SRBT
ISO 9001
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FOR IMMEDIATE RELEASE

April 15, 2008

Vacant lands in the vicinity of SRB are primarily zoned as Industrial.

To ensure the protection of the public and the environment SRB has agreed with the City of Pembroke to perform surface soil sampling at all new developments within the vicinity of the SRB Facility.

To date, two developments have been initiated near the site, including the construction on the vacant lands immediately to the east of SRB.

Soil samples were collected and analyzed by an independent third party with tritium concentrations in soil water of less than 340 Bq/L.

These results are well below the Ontario Drinking Water Guideline of 7,000 Bq/L.

It is important to understand how the Ontario Drinking Water Guideline of 7,000 Bq/L was developed.

If an individual was to use water with concentrations of 7,000 Bq/L as a sole source of drinking water for the entire year, their radiation dose would equal approximately 0.1 mSv/year or 10% of the public dose limit set by the Canadian Nuclear Safety Commission of 1 mSv/year.

Therefore if somebody was to extract the moisture within soil at the highest level found of 340 Bq/L, and use it as a sole source of drinking water for the entire year, their dose for the year from drinking that water would equal approximately 0.005 mSv, less than 1% of the public dose limit of 1 mSv/year.

For comparison it is important to note that on average according to the International Atomic Energy Agency (IAEA):

- Radiation exposure to the public due to all natural sources in Canada is 2.4 mSv/year.

- An abdomen x-ray would result in a radiation dose of 0.5 mSv.

- Air travel from Montreal to London, England would result in a dose of 0.0478 mSv.

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IAEA

International Atomic Energy Agency

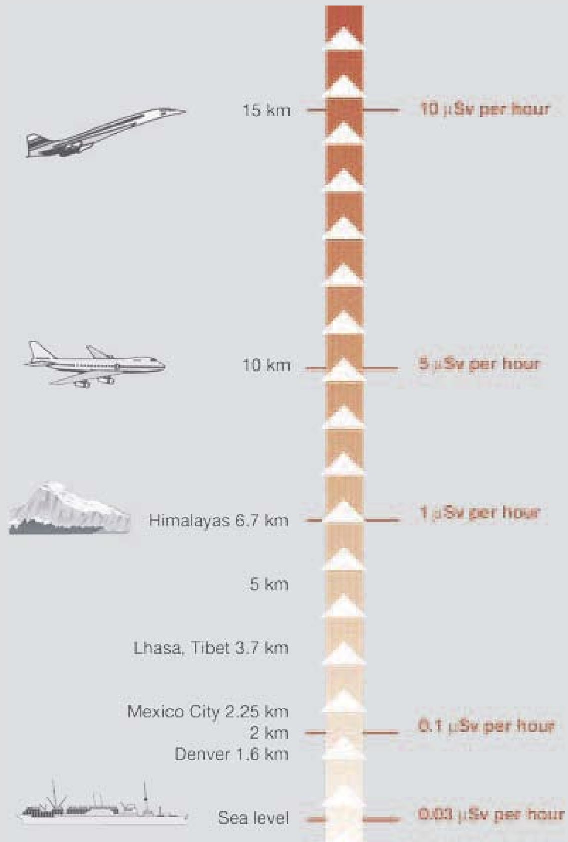
Radiation, People and the Environment

RADIATION, PEOPLE AND THE ENVIRONMENT

... a broad overview of ionizing radiation,
its effects and uses,
as well as the measures in place
to use it safely

IAEA
International Atomic Energy Agency

fliers' will be much higher than this average), but this does not affect the world average of 0.4 mSv.



Gamma radiation

All materials in the Earth's crust contain radionuclides. Indeed, energy from natural activity deep in the Earth contributes to the shaping of the crust and the maintenance of internal temperatures. This energy comes mainly from the decay of the radioactive isotopes of uranium, thorium and potassium.

Uranium is dispersed throughout rocks and soils in low concentrations of a few parts per million (ppm). Where it exceeds 1000 ppm or so in an ore, it may be economical to mine it for use in nuclear reactors. Uranium-238 is the parent of a long series of radionuclides of several elements, which decay in succession until the stable nuclide lead-206 is reached. Among the decay products in the series is an isotope of the radioactive gas radon, namely radon-222, which can reach the atmosphere, where it continues to decay. Thorium is similarly dispersed in the ground. Thorium-232 is the parent of another radioactive series, which gives rise to radon-220, another isotope of radon, sometimes called thoron. Potassium is far more common than either uranium or thorium and makes up 2.4 per cent by weight of the Earth's crust. The radionuclide potassium-40, however, constitutes only 120 ppm of stable potassium.

Annual effective doses from natural radiation

Source	**Worldwide average Dose (mSv)**	**Typical range Dose (mSv)**
Cosmic radiation	*0.4*	*0.3–1.0*
Gamma radiation	*0.5*	*0.3–0.6*
Radon inhalation	*1.2*	*0.2-10*
Internal irradiation	*0.3*	*0.2–0.8*
Total (rounded)	*2.4*	*1.0–10*

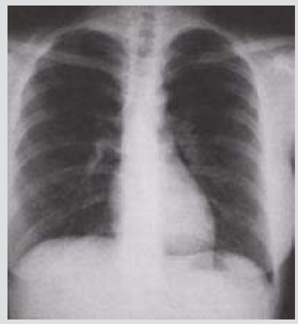
Based on Table 1 of UNSCEAR 2000 Report to UN General Assembly

Diagnostic radiology

First X ray of hand (Frau Röntgen)

In a conventional X ray examination, radiation from a machine passes through the patient. X rays penetrate flesh and bone to different degrees and produce images of the internal structures of the body on photographic film. In some cases, the images are captured and processed electronically. The value of these images explains why doctors conduct as many as one diagnostic X ray per person per year in developed countries.

The parts of the body most frequently examined are the chest, limbs, and teeth, each accounting for about 25 per cent of the total number of examinations. Doses are fairly low — about 0.1 mSv from a chest examination, for example. Effective doses from other types of examination, such as the lower spine, are higher because organs and tissues that are more sensitive to radiation are exposed to a greater degree. Examinations of the lower bowel using a barium enema result in a substantial effective dose around 6 mSv; only 1 per cent or so of all examinations are of this type.



Typical doses to patients from conventional X ray and computed tomography examinations

Derived from data in UNSCEAR 2000 Report, Annex D, Vol. 1 Tables 15 and 19

Examination	***Conventional X ray dose (mSv)***	***Computed tomography dose (mSv)***
Head	*0.07*	*2*
Teeth	*< 0.1*	*–*
Chest	*0.1*	*10*
Abdomen	*0.5*	*10*
Pelvis	*0.8*	*10*
Lower spine	*2*	*5*
Lower bowel	*6*	*–*
Limbs and joints	*0.06*	*–*

Typical doses to patients from common investigations of organs in nuclear medicine

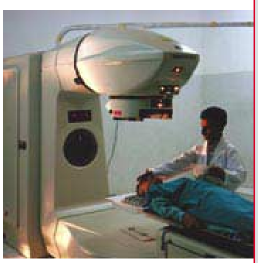
Rounded values, derived from data in UNSCEAR 2000 Report, Vol.1, Annex D, Table 42

Organ scan	Effective dose (mSv)
Brain	7
Bone	4
Thyroid, lung	1
Liver, kidney	1

When radionuclides are used for treatment rather than diagnosis, much greater activities are given to the patient and much higher doses are given to the target tissues or organs. The treatment of an overactive thyroid gland — hyperthyroidism — is probably the most common therapeutic procedure, the radionuclide used being iodine-131.

Although the radionuclides used for these procedures have short half-lives, medical staff need to take account of the fact that activity will remain in the body of a patient to whom a radionuclide has been given for some time after the procedure. This might need to be taken into account, especially after therapeutic procedures, in deciding when he or she can be discharged from hospital. Family and friends of the patient may also sometimes be advised by the hospital to take appropriate precautions against inadvertent exposure from this residual activity.

Radiotherapy



This technique is used to cure cancers or at least to alleviate the most distressing symptoms, by killing the cancerous cells. A beam of high energy X rays, gamma rays or electrons is directed towards the diseased tissue so as to give it a high dose while sparing the surrounding healthy tissue. If a tumour is deep in the body, the beam is pointed at it from several directions so as to reduce the incidental damage. Another form of treatment, in which a radiation source is placed in or on the body for a short period, is used for some cancers: it is called *brachytherapy*. As radiotherapy doses are strong, such treatment is only used when the outlook for a cure or relief is good and when other methods of treatment would be less effective.

Although radiotherapy can cure the original cancer, it may possibly cause cancer in other tissues or adverse hereditary effects in subsequent generations. Most people who receive radiotherapy are, however, past the age to have children and too old for delayed cancers to occur. So the aim of radiotherapy is to maximize the effectiveness of treatment while minimizing the adverse side-effects.

Tumours require absorbed doses of tens of gray to kill the cancer cells effectively. Prescribed doses to tissues are typically in the range 20–60 Gy. Considerable care is required to deliver accurate doses: too low or too high doses may lead to incomplete treatment or unacceptable side-effects. Rigorous quality assurance procedures are needed to make sure that equipment is properly set up and maintained. If this

Effective dose during air travel

Source: Exposure of Aircraft Crew to Cosmic Radiation, a report of the EURADOS Working Group 5 to the Group of Experts established under Article 31 of the Euratom Treaty. European Commission

Cities	***Effective Dose (μSv)***
Vancouver ➤ Honolulu	*14.2*
Frankfurt ➤ Dakar	*16.0*
Madrid ➤ Johannesburg	*17.7*
Madrid ➤ Santiago de Chile	*27.5*
Copenhagen ➤ Bangkok	*30.2*
Montreal ➤ London	*47.8*
Helsinki ➤ New York (JFK)	*49.7*
Frankfurt ➤ Fairbanks, Alaska	*50.8*
London ➤ Tokyo	*67.0*
Paris ➤ San Francisco	*84.9*

Total doses

The collective effective dose from occupational exposure to ionizing radiation is about 14 000 man Sv in a year worldwide, and workers can receive a few mSv in a year in some industries. Somewhat more than 80 per cent of this collective dose is from enhanced natural sources; less than 20 per cent is from man-made sources. The worldwide average dose to workers dealing with artificial sources is 0.6 mSv, and to workers exposed to natural sources it is 1.8 mSv. Combining these figures, the overall global average worker dose is 1.3 mSv per year. However, spread over the entire population, this implies an annual dose of about 0.002 mSv, a relatively minor contribution to the overall value of 2.8 mSv from all sources.