Radiation Exposures by Nuclear Facilities

Evidence of the Impact on Health

Inge Schmitz-Feuerhake, Michael Schmidt (Ed.)

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Introductory Remarks

Michael Schmidt
University of Portsmouth

The first announcement of this workshop was met with a very good response, and the programme committee was pleased to be able to include so-far unpublished new results and reports from on-going research projects.

The Sellafield leukemia cluster and the investigations following reactivated the debate on low dose effects of radioactivity and have been the subject of several scientific meetings. The questions of damage to the health of the population from normal operation of nuclear facilities, however, and of how radioactivity is absorbed into the human body, remain controversial (Fry, Schmitz-Feuerhake, Stewart, Kuni, Stather, Köhnlein).

It is generally accepted that health effects well above normal statistical variance would only be produced by high levels of radioactivity. Up to now, the most attempts to detect such levels failed to confirm exposures anywhere near the level to produce such effects. The work undertaken for COMARE (Robinson et al) in Sellafield and other British projects (Roman, Parker, Prosser, Sanchez) are published herein.

Gardner's contention that the Sellafield leukaemia cases where induced by preconceptual exposure of fathers was contested by many authors. The absence of measured effects in other at-risk populations does not necessarily statistically refute Gardner's thesis, and indeed new findings concerning preconceptional X-ray exposure for diagnostic purposes (Shu) confirm it, as well as findings in studies of male radiographers (Roman).

After the Sellafield leukemia cluster became known, investigations were started in other countries considering also other diseases (Viel, Goldsmith, West). In Germany, an exceptional leukemia cluster appeared between 1989 and 1991 in the vicinity of the boiling water reactor Krümmel. Higher than expected levels were also discovered near other nuclear facilities (Hoffmann, Kuni).

This conference took place ten years after the Chernobyl accident. Prof Lengfelder presenteds evidence that populations exposed over time to radioactivity suffer from a variety of diseases which until now were not thought to be related to radioactivity. Prof. Goldsmith presents interesting findings on a collective of immigrants from the Chernobyl region to Israel.

When effects appear near a nuclear plant and the question arises whether these were caused by radioactivity and if so, how one can show at what time in the past the exposure took place.An exciting new line of research is the reconstruction of exposure by counting broken chromosomes. This method has now been enhanced and refined by focusing on stable aberrations of chromosomes (Shevchenko, Snigiryova). It provides a way of measuring accumulated exposure over a long period of time. It was possible in this way to measure quite high doses in the population affected by the Three Mile Island nuclear accident in 1979 - in contradiction to former statements of the authorities - and through this to confirm the new epidemiologic findings about cancer in that region by Wing and coworkers.

Low accumulated gamma doses can now be detected by the new technique of Thermoluminescence Dosimetry in quartz containing material (Haskell). A significant increase in leukaemia was detected near the Nevada test site and this technique revealed the cause: radioacticity.

Another promising development of radiation detection is the Electron Spin Resonance in tooth enamel. It has been succesfully applied with populations affected by the Chernobyl fallout (Chumak).

Introductory Remarks

Frances A. Fry
National Radiological Protection Board

The presence of radioactive material in the environment, and particularly that due to discharges from nuclear facilities, continues to attract public concern. We are pleased to welcome you here to Portsmouth to this workshop on radiation exposures by nuclear facilities where, during the next few days, wen can discuss the current state of knowledge of the health facilities. I must warn you, however, that this is not an easy task. Geographical correlation studies may appear to show an association between nuclear facilities and health effects and may, indeed, point to a need for further investigation. Proof of causation is, however, an entirely different matter.

A timely illustration of this is given by a recent report from a UK advisory committee, the Committee on Medical Aspects of Radiation in the Environment (COMARE) which has considered the incidence of cancer and leukaemia in young people in the vicinity of the BNFL plant at Sellafield in Cumbria. The Committee rigorously examined a number of hypotheses: ionising radiation, not just as a result of operations at Sellafield but all sources (natural, medical, weapons fallout, the Chernobyl reactor accident, other industrial discharges); parental exposure to ionising radiation, exposure to chemicals; population mixing and the role of infections; combinations of factors. The Committee concluded that, on current knowledge, environmental radiation exposure from authorised or unplanned releases could not account for the excess cases of leukaemia and occupation exposure is very unlikely to have accounted for the excess. Environmental exposure to chemicals is unlikely to offer an explanation. The Committee did believe that a mechanism involving infection may be a factor, but considered that this alone could not account for the excess. The Committee could not rule out interactions between possible factors, but had no way of quantifying these effects. The Committee concluded by saying that little more would be gained by further studies of clusters in isolation, what is required is an insight into mechanisms of carcinogenesis.

Whilst some may find this outcome disappointing, it must be recognised that the report was the result of considerable, thorough work conducted by many experts in the relevant fields. I hope that we may conduct our workshop with the same scientific rigour that this Committee has shown. I look forward to an interesting workshop with, no doubt, some lively discussions.

Introductory Remarks

Inge Schmitz-Feuerhake
Society for Radiation Protection, Germany

A change of paradigm has occured in the science of radiation biology in the last few years. This has been caused by two extensive studies on occupationally exposed persons which confirmed that no threshold exists for effects, not only at the cellular level, but also in complete organisms, and that the low dose induction of cancer by low LET radiation is real. I refer to the investigation of Wing and coworkers on the Oak Ridge employees published in 1991 and the combined survey on nuclear workers in the U.K. published by Kendall et al. of the National Radiological Protection Board in 1992.

Of course, there have been several former findings in this field, as for example the Hanford results of Mancuso, Stewart and Kneale. But following publication of the mentioned later reports, there appears no longer to be any serious efforts to contradict the authors findings and establish refutations.

The non-threshold theory was developed more than 60 years ago by the geneticist and Nobel Prize Winner Herman J. Muller as a consequence of his X-ray studies in drosophila. At that time he also postulated that cancer is caused by a somatic mutation which can be initiated by a single cell event. Alice Stewart was the first one who found leukaemia induced by low level irradiation in humans. This was in 1956. Forty years later it is our aim in this workshop to evaluate health effects which are observed after the long term operation of nuclear installations.

The operation conditions and emissions in all kinds of reprocessing plants, nuclear reactors, and other establishments are certainly different. After repeated evidence of increased cancer and other effects in the neighbourhood of such establishments, however, the possible contribution of radioactivity should not be excluded any more. In my opinion, we have at least two proven cases in recent times where contamination has affected the population. One of them was the Pilgrim reactor in Massachusetts where Morris and Knorr found a correlation between reactor emissions and leukaemia increase in a case-control study. The other one is the boiling water reactor at Krümmel in Germany where we identified artifical radioactivity in several parts of the environment which can only be explained by emissions far above legal limits.

Summarizing the world-wide increasing experience, identifying gaps in the monitoring of releases and in the knowledge about radioactive pathways following releases into the environment would be of great value not only for the future protection of people but also for deriving the real dose-effect relationships for cases of chronical low dose exposure. I am convinced that this workshop will contribute to these aims.