OCCUPATIONAL HARM ATTRIBUTED TO IONIZING RADIATION EXPOSURE

An overview of current compensation schemes and dose reconstruction techniques

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Abstract

Compensation schemes for occupational radiation induced health afflictions vary considerably from nation to nation throughout the world. This paper reviews the readily available information on compensation schemes for various countries and focuses on whether such schemes for occupational radiation exposure induced health effects are covered by the specific circumstances of the work or under a general workers compensation regime. Conclusions lead to issues of what parameters make for an efficient, fair, timely and circumstance dependent occupational radiation compensation scheme.

1. INTRODUCTION

With increasing public awareness of the presumed risk to health attributable to the use of nuclear energy, there is also an increasing interest in the approaches (schemes) used to recognize the association of occupational exposure to radiation and adverse health outcomes in order to compensate fairly those so harmed. Furthermore, it is of interest to understand whether a compensation scheme is general in nature and applies to all workers regardless of the nature of work performed or specifically designed and applicable to radiation exposed workers. To review and evaluate various compensation schemes, the absence or application of several key concepts must be examined. These concepts include: the *types of affliction* compensated (injury versus illness, deterministic versus stochastic effects, permanent physical versus mental injury); the *criteria for compensation* (proof of causal relationship (existence of risk and/or proof of exposure), probability of causation versus presumptive, type and extent of radiation dose versus exceeded threshold dose); and, the *type of compensation* awarded (medical expense coverage, lump sum fixed amount, economic loss based on degree of wage loss or years of life lost, pain and suffering allowance, protection of employment contract).

The following discussion provides an overview of the current compensation schemes and the radiation dose reconstruction techniques utilized for cancer related claims.

2. DISCUSSION

A most enlightening summary of compensation schemes relevant to occupational harm attributable to ionizing radiation exposures may be found in the document entitled Compensation Regimes Applicable to Radiation Workers in OECD/NEA Countries produced by the OECD Nuclear Energy Agency (OECD/NEA) [1]. This summary examines compensation schemes from 20 participating OECD/NEA countries and in general notes an absence of specific compensation regimes solely applicable to radiation workers. With the exceptions of the United Kingdom and the United States of America, radiation workers in OECD/NEA countries are typically subject to the general worker compensation regimes or national based social insurance. This summary review does not provide information on pertinent OECD/NEA Member countries that failed to provide such information, or information on non-OECD/NEA countries.

For countries where general compensation regimes or national based social insurance schemes are applied, there is considerable variation in the types of affliction compensated, criteria for the proof needed to achieve compensation and type of compensation awarded. In the Republic of Korea, nuclear fuel cycle workers are compensated under standards established by the nuclear operator and approved by the Minister of Science and Technology, yet the standards governing payment of award comply with provisions of the Industrial Accident Compensation Insurance Act (a legislated general worker social insurance coverage). Australia, the Czech Republic, France, Germany, Greece, Italy, Japan, Luxembourg, Norway, Spain, Sweden and Switzerland use a general worker's compensation programme scheme or social insurance regimes to provide coverage for radiation related injuries and illnesses where the worker must 'establish' that permanent physical injury or illness occurred as a result of the work performed. France has perhaps one of the oldest (1898) general worker compensation schemes, one which has been amended several times to provide comprehensive coverage for deterministic and stochastic effects resulting from radiation exposure in various occupationally exposed workers (i.e. nuclear fuel cycle personnel, hospital and laboratory employees, miners and general industry workers). Denmark, Finland, Hungary and Iceland have no specific compensation scheme provisions for radiation workers. In Turkey, the Turkish Atomic Energy Authority has established an occupational radiation compensation scheme that requires a dose threshold (annual equivalent dose limits) basis be exceeded before additional health vacation or early retirement benefits would be awarded.

As regards countries with compensation schemes specific to radiation workers, these schemes vary in types of affliction compensated, criteria for compensation, type and extent of award coverage, and whether the scheme is nationally legislated or independently directed. In the UK, the Compensation Scheme for Radiation Linked Diseases (CSRLD) has provided compensation to workers exposed to ionizing radiation since 1982 [2]. The CSRLD is not a legislated legally binding scheme; participation is voluntary and supported by labour unions and nuclear energy employers. While it provides an alternative to legal recourse, the CSRLD does not prohibit a claimant from taking legal action unless the claimant has received an award under the scheme. In the USA, the Federal Government has intervened to provide federal compensation programmes with broad inter-state involvement in the case where large classes of radiation exposed workers are affected. For example, under the Radiation Exposure Compensation Act of 1984 (RECA), uranium miners, millers and individuals who transport ore are compensated if they are diagnosed with one of 22 'presumptive' cancers and meet specific time-frame requirements. Also in the USA, military veterans exposed to atmospheric nuclear detonations and tests are compensated once they provide diagnosis of a presumptive disease (cancer), proof that they were actually present during specified nuclear detonations and that they meet specific time-frame requirements. Lastly, the US Congress passed the Energy Employees Occupational Illness Compensation Program Act (EEOICPA) which compensates workers who were involved in the research development, testing and fabrication of nuclear weapons [3]. For cancer related claims, the EEOICPA scheme utilizes dose reconstruction methodologies which provide annual estimates of radiation dose for each claimant which are then used to determine the probability that the dose caused the specific cancer [4–6]. In the Russian Federation, a special compensation scheme legislated under the National Russian Federal Law on Social Protection has been initiated to provide coverage for emergency response workers exposed to, and affected by, radiation from the Chernobyl catastrophe [7]. All of these occupational radiation exposure related schemes are homogeneous in that they share the common trait of 'no fault basis' and require proof of eligibility in that the nature of the work resulted in the disease acquired. Each of these schemes employs various and different key concepts for determining a claimant's right to compensation.

With regard to type(s) of affliction compensated under these schemes, the CSRLD in the UK covers most cancers (Hodgkin's disease, chronic lymphatic leukaemia, hairy cell leukaemia and malignant melanoma of the skin excluded) and cataract of the eye. As previously noted, in the USA, RECA compensates for the stochastic effect of 22 cancers, as does also the compensation programme for military veterans. For the veteran's programme, types of cancer other than the 22 presumptive ones, cataracts and non-malignant cancer require a dose reconstruction and probability of causation process. Within EEOICPA, all cancers other than chronic

lymphocytic leukaemia are covered; deterministic effects are not compensated for under EEOICPA. In the Russian Federation, the Chernobyl 'liquidators' are compensated for acute (acute radiation syndrome and cataracts) and chronic (leukaemia and cancer) radiation induced effects as identified by the Public Health Ministry in a list of 21 diseases. Disabling effects from the Chernobyl catastrophe considered in this list include not only acute radiation syndrome, leukaemia and cancer, but also stress, change of life-style patterns and other social problems as well.

While all of these radiation worker specific schemes require proof of eligibility (employment as a radiation worker, exposure to radiation specific to the scheme and diagnosis of a covered health effect), the criteria for compensation under these schemes vary in application. The CSRLD utilizes a probability of causation determination to quantify the degree of confidence that a particular cancer was caused by the radiation exposure experienced. The probability estimate is used to determine the level of compensation as described below. The calculation of probability is accomplished by using dose histories provided by the employer, which are reviewed and confirmed by the claimant's respective trade union, and modified relative risk models accounting for uncertainty while giving the benefit of the doubt to the claimant. If agreement on dose history is not achieved between the employer and the trade union, the claimant may approach an independent expert panel or seek legal recourse.

In the USA, under the veteran's programme and EEOICPA for non-presumptive cancers, a dose reconstruction process using all available information on radiation exposure potential and established health physics methods provides annual reconstructed dose estimates. These dose estimates are then used in probability of causation, cancer specific risk models. These US approaches account for uncertainty in type and quantity of radiation dose, and uncertainty associated with the scientific basis for a given risk model. The US risk models are based on the 1985 National Cancer Institute's Radio-epidemiological Tables as modified for the respective scheme. Full benefit of the doubt is afforded to the claimant in how all uncertainty is handled and by the fact that probability of causation is set at the 50% probability level of the 99th percentile (upper bound of uncertainty). In the Russian Federation, manifestation of the covered health effect is sufficient for compensation of Chernobyl liquidators as determined by the Medical Commission; probability of causation is not used to determine degree of association of radiation exposure and health effect. Also, liquidator compensation is not dependent on recorded, assigned or reconstructed dose but on general information and data regarding working conditions (work performed, work location, time spent in work location). Dose reconstruction efforts on Chernobyl liquidators are performed as a critical component of research studies under way to better understand the health impact of the catastrophe.

Lastly, these compensation schemes specific to radiation workers vary considerably in type of compensation awarded. As indicated previously, the CSRLD awards

payments are based on a sliding scale using the calculated probability estimate to determine whether full, partial, or no payment is to be made. A 'quantum' determination of compensation amount (full sum) is comparable to that in a successful legal claim and the appropriate fraction applied to make the award with consideration given to claim specific factors (loss of earnings, pain and suffering, number of dependant children).

In the USA, RECA and EEOICPA provide a lump sum compensation of $150 000 and the veteran's programme compensates on the degree of disability or harm. The veteran's programme and EEOICPA also provide prospective medical benefits compensation for disabled claimants alive at the time of award. All Russian liquidators are compensated with a lifetime pension. For those found to be disabled with one or more of the 21 recognized diseases, their pension compensation is augmented by one of three levels of disability (1000, 2500, or 5000 roubles). Reportedly, all liquidators are further compensated by tax exemption, reduction of rent and communal services charges, free provision of medical services and free public transportation.

3. CONCLUSION

The majority of compensation schemes around the world which have been reviewed here do not have a specific focus on, nor are designed for, radiation workers; most schemes compensate health effects from radiation exposure under general, nationally legislated worker's compensation or social insurance regimes. Three countries were found to have compensation schemes designed and applicable specifically for the health effects associated with occupational radiation exposure. However, these varied in the types of affliction covered, criteria for compensation, and the type and extent of compensation awarded. There was similarity across the three countries' schemes with regard to 'no fault' ascribed to worker or employer and 'proof of eligibility' (presence in radiation work environment and diagnosed disease). Major differences across the schemes involve the manner in which causation is determined, the existence or not of lists or tables used to define compensatable afflictions presumed to be occupational in origin, and the type and level of compensation awarded. At issue is what parameters make for an efficient, fair, timely and circumstance dependent occupational radiation compensation scheme. Should occupational radiation compensation be designed and applicable to the circumstances of the work, and if so, should there be global compensation concepts or guidelines for a nation to consider in its scheme? Or, should compensation for radiation induced afflictions be covered under nationally legislated general worker's compensation or social insurance regimes, and if so, what global compensation concepts or guidelines should be available for consideration and use?

REFERENCES

[1] OECD NUCLEAR ENERGY AGENCY, Compensation regimes applicable to radiation workers in OECD countries, Nucl. Law Bull. **66** (2000) 7–12.
[2] LEWIS, M., IAEA-CN-91/108, these Proceedings (CD-ROM).
[3] ELLIOTT, L.J., et al., IAEA-CN-91/86, these Proceedings (CD-ROM).
[4] TAULBEE, T.D., NETON, J.W., ELLIOTT, L.J., IAEA-CN-91/87, these Proceedings (CD-ROM).
[5] ALLEN, D., NETON, J.W., ELLIOTT, L.J., IAEA-CN-91/85, these Proceedings (CD-ROM).
[6] SCHUBAUER-BERIGAN, M., et al., IAEA-CN-91/88, these Proceedings (CD-ROM).
[7] KOMAROV, E.I., IVANOV, E.V., IAEA-CN-91/124, these Proceedings (CD-ROM).
[8] CHUMAK, V., et al., IAEA-CN-91/59, these Proceedings (CD-ROM).

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