



How Safe are Medical x-rays? Environmental Health Guide

What are x-rays?

X-rays are electromagnetic radiations like light but, because of their greater energy, are able to penetrate materials that absorb or reflect visible light.

Discovered in 1895, x-rays are widely used in medical, dental and chiropractic diagnosis as well as in medical therapy, veterinary practice, industry and research.

Although x-rays can occur in nature from the decay of radioactive substances, they are more usefully generated artificially by passing an electric current at high voltage through an x-ray tube. The x-ray beam's characteristics - primarily its intensity and penetrating power - can then be more readily controlled.

Why are x-rays Useful?

When used for medical diagnosis, x-rays pass through the human body and are recorded on x-ray film or other imaging media. For example, during a CT (computed tomography) scan, the scanner constructs images of the body from electronic detectors placed on the body and connected to a powerful computer, reproducing the image on a video screen.

X-ray images of the body are formed because the x-rays are absorbed to varying degrees by the different density tissues they encounter. Denser tissues such as bone absorb more x-rays than the softer tissues of muscle and fat, which in turn absorb more x-rays than air.

What are the Effects of x-ray Exposure?

X-rays absorbed by the body during medical procedures release energy to produce ionisation. Ionisation is the release of electrons from atoms and molecules which may then produce chemical and biological change.

The more x-rays absorbed during an exposure, the greater is the number of possible biological changes. Although the ionisation process occurs at the time of the exposure, any potentially harmful effects, if they occur at all, generally take years to appear.

An exposure to x-rays does not make a person radioactive nor is there any 'residual' radiation in the body as a result of an x-ray exposure.

What is known about Radiation Effects?

Radiation effects on human health have been studied ever since the discovery of x-rays and other ionising radiations late in the 19th century, but the atomic bomb explosions over Hiroshima and Nagasaki in 1945 led to greatly increased research.

More is known about the risks from ionising radiation than from most other physical or chemical agents in our environment. The effects of large radiation doses on human health are well documented. However, at the much lower doses used in most diagnostic x-ray procedures, the effects are not obvious.

Short term effects from the radiation doses used in most diagnostic x-ray procedures should not occur (*although there have been reports elsewhere of radiation burns to the skin as a result of lengthy invasive procedures*).



Long term concerns include the possible induction of cancer, foetal and hereditary effects but the long term risk to an individual is low.

For example, the increased cancer risk from a single chest x-ray is about 1 in 400,000. In comparison, the lifetime incidence of cancer in the general population is about 1 in 4.

While there is evidence for radiation-induced hereditary defects in other species, no such effects in humans have yet been discovered despite detailed and continuing studies of exposed populations.

Natural Radiation Background

The highest radiation dose most people receive arises from exposure to the naturally occurring background of cosmic radiation sources and natural radioactivity in the earth, air and water.

Diagnostic x-rays add perhaps 25 per cent to the population's natural background exposure and are by far the greatest artificial source of radiation exposure to the population.

How Safe Are Diagnostic x-Rays?

Diagnostic x-rays cannot be considered to be completely without risk but the risks will vary depending on the procedure.

For many examinations, the radiation dose is no greater than the dose we receive from natural background radiation in one year.

Nevertheless, x-ray examinations should be limited to those which are necessary for proper management of a patient's condition. Examinations which are unlikely to be of clinical benefit should be avoided.

Some pre-employment x-ray examinations, particularly those of the lumbar spine, are of dubious value. Examinations involving exposure of the lower abdomen or pelvis in pregnant women need particular consideration by the referring practitioner.

The benefit of diagnosing a patient's condition from a properly conducted and clinically necessary x-ray examination should far outweigh the small risk involved.

What if I am Pregnant?

If you are pregnant or suspect that you might be pregnant, inform the doctor before having an x-ray examination. If the foetus is likely to be exposed to the direct x-ray beam it may be possible, if medically advisable, to delay the x-ray examination until after the pregnancy.

If the examination cannot be delayed, the person operating the x-ray equipment should take all practicable measures to minimise the radiation dose received by the foetus.

X-rays of the mother's body which involve the head or limbs are of negligible risk to the foetus provided the x-ray beam is restricted to the part of the body being examined.

With the imaging techniques now available it is unlikely that the foetus would be at significant risk even during pelvic or abdominal x-ray examinations.

An ultrasound examination does not involve the use of x-rays or other ionising radiations.



Control Over the Use of x-rays

In Western Australia, x-ray equipment and the premises where it is located must comply with internationally recognised standards of safety for the patient and operator, and for anyone else who may be in the vicinity.

Legal controls on the design and performance of the equipment, the competence of users, and structural radiation protection are applied through the State's Radiation Safety Act.

Further Information

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