to the final report, acknowledging that it faithfully included the full breadth of the committee's deliberations and that it accurately presented all opposing arguments.

Typifying the titanic struggle between those who endorse technologies that liberate ionizing radiation into the environment and those who oppose them, CERRIE failed to fulfill the directive with which it was charged of producing a document agreed upon by all of its members. The working coalition split along ideological lines, and the final report exhibited obvious bias in favor of the reigning orthodoxy. In flagrant violation of the reason for which it was created, CERRIE authored a paper that failed to present a full and fair presentation of all points of view. Disagreements among committee members were in many cases mentioned only in passing, and no space was allotted to adequately explain to the reader the underlying reasons for the differences in scientific opinion. On the important subject of post-Chernobyl infant leukemia, the final report did an excellent job of whitewashing the evidence of major errors in the risk factors published by the ICRP. Those who felt their points of view were not accurately reflected in the document published a separate minority report which contains the information suppressed by the majority.

The CERRIE debacle is mentioned here for only one reason. As the committee's deliberations drew to a close, representatives of the Cult of Nuclearists interjected a novel method of intimidation into the proceedings with the intent of controlling the final report and stifling free and open discussion that the current model of radiation effects is flawed. At the committee's last meeting, the Chairman produced a letter written by lawyers within the Department of Environment Food and Rural Affairs (DEFRA). The letter warned that if the final report contained any libels or "negligent misstatements on factual matters," liability could potentially fall on everyone connected with the report: the committee members, the government departments, the printers and the distributors. In a blatant threat to the livelihood of each member of the committee, the letter indicated that each member individually would be liable for damages if the government were sued by anyone on the basis of these unspecified negligent misstatements. As to why the committee failed to produce a unified report, the probable explanation was revealed in a *Sunday Times* article by Mark

Gould and Jonathan Leake entitled "Government Gags Experts Over Nuclear Plant Risks." According to this article, the 12 members of CERRIE each received a letter warning them that they could be sued for defamation if they included within their final documents the contents of what eventually became the minority report. This harassment produced the desired results. The "official" CERRIE document gives no indication that serious questions exist as to the accuracy of the current model of radiation effects. Successfully marginalized, the separately published minority report will undoubtedly receive little exposure.

The tactics used by elements within the British government to subvert CERRIE provides strong evidence that a new Inquisition is evolving to persecute heretics who preach against the state-sponsored doctrine. Anyone proposing ideas at variance with what is promoted as true by those in power may be brought to trial for libel and fined or imprisoned. This tolls the death knell for unbiased scientific inquiry — a cornerstone of Western civilization for the last four hundred years. To declare and support with evidence that the Hiroshima Life Span Study is flawed science, or that the ICRP publishes inaccurate risk factors, or that Sellafield is inducing leukemia in children will no longer be tolerated as a valid alternate interpretation of what is going on in the world. These pronouncements will instead be judged as "negligent misstatements on factual matters" and their authors will be criminalized.

SCAM NUMBER THIRTY-EIGHT: Design epidemiological studies in such a way as to guarantee that the results will underestimate the risk to health from radiation in the environment.

What knowledge exists about the medical effects of radiation on populations has been garnered from epidemiological studies. This research also has been used to validate the models of radiation effects upheld by the radiation protection agencies. Since nuclear/radiological weapons, commercial nuclear power and the biological impact of low-level radiation are such highly politicized subjects, it is not surprising that epidemiological studies are sometimes structured and implemented, either by intention or accident, to reflect the prejudices of the researchers conducting them. Biased studies pollute the knowledge base and are a propaganda device. Of interest here are the distortions of fact that can be insinuated into population studies in order to "prove" the correctness of ICRP models and thereby "verify" the minimal hazard predicted by the risk factors.

The ECRR has identified a number of common errors that have appeared in published epidemiological studies of radiation risk:

1. *Wrong Doses*: Many of the dosage scams mentioned previously have become

incorporated into studies of contaminated populations. When dosages are assessed inaccurately, no meaningful conclusions can be drawn about risks. In most studies of contaminated populations, dosages are not actually measured in each member of the study group but estimated or, in the vernacular of radiation epidemiologists, "reconstructed". This practice, based on numerous assumptions about the migration of radionuclides through the environment, is a simple means by which radiation studies can be subtly manipulated to deliver predetermined or politically acceptable results.

A common tactic used by the AEC during the period of aboveground weapon testing was to formulate dosages to the population from fallout in terms of external radiation. Conveniently, this served to downplay the level of exposure to those people living downwind by ignoring the additional dosages caused by internal emitters. This error of ignoring the cumulative effects of all the radioisotopes involved has compromised the Hiroshima Life Span Study, studies of populations living downwind of nuclear weapon detonations and studies of Chernobyl. As a variation on this theme, population studies are invariably based on the currently accepted models of external radiation. In instances where internal emitters are taken into account, the contribution made from external radiation and internal radiation are usually combined to derive a single dose estimate which is treated *as if* it were completely delivered externally. If internal emitters pose an enhanced hazard, as this book argues it does, no reliable conclusions about the hazard posed by radionuclides in the environment can be produced by this methodology.

2. *Wrong Controls*: To study radiation effects, the incidence of illness in an exposed population must be compared to that of a similar population that did not receive the exposure. If an inappropriate control group is selected for study, the health risks from radiation can be rendered woefully inaccurate. One way where this can occur is when the population chosen as the control group has been likewise exposed to radiation. When this occurs, the radiation-induced cancer rate in the study population will be made to appear lower than it actually is, perhaps even "nonsignificant," due to the heightened incidence of radiation-induced cancer in the control group. This error is a central shortcoming of the Hiroshima Life Span study, where members of the control group received undetermined dosages from internal emitters. It has also crept into studies of the inhabitants of the Marshall Islands, of people living downwind of the Nevada Test Site and of populations contaminated by the fallout from Chernobyl.

It is important to note that the entire human population has been exposed, both internally and externally, to radiation from weapon-test fallout, accidents, and routine ventings from nuclear installations. There *is* no uncontaminated subpopulation that can serve as a control group to test the impact of this pollution on the health of the human species.

Internal contamination by novel fission products befouling the environment may be more hazardous than Natural Background Radiation but its effect is masked by this universal contamination. The presence of these radionuclides in the environment might well explain the rise in the incidence of cancer across the population since the middle of the twentieth century. This lack of a suitable control group has important implications for interpreting of epidemiological studies of radiation and cancer causation. When the incidence of cancer in a study group exposed to the effluent of a radiation accident is compared to that of members of the general population, the frequency of radiation-induced cancer will end up appearing less than it in fact is, and the risk of cancer from radiation will be underestimated.

The ECRR notes that it may be inappropriate to select members of the general population as a control group if the study group does not itself reflect the general population. One example is the "war survivor effect" prejudicing the Life Span Study. Those in Hiroshima who survived a long war, the atomic bombing and the hardships that followed this holocaust became members of the study group in a project designed to determine radiation effects in humans. However, the survivors of this horrific ordeal might not have been representative of either the Japanese population or of the entire human race. The hardships of living through the war followed by the extreme trauma of the bombing, and survival through the subsequent five years before the onset of the study may have preferentially selected individuals with stronger immune systems or genetic resistance to certain types of radiation effects. As a consequence, their incidence of cancer may have been atypically low compared to members of the population at large. Similarly, employees in the nuclear industry may manifest a "healthy worker effect" which lowers their rates of cancer in comparison with equivalent age groups within the general population. Fit, employable individuals undergoing regular medical exams who selected themselves to work in the nuclear industry and were then selected again for employment may not represent a true cross-section of the general population. Such comparisons may generate spurious results about the risks to health from radiation exposure.

3. *Wrong Sample*: It is not uncommon for groups that have been differentially exposed to radiation to be pooled together in a common study group. For instance, people living within a defined radius of a nuclear installation may be grouped together in an effort to detect the effect of living near the facility on rates of cancer. This method can mask the fact, for instance, that those people living downwind of the plant will have received higher doses than those living upwind. When the number of cancers recorded is compared to the size of the population under investigation, those living upwind will dilute the findings, lowering the cancer rate and lowering the apparent risk.

4. *Wrong Assumptions*: This entire chapter has been devoted to proving that the current model of radiation effects is biased toward underestimating the risk to health from exposure to radiation. The assumption built into this model can profoundly influence the interpretation of data collected in epidemiological research. The ECRR provides a clear example. In studies of nuclear workers and the effects of Chernobyl in Europe, "the assumption of a linear no-threshold dose response has resulted in many clear observations of effect being discounted because high-dose groups may have lower cancer rates than intermediate-dose groups." According to the LNT hypothesis, those in a population who received the highest dosages should manifest the greatest degree of radiation-induced illness. If the greatest number of casualties do not exist in the high-dose group, then radiation is discounted as the cause of any detected cancer increase across the population. This line of reasoning is based on models originally designed to understand the effects of external radiation. It may not be valid for low-level internal exposure. For instance, a study might reveal that the greatest incidence of birth defects or childhood leukemia occurred in the intermediate-dose group rather than the high dose group. Does this finding justify the conclusion that radiation was not the cause? Certainly not! Perhaps a greater number of fetuses were spontaneously aborted in the group suffering the greater exposure, thus lowering the incidence of disease in the children of members of this cohort. The expectation of observing a linear dose response can thus blind researchers into discovering that low-level internal exposure may carry with it an enhanced risk for radiation injury. In line with this observation is another which deserves mentioning. When speaking of the effects of Chernobyl on the rates of cancer in Europe, the ECRR makes the following point:

> In addition, epidemiological studies have been influenced by or countered with the predictions of the ICRP risk models for populations exposed to the doses resulting from the discharges. These predict very modest effects which would generally be difficult to establish against the large background cancer rates experienced by the study populations and therefore, when increases in cancer are seen in such populations they are ignored or at least not ascribed to exposures from Chernobyl.

Another incorrect assumption mentioned by the ECRR has been incorporated in studies of the rates of cancer in geographical areas of high Natural Background Radiation. To "prove" the harmlessness of low-level radiation, studies have been conducted comparing cancer rates between populations living amidst different levels of naturally occurring radiation. When the areas of high NBR are not found to demonstrate higher rates of cancer, the conclusion jumped to is that low-level radiation is not a hazard to health. One factor that is not taken into account is the selection over time of radiation resistance among

members of a population exposed for generations to the elevated radiation in the environment. As noted by the ECRR: "Inducible radiation resistance has been demonstrated in animal studies yet no allowance has been made for this when comparing populations in Natural Background studies."

As a third example, the ECRR notes that current models of radiation effects are based on the assumption that cancer is initiated directly from a single exposure event which induces genetic alterations. The genetic theory of cancer on which this is based fails to take into account other factors that may come into play in influencing the progression of a cancer. For instance, immune system stress, diet, or other environmental toxins may either aggravate or mitigate the effects of the initial aberration thereby affecting radiation-induced cancer rates within populations.

5. *Wrong Conclusions*: The ECRR notes that it is quite common for the conclusions drawn in an epidemiological study to be out of sync with the data collected during the course of the study. Journal abstracts or the conclusions appearing at the end of research papers claiming no observed effect between radiation exposure and cancer incidence have been observed to contradict the information included in tables or text within the body of the papers.

For a long and detailed examination of the types of errors that have corrupted important studies that purport to show that radiation exposure has little or no effect on public health, the reader is advised to consult chapter five, "Paradigm Deconstructed," in *Wings of Death*.

SCAM NUMBER THIRTY-NINE: Use the risk factors to structure the perception of the health consequences of a radiation release.

In Edgar Allan Poe's short story, *The Masque of the Red Death*, all the influential people of a country assemble for a masquerade ball in the castle of a nobleman. Outside, a plague is ravaging the less fortunate population. Secure in their presumption that they are immune to the tribulations taking place beyond their walls, all are horrified to discover when they remove their masks, that Death has been an uninvited guest within their midst throughout the entire gathering. This, their final realization, marks the moment of their demise.

For purposes of this discussion, we must ask what costume, today, is Death wearing?

Death is disguised by the risk factors published by the radiation protection agencies. We fail to recognize Death in our midst because it is so craftily concealed.

Before this discussion proceeds, a single point needs to be hammered home. When estimates are manufactured for the number of people injured by nuclear weapon testing, how are the figures computed? On the basis of the risk factors! When a radiation accident takes place, what is used to determine the likelihood of illness to those dwelling downwind? The risk factors! Before commercial nuclear power plants are licensed, what criteria are used to determine the amount of radionuclides that can be legally discharged and the likely health effects of these to the surrounding population? The risk factors! For people employed in the nuclear industry, how is potential hazard to their health estimated? The risk factors! When modeling different accident scenarios at radioactive waste repositories, how is health detriment of those potentially exposed determined? The risk factors! When computing the possible hazards of a breach of containment accident during transport of radioactive materials along highways or railroad lines, how are possible casualty figures derived? The risk factors! On what basis is the hazard to health estimated from incorporating low-level waste into consumer products? The risk factors! When cancer patients receive radiation therapy, how are their chances for another cancer being induced by their therapeutic dose of radiation calculated? The risk factors! How are hazards to our own troops or enemy civilians evaluated when designing and deploying uranium weapons? The risk factors! When estimating collateral injury to the surrounding population from the proposed deployment of nuclear bunker-buster bombs, what information is necessary for such calculations? The risk factors! How are the number of radiation deaths produced in the varying scenarios of nuclear war fighting during World War III determined? The risk factors! The risk factors legitimize the entire nuclear enterprise. Human beings tolerate technologies that cause radiation exposure solely on the basis of their belief that this exposure represents minimal risk.

Scam Number Thirty-Nine is the preeminent scam, the reason for being of all the other scams. It lies at the heart of all the mischief that has infiltrated and corrupted the science of radiation protection. By the elaborate swindle deconstructed within these pages, the Cult of Nuclearists has fabricated inaccurate risk factors and then used these inventions to veil its misdeeds before the public. To fully appreciate the insidious role played by the risk factors in blinding humanity to true radiation effects across populations, one must get a feel for the profound indeterminacy that accompanies a radiation release. Due to the nature of the phenomenon, the impact of vented radioactivity on public health is clouded in ambiguity. Once liberated, radioactive atoms invisibly migrate through the environment at the whim of ever-changing meteorological and geophysical forces. From their point of origin to their ultimate abode, no one knows their fate. Extensive environmental monitor-

ing can provide a map of patterns of dispersal and potential avenues for contamination of the food chain, but this in itself will not divulge who was contaminated and to what extent. Those contaminated will never know they have absorbed radiation that may undermine their health. The most meticulous scrutiny will never disclose the fate of each radioactive atom as it courses through their bodies. When an atom undergoes radioactive decay, no one will witness the molecular consequences of the event or the possible genetic damage inflicted on a cell. When a cancer develops decades later, the victim will never realize that he or she was a casualty of a radiation accident.

With the exception of incidents that produce acute radiation syndrome, radiation injury in the wake of a radiation release is delayed and invisible. Only years or decades after an exposure event do indications of injury begin appearing, if anyone is bothering to look for them, in the form of an increased incidence of naturally occurring diseases. In the aftermath of a Chernobyl-type accident, perhaps the first indications of harm to a population are a growth in the number of miscarriages, stillbirths and birth defects. Increased rates of leukemia among children who were in the womb during or immediately after the event may begin appearing during childhood or adolescence. Among those who were children at the time of the accident, the dietary absorption of radioiodines will increase the number of thyroid abnormalities and thyroid cancers diagnosed within a few years of exposure. The next disease that may be identifiable as radiation-induced is leukemia throughout the population, with rates *beginning* to climb perhaps as soon as five years after the event, and continuing to climb as the population ages. Increases in the frequency of other types of cancer may go unnoticed for decades due to their long latency periods.

The conundrum facing the epidemiologist is how to determine the rates of those illnesses in the population which are radiation-induced against the pool of identical illnesses that occur naturally or from other environmental toxins. Due to normal statistical fluctuations in the frequency of these diseases over time, trends are not easily identifiable, or if they are, may require the passage of decades for meaningful elucidation. In some instances, what further complicates assessing the health consequences of a radiation accident is the sparsity of accurate data. Particularly in underdeveloped countries, illnesses may be misdiagnosed, causes of death may not be properly identified or may go unrecorded, and statistics on morbidity and mortality may not be gathered or may remain incomplete. Not to be overlooked is the politically motivated corruption of accurate data sampling. As noted in Scam Number Twenty-One, cancer registries are susceptible to fraud, or as in the case of Ukraine after Chernobyl, Soviet authorities forbade doctors from including leukemia in their diagnoses. Finally, definitive and indisputable conclusions of radiation effects on populations are a rarity among epidemiological studies. Due to political clashes between pronuclear and anti-nuclear factions, studies angering one camp are routinely challenged and

refuted by researchers of the opposing camp. Controversies inevitably erupt in the wake of studies that either underestimate or overestimate the number of radiation-induced casualties. As opposing camps fight to a standoff, consensus opinion is never achieved, and the public is left in bewilderment as to what really is the truth.

Given the formidable array of forces that delay or prevent a clear-cut assessment of the public health consequences of a radiation release, how do human beings in the immediate aftermath of environmental contamination arrive at an understanding of what has taken place? What tools do they have at their disposal for rapidly interpreting the event's impact? Public anxiety demands timely information. People are not going to wait patiently for decades to see if their health has been compromised. They want immediately to know how much radiation has been liberated into the environment, in what direction it dispersed, and if they should evacuate. They want to know about the safety of their food and water supply. They want to know who was exposed, what were their dosages, and what are the risks these dosages pose for initiating radiation-induced illnesses. How are answers to these pressing questions derived?

By this time, the answer to this fundamental question is self-evident: the risk factors! These are the lenses through which the ambiguities of a radiation emergency are brought into focus. They are the instrument used to structure the perception of a radiation release in the public mind.

As the history of radiation accidents has repeatedly demonstrated, the first response of representatives of the Cult of Nuclearists to a radiation emergency is to downplay or completely discount any potential threat. By this response, they attempt to avert panic, discourage social unrest and preserve confidence in the Cult's long-term nuclear agenda. To reinforce faith in the safety of nuclear technology, interpreters of the event — most often government spokesmen, apologists for the nuclear industry and media personalities — grab public attention and offer a sanitized version of the incident. Although radiation effects are profoundly difficult to discern and may take decades to decipher, these interpreters fabricate an instantaneously clear picture of what has transpired. This concoction, to attain credibility and be above suspicion, requires grounding on accepted scientific principles. This is where the radiation protection agencies enter into the scheme. Their science is recruited to legitimize the version of reality being invented. Elevated to the status of oracle, the risk factors are employed to divine the health consequences to the contaminated population. Following the protocols published by the radiation protection agencies, researchers mathematically model the radiation release. Based on estimates of the amount of radiation dispersed, the radionuclides involved, their chemical forms, prevailing weather patterns, dietary habits of the population, the number of people exposed and so forth,

dosages to the exposed population are *reconstructed*. On the basis of these *assigned* dosages, the potential types of illness and their frequency can be predicted based on the established risk factors. Without having to wait for decades to investigate what *actually* happened, a picture can be painted within hours or days of what supposedly will likely happen. Needless to say, the correctness of these speculations is wholly dependent on the accuracy of the assigned dosages and the fidelity of the risk factors.

The devilment lying at the heart of this elaborate charade is the authority bestowed upon the risk factors to accurately predict radiation effects. Consecrated by the high priests of the radiation protection community, the risk factors have been elevated to inviolable law. They are credited with the power of prophecy, foretelling the limits of the health consequences of released radioactivity. This point is essential to grasp. By sleight of hand, the portrait of a radiation event is painted by the risk factors. This is the image that reaches the public's awareness and shapes perception of the event. Distracted by this facsimile, the uninitiated fail to notice that the actual health toll remains undetermined or may be woefully out of sync with the whitewashed imitation.

The Cult of Nuclearists has built its castle upon the risk factors. To mollify concerns when radiation is released, the Cult of Nuclearists desperately requires an unassailable tool by which to paint a benign image of the event in the public consciousness. Groomed specifically for this purpose by the corrupted radiation protection agencies are the risk factors. These carefully crafted mathematical fictions are propaganda instruments designed to reassure a wary public that released radiation is no cause for alarm. They are the mask that disguises the plague unleashed upon the earth. The risk factors structure the perception that the guardians of radioactivity are adequately protecting the welfare of humanity. The public tolerates their mismanagement and mishandling of radioactive material based on their limited understanding of radiation effects and their trust in the accuracy of estimates of risk presented in the popular media.

This mischievous method of damage control is easily seen in the way that the radiation protection agencies are attempting to sanitize the Chernobyl catastrophe. By their approach, a dose is fabricated for a defined population, the risk factors are applied to this dose, and presto, the health toll of the accident immediately materializes out of nothing. To quote the ECRR:

> UNSCEAR 1993 gives the total committed effective dose from the Chernobyl accident to the world population as 600,000 person Sieverts. The ICRP risk factor of 0.05/Sv would predict 30,000 fatal cancers in the world from this; as UNSCEAR 2000 points out, such an increase would be statistically invisible.

As an exercise in epistemology, it is worth analyzing the meaning of this statement. UNSCEAR is not declaring that 30,000 fatal cancers will be produced from the accident at Chernobyl. What they are saying is something entirely different. They are saying something about their models, not reality. They are declaring that, according to their premises, the cancer fatalities that emerge at the other end of their equations is 30,000. BIG DEAL! We could start with different premises, apply other models, and arrive at different conclusions. In this manner, Gofman predicts 970,500 fatal cancers from external exposure to the single radioisotope cesium-137 released from Chernobyl. And the ECRR, employing its own models, predicts that over the next 50 years, in Belarus alone, an excess of 1,200,000 fatal cancers will occur, and worldwide, the total will reach 6,000,000. The conflict between different researchers is over models, not reality.

So, how many fatal cancers will **REALLY** occur as a result of the Chernobyl accident? No one on the face of the Earth has a clue!

Given this indeterminacy, the previous question needs to be reformulated: Who is in possession of the most *trustworthy* models for predicting radiation effects from Chernobyl? The Cult of Nuclearists ardently strives to convince the world that it is the ICRP, NCRP, NRPB, UNSCEAR, BEIR, and so forth. These are the organizations that have been sponsored and financed by the nuclear establishment and upon whom eminence and respectability have been conferred. Their version of reality is the one designed to be accepted by all inquirers. However, as we shall see in Exhibit F, when contaminated populations are investigated epidemiologically rather than mathematically, the rate of radiation-induced illness is greater than that forecast by the risk factors. This unfortunate intrusion of reality is the Achilles heel of the whole corrupted science of radiation effects and the slayer of the false models that have been intentionally crafted to underestimate the extent of injury suffered by humanity from nuclear pollution.

The risk factors have become so enthroned as the diviners of biological effects that they are frequently called upon to testify against observable health consequences that flatly contradict their accuracy. An excellent example is reported by Busby in *Wings of Death*. In the mid-1980s, the Committee of Medical Aspects of Radiation in the Environment (COMARE) concluded that radiation was not responsible for the confirmed leukemia cluster in the vicinity of the Sellafield nuclear installation first reported by Yorkshire TV. Despite the fact that the incidence of leukemia in the area was 10 times the national average, the committee insisted that radiation was not the causative agent. They justified their conclusion on the basis of the risk factors. Essentially, they said that given the *presumed* dosages, the observed leukemias could not possibly be radiation-induced because the risk factors did not predict them. In this instance, on the basis of the risk factors alone, radiation

was absolved of the responsibility of contributing to the obvious illness in the population. The committee was forced into upholding this dubious conclusion by an embarrassing dilemma. Confronted with the leukemia cluster, they were cornered into having to entertain one of two reasonable but politically unacceptable explanations. One, the dosages to the population were greater than modelled, perhaps due to unreported ventings of radiation from the facility. To endorse this conclusion would have called into question Sellafield's operating procedures. Two, the risk factors were in error. This determination would have compromised the credibility of the radiation protection agencies. To launder a potential threat to the credibility of the Cult of Nuclearists, the committee was left with no politically correct alternative other than using the risk factors to "prove" that the leukemia cluster was not caused by radiation exposure.

This issue is far from being just an intellectual game. It has real world repercussions that impact on human health. For instance, when the radioactive plume from Chernobyl was circling the Earth, citizens in the UK and the US received no warning of possible contamination to their food supply. This cavalier attitude was justified on the basis that the assumed accumulated dosages would be too low and that the risk factors applied to these dosages predicted that no threat to health existed. Evidence later surfaced that this presumption was woefully in error. In *Deadly Deceit*, Gould and Goldman provide convincing evidence that Chernobyl fallout was responsible for increased infant mortality in the US and significant increases in the death rate of the very old and those suffering from infectious diseases whose immune systems had been previously compromised. As will be revealed in Exhibit F, indisputable evidence also exists of an increased incidence of childhood leukemia in the US and the UK from the Chernobyl fallout which has been deemed by officials to have produced dosages too low to warrant concern.

The devastation of depleted uranium on the health of veterans and enemy noncombatants is destined to expose the lies buried within the science of radiation effects. All the major defenses of DU weaponry penned to date have been based on the models upheld by the radiation protection agencies. Researchers calculate the amount of energy deposited in tissue by different quantities of internalized uranium. The derived doses are then "proven" to be of no consequence to health, an opinion based ultimately on the data from Hiroshima and the resulting risk factors developed by the radiation protection agencies. This methodology cleverly avoids one essential ingredient: It fails to include actual epidemiological studies of groups exposed to depleted uranium who subsequently developed illnesses. Here again, the risk factors are being used as a smokescreen to draw attention away from any possible connection between radiation exposure and real illnesses suffered by real people. This game is played to convince all inquirers that depleted uranium is harmless. Given the rules of the game, this is the inevitable and logical conclusion. But the rules are about to change.

Once people awaken to the fact that the science of radiation effects has been intentionally corrupted, all conclusions as to the supposed harmlessness of low-level radiation in the environment will have to be reexamined.

"According to estimates of risk published by the radiation protection agencies, dosages to the population were too low to warrant concern!" Tirelessly, this refrain echoes around the world in the wake of every disclosed radiation release. Yes, we are told, mutagens and carcinogens have taken flight upon the winds, but no hazard exists, no one need be concerned. This carney game, played craftily for decades, is now an open book. The purpose of the Hiroshima Life Span Study is to define and delimit radiation effects in man. As this study matures, the data is continually massaged to produce conclusions acceptable to the Cult of Nuclearists. The types of illnesses observed in the Japanese study population and their frequency then become the basis for the risk factors developed by the radiation protection agencies. Studies are then sponsored by that Cult of Nuclearists designed to produce evidence that confirms the accuracy of the risk factors. Any investigators that produce results that call into question the veracity of the risk factors are vilified and marginalized; their work discredited and discounted for being outside the mainstream of "accepted" radiation science. Battle-lines form along any front that attempts to prove that more illness is produced in a population than that predicted by the risk factors. As long as the risk factors are upheld as an accurate depiction of reality, the swindle succeeds. When a new radiation event takes place, the tried and true damage control mechanism is activated. From the smorgasbord of scams rehearsed in this Exhibit, representatives of the Cult of Nuclearists pick and choose those most applicable to the situation. Artfully mixing together any number of the dosage scams, they contrive dosages for the exposed population that appear innocuous. By then applying the risk factors to these dosages, they "prove" that harm to public health was negligible or nonexistent. The hoax is artfully airtight.

A simple test should suffice to prove the truth or falsity of this allegation. ***If*** the Hiroshima Life Span Study is in fact honest, and ***if*** its findings can be applied to instances of internal contamination by radionuclides, and ***if*** the models of radiation effects promulgated by the radiation protection agencies faithfully mirror reality, ***then*** the risk factors should accurately forecast, within the limits of acceptable statistical error, the incidence of cancer in contaminated populations. If this is the case, no significant discrepancy should arise between the number of cancers predicted by the ICRP models and the actual number uncovered by epidemiological investigation. However, if the risk factors are shown to be inaccurate, what then? What if greater numbers of casualties are produced then those calculated by the accepted models of the radiation protection community? If evidence exists to this effect, then the whole house of cards of the Cult of Nuclearists comes tumbling down. It will prove that the risk factors, rather than being a tool in the service of

truth, are being used as an instrument of deception.

EXHIBIT F

The Cult of Nuclearists stands accused of perpetrating a fraud against the entire human race. Were the prosecution to rest its case at this point, the evidence presented in Exhibits A through E easily might be dismissed as toothless, theoretical arguments. Thus, before concluding, indisputable proof needs to be submitted to substantiate the charge that in many cases the risk factors for radiation induced disease are in error and the science of radiation effects has been intentionally corrupted. The information to be presented here will bear witness that the radiation protection community has allowed some monumental flaw to persist in current approaches to radiation safety, either through perpetuating defective models or a basic misunderstanding of radiation effects, ineffectual oversight as to the true extent of population exposure, insufficient epidemiological investigation or intentional malfeasance. When it is proven that levels of radiation in the environment deemed "permissible" are ruining human health, the science of radiation protection as currently practiced will stand exposed as counterfeit and duplicitous. This single crime has sired millions more, for it has given license to government and industry to deploy weapon systems and technologies that contaminate the Earth, invisibly sickening and killing untold numbers of unsuspecting victims.

According to the ECRR, there exists unequivocal evidence within the public domain that proves that the ICRP model of radiation effects is plagued by fundamental errors with regards to low levels of internal contamination. These errors lead to an underestimation of health detriment in the wake of a radiation release. The clearest example of these deficiencies surfaced after the accident at Chernobyl in 1986. As the clouds of fallout wafted around the planet, most governments broadcast reassurances to their anxious citizens that there was no cause for concern, that expected doses would be too low, *based on current standards of radiation protection*, to be medically significant. In most locales throughout the world, caution was not advised and people were informed that it was perfectly safe to continue to consume fresh meat and produce, dairy products, and unfiltered water from surface sources. This lackadaisical approach to radiation safety allowed the unnecessary internal contamination of unsuspecting bystanders and produced elevated rates of illness in many populations. What came to light in years subsequent to the accident was that children who received exposure to Chernobyl fallout, *while still in the wombs of their mothers*, experienced an elevated risk of developing leukemia by the time of their first birthday. In countries where unimpeachable data was collected for levels of fallout deposited in the environment, doses to the population, and the incidence of childhood leukemia, an unmistakable, uniform trend emerged: the cohort of children born during the 18-month period follow-

ing the accident suffered increased rates of leukemia in their first year of life compared to children born prior to the accident or to those born subsequent to the accident after the level of possible maternal contamination had sufficiently diminished. This was confirmed in five studies conducted independently of one another: in Scotland (Gibson *et al.*), Greece (Petridou *et al.*), the United States (Mangano), Germany (Michaelis *et al.*), and Wales (Busby and Cato). In calculations prepared by the ECRR, the probability that it was a chance occurrence that increased incidences of leukemia appeared in five different countries during the period of heaviest fallout from Chernobyl was less than 0.0000000001 (one in 10 billion). Low levels of internal exposure from Chernobyl was the indisputable cause of the childhood leukemia clusters.

In the UK, the National Radiological Protection Board measured and assessed the doses received by the populations of Wales and Scotland. Through environmental monitoring, they compiled data on the levels of Chernobyl fallout in the air, on the ground, and in food, milk, and water. Based on this information, they estimated the average level of exposure for members of the population. Plugging these dosages into their models of radiation effects, they calculated that no measurable harm was expected in the UK from the fallout of Chernobyl. To confirm or refute this assessment, Dr. Chris Busby and Molly Scott Cato undertook an investigation of the accuracy of the risk estimates of the NRPB as they applied to infant leukemia. Drawing upon the post-Chernobyl data collected by the NRPB and applying to it risk estimates for radiation-induced infant leukemia based on ICRP models previously published by the NRPB, they compared the expected number of cases of infant leukemia to the known incidence of childhood leukemia in one-year-olds born in the 18 months after the accident. This investigation was published under the title of "Increases in Leukemia in Infants in Wales and Scotland Following Chernobyl: Evidence for Errors in Statutory Risk Estimates." What Busby and Scott Cato discovered humiliated the pronouncements of the NRPB. The incidence of infant leukemia in the combined cohorts of Wales and Scotland exceeded that predicted by 3.8 times. According to the authors, *"Applying ICRP's risk factors to known levels of contamination from Chernobyl reveals 100 times less infant leukemia than actually found"* [emphasis added]. (As this cohort ages, further incidences of leukemia may prove that the accepted risk factors are even further off the mark.) The authors examined an alternative explanation, that the leukemias did not result from fetal exposure in the womb but from preconception exposure to radiation by the fathers. Under this scenario, the accepted risk factors were in error by approximately 2000 times. Simply stated, the NRPB models were proven to be in error. They substantially underestimated the hazard of the low levels of Chernobyl fallout on the health of developing children *in utero*. As stated by the ECRR:

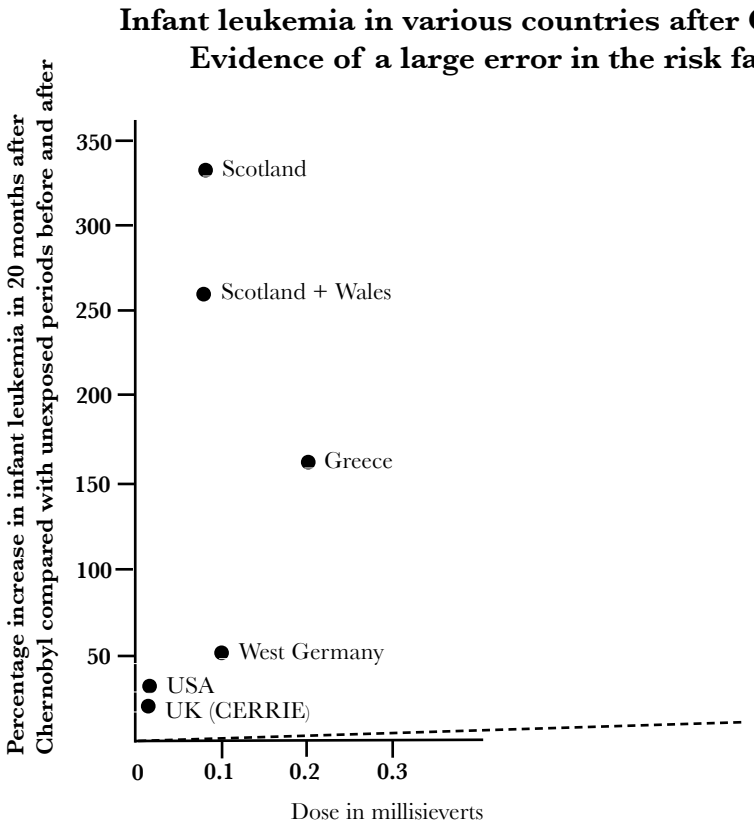
> The committee accepts that the infant leukemia results represent

> unequivocal evidence that the ICRP risk model is in error by a factor of between 100-fold and 2000-fold for the type of exposure and dose, the latter figure allowing for a continued excess risk in the cohort being studied. The committee notes that it will be necessary to follow the cohort as it ages.

Richard Bramhall of the Low Level Radiation Campaign analyzed the data on infant leukemia in Wales and Scotland after Chernobyl presented in the paper written by Busby and Scott Cato (Bramhall 2001). He made the following observation which further condemns the accepted models for radiation-induced childhood leukemia:

> In the case of infant leukemia, doses from Chernobyl should have produced far less than one additional case in the populations of Wales and Scotland. (To spare you the mental anguish of trying to imagine a fraction of a case of leukemia, I can tell you that all this means is that you'd have to investigate the cancer registrations for a population more than 50 times as big in order to expect even a single baby with leukemia caused by the radiation.)
>
> But Busby and Scott Cato looked at the figures and found that the rate had jumped quite sharply — 14 babies were diagnosed in the two years following Chernobyl. The average in a two-year period before it was 4.2, so finding 14 meant there were 9 or 10 extra cases.
> We don't know exactly how the radioactivity made these babies ill.
> Was it because it crossed their mothers' placentas?
> Or because it affected them after they were born?
> Or because the dose to their fathers' balls had mutated the sperm before they were even conceived?
> There are different risk factors for these different types of exposure routes.
> After doing some simple arithmetic with the figures in Busby and Scott Cato's paper we can display the implied errors like this:
>
> If the damage was done by the placenta-crossing dose, NRPB's prediction was about 72 times too small;
> if it was the postnatal effect, the prediction was 132 times too small;
> and if it was the preconception dose to the fathers' testes, NRPB was out by a whacking 2,390.

The Low Level Radiation Campaign (LLRC 2005) published this graph to visually



depict the disparity between the established risk factors for infant leukemia and the actual incidence of the disease from the five separate studies of the post-Chernobyl environment. The vertical axis of the graph represents the percentage of increase in cases of infant leukemia in the 20 months following the accident compared to the period before April 26, 1986 and the period after January 1988. The horizontal axis represents the doses, in millisieverts, received by the exposed population. It is important to note that these doses were derived from environmental monitoring of cesium fallout. Cesium, which emits highly penetrating gamma rays, is relatively easy to detect and its deposition over wide areas can thus be easily mapped. Monitoring this radionuclide provided investigators with a streamline method for estimating dosages to the exposed populations. According to the LLRC, however, this methodology may actually be flawed when determining the health effects produced from other radionuclides in the environment:

> But the very fact that it [cesium] is so penetrating means that its energy

> deposition (in the form of ionizations) is spatially well distributed in tissue, so its health effects are likely to conform with the external irradiation models. It is, moreover, soluble and does not form particles. The Chernobyl reactor fire produced other isotopes (including strontium-90) as well as microscopic particles of reactor fuel which traveled across Europe and beyond, exposing everyone in the path of the cloud to inhalation and ingestion. There is no reason why the health effects should conform with expectations based on cesium deposition.

The LLRC emphasizes that the doses, as shown in the graph, between 0.02 and 0.2 millisieverts represent levels below annual exposure to natural background radiation. The implication is that "dose" at this low level might not mean anything at all and that health detriment is produced by extremely low levels of internal contamination by radionuclides. Further, the infant leukemia data suggests that, far from being innocuous, natural background radiation may be the causative agent for some small fraction of human cancers. In the graph, the dotted line just above the horizontal axis represents the expected increase in infant leukemia according to currently accepted ICRP models *based on exposure to external radiation*. As the LLRC notes:

> [The dotted line] slopes up towards a point representing a 40% increase at a dose of 10 millisieverts. (This is five times natural background, and the graph would have to be almost a meter wide to show it). The origin of this yardstick is cancer deaths in children after their mothers had been X-rayed during their pregnancy.

The findings from Chernobyl flatly disprove the validity of this model. Doses much smaller than 10 millisieverts produced much greater increases in infant leukemia than were expected based on the yardstick mentioned in the quotation. Babies in Greece received a dose of only 0.2 millisieverts, and yet a 160% jump in the number of cases of infant leukemia was demonstrated there. Similarly, babies in Germany receiving a dose of 0.071 millisieverts showed an increased incidence of 48%. In Wales and Scotland, the doses were 0.08 millisieverts and the incidence of infant leukemia jumped over 200%.

Richard Bramhall has commented on the infant leukemia studies and compared the doses received from Chernobyl to those received by the residents of Seascale living near the Sellafield nuclear-fuel reprocessing facility. If the lower doses from Chernobyl produced elevated rates of infant leukemia, then this is indisputable evidence that the higher doses to the population from Sellafield pollution could have produced the cluster of infant leukemia in the vicinity of Seascale. Further, when the actual number of cases of infant leukemia is compared to that predicted by the currently accepted risk factors, the glaring inaccuracies

of current models come sharply into focus. According to Bramhall:

> In the parts of the UK mainly affected by Chernobyl fallout, the dose was about 80 microSieverts (i.e. 1250 times smaller than at Seascale); two separate studies showed [for infant leukemia] a 3-fold excess (Scottish infants) and a 3.6 excess (Scottish and Welsh infants combined). The implicit error in conventional risk factors is roughly 720-fold. In Germany there was a 1.6-fold excess and dose was 71 microSv (1400 times smaller than at Seascale). Implied error 450-fold. In Greece, there was a 2.6-fold excess and dose was 280 microSv (350 times smaller than Seascale). Implied error 300-fold. In UK data obtained by CERRIE, there was a 1.4-fold excess and the dose was 40 microSv (2500 times smaller than Seascale). We believe that these findings stack up to undermine ICRP's credibility.

Earlier in this chapter, it was mentioned that representatives of the Cult of Nuclearists vehemently deny that nuclear pollution from the Sellafield reprocessing facility is responsible for the cluster of childhood leukemia found in the nearby community of Seascale. Leukemia in the 0-14 year-old age group in Seascale shows a 12-fold excess compared with the rate of the disease for the UK as a whole. According to COMARE, on the basis of current models, the doses to the population were 300 times too small to be responsible for the observed incidence of leukemia. But look what the post-Chernobyl data has to say about this. It confirms that current models are incorrect to approximately this margin of error.

The infant leukemia produced by Chernobyl confirms that radioactive pollutants are the likely cause of childhood leukemia reported in the vicinity of Sellafield and of the other main sources of radioisotope pollution in Europe. Gardner *et al.* have confirmed a 10-fold increase in childhood leukemia near Sellafield. In proximity to the Dounreay reprocessing plant in Scotland, an eight-fold excess has been observed (Heasman *et al.*). A 15-fold excess in childhood leukemia has been reported near La Hague in France (Viel *et al.*). Near the nuclear facility of Harwell in Oxfordshire and the Atomic Weapons Establishment at Aldermaston in Berkshire, a two-fold excess in childhood leukemias were discovered. (Busby and Scott Cato 1997)

Rather than admit that the risk factors of the ICRP model are in error, representatives of the nuclear establishment in Europe have entrenched themselves in the position that the research is in error and that the infant leukemia clusters are a fabrication. How do they defend this position? They say that the "doses" in the vicinity of the studied nuclear facilities are simply too low to be responsible, based on the "accepted" risk models of the ICRP.

> All the analyses of causality in the case of nuclear site clusters rely exclusively on the ICRP risk model to show that the calculated doses to the children or their parents were insufficient to have been the cause of the disease since the linear ICRP model did not predict the leukemias or cancers. (ECRR)

According to the analysis of the ECRR, the numerous studies of childhood leukemia clusters in many parts of Europe confirm errors in the risk estimates of the ICRP models. When the doses to the population living in proximity to these installations are plugged into the model, wide discrepancies emerge between the expected number of cases of childhood leukemia and those actually observed. A 100 to 300-fold error in the risk estimates are evidenced by the leukemia clusters around Sellafield. A 100 to 1,000-fold error is observed from the clusters around Dounreay in the UK and La Hague in France. And a 200 to 1,000-fold error is apparent from studies of Aldermaston/Burghfield, Hinkley Point, Harwell and Chepstow in the UK, Kruemmel and Julich in Germany, and Barsebaeck in Sweden. From the 11 studies which it cites, the ECRR calculates that the probability that the excess leukemia is due to coincidence rather than being directly related to radioisotope pollution is less than 0.000000000001 (1 in one million million.)

> The confirmation of cancer and leukemia clusters in children living near nuclear sites has put considerable pressure on the scientific models of the ICRP and led to a dissonance between the model and observation that cannot be accommodated within a scientific paradigm (ECRR).

In 2007, the *European Journal of Cancer Care* published an article which further strengthened the conclusions reached by the ECRR. In "Meta-Analysis of Standardized Incidence and Mortality Rates of Childhood Leukemia in Proximity to Nuclear Facilities", Baker and Hoel confirmed that rates of leukemia in children are elevated near nuclear installations. Reviewing seventeen studies which covered 136 nuclear sites in the UK, Canada, France, the USA, Germany, Japan and Spain, the authors found that, depending on the distance of the child's home to the nuclear facility, the death rates from leukemia for children up to the age of nine were elevated between five and twenty-four percent. For children and adults aged zero to twenty-five, increased death rates ranged between two to eighteen percent. Regarding the incidence of leukemia, rates were elevated between fourteen and twenty-one percent in children zero to nine years old. When the age group zero to twenty-five was considered, the incidence rate of leukemia was elevated between seven and ten percent. Exercising caution, the authors couched there conclusions with this observation: "The meta-analysis was able to show an increase in childhood Leukemias near

nuclear facilities, but does not support a hypothesis to explain the excess." Relevant to the thesis of this chapter was the observation by Baker and Hoel that the **dose-response** studies they reviewed did not show excess rates of leukemia near nuclear facilities. **In other words, the current dose-response model fails to accurately depict reality.**

The significance of the infant leukemia clusters in the wake of the Chernobyl accident must not be lost on the reader. Radiation was delivered to developing fetuses through their mothers breathing and eating radionuclides that were released thousands of miles away. Levels of radiation in the environment where these women lived, declared by the radiation protection community as being below regulatory concern, adversely affected the development of their babies. This evidence definitively demonstrates that, at least for infant leukemia, the ICRP model is wrong. This model, based on instances of acute, high-dose exposure to external radiation fails to adequately account for illness induced by chronic low-dose exposure from decaying radioisotopes lodged within the human body's interior. The fact that the frequency of childhood leukemia occurred at a rate greater than predicted by the risk estimates derived from the ICRP model signifies that populations are incurring more illness from low-level radiation in the environment than the radiation protection community wants us to believe. An important corollary of this conclusion must never be forgotten. In the aftermath of many radiation releases, good epidemiological evidence is not always available. Consequently, the radiation protection agencies assess the impact to public health by turning to their models and allowing their models to inform the public of the cost they are paying in eroded health and death. When these models are flawed, they serve to cover up the true incidence of radiation-induced illnesses foisted on the population. Corrupted science becomes an accessory to murder. This is the fraud for which a guilty verdict is being sought against the Cult of Nuclearists.

The post-Chernobyl infant leukemia cohorts provide evidence that developing fetuses incur genetic damage from low-level radiation from internal emitters absorbed by their mothers. Although not proven, this evidence suggests that other types of genetic illnesses may likewise be traced to exposure in the womb to levels of internal emitters currently deemed inconsequential. In support of this hypothesis, Busby and Scott Cato cite evidence of other *in utero* effects in the immediate aftermath of Chernobyl. Data obtained from the UK Office of Population Census and Surveys provides evidence of babies with a very low birth weight — less than 1,500 grams (approximately 3.3 pounds) — born in Wales just after the accident. These births peaked between January 1987 and January 1988. (The Chernobyl accident occurred on April 26, 1986.) This evidence gives further credence to studies that demonstrated increased levels of infant mortality following exposure to fallout during the period of atmospheric weapon testing. In the light of these findings, it is essential to recall that, according to ICRP *models*, the radiation released into the environment by

humans has not been responsible for producing any fetal deaths, stillbirths, or death to infants. As the ECRR notes:

> The ICRP only considers heritable effects which are measurable in phenotype after birth e.g. congenital defects and perhaps increases in clinically diagnosed heritable genetic diseases. Thus fetal death and infant mortality are not addressed as radiation exposure outcomes by ICRP.

In addition to the research conducted on infant leukemia induced by Chernobyl fallout, the ECRR has identified a second body of research that unequivocally confirms that major shortcomings exist in the ICRP model of radiation effects. Again as a result of radiation vented from Chernobyl, data has been collected that proves elevated rates of minisatellite DNA mutations among exposed groups. Minisatellites are identical short segments of DNA that repeat over and over again in a long array along a chromosome. These stretches of DNA do not code for the formation of any protein. What distinguishes these minisatellites is that they acquire spontaneous repeats through mutation at a known rate, which is 1,000 times higher than normal protein-coding genes. Dr. Yuri Dubrova, currently at the University of Leicester, first realized that these stretches of DNA could be used to detect radiation-induced genetic mutations by showing that their known rate of mutation had increased subsequent to exposure. By this technique, only small population samples would be required to detect a trend in the rate of radiation-induced mutations. The accuracy of this methodology was first confirmed by Dr. Dubrova in mice. He then set out to investigate radiation-induced mutation in the human germ line — sperm and egg cells — among groups receiving exposure to Chernobyl fallout. That such mutation occurred in fruit flies and mice which was then passed on to their offspring had been known since the 1920s. That the same phenomenon occurred in humans had yet to be proven. Human germ line DNA is well protected against acquiring mutations. Most damage is immediately repaired. Irreparable damage frequently initiates cell death so that mutations are prevented from being passed on to the next generation. As a consequence, germ line mutations are rarely detected. The children of the atomic bomb survivors in Hiroshima and Nagasaki provided no evidence of any significant difference in mutation rates when compared to control groups.

Dr. Dubrova and his colleagues studied the rate of minisatellite mutations in families that had lived in the heavily polluted rural areas of the Mogilev district of Belarus after the Chernobyl meltdown. They found the frequency of mutations being passed on by males to their descendants was nearly twice as high in the exposed families compared to the control group families. Among those exposed, the mutation rate was significantly greater

in families with a higher parental dose. This finding was consistent with the hypothesis that radiation had induced the germ line mutations. It was the first conclusive proof that radiation produced inheritable germ line mutations in humans. The significance of this line of research was further confirmed by research in Belarus on the germ line mutations induced by Chernobyl fallout in barn swallows. (Ellegren *et al.*) Minisatellite mutations were observed and were accompanied by observable phenotypic alterations in plumage patterns as well as reduced rates of survival.

In 2002, Dr. Dubrova published further research in the journal *Science* concerning genetic mutation in populations exposed to fallout from atmospheric weapon testing. Between 1949 and 1956, the Soviet Union had detonated a series of aboveground atomic tests at the Semipalatinsk nuclear facility in Kazakhstan. The local population suffered significant radiation exposure throughout this period. The team led by Dr. Dubrova analyzed blood samples from three generations of about 40 families dwelling in the rural district of Beskaragai. They discovered a nearly 80-percent increase in the mutation rate in individuals directly exposed to the fallout in comparison with a suitable non-irradiated control population. The children of affected individuals evidenced a 50-percent increase in minisatellite mutations when compared to the children of non-irradiated parents. After the 1950s, when the practice of atmospheric weapon testing came to an end, the rates of mutation steadily declined.

Minisatellite DNA testing has also been performed on the children of Chernobyl "liquidators" i.e., those people who participated in post-accident cleanup operations. When the offspring of liquidators born after the accident were compared to their siblings born prior to the accident, a sevenfold increase in genetic damage was observed (Weinberg). As reported by the ECRR, "for the loci measured, this finding defined an error of between 700-fold and 2,000-fold in the ICRP model for heritable genetic damage." The ECRR made this further observation:

> It is remarkable that studies of the children of those exposed to external radiation at Hiroshima show little or no such effect, suggesting a fundamental difference in mechanism between the exposures [Satoh and Kodaira 1996.] The most likely difference is that it was the internal exposure to the Chernobyl liquidators that caused the effects.

This new body of data on minisatellite mutations provides unequivocal evidence that **radiation in the environment can induce alterations in the germ cells of human beings that can then be transmitted to offspring.** Due to current limitations in research techniques, the analysis of changes in the mutation rate of other parts of

the human genome has not yet been performed. The big question that remains to be answered is how frequently transmittable mutations occur in protein-coding segments of DNA and how often heritable diseases result from these mutations. Here, a whole new field of inquiry lies waiting to be explored. We must remove the blinders to our vision produced by the corrupted Hiroshima study. What has been considered in the past as hereditary disease might in fact be radiation damage to the germ cells of the parents, producing an array of chronic diseases in the next generation. At this point in history, we have no idea what portion of the inheritable diseases suffered by our progeny is being created by the radiation we have scattered throughout the biosphere. The CERRIE Minority Report offers this cautionary note:

> The question before the Committee is not whether such changes occur [minisatellite mutations] but whether they are associated with significant health detriment. In our view, repeat sequence mutations of various types have been associated with recognizable effects in humans, including neurological disorders, mental retardation, malformations, spontaneous abortion, epilepsy, diabetes, and cancers.

Observed health effects after Chernobyl have provided further evidence that the ICRP models are in error. For instance, research conducted in Sweden confirmed a 30% increase in the incidence of cancer between 1988 and 1996 as a result of the fallout from Chernobyl (Tondel *et al.*). In this study, dosages to the population were estimated on the basis of the deposition of cesium-137 in 450 parishes in northern Sweden and cancer rates were recorded for the 1,143,182 residents of the area. The 22,409 cases of cancer that were diagnosed during the nine-year study period presented an excess of 849 cases compared to what was predicted by ICRP models. According to analysis conducted by the Low Level Radiation Campaign, these excess cancers are 125 times the incidence predicted by the ICRP on the basis of the cesium doses. Due to the fact that this study was concluded nine years after the accident, LLRC warns that, due to the long latency period prior to the onset of cancer, future diagnoses are likely to demonstrate even greater error in ICRP models. If the observed effect up to 1996 is representative of the distribution of increased cancer risk throughout the lifetime of the study population, cancer incidence may prove to be more than 600 times that predicted by the ICRP. The LLRC has offered a further interesting observation about the Tondel study:

> The dose response trend calculated by Tondel on the basis of the various levels of cesium deposition is biphasic, not linear. In other words it does not conform with the ICRP dogma that dose and effect are always strictly proportional or "linear." The Tondel study does not show twice as much dose causing twice as much cancer.

> The doses given by Tondel *et al.* are calculated from cesium fallout. This may mean nothing since cesium is a gamma emitter which means that its energy deposition (in the form of ionizations) is spatially well distributed in tissue. It is, moreover, soluble and does not form particles. Its health effects are therefore likely to conform with the external irradiation models. However, it is well known that north Sweden received a large amount of fallout in the form of uranium fuel particles. With diameters of less than a few millionths of a meter such particles are highly mobile in the environment and they can be inhaled or swallowed. Once embedded in body tissue they deliver their energy so locally that the few cells immediately next to them are irradiated at very high energies while the rest of the body gets no dose at all. This makes nonsense of the concept of "average dose" – another establishment dogma (Bramhall, November 2004).

Under normal circumstances, thyroid cancer is a rare occurrence. After the core of the Chernobyl reactor became scattered to the winds, however, an epidemic of thyroid cancer among children and teenagers broke out in the most affected Soviet territories. For example, Stsjazhko *et al.* reported in 1995 on the officially validated rate of thyroid cancer in Belarus in the under-15 age group before and after the accident (2.8 million children fell within this group out of a total population of 9.9 million.) In the years 1981 to 1985, approximately 3 cases of thyroid cancer existed per million children. In the years 1986 to 1990, the number of thyroid cancers had increased to 47 per million — 17 times the pre-accident level. Between 1991 to 1994, 286 cases per million were validated — 102 times greater than before the accident.

This epidemic was beyond the purview of the ICRP risk models. Ignoring the tragedy of the Marshall Islanders, the prevailing view of the cancer-causing potential of internalized iodine-131 was given clear expression in UNSCEAR 1988. The authors stated that their literature review provided "little proof that iodine-131 is carcinogenic in humans and support[ed] the notion that the carcinogenic potential of I-131 beta particles might be as low as four times less than external x-rays or gamma rays." Here in a nutshell is expression of the corrupted paradigm of radiation effects: external radiation is more hazardous than internal contamination and the risk to health is extremely diminished if the exposure is chronic rather than acute. According to the ECRR, these two errors were demolished by the high rate of thyroid cancer after Chernobyl. First, internal contamination, not external irradiation, caused the runaway epidemic. Second, chronic low-dose exposure from radionuclides in the environment was the method of delivery. Further, Chernobyl refuted the prevalent idea that a latency period of 10 years or more was required between thyroid exposure and the onset of clinical symptoms. After the Chernobyl explo-

sion, increases in the rate of thyroid cancer became observable within a few years.

To fit the skyrocketing incidence of thyroid cancer to their incorrect models, the radiation protection agencies attempted to massage their data:

> The risk agency community, having had to swallow the facts of the increase, promptly responded by adjusting the doses to as high a level as possible to try and fit the data to the model. The idea was to assume that the children who were affected had been iodine-deficient and therefore their thyroid glands would take up more iodine. This was unsuccessful since doses large enough to fit the cancer data would be so high that the children would have died of radiation sickness (ECRR).

In his book *Wings of Death*, Chris Busby provides an excellent example of the type of shenanigans that can infiltrate the field of radiation protection. It is mentioned here because it bears on the accepted risk factor for thyroid cancer and the reason for the inaccurate predictions made for this endpoint in the wake of Chernobyl. Both BEIR V and UNSCEAR 1988 cite a study by Lars-Erik Holm and colleagues on iodine-131 induced thyroid cancer. (The UNSCEAR document referred to the study as "important evidence." Lost to many in the fine print was the fact that Holm was one of the authors of UNSCEAR 1988.) The development of the accepted risk factor for thyroid cancer relied heavily on this study. Holm *et al.* conducted research on a population of 35,000 patients, who between 1951 and 1969 had undergone diagnostic procedures that involved injections of iodine-131. In determining the incidence of radioiodine induced thyroid cancer, the authors made a scientifically questionable procedural decision. They discarded from consideration all cases of thyroid cancer that had been diagnosed within five years of the I-131 injections. They justified this extraordinary step on the basis of the Hiroshima Life Span Study, that claimed that a considerable time elapsed between exposure and the clinical expression of thyroid cancer. Assuming the truth of this observation to be applicable to all avenues of exposure, the authors concluded that cancers diagnosed within five years of exposure could not be reliably attributed to the radioiodine injections. They proceeded on the unwarranted premise that these cancers were present prior to the injections but had gone undiagnosed. From a study of the control population, the authors calculated that in a population of 35,000 the expected number of thyroid cancers would be 39.4. After discarding the questionable cancers appearing within five years of injection, 50 cancers were recorded in the study group. This number was not statistically significant when compared to the control population, and the conclusion the authors arrived at was that the internalized iodine-131 had no effect on the incidence of thyroid cancer. How many cases of thyroid cancer

did they need to throw out to reach this conclusion? As Busby reports: "Careful analysis of the paper reveals that 156 extra cancers developed in the group in the first five years but that these were discarded. The true result should have been 156 + 50 = 206 cancers, or five times the control group incidence (Gofman 1990)" (Busby 1995).

By this time, the reader needs little coaching to discern the scam being enacted, perhaps unwittingly, by scientists enmeshed in the bastardized system of radiation effects. Holm and colleagues ground key ideas of their research on the corrupted Hiroshima data of acute, external irradiation that purportedly "proved" that thyroid cancer requires a long latency period. They then imported this "fact" into a study of internal contamination by iodine-131 and used it to justify throwing out 156 cancers from their study group. This permitted them to reach the conclusion that internalized radioiodine does not contribute to excess thyroid cancers. At this point, the radiation protection agencies step in and use this "important evidence" to establish risk factors for iodine-131. In the event of a radiation accident that vents radioiodine into the environment, the radiation protection agencies can refer to what by this time has gained the stature of a canon, in order to bamboozle the population into believing that the public health impact will be much less severe than what actually transpires. In the event that anyone questions the accuracy of these authoritative assessments, they will be referred to the mind-numbing Gordian Knot of indecipherable journal articles, cryptic mathematical models, and unconquerable decrees of the ICRP: the *modus operandi* of a near-perfect crime. One can only marvel at the sophistication of this debauched edifice, which masterfully conceals mass casualties and death delivered to the people of the Earth by the Cult of Nuclearists.

The severity of the Chernobyl accident caused this corruption to be unveiled. Using data from Belarus that was reported in UNSCEAR 2000, the ECRR calculated that the error in the risk factors of the ICRP for thyroid cancer was about six-fold or more. In confirmation of this conclusion, *Wings of Death* contains the following observation:

> It is clear, nevertheless, that a major error exists in the accepted risk for thyroid cancer. There are already 450 cancers in the first 10 years for the under-14 age group alone in the areas into which the evacuees [from Belarus] were moved. Only 100 excess thyroid cancers were predicted for all age groups combined in this population for the next 50 years. Thyroid cancer has also increased in adults. In 1993 there were 2,039 registered cases in Belarus (population 10.5 million) and more than 3,000 in the Ukraine (population 53 million) (BMJ, 1993). At minimum the error defined by this is already several hundred per cent; at maximum it is truly enormous, since only 10 years have passed out of the 40 years covered by the prediction. The trend is

> upward: this error will grow. These predictions were made on the basis of the existing risk factors, so their inaccuracy, already apparent and no doubt to become more obvious over the coming years, indicates that the risk-factor calculations for thyroid cancer, like those for leukemia, are unreliable. Chernobyl represents the most important recent test of these risk factors; it has proved that they are in urgent need of revision (Busby 1995).

Before proceeding, it is worthwhile to digress for a moment to explain how inaccurate risk factors for internal contamination have been able to endure. The radiation protection agencies are responsible for perpetuating a number of dogmatic ideas concerning radiation effects in man. Students of the radiation sciences are indoctrinated with these ideas and have no reason to question them. These ideas have a powerful influence on the thinking of researchers and have caused otherwise sincere and scrupulous scientists to reject data that is out of sync with so-called "conventional wisdom." By this means, the knowledge base of radiation effects is severely constrained. The authors of the CERRIE Minority Report have identified a number of the presumptions that have held sway over radiation epidemiology and prejudiced the outcome of so-called "definitive" studies of the effect of radiation on human health. These include the following:

1. In response to expectations inherent in the ICRP's models and risk factors, a large range of epidemiological studies of internal radiation have been dismissed. Rejection of this data is justified on the grounds that it is not in harmony with what is presumed to be unassailable scientific fact.

2. Radiation effects in populations are assessed through the prism of the Linear No-Threshold Hypothesis. Those who receive the highest dosages are presumed to be the ones that will manifest the greatest effects. If evidence is gathered that shows that the greatest effects are suffered by those with less than the highest dosages, this evidence is considered suspect and frequently rejected. The hidden assumption in this is that **ALL** endpoints of radiation-induced damage is linearly related to dosage. This certainly may not be the case with certain endpoints created by internal contamination. For instance, in the case of infant leukemia after Chernobyl, populations receiving the highest dosages may not have exhibited the highest incidence of infant leukemia because of an increase in spontaneous abortions, fetal deaths or still births.

3. In most incidents of radiation exposure, populations receive a mixture of external irradiation and internal contamination. However, by convention, the dosages of those exposed are almost invariably defined in terms of the dose delivered externally. In this way,

the health effects produced by the internal contaminants are either missed entirely or not adequately studied.

4. Frequently, simplistic assumptions are made about how radioactivity, once liberated, migrates through the environment, which groups receive exposure and the dosages received by those exposed. These "assumptions" color the outcome of epidemiological studies and prejudice the "objective" findings of a study.

5. Only certain disease endpoints are assumed to be radiation-induced, namely cancer, leukemia, and genetic disorders. Other possible endpoints receive no attention. This cocksure assumption has presented a severe obstacle to the investigation of the role played by depleted uranium in the etiology of Gulf War Illness.

Currently, an epidemic of cancers is ravaging the health of people in many parts of the world. In response, a highly contentious debate has arisen over the contribution played by fallout from nuclear weapon tests to this scourge. The Cult of Nuclearists rigidly adheres to the position that fission products, now ubiquitous in the environment, do not contribute significantly to people's yearly doses from natural background radiation and cannot possibly be a health hazard. They base this assessment on their biologically questionable concept of dose, the total amount of energy deposited in the body by radiation. They give scant attention to the reality that the radionuclides from weapons tests, which we all carry within our cells, may decay while in proximity to a cell's genetic material and disrupt that cell's programming for healthy functioning. Under this scenario, the biological effect might be totally unrelated to the total amount of energy absorbed.

In 1993, using models of the ICRP, UNSCEAR published calculations of the average committed effective doses in person Sieverts from fallout to world populations. According to their tabulations, the amount of fallout radiation released on the Earth since 1945 and stretching infinitely into the future due to the decay of long-lived radionuclides, totals 29,800,000 person Sieverts. Applying to this number the ICRP risk factor for fatal cancer of 0.05 per Sievert yields the estimate that fallout from weapon testing will be responsible for ultimately producing 1,500,000 cancer deaths. As mentioned elsewhere, this number is totally dependent on the assumptions and models upheld by the ICRP. Using different models which attribute greater biological effect to internally incorporated radionuclides, the ECRR estimates that 120,000,000 radiation-induced cancers will be diagnosed, with 60,000,000 of these being fatal. In other words, the so-called nuclear superpowers, flaunting their nuclear machismo, have already committed crimes against humanity, and World War III hasn't even started yet. With talk of a new, fourth generation of nuclear weapons, mini-nukes, micro-nukes, nuclear bunker-busters and so forth, the human guinea

pigs of the world must not be lulled into forgetting that these weapons release vast quantities of radionuclides that migrate freely around the globe.

In their review of the literature, the ECRR examined 10 studies of cancer incidence in the wake of fallout from nuclear weapon tests. They assert that evidence exists that global fallout has produced infant mortality and increases in the rate of cancer, leukemia and other diseases of genetic origin. They make a very convincing argument that the cancer epidemic of today can be sourced to the nuclear contamination of the Earth that occurred decades ago. According to the ECRR:

> In reaching this conclusion, the committee has been impressed by the lack of evidence as to the origin of the global cancer epidemic which began in the period 1975-85. Cancer is now widely seen, in the medical community, as a genetic disease expressed at the cellular level, and both early and recent research have supported the idea that the origin of the disease is essentially environmental exposure to a mutagen. If cancer rates began to increase sharply in the period 1975-1985, and since research has shown that the disease is known to lag the exposure by 15-20 years, clearly, the origin of the epidemic must be the introduction of some cancer-producing mutagen into the environment in the period 1955 to 1965. The identification of the mutagen with ionizing radiation from weapons fallout is persuasive. In addition, the variation in cancer incidence rates across regions of high and low rainfall and deposition points to radiation as the main cause of the cancer epidemic.

Nuclear weapon testing vented an enormous quantity of radionuclides into the atmosphere. Since rainfall washes radiation out of the air, the presumption is made that people living in high rainfall areas received greater doses of this radiation than people living in low rainfall areas. To gauge the impact of fallout radiation on health detriment, a number of studies have been conducted comparing the rates of cancer in high and low rainfall areas. As reported by Busby in *Wings of Death*, when cancer rates in Wales (high rainfall) were compared to rates in England (low rainfall), a high correlation was discovered between cumulative strontium-90 exposure of between 0.2 and 1.0 mSv over the period of fallout and the trend in Standardized Incidence Ratios for all malignancies in Wales 20 years later. According to the CERRIE Minority Report, "The error in ICRP implicit in this correlation is 300-fold."

The ECRR relates an interesting story with regard to the search for correlations between atmospheric weapon testing and childhood cancer. During and following the period

of aboveground weapon detonations, a disturbing increase in childhood cancers, notably leukemia and brain cancer, began to be noted. In an attempt to provide an explanation for this trend, the hypothesis was advanced that fallout, perhaps strontium-90, occurring in milk, was responsible. In the UK, the Medical Research Council was asked to make a study of this hypothesis. The council reported, on the advice of the epidemiologist Sir Richard Doll, that according to the data from Hiroshima, fallout could not be the cause of the childhood cancers because the *doses* were too low. In 1994, Doll, with a number of other researchers (Darby *et al.*), published a famous study concerning the relationship between childhood leukemia and fallout in Nordic countries. They discovered a modest increase in the incidence of the disease during the period 1948-58 and 1965-85, from 6.0 cases per 100,000 to 6.5 cases. This increase was deemed insignificant. According to the ECRR, this study is frequently cited as proof that low doses of internal radiation produce no adverse affects on health. Since then, the study has been reexamined and found to be riddled with errors that prejudiced the conclusions. (An extensive discussion can be found in Busby's *Wings of Death*.) The first error was that the rates of childhood leukemia in the five Nordic countries of Denmark, Norway, Sweden, Finland, and Iceland were pooled together despite the fact that, due to different rainfall patterns, doses to the populations would not be uniform. Further, the populations had different eating habits and different genetic make-up. These differences invalidated the methodology of pooling the data. The second error was that no data of childhood leukemia were presented for any time prior to the study period. (A study in the UK by the Medical Research Council, co-authored by Richard Doll, displayed unequivocal evidence of a rise in the rate of childhood leukemia corresponding to the beginning of atmospheric detonations of atomic bombs.) The third error was catastrophic to the study. The leukemia data for the period 1948-58 was drawn exclusively from the Danish Cancer Registry. This was then compared, for the period 1965-85, with the pooled data from the five Nordic countries. No mention is given in the paper that the study population changed halfway through the study! Only by these monumental errors were the authors of the Nordic Leukemia Study able to conclude that the risk factors of the ICRP for childhood leukemia were essentially correct.

The ECRR states that when the pooled data of the five Nordic countries is correctly compared for the period under study, leukemia in children 0-4 years old increased from about 5.0 cases per 100,000 to 6.5 cases. This was an increase of about 30%. Concerning this increase, the ECRR makes the following observation:

> The leukemia incidence increase of 30% in the children exposed over the 5-year period [1958-63] followed a cumulative dose of between the 0.15 mSv bone marrow dose received in utero and the 0.8 mSv received between ages 0 and 4. This suggests an error in the ICRP

> risk factor (of 0.0065 per Sievert, for children) of between three and 15-fold if no further excess leukemia occurred in this cohort and an error of between 40 and 200-fold if this excess risk continued throughout their lives. In this respect it is of interest that a similar proportionate increase of about 30% occurred in the trend in Standardized Incidence Ratio of 'All Cancers' in England and Wales some 20 years after the exposure.

The CERRIE Minority report mentions a study by Bentham and Haynes of childhood leukemia in England and Wales after weapons fallout. The researchers stratified different geographical areas by rainfall exposure and studied the correlation between this exposure and rates of leukemia. A 25 percent excess in the disease was observed in high rainfall areas relative to areas of low rainfall. This observation is in agreement with the revised data of childhood leukemia in Denmark and supports the conclusion that an error of greater than 100-fold exists in the currently accepted risk factors.

Further cracks in the ICRP barricade against truth have surfaced as a result of research conducted on nuclear workers. The ECRR mentions a study conducted by Roman *et al.* of prostate cancer risk in nuclear workers who were monitored for internal contamination. Results suggested an error of up to 1000-fold in the ICRP model for this disease. The CERRIE Minority Report cites a study by Beral *et al.* of prostate cancer in UKAEA workers, which provided evidence that the risk factors for a number of radionuclides including zinc-65 and tritium were in error by at least three orders of magnitude. The Report also mentions in passing a number of other studies of nuclear workers that revealed greater numbers of cancer than those predicted by the ICRP risk factors. These were conducted by Carpenter *et al.*, 1998; Muirhead *et al.*, 1999; Draper *et al.*, 1997; and Omar *et al.*, 1999. Of these studies, the CERRIE Minority makes an interesting observation: "*Many of these effects in nuclear workers have been discounted by the authors on the basis of their failure to conform with a linear dose response relationship*." This is truly startling. Rather than trust the veracity of their data, researchers will discount findings that are in violation of established dogma, never questioning that the dogma itself might be based on faulty premises. In the case of low levels of internal contamination, as this work has attempted to demonstrate, there is no evidentiary basis for the belief that biological effect is linearly related to the quantity of energy deposited in tissue.

When confronted with evidence that radionuclides emitted from nuclear installations do cause leukemias and other cancers, nuclear apologists parry the attack with the observation that those studies which do demonstrate a correlation between radionuclide exposure in the environment and illness involve relatively small population samples and the

frequency of observed illnesses are not statistically significant. In many cases, this is a valid criticism which, for over half a century, has successfully prevented liability being assigned to those who discharge radiation into the environment. However, as research continues to accumulate, this position is becoming increasingly less tenable. Although small studies may produce statistical anomalies that fail to prove a rule, the cumulative power of numerous small studies, all confirming heightened incidence of childhood leukemia and cancer in contaminated areas, has to be respected as evidence that some real effect is being observed.

In Europe, a number of epidemiological studies have been carried out to examine the relationship between nuclear pollution and ill health. In geographical areas where isotopes have been found to accumulate, the local inhabitants have consistently faced greater risks of developing leukemia and cancer than predicted by ICRP models. Coastal communities in Ireland and Wales in proximity to the Irish Sea have been investigated due to the accumulation in that body of water of fallout, discharges from nuclear fuel-reprocessing (Sellafield) and dumping of radioactive waste (Sellafield and nuclear reactor facilities.) Along certain shorelines, radionuclides — most notably plutonium-239, cesium-137 and strontium-90 — have contaminated mudbanks, estuaries, and intertidal sediment (the sediment lying between high tide and low tide marks). Studies have shown that the radioisotopes discharged into the Irish Sea bind preferentially to fine silts. While afloat on the water surface, the action of wind and waves resuspends this fine particulate matter and blows it ashore. Alternatively, radioactive sediment trapped in the intertidal zone during low tide dries and is swept into the air by wind. In either case, the end result is that radionuclides from the sea contaminate inland air where it is available for inhalation by populations living along the coast. This hypothesis is supported by a number of observations. Airborne plutonium was collected in muslin screens set at various distances from the Irish Sea. The highest concentration of plutonium was found in those screens closest to the coast with a rapid falloff occurring within a few kilometers inland and then flattening out further into the interior. Analysis of plutonium in deciduous teeth showed the same gradient. Residents close to the coast bore a higher burden of plutonium contamination in their teeth than their neighbors living slightly further inland. As distance from the coast increased, plutonium concentrations decreased. A study of plutonium concentrations in sheep feces bore witness to the same phenomenon. Another study looked at the concentration of plutonium and cesium-137 in autopsy specimens. Again, a correlation was established between the distance of a person's home from the Irish Sea and the extent of the body burden of contaminants. In this study, it was observed that the highest levels of radionuclides were found in the lymph nodes draining the lung, suggesting that inhalation was the route of exposure. This evidence of differential exposure to radiocontaminants diminishing with distance from the Irish Sea strongly suggests that sea-to-land transfer is the best explanation for the phenomenon. This radioactivity in the environment correlates with observations of a high

incidence of cancers in certain coastal communities. In Ireland, a significant excess of childhood leukemia was discovered in a strip three miles wide along the east coast (Busby *et al.*, 1998). An excess of breast cancer was also observed among Irish women living close to the coast (CERRIE Minority Report.) As noted in the CERRIE Minority Report: "The trends in cancer risk by distance from the sea correlated well with inland penetration by sodium chloride and concentrations of plutonium in air as measured by Harwell [Nuclear Research Establishment] workers in the late 1980s (Eakins and Lally 1986)."

The period of peak emissions from Sellafield, coinciding with the highest level of radioisotope pollution along the coast of Wales, occurred between 1974 and 1989. According to the Green Audit Irish Sea Research Group, the incidence of cancer in Wales for most age groups was significantly higher among people living in population areas centered within a 800-meter wide strip stretching along the coast of the Irish Sea. Compared with the combined population of England and Wales, a 4.6-fold excess of leukemia in 0-4 year olds was discovered in this coastal area (Busby *et al.*, 1998). The risk of contracting cancer was found to fall off as one moved west from the coast, first of all falling sharply, then showing a slight rise inland at the mountains, and then steadily decreasing toward the border with England where rates then became comparable with English rates.

A very dramatic cluster of cancers has been discovered along the Menai Strait between the island of Anglesey and North Wales. Mud banks in this area are known to be heavily contaminated by radionuclides discharged from Sellafield. As reported by the Low Level Radiation Campaign:

> In the seaside town of Caernarfon, leukemia in the 0-4 year-old age group is more than 20 times higher than the UK national average. Brain cancers in the 0-14 age group are 18 times the average. Elevated risks not confined to the town — the 34 wards surrounding the Menai Strait - have:
>
> * an eight-fold excess of leukemia in children younger than 4
> * a five-fold excess of brain and spinal cancer in children younger than 15
> * a 10-fold excess of retinoblastoma in children under 14.
>
> (Retinoblastoma, a rare eye cancer, has been associated with radioactivity since the Seascale cluster of leukemia is accompanied by a 20-fold excess of retinoblastoma in children of Sellafield workers) (LLRC 2004).

These findings are highly relevant to the current discussion. Britain's Committee of

Medical Aspects of Radiation in the Environment (COMARE) investigated the reported childhood leukemia cluster in the environs of Seascale, near the Sellafield reprocessing plant. Repeatedly, they advised that, according to the current knowledge base, *doses* to the surrounding population from Sellafield were too low to be responsible for inducing the observed illnesses. The even more dramatic cluster of childhood cancers along the Menai Strait serves as a powerful indictment of COMARE's objectivity and its assessment of Sellafield's innocence. What it does is offer further confirmation that radioisotopes released from this reprocessing facility are inducing cancer in children. This newest revelation of the relationship between radiation in the environment and cancer screams out, once again, that there is something terribly suspect in what is currently embraced as the "truth" about the risks to health posed by internal exposure.

In Europe, other nuclear facilities besides Sellafield have been found to be inducing illness in their neighbors. Clusters of childhood cancer and leukemia have been discovered in communities near the nuclear reprocessing facility at Dounreay in the far north of Scotland. Research undertaken in 1986 revealed that childhood leukemia within 12.5 km of Dourneay was 600% higher than the average incidence elsewhere in Scotland (Busby, *Wings*). As at Sellafield, COMARE confirmed that this excess was real, but denied that it was the result of nuclear pollution, on the grounds that the currently accepted dose-response models could not account for it. Another cluster of childhood leukemia in the United Kingdom was identified in the region close to the Atomic Weapons Research Establishment at Aldermaston in Berkshire. The excess was observed in children under five years old who lived within 10 km of the facility (Beral 1993). According to the CERRIE Minority Report: "these well-documented effects indicate a potential for the existence of errors in the ICRP risk model of between two and three orders of magnitude."

The Hinkley Point nuclear power plant is located near Burnham-on-Sea in Somerset, UK. The first reactor came online in 1964. That the plant was contaminating the surrounding area was confirmed in subsequent years with the discovery offshore of radionuclides adhering to fine sediments in the Steart Flats mudbank. To discover whether or not this pollution was harming the local population, the Somerset Health Authority in 1988 undertook a study of the incidence of leukemia in parishes within a 15 km radius of the plant. The study confirmed that, during the period 1959-1986, a significant increase occurred in the incidence of leukemia and non-Hodgkins lymphoma among people younger than 25 years of age (Green Audit). The relative risk, driven by a high number of cases occurring in the first five years of the plant's operation, was between 2.0 ad 2.5 times the national average. For the period 1995-1999, breast cancer mortality in Burnham-on-Sea was twice the national average. Evidence that Hinkley Point pollution was responsible for this increase was made obvious by this observation from the researchers who discovered

this increase:

> Our first analysis of the Hinkley Point area was for breast cancer mortality. Results supported the hypotheses: analysis showed that there was a statistically significant excess risk of dying of breast cancer in the aggregate wards within 5 km of the center of the offshore mud banks near Hinkley Point (RR=1.43; p=0.02). The risk fell off with increasing distance from a point source taken to be the center of the mud bank with Relative Risks of 1.43, 1.33, 1.24, 1.16 and 1.13 in wards contained within 5, 10,15,10 and 25 km rings around the point source. The overall risk in the study area was 1.09 (relative to England and Wales rates for the same period). The most significant high risk ward was Burnham North with 8.7 deaths expected, 17 observed (RR=1.95; p=0.02).
>
> We followed this by analyzing risk of dying of prostate cancer (Busby *et al*., 2000b). This also supported the hypothesis. As with the breast cancer, prostate cancer mortality showed a significant trend with distance, falling from 1.4 in the 5 km ring around the center of the offshore mud banks to 1.02 in the 25-30 km ring (Chi square for trend 3.47, p = .05). Again, the downwinders at Burnham-on-Sea suffered a significantly raised cancer mortality risk: for prostate cancer mortality in the two wards, Burnham North and Burnham South combined, the Relative Risk was 1.5 with p = 0.05 (14 expected, 21 observed) (Busby, Dorfman, Rowe).

In the UK, HM Dockyard Plymouth services nuclear submarines. When the decision was made in 2000 to increase capacity, Devonport Management Limited, which operates the facility, applied to the Environment Agency to be allowed to increase its annual emissions of radionuclides. A 700% increase, from 120 GBq to 800 GBq, was proposed for tritium discharges into the Tamar River, which flows past Plymouth. In addition, permission was sought for raising tritium discharges into the atmosphere from 1 to 5 GBq together with a new requirement for releases of 45 GBq of carbon-14 and 15 Gbq of argon-41. This proposal raised concern among local citizens. One question that many people sought an answer to was the health effects, if any, caused by the lower levels previously permitted. In response, the South West Devon Health Authority (SWDHA) issued a report on leukemia in the Plymouth area, based on figures provided by the South West Cancer Intelligence Unit. According to the report, a statistically significant excess in leukemia incidence of 25-30% was present for the period 1995-1997, for both men and women of all age groups. However, the SWDHA report concluded that these increases were not related

to radionuclide discharges from the dockyard. Their reasons, according to *Cancer and Leukemia and Radioactive Pollution from HM Dockyard, Plymouth* was: "(a) the crude death rates from leukemia were not highest in the wards closest to the dockyard, Keyham [on the east side of the Tamar near the dockyard] and Torpoint [on the western side of the Tamar, opposite the dockyard], and (b) radiation exposure from the releases were too small to cause any measurable increases in leukemia (Busby and Avent)." To prove (a) as false and (b) as an invalid assumption based on incorrect risk models of the ICRP, Plymouth's Campaign Against Nuclear Storage and Radiation (CANSAR) and the environmental group Green Audit conducted research on the incidence, *not death rate*, of cancer and leukemia in Keyham and Torpoint. The results of their study confirmed that in the 10-year period 1994-2003, there was an 18-fold excess risk of leukemia in Keyham (seven reported cases where only 0.38 were expected based on national rates) and a 4.7-fold excess in Torpoint (four cases reported where only 0.84 were expected.) To add greater strength to the findings, a proportional incidence analysis was carried out in which the ratios of leukemia to all cancers were determined and compared to the ratio for the country as a whole. Again, an excess incidence of leukemia in the two wards was confirmed. The risk for all cancers combined was also elevated. In Keyham, for all ages, there were 39 cases of cancer reported when the expected number was only 20. In Torpoint, there were 76 reported cases where only 45.8 were expected. These results confirmed the excess leukemia risk in the vicinity of the Plymouth dockyard. Further, they drive another nail into the coffin of inaccurate risk factors that leave leukemia incidence near nuclear installations unexplained.

The finding of an excess incidence of leukemia in areas near nuclear installations is not confined to the UK. A 15-fold excess in the incidence of childhood leukemia has been discovered near Cap de la Hague, France's nuclear fuel reprocessing facility (Viel *et al.*). In this study, it was determined that the two excess risk factors for children were playing on the beach and eating shellfish. In a separate study, childhood leukemia within a 10 kilometer radius of the plant was six times the expected rate (Guizard *et al.*). In northern Germany, a similar discovery was made. In children 0-4 years of age living within five kilometers of the Krummel nuclear power plant, a five-fold relative risk of leukemia was observed. This jump in leukemia incidence appeared five years after the plant began operations in 1983. A significant increase in adult leukemia in proximity to Krummel was also observed. Elevated levels of chromosome aberrations in the blood of local residents further supported the hypothesis that radiation was the causative agent for the leukemia cluster (Ziggel *et al.*, 1997). Environmental monitoring detected the presence of artificial radioactivity in air, rainwater, soil and vegetation, confirming chronic leakages of radioactivity from the facility. Calculations applied to the observed levels of radioactivity in the environment implied that emissions from the plant must have been well above authorized annual limits. In a separate study conducted by Korblein *et al.*, a statistically significant increase in *all* types of

childhood malignancies was discovered in children, ages 0-4, who lived in the areas closest to *all* commercial nuclear power plants in Germany. These findings remained unchanged when statistics for the area around the Krummel plant, with its confirmed leukemia cluster, were excluded.

In 1995, Iwasaki *et al*. published data concerning leukemia and lymphoma mortality between 1973 and 1987 in the vicinity of nuclear power plants in Japan. Their study concluded that mortality from these diseases in the municipalities where the facilities were located was not significantly different from the control areas. The authors reached this conclusion by analyzing Standardized Mortality Ratios for each individual municipality. This created a multitude of small-number comparisons producing results of very low statistical power and guaranteeing that unless large numbers of illness were detected, no statistical significance would ever be derived from the study. The data was reanalyzed by Ziggel *et al.* (1996) by pooling the incidence of leukemia and lymphoma for all municipalities housing reactors and for the control regions. When this was done, it was discovered that in the period 1973-1987, there were 307 observed leukemia deaths in all age groups where only 251 would have been expected based on Japanese national figures. The resulting Standardized Mortality Ratio of 1.22 demonstrated a 20% increase in leukemia in the study areas.

The previous examples come from Europe and Asia, but health and longevity can be compromised just as easily by reactors operating within the United States. Evidence substantiating this was published in the *Archives of Environmental Health* in the article "Elevated Childhood Cancer Incidence Proximate to US Nuclear Power Plants." Mangano *et al.* compiled data on rates of cancer and leukemia in people living within a 30-mile radius of 14 commercial nuclear power plants located in the eastern United States. The 49 counties under investigation were home to approximately one-third of the 50 million Americans who live within 30 miles of a nuclear reactor. The rates of illness in the study area were then compared to rates compiled by the Surveillance, Epidemiology, and End Results Program (SEER) of the National Cancer Institute. SEER data is widely regarded as an accurate proxy for national incidence data. It compiles statistics from established tumor registries in five states and four metropolitan areas, representing about one-tenth of the US population.

In their study, Mangano *et al.* discovered that the incidence of total cancers in children under five years of age during the period 1988 to 1997 was higher near every one of the 14 nuclear plants than the national incidence rate represented by SEER data. The smallest excess in the cancer rate, + 0.7%, was observed near the Salem/Hope Creek nuclear facility in New Jersey. The largest excess, +29.1%, occurred near both the Turkey Point and St. Lucie power plants in Florida. The childhood cancer rate for all 49 counties

combined was 22.51 per 100,000. This was 11.4% greater than the SEER rate.

For the same period, cancer incidence in children between the ages of five and nine exceeded the SEER rate in 13 of the 14 areas under study. Cancer incidence was 12.15 per 100,000 — 12.5% higher than the SEER rate of 10.80. The smallest excess of +2.2% was found near the Millstone reactors in Connecticut. The largest excess, +73.6%, occurred near the St. Lucie reactors in Florida. (For the sake of comparison, the incidence rate near the Crystal River facility in Florida was 6.5% below the SEER rate.)

When the two age groups were combined, the rate of cancer incidence was calculated to be 17.42 per 100,000 children, which is 12.4% above the national rate found by SEER. In 38 of the 49 counties studied, cancer incidence rates in children from birth to nine years old exceeded the rate for the US as a whole. When the incidence of childhood cancer occurring in counties within 30 miles of the reactors under study were compared to the rates for the remaining counties in states where the reactors were located, cancer incidence was once again discovered to be higher. The total excess incidence between the two groups of counties was 5.0%.

Investigating the incidence of childhood leukemia, Mangano *et al.* examined the rate in the 23 counties near five nuclear power plants in Pennsylvania. These regions accounted for slightly more than half the population of the state. Leukemia in these counties exceeded the US rate by 10.8% while the remainder of the state showed an incidence that was 11.5% *below* the US rate. According to the authors: "This finding supports the considerable evidence that, although the risk of all forms of childhood cancer is increased by radiation exposure, the risk may be greatest for leukemia." For all other cancers, no difference was seen in the rate of incidence between the nuclear and non-nuclear counties even though they both exceeded the national rate by 2.6% and 3.2% respectively. The researchers concluded:

> This study found a consistent pattern of increased childhood cancer incidence in all study areas < 30 mi (48 km) from nuclear plants in the eastern United States. Our findings support the biologically plausible concept that susceptibility to carcinogens, such as radioactivity, is greatest in utero and in early childhood. They also support numerous analyses documenting elevated childhood cancer rates near nuclear facilities in the United States and other nations. The finding that cancer incidence for children < 10 yr. is 12.4% greater in the study counties than the US as a whole suggests that emissions from nuclear power plants may be linked with 1 of 9 local cases of childhood cancer. These descriptive epidemiological findings suggest a relationship

> between radioactive nuclides and childhood cancer and should be taken seriously in future research.

People tolerate nuclear power plants in their midst only because of constant reassurances by government and industry that routine emissions of radionuclides are insignificant and "doses" to the population are below regulatory concern. This posturing is intended to imply that the health of citizens is not being eroded by radiation. But what about the high incidence of breast cancer consistently found downwind of nuclear reactors?

"Libel!" thunders the Cult of Nuclearists. "Call in the prosecutor! The National Cancer Institute, in a study completed in 1990, found no heightened rates of cancer among populations living in proximity to nuclear reactors!"

The NCI study being referred to is *Cancer In Populations Living Near Nuclear Facilities*. If ever there was a scam orchestrated to beguile citizens, this was it. Thanks to Jay M. Gould and members of the Radiation and Public Health Project, its fraudulent conclusions were exposed in their book, *The Enemy Within: The High Cost of Living Near Nuclear Reactors*. As revealed in this work, the authors of the NCI research, in a brilliant act of deception, based their entire study on the devious premise that the only people exposed to radioactive emissions from nuclear power plants are the people living within the counties where the facilities are located. Swept under the carpet was the embarrassing little detail that liquid and gaseous effluents pay no attention to county lines, that they are whisked to outlying counties by meteorological and geophysical forces. By defining at-risk counties as those actually hosting the reactor, the NCI authors harvested a second boon for deceit. Most nuclear reactors are located in rural counties with relatively small populations. Consequently, an increased incidence of breast cancer mortality, if one were detected, would represent only a small number of cases, too small to be considered statistically significant. As observed by Gould,

> A change in mortality in any county cannot be considered significant if it can be shown to be the product of chance variation. Most of the 3,000-odd counties in the United States are small rural counties. Any single county would have to register an extremely high above average mortality increase to be judged statistically significant, simply because there would be too few deaths involved.

Thus, guaranteed by the dishonest methodology of examining cancer mortality in individual counties, the foregone conclusion was that no "statistically significant" rise in cancer mortality would ever be found among residents of "nuclear counties." The NCI

study echoed this in its conclusion: "if any excess cancer risk was present in the US counties with nuclear facilities, it was too small to be detected with the methods employed." Case closed! Nuclear reactors do not cause cancer.

The monumental deficiencies of the NCI study and its counterfeit claim that living nearby to nuclear reactors presented no hazard to health were first exposed by Joseph Mangano in his article "Cancer Mortality Near Oak Ridge, Tennessee." (Oak Ridge was one of the secret cities of the Manhattan Project, created during World War II to produce uranium-235 by the process of gaseous diffusion. After the war, it remained a major production facility, helping America to amass its nuclear arsenal.) When the NCI turned its attention to Oak Ridge, it confined its study to examining cancer mortality for the two counties in which the facility was actually located, Anderson and Rowe. Although it identified an increased rate of cancer mortality in these counties when compared to the nation as a whole, the excess cancer deaths did not represent a sufficient number of cases to be statistically significant.

Using a more sensible methodology, Mangano set out to reexamine any possible connection between cancer mortality (from all types of cancer) and the nuclear pollution emitted from Oak Ridge. He compiled NCI statistics of the aggregated age-adjusted cancer mortality rates from 1950-52 to 1987-89 for the 94 contiguous counties within a 100-mile radius of the Oak Ridge facility. Using this approach, he overcame the two shortcomings of the NCI study. His "nuclear counties" were more realistically representative of areas actually contaminated by radionuclides emanating from Oak Ridge, and the study population was large enough for statistical significance to be achieved. (During 1987-89, 20,000 cancer deaths were on record within the area studied.) What Mangano uncovered put the NCI research to shame. During the period under investigation, combined cancer mortality rates in the counties under investigation increased 34 percent as compared to the five percent increase for the United States as a whole. As Gould observes,

> The probability that so great a divergence over a 37-year period could be the result of chance is less than 1 in 10,000 cases. Proximity to the plant must be a factor involved in this epidemiological anomaly. In the absence of a plausible alternative explanation, it is evident that some malevolent force of mortality has been emanating from the Oak Ridge reactors for a long enough time to have a much wider geographic impact than would be shown by merely the two counties chosen by the NCI for study."

Through his new window on the cancer cluster near Oak Ridge, Mangano was also able to observe important environmental trends that had remained invisible in the NCI

study. For instance, he discovered a significantly greater combined cancer mortality risk for counties located downwind of Oak Ridge, to the north and northeast, in comparison with counties upwind of the facility. This was to be expected if the center of the study area, the Oak Ridge reactors, were responsible for the increased mortality rates. He also discovered that residents living in elevated mountain counties faced a greater risk of cancer mortality than people living in lowland counties due to the greater precipitation to which they were exposed. This also was to be expected since radionuclides afloat in the air are brought down to the ground primarily by rain and snow.

Replicating Mangano's methodology, Gould *et al.* studied age-adjusted breast cancer mortality in white females nationwide based upon a county-by-county database published by the NCI. Examining statistics for the 71 counties fully enclosed within a 100-mile radius of Oak Ridge, they calculated a *29* percent increase in aggregated breast cancer mortality during the same study period (1950-54 to 1980-84) compared with the national increase of only *one* percent. Recognizing that nuclear pollution from other distant sites may have contributed to the cancer increase in so large an area, the researchers narrowed their study to 20 contiguous rural counties downwind of Oak Ridge. In this instance, the aggregated breast cancer mortality rates showed a gain of *38* percent. In comparison, eight counties upwind of Oak Ridge during the same period had a four percent *decline* in breast cancer mortality.

The Enemy Within recounts the complete study performed by Gould *et al.* who investigated 60 reactor sites throughout the United States and calculated the age-adjusted breast cancer mortality rates within areas of 50- and 100-mile radii from these installations. What they uncovered was that, throughout the nation, counties within these designated areas had significantly higher rates of breast cancer mortality than either aggregates of counties further from reactor installations or for the nation as a whole. (The 50-mile radius was set for the study because the Nuclear Regulatory Commission uses a 50-mile definition to calculate dosages to the population in connection with nuclear plant licensing procedures. The implication is that the NRC is granting licenses to facilities that are killing women with dosages that are deemed safe.)

The national database used by both the NCI and Gould *et al.* consisted of 3,053 counties. In the research conducted by the NCI, cancer mortality rates around 62 reactor facilities were studied. On the basis of their location, only 107 counties were identified as "nuclear" counties, i.e., counties hosting or immediately adjacent to the reactors whose population was considered potentially exposed to radionuclides. This fundamental premise of the NCI study is completely unsound. Any eighth grader would know that pollution vented into the air or flushed into waterways will migrate great distances through the envi-

ronment, contaminating humans either directly or through food chains or water sources that in turn will be the vehicle for contaminating humans. The control population used by the NCI consisted of people living in 292 different counties. For three-quarters of the nuclear facilities under investigation, the control counties were *adjacent* to the nuclear counties. All the control counties were located within 100 miles of a reactor. This ridiculous choice hopelessly biased the data. Whatever exposure to radionuclides suffered by people in a "nuclear county" would likely be suffered by people dwelling in a "control county." Rates of cancer would be similar, allowing the fraudulent conclusion to be reached that people in nuclear counties are at no greater risk of dying of cancer than anyone else. This foolishness is an example of our tax dollars at work.

Gould *et al.* reviewed the conclusions of NCI study. When they looked at all 107 nuclear counties as an aggregate (simultaneously taking into account cancer rates in each county before and after the startup of each reactor), they observed a statistically significant increase in all types of cancer including breast cancer. When they combined the populations of the 107 nuclear counties with the 292 control counties and compared the cancer mortality rates in this population to the rates for the US as a whole, they once again discovered a statistically significant increase in cancer risk for this group of people. This finding soundly refuted the NCI claim that nuclear reactors were not inducing excess rates of cancer.

In their own study, Gould *et al.* studied 60 reactor sites and the age-adjusted breast cancer mortality rates in those counties located within a 50- and 100-mile radius of these facilities. This procedure produced study populations large enough to display statistical significance. At one point, using a methodology similar to that of the NCI, they calculated the combined breast cancer mortality trends of seven contiguous rural counties downwind and within 50 miles of each reactor. The total number of counties was 346. For the period 1950-54, the recorded age-adjusted breast cancer mortality rates for the people living within these counties was well below that of the US as a whole. In contrast, breast cancer mortality among women living within these counties today is well above the national rate. This observation again refutes the conclusions of the NCI study. As Gould observes in *The Enemy Within*:

> All in all, for 55 out of the 60 reactor sites we have been able to define some 346 contiguous, mainly rural counties that adjoin one or more reactor sites that have registered aggregated increases in current breast cancer mortality rates significantly higher that the corresponding national increase. Our sole purpose here is to demonstrate the

> limitations of the NCI definition of proximity to nuclear reactors, which in almost all cases resulted in too small a number of deaths to achieve statistical significance.

In the Gould *et al.* study, 1319 counties in the United States were identified as being "nuclear," within 100 miles of a nuclear reactor. The remaining 1734 counties, mostly rural and lying between the Rocky Mountains and the Mississippi River, were defined as "non-nuclear." For the period 1985-89, the combined age-adjusted breast cancer mortality rate for the nuclear counties was 25.8 deaths per 100,000. By contrast, the breast cancer death rate in the non-nuclear counties was 22.1 deaths per 100,000. Once again, the conclusion was reached that nuclear reactors were inducing cancer in the population. In an attempt to discredit this conclusion, the NCI undertook a review of the study of Gould *et al.*, copying their methodology. Looking at the mortality rate of nuclear counties within 50 miles of a reactor site, they estimated a rate of 26.9 breast cancer deaths per 100,000 women, based on the 69,554 deaths nationally in the years 1985-89. In contrast, the breast cancer death rate for all other counties was calculated at 23.3. Of this, Gould made the following observation:

> The probability that so great a difference could be due to chance is infinitesimal. This means that the cause of the current epidemic increase in breast cancer involves geographical factors that must be environmental and cannot be ascribed to differences due to genetic factors. We must therefore discard all the "blame the victim" and lifestyle factors invoked by the authorities to conceal the true man-made cause of the epidemic.

Following up on the idea that a woman's geographical location and the environmental forces acting within that location may be a factor in the development of breast cancer, Gould *et al.* compiled data for age-adjusted breast cancer mortality rates (age-adjustment to 1950 standard population) of white women for each of the continental 48 states and the District of Columbia. They compared the breast cancer mortality rates for the periods 1950-54, 1980-84 and 1985-89, and displayed this data in a chart where the states were organized into the nine census regions of the country. In this way, regional variations would be immediately apparent and possible environmental factors could be easily postulated. Shockingly, the NCI had never published national data in this format, ruling out a useful method for detecting environmental influences that may be contributing to cancer. This was either a gross oversight, or perhaps, another scam. Gould notes that only once did the NCI publish a table for breast cancer rates for all states, for the period 1984-1988, but the data was organized with the states listed alphabetically. This method precluded easy detection of regional, i.e., environmental, causes of cancer. When the statistics compiled by the

NCI were organized and displayed by regions, the end result supported the conclusion that a regional correlation existed between age-adjusted breast cancer mortality rates and cumulative release of radioactivity from weapon tests and commercial nuclear power plants. Fission products in the diet and drinking water — new pollutants introduced into the environment at the end of W.W.II — were identified as the likely initiators for the increasing rates of breast cancer. During the course of their research, Gould *et al.* made a host of interesting discoveries, some of which are listed below:

1. In the New England, Middle Atlantic, and East North Central regions, breast cancer mortality rates are significantly above the national average. Such widespread distribution of above-average rates in a genetically diversified population rules out the possibility that genetic factors alone are responsible. Some unidentified environmental factor is at work sustaining the breast cancer epidemic.

2. Breast cancer mortality rates in the Southern and Mountain regions have been rising since 1950-54 far more rapidly than in the nation as a whole. New Mexico and North Carolina registered increases as great as 30% since 1950 compared to moderate increases for the US as a whole of only 2% for 1980-84 and 1% for 1985-89.

3. For the period 1950-54, 10 years after the beginning of nuclear weapon testing, breast cancer mortality rates differed widely between regions. The lowest rates were in the rural East and West South Central regions. Arkansas had the lowest mortality rate of 15.4 deaths per 100,000. Again, differing rates of breast cancer in different geographical regions bear witness that genetic factors are not the sole cause of the breast cancer epidemic.

4. In the period between 1950-54 and 1980-84, the state with the greatest increase in breast cancer mortality was New Mexico, with the rate increasing by 39%. Why New Mexico? Could the Trinity nuclear weapon test in 1945 and the presence of the Los Alamos nuclear laboratory be possible contributing factors? Supporting this contention is the fact that in the 10 contiguous counties in the southeast corner of New Mexico, the region in which the Trinity blast occurred, combined age-adjusted mortality rates increased by 72%. In 1950-54, there were 12.1 deaths per 100,000 people. By 1980-84, 40 years after the test blast, the rate had increased to 20.9 per 100,000.

5. After New Mexico, Arizona and Utah showed the next greatest increase in breast cancer mortality — 29%. These states, bordering Nevada and immediately downwind of the Nevada Test Site, were the routine dumping ground of large amounts of radioactive fallout from weapon tests that silently and invisibly contaminated food and water sources.

6. The cessation of aboveground weapon testing in the early 1960s had a marked influence on breast cancer mortality rates 20 years later. Not only did the enormous increase in breast cancer mortality taper off within the rural states of the Mountain region bordering the Nevada Test Site, they actually showed a significant decline between 1980-84 and 1985-89. This reversal is no surprise if fallout contamination in the diet was a contributing factor to cancer rates.

7. Of the nine census regions, the West South Central region, comprised of Arkansas, Louisiana, Texas and Oklahoma, had the lowest rate of breast cancer mortality for the entire period between 1950 and 1989. These low rates persisted despite the fact that these states hosted the largest petrochemical manufacturing facilities in the nation and their agricultural lands were the repository for large amounts of DDT and other chlorine-based pesticides and herbicides. Consequently, these environmental factors by themselves cannot be responsible for the breast cancer epidemic. If they are in some way responsible, some other unidentified cofactor(s) must also be involved.

8. In contrast to the declining rates of breast cancer in the Mountain region after the end of aboveground weapon testing, breast cancer rates continued to climb between 1980-84 to 1985-89 in the rural southern states along the east coast from Delaware to Florida. If nuclear pollution is contributing to the breast cancer epidemic, this fact can be explained by the ongoing emissions of radiation from the region's commercial nuclear reactors and releases from Oak Ridge and the nuclear weapon installation at Savannah River. All but one of the nine southern states along the Atlantic coast with nuclear reactors registered increases in mortality rates. In contrast, this was not the case in the high rainfall states of Louisiana, Kentucky, and Mississippi, which had no operating reactors before 1982. These states registered declines in breast cancer mortality of three, six, and three percent respectively during the 1980s.

9. Despite the cessation of aboveground weapon testing, breast cancer mortality continued to climb in states receiving large amounts of radioactive pollution from nuclear facilities. This was particularly evident in Rhode Island, downwind of four large reactors in Connecticut and two smaller reactors at Brookhaven National Laboratory in Upton, New York. Rhode Island, during the 1980s, had the largest increase of any state in breast cancer mortality.

10. Identifiable trends in the rates of breast cancer mortality exist between different states that are explainable on the basis of varying levels of radioactive pollution. For instance, almost every rural state showed increases between the period 1950-54 to 1980-84, most probably as the result of fallout from weapon tests. In the period between 1980-84

and 1985-89, a different pattern emerged. In states with no operating nuclear reactors, the rate of breast cancer deaths began to decline whereas in states most significantly exposed to emissions from nuclear reactors, rates continued to climb. The rural states evidencing declines in breast cancer mortality included North and South Dakota, Kansas, West Virginia, Kentucky, Louisiana, Oklahoma, Texas, Montana, Wyoming, Colorado, New Mexico, Arizona, Utah, and Nevada. As observed by Gould: "Since all of these rural states had similar exposures to pesticides and other chemical pollutants, we may conclude that exposure to bomb-test radiation was the principal cause of the overall increased mortality since 50-54."

11. Between the period 1950-54 and 1985-89, breast cancer mortality in the Washington state county housing the Hanford Reservation increased from 13.2 to 21.7 deaths per 100,000. For the county in which the Idaho National Engineering Laboratory was located, rates increased from 4.8 to 21.7. In St. Lucie county in Florida, exposed to pollution from four commercial nuclear reactors, the death rate from breast cancer jumped from 6.5 to 23.5.

12. In the 14 counties in which the seven oldest DOE reactor sites are located, combined age-adjusted breast cancer mortality rates for white females rose by 37 percent during the period 1950-54 to 1985-89. During the same period, the corresponding rate in the US as a whole rose by only one percent. In these 14 counties, the rate quintupled, from 371 deaths to 1,926 deaths, while the rate in the US as a whole only doubled.

13. The Oak Ridge study can be replicated for any area in the country where old DOE facilities are located. Women living in counties near the oldest reactor sites have registered by far the highest long-term increase in breast cancer mortality of women in any group of counties in the nation.

14. A comparison was made of breast cancer mortality rates among women in an aggregate of 14 counties that housed seven DOE facilities with reactors to women in an aggregate of nine counties housing DOE facilities without reactors. The women living in the 14 counties exposed to reactor emissions displayed an extraordinary and significant increase in breast cancer mortality of 37% between 1950-54 to 1985-89, compared to a 6% decline among women living in the counties not receiving emissions. This is a clear demonstration that reactor emissions are producing breast cancer.

15. The flat low-rainfall states between the Rocky Mountains and the Mississippi River receive the lowest exposure to fallout from commercial nuclear reactors and have the lowest rates of breast cancer mortality.

16. Most civilian nuclear power plants are located in areas where precipitation levels are over 30 inches per year. There are only five reactors located in states with annual levels of precipitation below 15 inches. Interestingly, these five reactor sites are the only ones studied that fail to show a significant upward divergence in breast cancer mortality rates compared to the nation as a whole.

17. Brookhaven National Laboratory is located in Suffolk county in New York state. From 1950-54, when BNL began operation, through 1985-89, the county's rate of breast cancer mortality was 40 times greater than the increase throughout the nation as a whole.

The research accumulating on the health detriment produced by released radioisotopes is putting the Cult of Nuclearists in a terrible double-bind. Mounting pressure will eventually force them into admitting either that doses to exposed populations have been greater than previously published or that the risk factors are in substantial error. They cannot have both. The only escape from this predicament is to attack the integrity of the research that casts them into this dilemma. This tactic, however, is becoming increasingly transparent as evidence mounts that radioisotopes in the environment are producing illness and death.

To complete this indictment, we must return to the subject of depleted uranium weaponry. Research, to be discussed in later chapters, has confirmed that veterans suffering symptoms of what is called Gulf War Illness test positive for the presence of depleted uranium in their bodies. These findings must be taken seriously. But those who defend depleted uranium munitions as radiologically benign don't sponsor credible research to confirm their claims. Instead, they rely on two arguments to bolster their position. First, the *dose* of radiation delivered by internalized uranium is too low to produce injury; second, a review of published studies on internal exposure to uranium provides no evidence that DU, in concentrations likely to be encountered on the battlefield, could be radiologically hazardous. Setting aside the second argument for a later chapter, the first argument can now be easily refuted. The concept of dose falls apart when applied to low levels of internal contamination with radioactive particles. It is a meaningless and scientifically fraudulent idea when transported from the phenomenon of external exposure at high doses of x-rays and gamma rays and then forced to fit the altogether different phenomenon of localized damage to cell clusters vastly smaller than whole organs. The rationale of this translation is that both phenomena share the common characteristic of transferring energy from the radioactive source to tissue. However, dose requires averaging energy over masses of tissue, and it is scientifically absurd to take localized emissions from embedded radioactive particles and average that energy over the mass of an entire organ. All this does is make the biological damage disappear behind some mathematical hocus-pocus, which then pro-

duces the impression that the contamination and the cellular chaos it causes are irrelevant. Radioactive particles decaying within the human body cause biomolecular alterations and cellular damage. The important scientific question is whether this damage is repaired or if it induces altered function and disease. "Dose" provides no relevant information on this fundamental issue. It is just a mathematical abstraction that is adequate for quantifying whole-body exposure or whole-organ exposure to either x-rays/gamma rays or a uniform distribution of a radionuclide throughout an organ, but it is meaningless when applied to nonuniform distribution of radioactive particles. Further, the Hiroshima study and other studies of external exposure provide no relevant information regarding low levels of exposure to internally embedded hot-particles. Again, the notion that it is scientifically justifiable to extrapolate from high levels of external exposure to low levels of internal exposure is grounded on the erroneous idea that biological effect is proportional to the quantity of energy absorbed. However, as has been shown, the alteration of essential macromolecules within cells has nothing to do with the quantity of energy absorbed. It is voodoo science to discount the hazard of embedded uranium particles, or any other radioisotopes, solely on the basis of dosage. The only responsible way to proceed for determining whether or not contamination by depleted uranium is hazardous is to examine the outcome of epidemiological studies of instances of uranium exposure and determine the health consequences. The question to be addressed later is whether or not any previous studies have any relevance to the inhalation on the battlefield of insoluble, micron-sized particles of alloys of uranium metal laced with other contaminants such as plutonium, americium, neptunium, and technetium-99.

SUMMATION

On the landscape of human affairs, the Cult of Nuclearists are deceivers. Members of this syndicate confound the world with their magnificently orchestrated stagecraft, but in the wake of their theatrics, the fruits of their deeds have left indelible signs of their intentions. Can humanity entrust its common welfare to a pack of liars? Are people to be trusted who harbor a mentality for harnessing the fundamental forces of the universe for the purpose of committing acts of genocide? Is it prudent to expect beneficence from those who poison the biosphere with radionuclides that never before existed on the Earth's surface and then artfully lie to cover up the implications of their misdeeds? What kind of people are these? What is their ultimate agenda? With abundant evidence of their mentality, is it prudent for us to allow them further management of human affairs?

Karl Morgan was the father of health physics and the chairman of Subcommittee Two, which set the first standards of safety for fission-produced internal emitters. During the Allen trial in the early 1980s, when downwinders of the Nevada Test Site unsuccessfully

sought compensation from the US government for radiation induced illnesses, Morgan made the following observation:

> We have radiation with us, we've always had some radiation with us, and it's an added risk. The people deserve to know what the risk is, and they should make the decision on how much radiation they want to take or are willing to take, and there shouldn't be any cover-ups. There shouldn't be any withholding of information. The people themselves should decide on their own future and the future of their families (Fradkin).

Rather than allow the people this choice, the Cult of Nuclearists defrauded the entire human race in order to fulfill their still unstated agenda. Why? In fabricating the ultimate weapon, those who thirst for dominance fulfilled their crowning achievement. But they were left having to explain away one bothersome little side effect: nuclear radiation dissolves human molecular structure. From the moment the smoke cleared over Hiroshima, disparaging rumors began circulating around the globe of an atomic plague that infected all who managed to survive the bomb's initial decimation. To preserve their good name, the Cult of Nuclearists mounted a campaign of deceit to distract the minds of inquiring humanity. At times they went to ridiculous lengths. General Leslie Groves had the audacity to testify before Congress that death by radiation was a pleasant way to die! This campaign of misrepresentation has continued nonstop since 1945. As absurd as it will sound to future generations, it has been eminently successful. Through craft, the Cult of Nuclearists has pushed back every challenge to its self-proclaimed right to build and test its arsenal of conflagration, all the while contaminating the Earth and robbing the lives of unsuspecting innocents. It withstood the numerous waves of worldwide protest staged by anti-nuclear activists. It covered up the plight of sickened populations such as the downwinders and the Marshallese Islanders. It successfully postponed, indefinitely, a call for a solution to the problem of disposing of nuclear waste. It rebuffed the claims of liability for illnesses incurred by atomic vets, vets contaminated by depleted uranium, nuclear workers, uranium miners, and residents living in proximity to weapon production facilities. The brilliant propaganda matrix it walled itself behind was vulnerable by just one inroad: science. When researchers, beginning in the late 1950s, began to publish projections of a future cancer epidemic induced by fallout, followed in later years by studies of the link between low-level radiation and infant mortality, thyroid disease and cancer, the Cult of Nuclearists flinched. Their self-assumed supremacy was threatened by possible future revelations of the medical effects of contamination by low-levels of radionuclides that they had vented into the environment. To permanently protect themselves from this Achilles heel, their devotees infiltrated the science of radiation effects and the radiation protection community.

By stealth, they promoted ideas and policies that gave license to the nuclear intrigues of government, rather than the other way around, with government forced to constrain its activities within stringent guidelines designed to protect the health and welfare of the governed. The archaic, devious and deadly system in place today that is supposed to be protecting humanity from the hazards of radiation is the fruit of this mischief and contains within itself abundant proof of intentional malfeasance.

Exhibits A through F provide copious evidence that the science of radiation effects, as currently construed, harbors fundamental errors. While biology has been completely transformed since the 1950s, the radiation protection community insists on clinging to an outdated model to explain how internal contamination by radionuclides affects living systems. Had it been in any other discipline, this antiquated model would have been junked long ago. The reason it has remained entrenched and is continually fortified by new layers of deceit is that it serves the strategic role of disguising crimes against humanity as perpetrated by the nuclear powers and much of the nuclear industry. The corrupted science has helped to sanitize the immense evil that lurks in the shadows of our modern life. The possessors of nuclear weapons have reserved for themselves the capacity to annihilate any population of their choosing, at any moment of their choosing. People of today have erected a facade of normality around this harrowing fact where the fairytale of benign radiation fits perfectly in place. The masquerade we are forced to assume to retain our sanity disguises the ruthless brutality that encompasses us. Our seemingly secure lives are but a single moment away from cataclysmic annihilation.

Albert Einstein once said: "The splitting of the atom has changed everything save our mode of thinking, and thus we drift towards unparalleled catastrophe." Some Manhattan Project scientists recognized this in the course of their work. Once Germany surrendered, they began to question the need for fielding an atomic bomb as the war wound down. They recognized that the bomb was going to produce a crisis in governance, that a world divided into autonomous nation-states possessing nuclear weaponry would eventually self-destruct. Many lobbied for the new weapon to be put under international control. Some fantasized that a world government, more humanitarian and less insidious than the New World Order of today that is conniving toward world domination, would be the only safeguard from self-annihiliation. But the old mentality was not dislodged by the advancement in weaponry, and it accommodated itself to a world of nuclear confrontation.

The Cult of Nuclearists is a confederation of like-minded individuals. What binds them together is their shared mentality. They premeditate genocide and call it national defense. They retain their hold on power by threatening ruthless force of unlimited constraint. Their manifesto perpetuates the ideology that nuclear weapons are beneficent, that

threatening extermination ensures the peace, that those with their finger on the button are our caretakers. They consume the wealth of the people of the Earth with trillions of dollars in armaments spending. They inflict heart-gripping terrorism on every human being alive. While the rest of us wile away our days in sanity-preserving somnambulance, the Cult of Nuclearists builds, meditates, plans.

Until today, the Cult of Nuclearists has escaped accountability for its deeds. Rather than wait for Armageddon to unmask these liars and the hidden intentions that lurk within their hearts, the trial within these pages has been convened to give humanity a chance to ward off catastrophe. With the evidence of Exhibits A through F now before the jury, one last question needs to be addressed. Why is the Cult of Nuclearists not being brought to trial for murder? Why fraud? The answer to this question ultimately leads to an indictment of us all for our complacency. Beyond debate, the bombings of Hiroshima and Nagasaki were merciless crimes of wholesale slaughter. What followed, during the era of atmospheric weapon testing, was a dusting of the Earth with nuclear pollution that has induced millions of fatal cancers. A repetition of this atrocity is underway with the first fielding of radiological weapons. These deeds should be sufficient to earn a murder conviction for their perpetrators. But the Cult of Nuclearists has escaped accountability. And with their freedom, they have gone on to devise the means for further crimes against humanity yet to be enacted. By some quirk in the make-up of modern human beings, the crass materialism and barbarity of the twentieth century has deadened our consciences. Extreme brutality and mass murder has left us jaded. Moral outrage about the transformation of our world by nuclear weapons has never crystallized. Like a deer caught in the headlights, the entire human species has been intimidated into inaction by hellish displays of mushroom clouds and terror for the future of our children. We accept the possibility for our species of self-immolation, believing this to be an innate expression of the darkness lurking within the human heart rather than the connivance of a bunch of gangsters. The Cult of Nuclearists has gotten away with murder, for the will to confront and condemn them has never coalesced.

If any hope remains for our outrage to be inflamed, it lies in the personal recognition within each human heart that the lies we have been tutored in has done violence to our own humanity. By deceit, we have been transformed into submissive allies in the war being waged against nature and against life. Having been robbed of the ability to recognize evil and take a stand against it, our own personal integrity has been compromised to make way for criminals to rule the Earth. As bitter a remedy as it is, courage is demanded for each one of us to finally acknowledge that we have been conned into forsaking our own safety, the welfare of our children, the future of our planet, the endless possibilities of our species.

The Most Heinous Crime in History

If a nuclear holocaust ever engulfs the earth, those who crawl out from the rubble, and their descendants, will hunger to know what happened. Around the campfire, they will enchant each others with marvelous tales of their forebears: of our ability to fly through the air, to instantaneously talk to anyone else on Earth, to miraculously harvest whole fields in a single day without effort. They will scratch their heads in bewilderment at how a whole generation of humans, given so much, sacrificed it all in a senseless act of self-destruction. They may never know that this inglorious end was facilitated by deceit and treachery. But they will feel our humiliation, and this will be part of the oral tradition that will pass down from generation to generation. Our dishonor will be the dishonor of all human beings that follow. Our tragedy and shame will be the legacy our complacency bequeaths to the future.

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