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NRL Radiation Incident Response Plan

The out-of-hours number for contacting the NRL Duty Incident Officer in the event of a radiation incident has changed. The new number is **021 393 632.** Please remember to update your emergency procedures.

For more information on the NRL Radiation Incident Response Plan refer to issues 7, 9, 14 and 15 of *The Source*.

Radioactive materials package taken from Auckland depot

On 22 June 2004 a radioactive materials package was taken by an unauthorised person from the depot of a courier company in Auckland. The package contained approximately 6 GBq of samarium-153 intended for the pain relief of a cancer sufferer.

Prolonged exposure to the unshielded source, or ingestion of the radioactive material would have resulted in a significant and potentially harmful radiation dose. Consequently, NRL notified the police as soon as it was made aware of the incident. The incident was followed up by the police and media releases were made to alert the public of the potential hazards.

The following day the package was returned to the depot. It transpired that the package was inadvertently picked up by another courier company. Due to the delay in transport the material could no longer be used for its intended purpose.

NRL is conducting investigations with the courier companies involved to review security arrangements and compliance issues related to the International Atomic Energy Agency Transport Regulations. The event was reported to the IAEA.

Updated laser Standard published

Standards New Zealand has recently published AS/NZS 2211.1:2004 Laser safety - *Equipment classification, requirements and user's guide*. This replaces the 1997 version, and follows the IEC 2001 laser safety Standard with the exception of a few minor variations noted in an appendix.

The main change to the Standard is the introduction of Classes 1M and 2M. Lasers in these classes produce either large diameter or highly divergent beams, and when viewed by the naked eye the risks are the same as for Class 1 and 2 lasers respectively. However, these beams pose greater risks when viewed through magnifying optics which concentrate more of the beam onto the retina. Class 3A is renamed Class 3R, and the old "Class 3B (restricted)" (an Australasian peculiarity added to distinguish surveying lasers from other Class 3B devices) has been removed.

Medical users of lasers are reminded that AS/NZS 4173:1994 *Guide to the safe use of lasers in health care* is still current and contains a wealth of informative and practical material on the development of laser safety programmes in hospitals and clinics.

Standards can be obtained from Standards New Zealand, 155 The Terrace, Private Bag 2439, Wellington, phone 0800 782 632, fax 04 498 5994, www.standards.co.nz

For further information contact Martin Gledhill (martin_gledhill@nrl.moh.govt.nz).

MINISTRY OF HEALTH
MANATŪ HAUORA

NRL is a specialist business unit of the Ministry of Health

2005 Recommendations of the International Commission on Radiological Protection (ICRP)

Radiation protection worldwide is based on the recommendations of the International Commission on Radiological Protection (ICRP). This is an international group of experts that was originally established in 1928 to review and advise on the safe use of radiation. Their most recent recommendations were issued in 1990 (ICRP 60) which established a radiation protection framework based on the well-known radiation protection principles of justification of a practice, optimisation of protection ("ALARA"), and individual dose limitation.

In the years since publication of ICRP 60 the Commission has been reviewing the data on the health effects of radiation, and how successfully the previous recommendations have been implemented. The result is a proposed new set of recommendations to be published in 2005. These are currently available in draft form for comment (see http://www.icrp.org/icrp_rec_june.asp).

The ICRP introduces the 2005 recommendations by stating that there is nothing fundamentally wrong with ICRP 60. The new developments are a "natural evolution of and further clarification of" the previous recommendations. The most fundamental shift in focus is the acceptance that societies now prefer to take responsibility for setting their own safety standards. Instead of the ICRP making decisions on safety standards and expecting the international community to adopt them, they see the new recommendations as guidelines to allow communities to make their own informed decisions.

The most fundamental level of protection is now the "dose constraint". This is a restriction on the maximum dose that can be received by anyone in a year from any particular controlled radiation source, and has the advantage of being directly controlled by regulation. National authorities can set dose constraints applicable within their jurisdiction, which should be within the maximum constraints set by the Commission. The recommendations have retained the individual dose limits. These remain at the ICRP 60 levels, although new data suggest that the health risks from radiation, particularly for hereditary effects, are not as great as was thought when these limits were set in ICRP 60. Justification of practices involving radiation is now seen as the function of society and the relevant professional groups, and is not considered to be within the ICRP scope. The concept of optimisation is widened to include the fostering of a "safety culture", a process of review and improvement, and now embraces accidents and potential exposures as well as planned exposures.

A new element is the inclusion of specific protection of the environment and non-human species, rather than assuming this would necessarily happen as a result of protecting humans. The Commission does not set safe levels, but rather provides a framework to allow standards to be set and particular situations to be evaluated.

The question must arise: what difference is all this likely to make in New Zealand? The answer is probably not much. Practice here is well within the standards set in ICRP 60, and if anything the new recommendations give assurance that the old standards are at least as safe as we thought, and they will give greater room for flexibility. That should be good news for everyone using radiation.

Radiation Safety Course for Industrial Radiographers

NRL is planning a radiation safety course for industrial radiographers. The course will be run in Christchurch and is scheduled for the later part of September.

The course will cover the "Core of Knowledge" that a licence applicant must demonstrate an understanding of in order to be granted a licence to use irradiating apparatus and/or radioactive sources for performing industrial radiography.

Please contact Wayne Randle or Cris Ardouin at NRL to register your interest.

ReSources

Newly available on the NRL website (www.nrl.moh.govt.nz):

- Modified information sheet: IS20. *Laser safety*
  (Follow the links:
  Publications – Information sheets
  or
  FAQs & Advice – Information sheets – Laser safety)
- Modified information sheet: IS24. *Safe use of laser pointers*
  (Follow the links:
  Publications – Information sheets
  or
  FAQs & Advice – Information sheets – Laser pointer safety)
- Environmental radioactivity in New Zealand and Rarotonga – Annual report 2003
  (Follow the links:
  Publications – Miscellaneous items – Environmental annual report
  or
  Services & Products – Environmental – Radioactivity monitoring)

MINISTRY OF HEALTH
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Dental drill: radiation effects arising from dental uses of x-rays

In this concluding article in the current series of the *Dental Drill* I will briefly discuss health effects to the patient and dental staff that have been attributed to the use of dental x-rays.

Fingers in the beam

In the pioneering days of dental radiography it was fairly common practice for dentists to hold the film in the patient's mouth with their hands. This usually resulted in the fingers being in the incident primary x-ray beam. The incident radiation doses at the time were significantly higher than they are now (see *The Source* Issue 13, August 2003) and, combined with large numbers of exposures over periods of years, resulted in many of these dentists suffering significant radiation damage to the fingers – radiation-induced dermatitis, squamous cell carcinoma, and tissue necrosis were among the effects reported.

Cancers?

As the practice of performing dental radiography evolved and as x-ray and imaging technologies were developed and improved, occupational and patient exposures became less with the result that the potential for health effects diminished. Doses to patients in dental radiography today (see *The Source* Issue 7, September 2001) are of a small magnitude with any health effects being limited to a very small increase in the risk of cancer.

Other effects?

Some studies have suggested an association between dental x-rays and an increase in salivary gland tumours. That the association is causal is considered unlikely because the same studies did not report thyroid effects despite similar doses and the latter's comparative radiation sensitivity. Dental x-rays have also been indicated as a risk factor for brain tumours.

Interestingly there have been two articles in the literature this year that have reported possible links between dental x-rays and health effects. Both articles address effects that have previously either been reported or postulated.

An article in the *Journal of the American Medical Association* (Vol 291, pp 1987-93, April 28, 2004) has reported an association between dental x-rays during pregnancy and an increase in the percentage of low-birth-weight infants. In particular, for a thyroid dose of more than 0.4 mGy (as would typically arise from 5 or more bite-wing or similar exposures), the associated odds ratio for a term low-birth-weight pregnancy was 3.6 (compared with normal-birth-weight pregnancy). At lower thyroid doses (0.1 to 0.4 mGy – typically, 1 to 4 bitewings) the association was less, but still present. Most of the dental radiography in the study occurred during the first trimester. Taken at face value this paper would suggest that dental x-rays during pregnancy should be avoided as much as possible.

However, the association is statistical and of course may be due to factors other than maternal radiation exposure. Irradiation of the hypothalamus-pituitary-thyroid axis with indirect effects on pregnancy outcome is postulated in the paper (in line with earlier such hypotheses), but no such causal links are established, nor possible biological mechanisms.

The second paper, in *Cancer* (Vol 100, No. 5, pp 1026-1034, March 1, 2004), found an association between full-mouth series dental x-rays (performed 15-40 years ago) and an increased risk of meningioma, but no increased risk with bitewings, lateral cephalometric and panoramic radiographs. In particular, the association was for patients that had had six or more full-mouth series, resulting in cumulative doses that would have been considerably higher than typical for patients undergoing dental care these days.

What does all this mean?

It is probably too early to gauge the importance or not of these recent papers, but regardless of the final outcome the radiation protection principle of justification is still valid – the benefit to the exposed person must outweigh the risk from the radiation dose received. Hence any decision to perform dental radiography on a given patient must be because the information to be gained from the examination is going to contribute to the clinical management of that patient.

For general information on topics associated with radiation safety in dental x-rays, readers are referred to earlier *Dental Drill* articles in previous issues of *The Source* or to the Dental pamphlet which can be found at the NRL website (www.nrl.moh.govt.nz - follow the links: Publications – Miscellaneous items – Dental pamphlet). If the information cannot be found there then contact enquiry@nrl.moh.govt.nz.

Personal radiation monitoring

Many readers of *The Source* will be familiar with the personal radiation monitoring badges shown on the right, and will in fact be clients of the NRL Personal Dosimetry Service. In this issue of *The Source* we are starting a series of articles on the topic of personal monitoring. The aim of the series is to provide both background information on radiation monitoring, and more specific information relating to the use of personal radiation monitoring products. Over the next few issues of *The Source*, we will briefly cover the following topics:

- how ionising radiation can harm us
- radiation detection and measurement
- why we monitor personal radiation dose
- radiation measurement quantities and units
- recommended occupational dose limits
- what measurement technologies are available for personal dosimetry
- recommended wearing positions for personal dosemeters.

How ionising radiation can harm us

When ionising radiation (such as the x-rays produced by an x-ray tube, or beta rays from a radioactive material) interacts with matter, electrons are stripped away from the atoms and molecules that make up the matter. This process is called ionisation (hence the term ionising radiation – radiation such as visible light or microwaves is referred to as non-ionising radiation because it does not have the energy to ionise atoms and molecules in the same way).

When ionising radiation passes through our bodies, the ionisation that occurs can ultimately cause changes in the biochemistry of the individual cells from which our bodies are made. The health effects that can occur from this are classed into two categories: deterministic effects and stochastic effects. Deterministic effects are characterised by having a threshold dose below which effects are not observed, and a response where the severity of the effect increases with the dose received. An example of a deterministic effect is skin erythema (ie, reddening of the skin like sun burn). Stochastic effects are characterised by there being no threshold dose, the probability (but not the severity) of the effect occurring increases with radiation dose received, and there is a latency of some years between a dose received and a potential effect being observed. An example of a stochastic effect is cancer.

Radiation detection and measurement

Our senses do not detect the presence of harmful radiation in the same way that we can feel heat from a dangerously hot surface or taste some poisons, and so we need to rely on the readings from a radiation detecting instrument to determine if an environment has radiation present.

A film exposed in a yellow holder.

The methods used to measure radiation are varied, but all rely on the ionising properties of the radiation discussed above. For example, hand-held radiation survey meters and Geiger counters rely on the production of an electrical current in a gas which can then be measured by an electronic circuit.

In film-based personal dosimetry, the radiation causes some electrons in the silver bromide emulsion to become "trapped". When the film is developed, the silver ions are reduced to silver metal which is what darkens the film, and the trapped electrons act as catalysts, increasing the rate of this reaction. Hence the more radiation, the darker the film becomes. The film darkness is then measured in order to quantify the amount of radiation received.

In the next article in this series we will look at the underlying reasons for personal monitoring, and the meaning of the quantities that are used to report level of personal dose.

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