NRL
National Radiation Laboratory

The Source

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Introducing *The Source*

The Source is a quarterly publication produced by the National Radiation Laboratory (NRL) distributed free to users of ionising and non-ionising radiation in New Zealand.

Over the last two years we have been looking at ways to improve our communication with radiation users so that they can be better informed about their legal obligations and radiation protection in general. As a result, NRL has developed a website which is regularly updated (www.nrl.moh.govt.nz), and the regulatory affairs newsletter *NRL Matters,* which keeps licensed users and other parties informed of emerging legal issues that may affect them.

The Source is intended to inform across a wider range of topics and issues of interest. While some articles will be of specific vocational interest, our objective is to inform and educate across the whole subject area of ionising and non-ionising radiation. In keeping with this aim, Issue One considers aspects of the present debate regarding the effectiveness of mammography screening programmes, presents advice regarding where dentists should stand when taking x-rays, while also noting New Zealand's involvement with research into cellphones and cancer, and our involvement with the Comprehensive Nuclear Test Ban Treaty.

In many cases, NRL will have more detailed information available relating to articles included in *The Source,* and contact details are provided in such cases. Each issue will be available on our website.

We welcome feedback from readers regarding the content and usefulness of the publication, and in particular we would like **you** to tell us what information should be included in future issues.

The role of mammography in breast cancer screening

A recent article in *The Lancet* (Is screening for breast cancer with mammography justifiable? P C Gotzsche, O Olsen. **355:**129-134, 2000) casts doubt on the effectiveness of the use of mammography in national breast screening programmes as a means of reducing mortality rates. The article claims that previous studies which demonstrated the efficacy of screening mammography had deficiencies which rendered those findings invalid.

Interpreting epidemiological studies has always been fraught with difficulties and those associated with mammography in breast screening are no exception. Indeed there is a commentary in the same issue of *The Lancet* which provides a different interpretation of the new study.

In the wake of *The Lancet* article the Ministry of Health has reiterated its position on New Zealand's breast screening programme: "Evidence indicates that death rates from breast cancer are declining in many countries which have screening programmes… the public should be aware that it takes up to a decade for benefits to appear."

As part of setting up the national breast screening programme the Interim National Quality Standards were developed by the Ministry of Health in conjunction with professionals from the many disciplines involved. In 1999 the Ministry and the Health Funding Authority contracted Standards New Zealand to, amongst other work, review the interim standards with a completion date of June 2000. Input from radiologists, medical radiation technologists and medical physicists will be sought in the area of mammography.

Further information can be obtained from John Le Heron (John_Le_Heron@nrl.moh.govt.nz)

The 1999 NHS (UK) Breast Screening Review can be accessed on the internet at: www.carelink.info-com.com/breast-screening/bsp_news.htm

A new edition of the American College of Radiology's *Mammography quality control manual* has recently been published. This fourth edition, 1999, includes a new section on *Clinical image quality* in addition to the existing *Radiologist's, Radiologic Technologist's, & Medical physicist's* sections.

NRL calibration services

Calibration of radiation monitoring equipment is critical in ensuring radiation safety. NRL provides a service that can deliver calibrations for most types of radiation measuring equipment found in industry, research and medicine in New Zealand.

In the same way that standards exist for mass (the international standard of mass is a 1 kg block of metal situated in Paris, and the New Zealand standard is a metal block that has been compared with the Paris block and is sitting in Wellington), there are standards for radiation quantities such as dose and exposure.

NRL maintains its own primary standards of exposure, including free-in-air ionisation chamber primary standards of exposure for low and medium energy x-rays (10 kV to 300 kV) and a graphite cavity ionisation chamber primary standard of exposure for cobalt-60 gamma radiation. It also holds secondary standards that are traceable to American and Australian national standards for low and medium energy x-rays, caesium-137 and cobalt-60 gamma rays. Traceability to the National Institute of Standards and Technology (NIST), USA, is also maintained for caesium-137 gamma rays. Types of instruments calibrated include dosemeters used by hospital radiotherapy centres, "Geiger counter" type survey meters used in radioactive materials laboratories, and the film badge monitors that a number of readers will be familiar with.

For further information contact John Laban (John_Laban@nrl.moh.govt.nz)

Trans-Tasman harmonisation of radiation safety practices

Australian State and Commonwealth regulators, together with NRL, have been discussing for some time the need to harmonise radiation safety practices, both between the two countries and inter-state. One of the main reasons for this has been the recently introduced *mutual recognition* legislation. In addition, a number of professional medical bodies, including the Royal Australian and New Zealand College of Radiologists, are well advanced in developing their own harmonisation policies regarding registrations and competency assessment procedures.

As part of this process NRL has been given official observer status on the newly constituted Australian *Radiation Health Committee (RHC)*. At its most recent meeting it was agreed that wherever possible both countries should develop similar *Codes of Safe Practice*, licensing protocols, and competency assessment programmes. Trans-Tasman harmonisation is likely to have considerable effect upon the processes adopted for both approving and re-issuing licences in the future. More information will be provided as these changes are considered for adoption.

Cellphones – the final word?

New Zealand researchers are taking part in a world-wide study coordinated by the International Agency for Research on Cancer (IARC) to try and resolve the question of whether the radio signals from cellphones cause brain tumours.

Research carried out to date does not provide persuasive evidence of a link between the two. There are conflicting results from both human and animal studies, and many of the studies carried out so far have suffered from flaws in their research methods. For these reasons, and because exposures to the head of a cellphone user are amongst the highest encountered in everyday life (although they comply with internationally recommended limits), the IARC decided to coordinate a comprehensive study of several thousand cellphone users in different countries in order to have more definitive data.

The New Zealand part of the study, which will run for several years, is being led by Professor Alistair Woodward of the Wellington School of Medicine. He is presently working on the study design to ensure that robust methods are used.

NRL continues to monitor research in this area and an NRL Information Sheet no. 21, *Safety of cellphones*, is available on our web page. For further information contact Martin Gledhill (Martin_Gledhill@nrl.moh.govt.nz)

Dental drill

This is the first of a series of brief articles on a wide variety of aspects associated with radiation safety in the dental practice. Some of the topics covered will relate to the safety of the dentist and their staff, such as why there is a safety issue, should you wear a lead apron, should your occupational exposure be monitored, and what if the dentist or staff are pregnant? Other topics will relate more directly to the patient. Many of these will be a discussion of factors which influence the relationship between image quality and patient dose, given the primary aim of ensuring good films for a minimum of patient dose. Debate and further questions are welcome and should be addressed to John Le Heron (John_Le_Heron@nrl.moh.govt.nz)

Scattered radiation in the dental practice – where to stand

Where do the x-rays that can lead to staff exposure come from? Obviously the original source of the x-rays is the x-ray machine, the intra-oral, panoramic or extra-oral unit. This controlled beam of x-rays (usually called the primary beam) is directed at a specific part of the patient's head in order to produce the required image. Staff should never stand in the line of the primary beam. As the primary beam passes through the patient's head some of its x-rays interact with the tissue, bone and teeth in its path producing what are called scattered x-rays (commonly referred to as scatter). These x-rays leave the head in all directions and can lead to occupational exposure.

How much scatter is there?

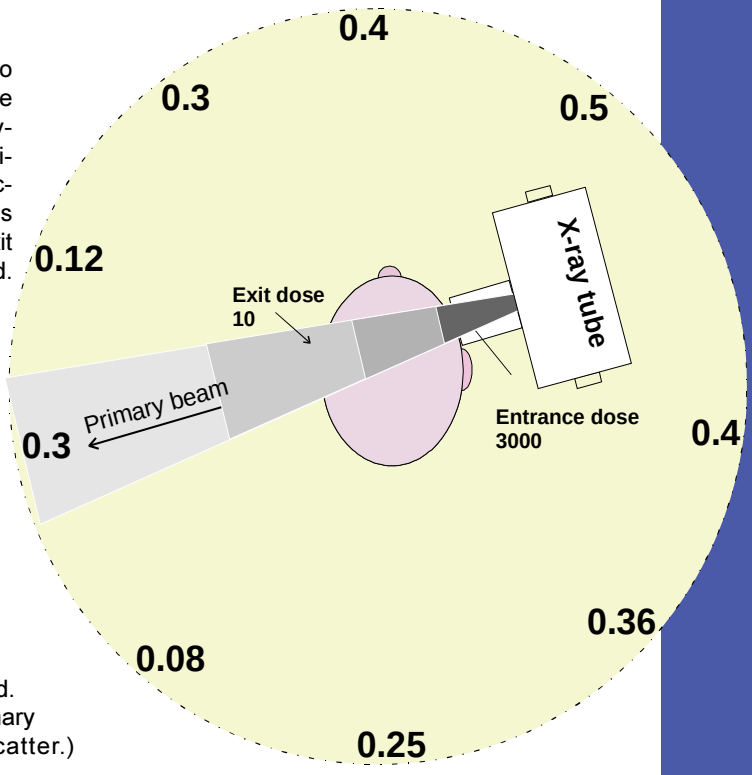
The amount of scatter from the patient's head is largely determined by the intensity of the primary beam and the volume of head irradiated. So, the larger the amount of incident radiation, and the bigger the volume of tissue in the primary beam, the more scatter. Fortunately in dental radiography (especially intra-oral and panoramic) the x-ray beam area is very small leading to comparatively low levels of scatter. A rough rule of thumb is that the amount of scatter at 1 metre from the patient is less than one-thousandth of the incident primary beam intensity.

So, where should you stand?

There are, therefore, two factors that can be varied to minimise occupational exposure. These are the direction with respect to the patient (and deployment of the primary beam) and distance. A minimum distance of 2 metres from the patient is recommended and in a position behind the patient's head. This position is exposed to the lower level exit beam scatter, as well as using the head as a shield.

Does the same amount of scatter reach all parts of the room?

The amount of scatter produced that ends up at a given point in a given direction is dictated by the amount of overlying tissue and bone that the scattered x-rays pass through, and the distance from the head. The overlying tissue attenuates the scatter, and distance allows it to diverge, giving an approximate reduction in intensity in proportion to the square of the distance from the patient. More scatter is produced on the entrance side of the primary beam (because the x-ray intensity is higher) than on the exit side, so this will also affect the amount of scatter reaching a given position in a room.



Scatter doses at 1 metre in microsieverts for an intra-oral exposure made at 60 kV, 0.7 second, 200 mm FSD.

These are illustrative values only. (NB: scatter levels are highest on the entrance side of the head. Note also that the dose value given in the exit primary beam is due to both the primary beam and scatter.)

Test Ban Treaty monitoring stations: New Zealand first in the world

Three radioactivity monitoring stations forming part of a global network established under the Comprehensive Test Ban Treaty (CTBT) were installed by NRL at the end of January. The stations, in Kaitaia, the Chatham Islands and Rarotonga, are the first three purpose-built stations in the world established under the Treaty.

Chatham Islands' radioactivity monitoring station

Data is transmitted over a satellite link to the CTBT Headquarters in Vienna for analysis. Spectra from each station are compared with the characteristic spectrum of gamma rays produced by radionuclides released from an above-ground nuclear test, and unusual spectra are logged on daily event bulletins which are made available to treaty signatories.

At each station air is drawn through a filter which traps airborne particles. At the end of 24 hours (by which time around 20,000 cubic metres of air will have passed through the filter), the filter is replaced and set to one side for a further 24 hours to allow short-lived radionuclides to decay. Finally, the filter is compressed and placed on a sensitive gamma-ray detector enclosed in a lead shield for 24 hours. The detector accumulates a spectrum showing the energies of gamma rays being produced from particles on the filter.

Construction and operation of the system is entirely funded by the CTBT organisation. NRL is also hosting one of 16 Certified radionuclide measurement laboratories under the Treaty, and in the future equipment involving different technologies, including seismic monitoring for detection of underground tests, will be installed in various locations.

Further information can be found on the NRL web page, or contact Rick Tinker (Rick_Tinker@nrl.moh.govt.nz)

ReSources

Items of interest in radiation safety and protection received recently at the NRL library.

The *Ionising Radiations Incident Database (IRID)* was established in the UK in 1996. This *First review of cases reported and operation of the database*, includes a brief case history of 84 of the incidents and accidents listed in the *Database*, including a valuable section on lessons learned from each incident.

ICRU report 62, 1999, is a supplement to ICRU report 50, 1993, and shares the same title: *Prescribing, recording and reporting photon beam therapy.*

ICRP publication 80: *Radiation dose to patients from radiopharmaceuticals* (addendum to ICRP 53). ICRP 80 also includes an Addendum to ICRP publication 72: *Age-dependent doses to members of the public from intake of radionuclides : part 5. Compilation of ingestion and inhalation dose coefficients*.

Documents of the NRPB v 10 no. 3, 1999 is entitled *Genetic heterogeneity in the population and its implications for radiation risk*. While it is normally assumed that the risk of exposure to a dose of ionising radiation is the same for everyone of comparable age and sex, if certain individuals were hypersensitive to radiation, they would then be at greater risk than an average member of the population. Equally, there could be resistant individuals who would be at lesser risk. This report by the Advisory Group on Ionising Radiation summarises what is known about variations in response to radiation due to genetic differences in people.

The *ICRP database of dose coefficients: workers and members of the public*. This CD-ROM is an extension of ICRP publications 68 & 72. The NRPB has also published a *Guide to dose coefficients*. Its main purposes are:

- to review some of the models and methods used in the calculation of dose coefficients
- to list the publications in which the models, methods and dose coefficients appear
- to advise on how the dose coefficients can be applied in various situations.

Most of these items can be borrowed on interloan through your library.

For further information contact: National Radiation Laboratory
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