

NOMAD™ RADIATION TEST RESULTS – FACT SHEET

1. *Applicable Dental Radiation Safety Standards:*

a. **Whole-body Deep-dose Equivalent to the Operator:** 5,000 mrem/yr.

*This is the *key* standard used in assessing occupational dental radiation safety. Personal dosimetry is required when the operator is expected to receive 10% or more of the whole-body deep-dose (500 mrem/yr).

b. **Shallow-dose Equivalent to the Hand due to Scatter and Leakage Radiation:** 50,000 mrem/yr.

*Personal dosimetry is required when the operator is expected to get 10% of the shallow-dose Equivalent (5,000 mrem/yr).

c. **Total Effective Dose Equivalent to the Public:** 100 mrem/yr and 2 mrem in any one hour.

2. *Summary of AFIOH NOMAD test results:*

a. **Whole-Body Deep-Dose Equivalent to the Operator.** Assuming 15,000 exposures/year the predicted annual Whole-body Deep-dose equivalent to the operator was estimated, from test results, to be 123.6 mrem/year. This is well below the limit of 5,000 mrem/year and the requirement for mandatory personal dosimetry of 500 mrem/yr.

b. **Shallow-dose Equivalent to the Hand due to Scatter and Leakage Radiation:** Assuming 15,000 exposures/year the predicted Annual Shallow-dose Equivalent to the operator's extremity was estimated, from test results, to be 1,831.9 mrem/year. This is well below the limit of 50,000 mrem/year and the requirement for mandatory personal dosimetry of 5,000 mrem/yr.

c. **Total Effective Dose Equivalent (TEDE) to the Public:**

- Assuming 15,000 exposures/year, the annual TEDE to the public was estimated, from test results, to be 61.8 mrem/yr for an individual standing 4.0' away on the opposite side of the patient, 103.0 mrem for an individual standing 1'10" to the left or right of the patient, and 46.5 mrem for an individual standing 6' away and to the side.

- The estimated annual TEDE of 103.0 mrem to a member of the general public standing 1'10" to the left or right of the cone slightly exceeds the annual dose limit for the public of 100.0 mrem. However, a member of the general public would not be expected to be at this location for 15,000 exposures.

- Assuming a maximum duty cycle of 60 exposures per hour, the estimated TEDE to the public in any one hour would be 0.25 mrem for an individual standing 4.0' away on the opposite side of phantom, 0.41 mrem for an individual standing 1'10" to the left or right of the phantom, and 0.19 mrem for an individual standing 6' away to the side. These results meet the "2 mrem in any one hour" requirement.

3. *Summary of DECS Simulated-Clinical-Operator NOMAD™ Test Results:*

- Three-hundred periapical/bitewing exposures were made through a human skull with dosimeters at the left clavicle, right hip, left little finger, and right index finger of the operator.

- No radiation was detected by the dosimeters on the left clavicle and right hip and so safety standards for Whole-body Deep-dose Equivalent were easily met.

- The right index finger dosimeter detected 67 mrem and the left little finger dosimeter detected no radiation. The left little finger dosimetry reading would indicate a predicted annual Shallow-dose Equivalent of approximately 3,350 mrem/year (50 weeks x 67 mrem). This is well below the

limit of 50,000 mrem/year and below the requirement for mandatory personal dosimetry of 5,000 mrem/yr.

4. Comment on backscatter shield protection:

With some patient-positions, it may not be possible to position the NOMAD™ and backscatter shield to fully shield the operator from backscatter. When assessing the risk in these situations it may be helpful to evaluate the Total Effective Dose Equivalent (TEDE) to the Public data (2c). In these tests the dosimeter (the “public”) was not protected by the backscatter shield and exposure to radiation was still within standards.

5. Additional information:

- a. All annual exposure calculations assumed 15,000 exposures/year (high-volume practice of 300 exposures/wk). The NOMAD™ would not be expected to be used for this many exposures.
- b. All 15,000 exposures would not be expected to be made by the same technician in a high-volume practice.
- c. All test exposures were at 0.99 seconds. Actual exposure times are typically less than this.

REFERENCES:

1. Air Force Instruction 48-125. USAF Personnel Dosimetry Program. 1 Mar 1999: 10-20.
2. Air Force Instruction 48-148. Ionizing Radiation Protection. 12 Oct 2001: 14-22, 30-31, 42-43.
3. U.S. Nuclear Regulatory Commission, Regulatory Guide 8.29. Office of Nuclear Regulatory Research. Revision 1, February 1996; 7-14.
4. Radiation Protection in Dentistry. NCRP Report No. 145. National Council on Radiation Protection and Measurements, Report No. 145. 31 Dec 2003; 8-12, 16-22, 27-30, 68-73, 76-77.

NOMAD GUIDELINES-FOR-USE

1. The NOMAD™ should be secured when not in use.
2. All users should receive initial training from the Dental Radiology Officer or designee on proper use of the NOMAD™. At a minimum, training should include radiation safety, operation of the NOMAD™, and proper patient/provider positioning to ensure maximal benefit from the backscatter shield.
3. No unnecessary personnel should be allowed in the room when exposures are made with the NOMAD™.
4. Personnel must not be in the direct path of the NOMAD™ x-ray beam.
5. As with any medical equipment item, the Medical Equipment Repair Center (MERC) must perform an initial evaluation of the NOMAD™.
6. The MERC should return the NOMAD™ to Aribex for evaluation and recertification every two years (earlier for heavy use). If damage is suspected the NOMAD™ should be returned immediately. The recertification tests include: kVp accuracy, kVp reproducibility, mA accuracy, timer accuracy, timer reproducibility, linearity, half value layer, and radiation leakage tests.
7. The convenience and versatility of the NOMAD™ does not justify it becoming a total substitute for traditional x-ray units already on location.