

THE LAW AND LOW LEVEL RADIATION
Charles F. Eason and Natalie Y. St. Denis
U. S. Atomic Energy Commission
Washington, D.C.

Abstract

One of the responsibilities of the health physicist is to recommend and enforce radiation protection standards based upon recognized occupational radiation exposure guides. It follows, therefore, that the health physicist, because of his background and technical knowledge, will play a key role in evaluating a claim allegedly arising out of exposure to ionizing radiation.

It is the purpose of this paper to examine a number of latent radiation injury cases with particular emphasis on the kinds of radiation records offered in evidence, the nature of the expert testimony by both the health physicist and the medical expert and the conclusions of the court or Board in the final adjudication of the claim. The paper will also explore the views of those who hold that the present legal system in the United States is not appropriate for the handling of latent injury claims.

Introduction

It is well known that in spite of the highly successful efforts of those engaged in the field of radiological health, radiation workers run a risk of being exposed to some degree of radiation in the course of their employment--however small that risk may be. Radiation workers may also develop certain diseases that are known to be caused by radiation but which also develop spontaneously in the absence of radiation exposure. What happens in the United States when a radiation worker sues for compensation on the basis that the disease from which he is suffering was incurred in the course of his employment?

In cases involving substantial exposure, recovery is almost always assured. However, in cases involving delayed injury, the claimant rarely recovers. Should he?

The purpose of this paper is to examine this question.

In order to understand the reasons why so few cases involving low exposures and delayed occupational injuries are compensated, one must appreciate that it is first necessary under our legal system to determine whether the exposure "caused" the injury. It is also necessary to draw a distinction between the two categories of radiation injury cases: (1) Claims involving acute effects which appear immediately or within a short period after a very large exposure; and (2) Claims involving latent effects which do not manifest themselves until years later. In the first instance they offer the litigant, the expert

witnesses and the courts little difficulty. Dosimetry can be reconstructed, and the symptoms or illnesses are usually characteristic. Because the nexus between the pathology and the disease is obvious, causal relation is relatively simple to establish. It is the second category of cases that pose problems of causation. Why?

Causation

Simply stated, it is because the proof of causal connection in a claim for injury, if we accept the medical notion of the meaning of the term, is, in most instances, extremely difficult to establish.

In a radiation claim both the physician and the court must confront the problem of causation. When the medical expert is asked to testify concerning the cause of the claimant's pathology it frequently develops that his testimony is so couched with reservation that the court or board has no alternative but to make the medical determination on its own. The reason for this hesitancy or inability on the part of the medical profession to find causation lies in its notion of the meaning of causal connection. Doctors define causation in a special sense. They prefer to base their conclusions on statistical studies of the relationship between a suspected causative factor and the disease.¹ In 1969 an outstanding authority on workmen's compensation pointed out that longitudinal studies, using an exposed population group and one or more control groups are a principal device for testing causal theories involving human pathology and that longitudinal studies yield information concerning probabilities of causal nexus in a population. But the legal problem, always, is to determine causal nexus in each individual case. "The unspoken medical assumption is that causation in a legal proceeding is a pure question of scientific fact."² However, in the absence of a suitable test which could be used to establish the dose-response relationship at low range, the medical expert is willing to assume for purposes of conservatism that no threshold exists and that linear build-up may possibly result in adverse biological response. But when the etiology of a disease remains unknown, the medical expert will not under most circumstances say that the exposure "probably caused the disease." The reasons are crystal clear. At the present state of scientific knowledge it is simply not possible to relate individual response to disease, nor does the solution appear imminent. Some fourteen years ago a view was expressed before a Congressional Committee that "The more that is discovered about the complex etiology of disease . . . the less it appears possible to identify causality, and the more we grow dependent upon vague and arbitrary interpretations, with inevitable inequities"³

When an employee develops a disease which conceivably could have resulted from occupational exposure, should the economic loss fall on the employee or should it be shifted to the employer? The courts in the United States in many instances have taken a rather juristic view in response to this question. It is clear that the courts need not be bound by medical notions of causation for medical evidence indicating a distinct possibility of a relationship between the job and the disease, while insufficient to support a finding of causation in the medical sense, may warrant a finding of causation in the legal sense. Our workmen's compensation laws in the United States typically include a mandate that they should be liberally construed to protect the employee. This being the case, decisions not to compensate where the exposures are small but, nevertheless, the employee is suffering from a radiation connected disease, may very well be inconsistent with the policy and purpose of our workmen's compensation laws.

Unfortunately most courts take the position that they cannot deviate from the requirement of medical probability. For example, in a recent Texas Supreme Court case⁴ in which the claimant was denied compensation, the court found

that the evidence did not indicate the existence of "a reasonable medical probability" of causal connection between petitioner's cancer and radiation but merely "the possibility" of such a connection. In drawing what it termed a logical distinction between a "reasonable medical probability" and a "medical possibility" the court said, ". . . a possibility becomes 'probable' when in the absence of other reasonable causal explanations it becomes more likely than not that the injury was a result of its action."

However, the opinion of the dissenting judge is worthy of note. He found that the expert medical testimony indicated that the etiology of cancer is really unknown, that the claimant's cancer could have been caused by radiation, but that there was no way to determine the cause of a particular cancer; that it is possible for a person exposed to radiation over a long period of time to develop cancer, but that it could not be stated how much exposure would be required; that any radioactive material can conceivably cause cancer on prolonged exposure; that anyone exposed to certain amounts of radiation has a higher than normal risk of developing malignant changes in the body tissues but that in this particular situation a diagnosis of probability either way could not be made.

Further, he rejected the weight the court placed upon the medical opinion evidence of experts who refused to testify that the cancer was "probably" caused by the radioactivity to which the petitioner was exposed. In his dissenting opinion he stated, "We are not to isolate the testimony of the doctors, but must determine the effect of such testimony upon other evidentiary proof in the case."

This statement was followed up with a reference to the spirit of workmen's compensation statutes and the need for liberal interpretation. He admonished the court for apparently forgetting "for the moment" the purpose of the Texas Workmen's Compensation Act. He stated that to hold, as the court held, that the evidence as a whole, which the jury considered in reaching its conclusion, did not meet the standard of proximate causation with sufficient certainty to impose liability upon the insurance carrier of claimant's employer, "is to effectively remove injuries which require medical testimony to substantiate causation from the common law of tort."

Health Physics Testimony

Now when it comes to dealing with roentgens, rads and rems and the recommendations of the various standard making bodies, we find that this is the field of expertise of the Health Physicist. It thus follows that because of his background and technical knowledge and the complicated array of terminology which finds its way into a radiation claim, the health physicist will play a key role in evaluating an individual's radiation exposure. The courts cannot adjudicate and the medical expert cannot opine until the source, duration and amount of exposure is known. In fact, the health physics experience of the injured claimant is one of the most important factors in any claim involving radiation injury and the health physics testimony and evidence is of extreme importance because it protects medical experts by assuring them that their testimony and opinions are predicated on the most probable exposure.⁵ Furthermore, the health physicist supplies and interprets available radiation records of claimants' external and internal occupational exposure (e.g., film badge and other types of dosimeter records, whole body counter records, records of bioassay data and interpretation, etc.) and he supplies estimates of exposure in the absence of radiation records and interprets other records relating to the claimant's exposure (e.g., records of work orientation and training, radiation and contamination survey reports, records relating to the radiation status of the claimant's work area and records relating to the employer's radiation protection program.)

Although it is the considered view of many lawyers familiar with radiation litigation that "records are the most important item in establishing dose from a legal standpoint,"⁶ there are still members of the health physics establishment who, I regret to say, maintain that the record developed on a day-to-day basis to assure the safety of the radiation worker has little value 15 to 20 years later when that very same record is introduced in a workmen's compensation proceeding as evidence of exposure. However, it is apparent from a reading of the cases that not all health physicists agree with this position for they have on many occasions furnished courts and boards with convincing evidence of the claimant's exposure from the radiation exposure records in their possession.

For example, in almost all of the claims containing allegations of radiation injury, radiation records (e.g., dosimetry, bioassay and other records related to the claimant's exposure) are not only supplied by the health physicist but are examined and referred to by the health physicist and the medical expert in deciding causation.

By way of illustration, in a case involving a blood disorder a health physicist testified that records showed the premises where the claimant worked were found to meet the standards of radiation protection as recommended by the National Committee on Radiation Protection. He also testified that film badge reports indicated all exposures were below permissible dose. The radiation expert in the case noted that after reviewing the case file, film badge readings and the physicist's survey of the environment, it seemed apparent that claimant's exposure had been at a relatively low level which would not be expected to give rise to incapacitating bodily injury. Compensation was denied.⁷

In another case involving exposure to radioactive tracers for a five-year period, a medical expert stated, after review of the records:

"Beginning with the exposures received, we find that these are well documented and do not appear excessive Dosimetry appears to have been reliable and film badge and monitoring reports indicate that the decedent's exposures were well below those considered maximum permissible. . . ." Compensation denied.⁸

The most popular argument advanced by those who discount the value of radiation records is the unreliability of monitoring devices to record low exposures. Yet from my own experience I know that a properly organized health protection program can and does furnish data which provides a pretty good estimate of the maximum exposure which the individual worker could have received in the course of his employment. In fact, there is testimony from the medical establishment that negates the view that records have no value. In a recent case in which the claimant wore no film badge a medical doctor noted: ". . . [claimant] wore no protective badge which would have adequately monitored his X-ray exposures." Compensation denied.⁹

While recorded exposures are valuable evidence in a radiation claim, I believe you will agree that it is important that the courts not give undo weight to evidence of exposure in recorded form at the expense of other evidence of exposure. For example, in the Texas case which I cited earlier it appears that the court may have relied too heavily on the film badge analysis alone in denying the claim of a radiation worker while disregarding other estimated evidence of exposure.

In this case the decedent was engaged in handling, assembling and disassembling nuclear materials and weapons for approximately four years. For a two-year period while "handling" the materials, he was not issued a film badge or

or protective clothing. For the other two-year periods, he was issued film badges and protective clothing. Badge analysis revealed exposure on two occasions as 36 millirems, although this was determined to be only a fraction of his total exposure since the badge was being worn under protective clothing. The amount of exposure was not known but estimated to be greatly in excess of 36 mr. In addition, evidence showed that petitioner was on one occasion in an "incident" area but the proximity of petitioner to the location of the "incident" or number of rems to which he was, in fact, subjected was not known. The protective badge worn by a fellow worker also in the "incident" area showed 6,500 millirems of radiation. Evidence further showed that, for two years petitioner was exposed to "radiation leaks" from material handled, but the amount of radiation to which he was subjected was not known since he was issued no measuring device.

In addressing itself to the petitioner's contention that "the whole evidence" of this case did create a reasonable medical probability, the court agreed that reasonable medical probability can be based upon "the whole evidence." However, the court could not agree that such evidence was before them inasmuch as the extent of any radiation beyond the relatively safe dosage of 30 mr was unknown.¹⁰

In another case it was the absence of recorded evidence which appears to have influenced the U. S. Veterans Administration in denying compensation to a veteran who was assigned as an X-ray technician from 1953 to 1954 and developed acute lymphocytic leukemia in 1969. He wore no film badge and there were no records of his work environment. In spite of health physics testimony that there was a 50% to 80% chance that occupational exposure caused his death, the Board pointed out that the evidence of record did not indicate that the veteran received "excessive radiation" during service.¹¹

In a 1961 Federal Workmen's Compensation Appeals Board Decision, the Board stated that because of the absence of a film badge during one period of the claimant's exposure, it was impossible to determine whether there was a significant exposure to radiation. Compensation denied.¹²

Total Evidence

From the point of view of the lawyer, the radiation record can never be too extensive. Accordingly, he will want to know of his client's total environmental exposure--occupational and non-occupational.

In a radiation claim a statistical game of possibilities and probabilities can, and in many cases does, greatly influence the result in a workmen's compensation case and, accordingly, the availability, accuracy and adequacy of exposure data, including prior medical as well as industrial exposure, takes on great legal significance.¹³

By way of example, take the case of a young man who developed acute leukemia after an exposure of a little more than 5 rem during a four-month period. A physician, knowledgeable in the effects of radiation, became acquainted with the case and noted that the man had received an indeterminate but apparently large amount of therapeutic radiation as a child. Keeping this in mind, and the fact that there is usually no decrease in the potential to induce leukemia by a long interval from the time of a first dose to the time of a second additional dose, the doctor felt that the worker's leukemia, if not caused, was at least aggravated and precipitated by his low occupational exposure. Compensation was granted.¹⁴

The Aggravation or Acceleration Theory

The concept of aggravation appears to offer an alternative for the medical expert who seeks to establish medical probability in the face of low occupational exposures. In one case, a veteran who had been involved in nuclear testing while in the service was then employed teaching radiological safety as a civilian. He claimed that his leukemia was a result of exposure received during six years of civilian employment. Service connected exposures were unrecorded and civilian exposures were low. However, it was noted that there were certain instances of exposures which could well have been "over permissible limits." A radiologist found that the final monitored exposure could well have been an aggravating factor and, although the degree of claimant's exposures were conjectural, the leukemia could be considered the probable result of his occupational exposure. Compensation was granted.¹⁵

In another case, the claimant had a history of working in a microwave environment. After a latent period of many years he worked intimately with a weak ionizing radiation source. A board certified radiologist found that the low exposure to ionizing radiation resulted in a reactivation and/or acceleration of a dormant cataract and pointed out that without prior sensitization of the lense by exposure to microwave radiation, the radiation from the electron microscope would not have adversely affected the claimant. Compensation was granted.¹⁶

In yet another case, claimant was employed as a medical radiology and X-ray technician for approximately eight years. He developed leukopenia. Evidence showed that radiation protection practices were good and records showed exposures were low. The Bureau's Medical Director supported a causal relationship by aggravation from chloromycetin, a potent antibiotic with a known side effect of bone marrow depression.¹⁷

In a 1971 decision a civilian X-ray technician was granted compensation for chronic myelogenous leukemia. Evidence showed he had been exposed to low cumulative exposures for 20 years in the course of employment; that radiation protection was good; that he had service-connected exposure for a period of one year at the age of 18; that during three months of training while in the service he was constantly exposed to X-ray without benefit of safety equipment or protective measures to avoid exposure. The medical opinion indicated that there was aggravation of previous pathology. The claim was allowed for leukemia due to radiation exposure.¹⁸

Occasionally an award is made even when occupational exposure is low and with no need to resort to the theory of aggravation. For example, in one case a medical radiology technician employed in that capacity from 1957 until 1961 was isolated from further ionizing radiation in 1961 as the result of blood tests and the industrial medical officer's opinion that claimant had apparently reached his "personal level of tolerance." He developed leukopenia in 1966. Radiation records revealed no excessive exposure on film badge and personal pocket dosimeter. Work was performed using the accepted precautions of lead screens and aprons. It was established that claimant used reasonable care and had not been exposed to the direct X-ray beam at any time. However a radiology specialist attributed claimant's blood disorder to "incidental radiation effects." Compensation granted.¹⁹

In another case a 36 year old physicist at a radiation laboratory developed cataracts in both eyes. In his work around accelerators from 1950 until 1962 film badge exposure showed only 0.61 R. An ophthalmologist testified that claimant had radiation cataracts. Another doctor stated that claimant's cataracts were of the location and appearance associated with radiation cataracts; that while these cataracts can occur without radiation and while

claimant's record of exposure was very low, in view of claimant's work and age group the situation was "highly suggestive." Compensation granted.²⁰

Radiation Protection Standards

The health physics profession readily admits that there is no such thing as known radiation safety; by that I mean some level of radiation exposure below which there is no biological effect whatever.²¹ In short, frank admission is made that total protection against harm from man-made radiation would require a health standard of zero exposure; that radiation protection standards are not merely technical, that they are established through a balancing of risk versus economic and social benefit. Safety standards do not take into account the physical difference among individuals. Even though for safety guide purposes use is made of a "standard man" concept to determine the mass and effective radius of the critical organs of the body, when it comes to an individual radiation claim, the claimant's dose-response can hardly be considered standard. Yet a review of the cases shows that in a substantial number of claims permissible levels of exposure are used as indices of safety when deciding the issue of causation.

For example, a radiologist noted that the claimant's exposures "were in fact considerably in excess of the maximum permissible dose." He concluded the claimant's exposure probably caused his death from lymphosarcoma. Compensation granted.²²

In still another case the medical expert noted that there was no contamination of the claimant's working environment "above permissible limits." Compensation denied.²³

In another case a health physicist testified that the premises where claimant worked were found to meet the standards of radiation protection as recommended by the National Committee on Radiation Protection. The health physicist also testified that the film badge reports indicated that all exposures were "well below the maximum permissible dose." Compensation denied.²⁴

In all of the claims referred to available film badge and other radiation records relating to claimant's exposure were introduced into evidence. Health physicists referred to records of exposure and related them to protection standards. What was the purpose of such testimony if not to imply safety or lack thereof? It has been said that there is a general tendency among laymen to assume that any exposure in excess of the various permissible levels and standards for any period whatever can be equated with proof of medical causation,²⁵ but since protection standards were never intended as indicators of absolute safety their use in the courtroom should be carefully scrutinized.

Alternative Proposals

At this point I believe that the problems inherent in our present legal system, as it is applied to low-level radiation claims, are abundantly clear. However, it is still the majority view of the legal establishment that the established principles of common law torts should continue to be employed in cases of delayed injury from radiation exposure.

Is there another route?

Professor Samuel B. Estep of the University of Michigan Law School has, over the years, suggested a somewhat novel approach to the problem. He would award compensation simply for the increased susceptibility to possible future disease. The uncontrollable factors which limit the accuracy of biological measurement by physical dosimeter readings seem essentially the basis for Estep to suggest

establishment of a "Contingent Liability Fund"²⁶ which would provide benefits to a radiation injured claimant regardless of his failure to show a causal relationship between the exposure and the injury. The proposed fund would consist of contributions by both the employee and the employer, the respective contributions to reflect both the "spontaneous" risk of leukemia and that due to the occupational exposure. In the event that the employee does develop leukemia, he is awarded a fixed amount of compensation without the necessity of adjudicating the causal relationship to occupational exposure. "Not only would such a scheme avoid the necessity for arbitrary adjudication, it would also avoid the expensive costs of administration. This would be of benefit to the worker, the employer and society as a whole."²⁷

The Estep approach is somewhat akin to the concept of national health insurance. There are those who point out that in Great Britain no man, woman or child need for any reason fall below a minimum standard of life. By a combination of insurance schemes, a worker who comes down with a disease, occupational or otherwise, is assured of full medical treatment and weekly benefits during the course of his illness.²⁸

Some ten years ago, Dr. Herman Somers in testifying before a committee of the United States Congress stated that:

"The evidence has been mounting for some time that the problems rising out of the scientific and technological revolution of our day are of a character which may not be capable of resolution within the traditional workmen's compensation design. The central question which we must ultimately face is whether or not, in the second half of the Twentieth Century, it will remain feasible, let alone justifiable, to operate a social insurance program on the old premise that a reasonably clear demarcation can be made between occupational and non-occupational disability."²⁹

Lastly, for those who reject the insurance approach, a statutory prima facie presumption in favor of the claimant has been suggested. The burden of proof would then be upon the employer to show that radiation exposure was not the cause of the claimant's disease. It is my guess that the employer may have just as much difficulty in proving no causal connection as the plaintiff now has in proving causal nexus. New York has adopted such a law. In a recent New York case³⁰ the employee, a theoretical physicist, died from acute myeloblastic leukemias. In affirming an award the Court said:

"The record discloses that decedent was exposed to radiation for a substantial part of two periods and also at other times in various amounts. The testimony of the medical experts is emphatic that there is really no 'threshold' or 'safe' dosage of radiation because at the present stage of scientific knowledge it cannot be ascertained exactly what effects radiation has on the human body. It is also admitted that each individual reacts differently to exposure to radiation. The award is supported by substantial evidence and by the presumptions [N.Y. Workmen's Compensation Law §§ 3(2), 47] . . . especially so in view of decedent's good health prior to his employment."

Another example of the presumption concept can be found in the Federal Coal Mine Health and Safety Act of 1969³¹ which provides for certain presumptions in favor of the claimant in pneumoconiosis claims where it is found that the miner was employed for ten years or more in underground coal mines.

Congress has in the past considered legislation which would have instituted a Federal workmen's compensation program for employees exposed in their employment to "radioactive materials." The Price-Zelenko bill³² would have established a presumption of causation in favor of any employee who (a) received an exposure in excess of the limits set by a Federal agency and (b) developed any ordinary disease which the United States Public Health Service certified can be induced by exposure to radioactive material.

During hearings on the bill there was strong opposition and rightly so to the proposal because a presumption of medical injury would be based on some arbitrary maximum permissible dose limit.

However, it has been stated that a statutory prima facie presumption in favor of the claimant would not shift significantly the percentage of cases in which the claimant would be upheld.³³ The solution would be for the Courts to apply the laws of negligence, of product liability and of workmen's compensation in the growing field of radiation hazards in a manner which supports preference for the plaintiff when causal relationship, though not clearly established, is clearly possible. The cases involving low exposures are relatively few. If, as has been said, ionizing radiation "is the most studied, best understood and most wisely used agent,"³⁴ the cases will continue to be few. Thus compensating a few individuals who have been exposed to levels of radiation which may have "possibly" caused their disease will not establish radiation as a hazard worse than it is at the present time. If, in fact, the hazard is miniscule, it will remain miniscule except for the injured worker.

Those of you who have followed the course of this paper have reason to wonder as to the proper solution for the handling of injury claims involving low level exposures to radiation. There is no easy answer to this question. When a court of law is attempting to determine the cause of a claimant's pathological condition in a workmen's compensation case, the court is faced not only with the question of scientific etiology but with a policy problem as well; namely, whether under all the circumstances it is fair to shift the economic consequences of the pathological condition from the claimant to the employer. Some of the techniques I have described today would do this very thing, but until more research is done and we better understand biological response to radiation, a great deal of inter-disciplinary concern and effort must go into solving the problem of the worker who allegedly suffers disease and death from low exposures. IRPA, with so many qualified persons from all over the world professionally engaged and actively interested in radiation protection, can contribute significantly toward a solution of this problem.

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