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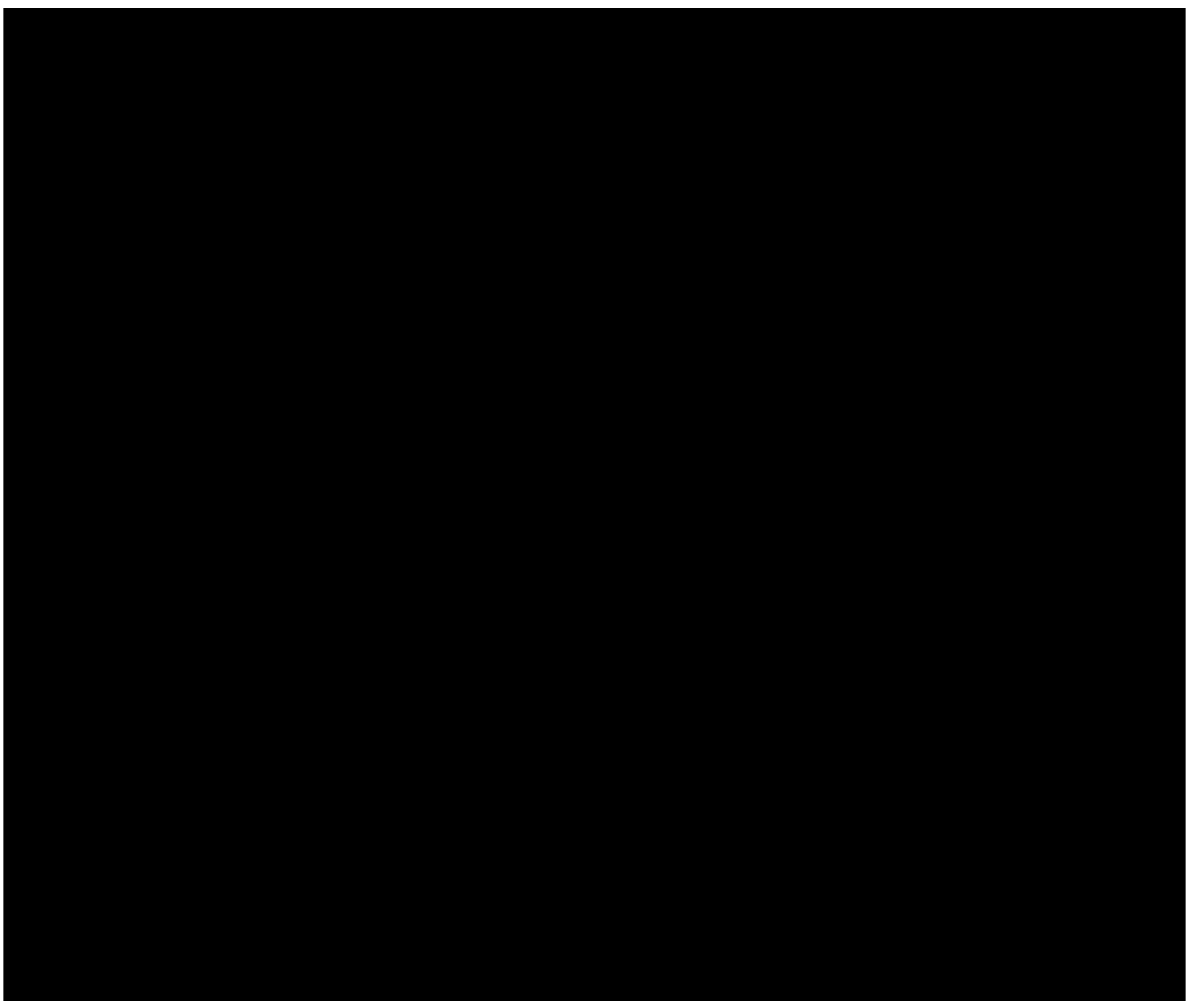
NWMO BACKGROUND PAPERS
3. HEALTH AND SAFETY

3-2 HEALTH ASPECTS OF HIGH-LEVEL RADIOACTIVE WASTES

EXECUTIVE SUMMARY

John K. Sutherland
Edutech Enterprises, Fredericton, New Brunswick, CANADA



Executive Summary

Everyone in society is unavoidably exposed to radiation from many sources and at an average annual chronic dose of about 3 millisieverts (mSv). Except for those individuals who undergo medical radiation treatments to counteract cancer or other health problems and who might receive up to several sieverts of acute dose, most individuals receive nearly all of their radiation dose from natural sources of radiation.

On average, about 75% of anyone's annual dose comes from nature, about 25% comes from medical sources of radiation, and about 1% is derived from industrial uses, other exposures, and sources within the home. Less than about 0.01% of the average radiation dose in society comes from all aspects of nuclear power including radioactive wastes [1] and yet it is this latter contribution that attracts the greatest media and political attention and thus causes the most public concern.

Studies on the health effects of radiation from extremely high and significant exposures, usually from bomb survivors, medical uses, or from radiation accidents, show that very high radiation exposures are associated with both short-term injurious somatic effects and - potentially - with long-term adverse health effects which extend out to several decades.

Radiation at acute doses of about 7 to 10 sieverts (Sv) is likely to be fatal in the short-term (weeks), to most of those who receive it. Those who survive, then face a longer-term radiation risk - suggested to be about 10%/Sv - of contracting a fatal cancer from 10 to 30 years following the exposure. Most individuals survive an acute dose of 1 sievert.

From about 1 sievert down to about 200 mSv of acute dose, short-term fatalities do not occur, and delayed effects are possible but are not expected. Long-term adverse effects can be calculated and may be epidemiologically defined, but are usually not obvious.

Below about 200 mSv of acute dose, no adverse health effects - short-term or long-term - can be statistically defined with any significance. For both low dose and low dose rate exposures, whether acute or chronic, the longer-term risk, assuming a straight-line relationship to dose, is believed to possibly overstate the risks by a factor of up to about 10. In this region, a low dose and low dose rate reduction factor of 2 is applied to the risk relationship, and the risk of development of a future fatal cancer is assumed to be 5%/Sv.

Health studies of occupationally exposed groups whose work exposures are comparable to average natural background levels - about 3 millisieverts per year - are not statistically associated with definable ill health that might be attributed to their exposures.

The average individual public dose from emissions from nuclear power production is suggested to be less than about 0.2 microsievert per year on average to each of the world's population [1], or about 15,000 times less than natural background exposures. There are no health studies which are statistically capable of defining any adverse health effect from any chronic radiation dose as low as 1 microsievert, or even of 10 millisieverts (ten thousand times larger) in a year.

As currently managed, high level radioactive wastes, contributing less than about 1 microsievert of dose each year to the public, and less than a few millisieverts each year to those who work with such wastes, do not appear to present a significant health risk.

Purpose and Scope of the Background Paper

In the last forty years there has been a growing concern about society's ability to manage its ever-expanding needs while protecting the general public, the environment, and future generations from those present activities that are presumed to be unusually hazardous or environmentally damaging. One of the many such activities is that associated with the production energy and of radioactive wastes, and their management and potential health effects.

The purpose of this paper is to define what we know about the human health aspects of radioactivity associated with short-term and long-term management of high-level radioactive wastes. It is generally recognized that if we protect humans - those most significantly exposed to such wastes and their associated radiation - then other generally less radiation-sensitive species [2] that are much less exposed or much less sensitive, will also be adequately protected [3]. However, this assumption has led to detailed evaluations of the effects of radiation on non-human biota to ensure that it is indeed reasonable and valid in all circumstances. Whereas human protection is concerned mostly with individual protection, the concern about non-human biota is more to do with species protection in individual habitats.

The paper is divided into several broad parts. The first describes some basic aspects of radiation. The second briefly describes and defines radioactive wastes, especially high-level radioactive wastes. The third provides a simple overview of what we know about radiation-related health effects learned over the last 100 years of radiation use, especially from its widespread use in medical procedures, where the highest radiation doses are received. The final section briefly looks at a ranking of the most significant social risks in our society and attempts to place the defined radiation risks from nuclear power and high-level radioactive wastes into the broader social context of risks and harm.