**Inspection Report**

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<th>Licence Holder: Department of Defence and Australian Defence Force (Defence)</th>
<th>Licence Number: S0042</th>
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<td>Location of source(s): A random selection of Defence bases across Australia</td>
<td>Date/s of inspection: 3 February - 12 May 2017</td>
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<td>Report No: R17/04936</td>
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An inspection was conducted as part of ARPANSA’s baseline inspection program. For the purposes of this inspection, the inspector did not enter the licence holder’s premises; instead the inspection was conducted using documents, photographs, and records sent by the licence holder, and further clarification via phone or email as necessary.

The purpose of the inspection was to assess compliance with the *Australian Radiation Protection and Nuclear Safety Act 1998* (the Act), the *Australian Radiation Protection and Nuclear Safety Regulations 1999* (the Regulations), and conditions of Source Licence S0042.

The scope of the inspection included an assessment of Defence’s performance against the Source Performance Objectives and Criteria.

**Background**

Defence uses conventional dental X-ray machines as part of the dental healthcare service provided to its personnel.

**Observations**

**Performance Reporting and Verification**

As a condition of licence, Defence is required to comply with the relevant sections of the *Code of Practice for Radiation Protection in Dentistry* (RPS 10). This code was published in December 2005. It contains provisions (in section 4.1) for dental X-ray equipment which was already in use at the time the code was published and which does not comply with the relevant requirements of Australian Standard AS/NZS 3200.2.201(2000). At least three X-ray machines were identified as having been installed during the period 2000 - 2005. Records were provided showing that the X-ray machines are being inspected and serviced. However, there was no evidence that the X-ray machines have been assessed against the relevant standard and modified if necessary.

**Configuration Management**

Defence has used a template to prepare its radiation safety plans (RSP). Many of these plans appear to have been created specifically for this inspection. In New South Wales this has resulted in five out of six Units repeatedly making the same errors. Further to this, one Unit was unable to provide any relevant procedures, instructions, local rules, safe work permits or safe work method statements associated with the safe operation of the X-ray equipment held at that site.
Each of the Units in Queensland has a RSP. Each RSP requires compliance with the Joint Health Command Radiology Exam Protocols and the dose limits in that document. However, these protocols do not list the commonly performed dental X-ray views (i.e. bite-wings and periapical) nor do they actually provide any dose limits.

The RSP for each of the Units in Queensland contains an annex dedicated to previous internal inspections. Defence’s radiation safety group has conducted internal assurance inspections at two of the three sites within the last two years. However, no recent inspections are reflected in any of the plans.

Each of the Units in South Australia has a RSP. Each RSP makes reference to the monitoring of doses using TLD film badges. This is a misnomer; TLDs and film badges are two different types of personal dosimeter. In Australia, the transition from film badge to TLD began in about 1979. Each of the radiation safety plans also makes reference to the ‘Radiation Act 2011’. This is irrelevant as Defence comes under the jurisdiction of the Commonwealth and is not subject to state or territory legislation. The identification of the same errors in each of the radiation safety plans suggests that the problem stems from the template used to create the plans.

The radiation safety plan for one of the Units in Victoria makes two references to another base. One of these references relates to the shielding present at the dental surgery, and therefore, is likely to be unique to the specific dental surgery. It appears that this Unit has duplicated another Unit’s plan without appropriately amending it for their own purposes.

One of the bases has a dental surgery with two chairs located within the same room. There is only one X-ray machine in the room and it is positioned in such a way that it can only reach one of the chairs. However, there is no shielding between the two chairs. The Unit has a local arrangement, that only one chair is used at any time. For instance, the dental assistants use one of the chairs to conduct dental hygiene appointments when the Dental Officer is not using the surgery. This arrangement has not been written into the Unit’s radiation safety plan.

The Radiation Safety Plan for one of the Units in Victoria indicates that risk assessments should be conducted annually with reviews and amendments conducted if required, or if there is a significant change to the equipment or generic processes. However, there is no evidence that a risk assessment has ever been conducted.

**Inspection Testing and Maintenance**

Defence’s source licence requires it to meet the compliance testing requirements of the state/territory in which the apparatus is located. It is noted that there are no compliance testing requirements for dental X-ray machines located in Victoria. However, the Units located at four locations elsewhere in Australia were unable to provide any evidence that compliance testing is conducted.

Dental Units typically have personal protective equipment such as lead aprons, thyroid collars, and gloves available for use during imaging. Defence requires annual checks on these items but was unable to provide any records to confirm that such checks have occurred.

The film used for dental radiographs is categorised based on speed. From the slowest (D-speed) to the fastest (F-speed). The speed of the film affects the radiation dose incurred by the patient. For instance, use of D-speed film will result in twice the dose of E-speed film. In order to expose the patient to the
least amount of radiation, RPS 10 requires the use of the fastest radiographic film possible, as long as it provides the diagnostic information that is sought. Therefore, it is expected that E-speed, or greater, film is used. Two Defence Units identified through internal auditing that they were unable to obtain adequate images from E-speed film and instead use D-speed. However, there is no evidence that the equipment and systems used at these locations was optimised for high quality images.

It is standard practice to use a quality assurance program to ensure radiographs are produced to a consistent diagnostic quality. The Safety Guide for Radiation Protection in Dentistry (published with RPS 10) provides two suggested methods of performing quality control procedures for dental X-ray film processing. One Unit provided a checklist requiring daily exposure and development of test strips. However, there was no description of the quality control process. The other Units were unable to provide evidence of any quality control arrangements. Defence’s Radiation Safety Management Programme and Radiation Management Plan (RSMP and RMP) for the management of dental radiography make it the responsibility of the Dental Officer to implement quality control arrangements.

Training

Defence requires operators of dental X-ray machines to have completed a professional training program. Dental officers are required to have completed a Bachelor of Dental Science (or equivalent) and oral hygienists are required to have completed a Bachelor of Oral Health (or equivalent). Likewise, dental assistants and senior dental assistants are required to have completed a Certificate IV in Dental Assisting – Dental Radiography or Senior Dental Assistants – Preventative respectively.

In 2015 Defence integrated a radiation safety course into the training of Dental Officers. This aims to create a cohort of dentists that are trained and capable of also performing the role of Defence Ionising Radiation Protection Officer (DIRPO). Approximately six personnel have been officially designated as DIRPOs for their state/region. However, temporary arrangements have been implemented in one region until the designated DIRPO completes the required training.

Security

Defence has sound security measures in place. For example, the X-ray machines in the Northern Territory are fixed to the wall of the dental surgeries. The machines are turned off and unplugged when not in use. During work hours, reception staff monitor the entrance to the surgery. Outside these times, the building is secured and patrols conducted by Base security.

Radiation Protection

The NSW Environment Protection Authority (NSW EPA) has published a guideline on shielding design assessment and verification. Defence has adopted this guideline for all conventional dental X-ray machines located all around Australia. In all likelihood, this document provides sound advice for shielding dental surgeries containing X-ray machines. However, ARPANSA was not involved in the development of this document, and as such, does not guarantee that the guidance is suitable or endorse the judgements contained within the document.

The aforementioned shielding guideline allows for some low hazard sources, such as standard dental X-ray machines, to be ‘self-assessed’ provided that a record of the self-assessment is maintained. Defence was only able to provide three self-assessment reports and only one contained enough information to verify that the surgery met the requirements of the NSW EPA guideline.
RPS 10 requires the operator of an X-ray machine to be able to observe the patient during radiographic procedures. This allows the operator to assess that the X-ray machine is correctly positioned with respect to the patient. This is less likely to occur within a Defence dental surgery as the patients are expected to be adults, and therefore, more likely to stay still until the X-ray is performed. However, it appears that this has not been considered in the room layout of several surgeries.

The RSMP and RMP requires that clinically indicated dental radiographs should be based on (a) an assessment of disease risk; (b) the usefulness of a radiographic image to diagnose disease, treatment, progression or pathology resolution; and (c) consideration of the overall health and wishes of the patient. However, the documents also require bitewing and orthopantomogram radiographs be taken when a Defence member enlists. There are some advantages to doing this. For instance, it is foreseeable that the member may be put in a situation whereby they have limited access to dental care. Hence, it is important that all steps are taken to identify and manage dental issues prior to them deploying overseas. Furthermore, these records can assist in the time taken to perform forensic identification if it is needed. However, taking X-rays of all defence members without first establishing an actual or suspected dental condition is not considered to be medically justified and is contrary to RPS 10 (section 3.1).

A standard form is used for the admission of patients. This collects the individual’s medical and dental history. This form includes two questions that are specific for females only. These ask if the woman is, or could be, pregnant and if they are breastfeeding.

Uniformed military personnel are typically posted to a base for a period of two to three years. After this, the individual is usually moved to another base. Defence has many bases located around Australia. Therefore, if the individual was being treated in the civilian dental system, it is highly likely that, over a period of many years, they would be seen by many different dentists. However, when a Defence member is posted to a new base, their dental records accompany them. This includes previous radiographs. The availability of this background information means that the dentist is well informed of the patient’s history, and therefore, is expected to result in better dental outcomes and better radiation protection of the patient.

ARPANSA has previously granted Defence an exemption from the requirement to provide personal monitoring devices to all staff performing dental radiography. This does not exempt Defence from ensuring that doses incurred by personnel are below limits or from the requirement to optimise doses to radiation workers. Defence has not implemented any alternative methods of assessing or optimising doses.

**Emergency Preparedness and Response**

The radiation safety plans for each Unit typically contain details for reporting of incidents and near misses. However, the majority of the plans do not describe any reasonably foreseeable emergencies that may occur and how they would be managed.

**Findings**

The inspection revealed the following potential non-compliances:

1. Routine radiography of all Defence members on enlistment without justification.

2. Failing to conduct compliance testing of X-ray machines.
The inspection revealed the following areas for improvement:

1. Assessment of equipment installed prior to 2005 against the requirements of the relevant standard.
2. Preparation of local documentation, including plans to manage any reasonably foreseeable emergencies.
3. Record keeping associated with inspections at the site.
5. Consideration and analysis of the effectiveness of room layout and shielding.

It is expected that improvement actions be taken in a timely manner.