

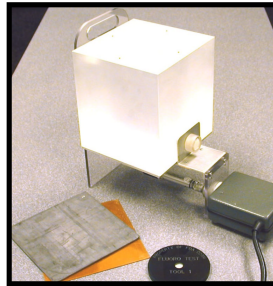
## What's NEXT?

The FDA Center for Devices and Radiological Health (CDRH) collaborates with the Conference of Radiation Control Program Directors (CRCPD) in a unique federal-state partnership to characterize the radiation doses patients receive and to document the state of the practice of diagnostic radiology. Each year the *Nationwide Evaluation of X-ray Trends (NEXT)* survey program selects a particular radiological examination for study and captures radiation exposure data from a nationally representative sample of U.S. clinical facilities. From 1973 to 1983 the *NEXT* program annually surveyed facilities performing twelve common diagnostic x-ray examinations. Exposure data was collected using manual techniques selected for a standard reference patient. With the implementation of automatic exposure controlled (AEC) x-ray equipment, it became necessary to develop a method to



**NEXT Adult Chest Phantom**

simulate the radiographic attenuation properties of a real patient. These phantoms, as they are referred to, had to invoke a response by the AEC system similar to that for a real patient for a wide range of practical x-ray conditions (beam kilovoltage peak, beam quality), yet also had to be economical, easily transportable, and most importantly produce consistent, clinically representative results. The first phantoms to be developed by CDRH were the adult chest and the adult abdomen-lumbosacral spine phantoms, and the adult chest surveys of 1984 and 1986 provided the testing ground for the new phantoms. There are



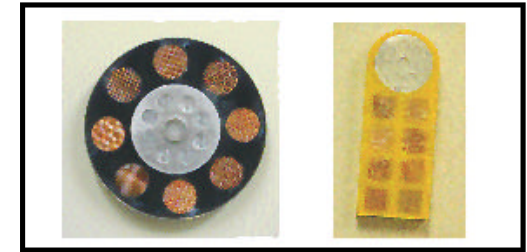
**NEXT Fluoroscopia Phantom**

now seven phantoms in the *NEXT* family: Adult PA chest, adult abdomen-lumbosacral spine, adult fluoroscopia, dental, pediatric PA chest, computed tomography (CT), and mammography. The CT head phantom used for *NEXT* is constructed to conform to the CT dosimetry phantom parameters specified in CFR 1020.33(b)(6). The phantom used for the *NEXT* mammography surveys is commercially available, and is approximately equivalent to a 4.2 cm compressed breast. Currently no *NEXT* survey of mammography is planned because data on U.S. population dose from this x-ray exam is collected from the 10,000 annual MQSA inspections using the same mammography phantom. The *NEXT* adult chest, fluoroscopia, and dental phantoms are also now commercially available.

The *NEXT* surveys today capture comprehensive data on the practice of diagnostic radiology including the evaluation of film processing quality, the integrity of the film processing darkroom environment, x-ray film image quality, and information about the facility's general practice. With digital x-ray imaging technology now available, the established relationship between patient exposure and film image quality will no longer hold for such systems. The impact on patient exposure can be significant because there is no film to under- or over-expose. Will facilities using digital x-ray



**NEXT Dental Phantom**



**Image Quality Test Tools**

systems tend to have lower or higher patient exposure levels compared to facilities using standard film systems? *NEXT* will provide the means of answering this question and many others that relate to FDA's mission to protect the general public from unnecessary exposure to radiation.

## On the Horizon...

*NEXT* is finding its way across the U.S. borders, with a number of international organizations and countries requesting *NEXT* program information as well as phantoms for use in various projects. Organizations expressing such interest include the International Atomic Energy Agency (IAEA), which is developing recommendations for the determination of patient doses in common x-ray exams, and the American Association of Physicists in Medicine (AAPM), which is working to develop reference exposure values for common diagnostic exams.

For more information on NEXT contact:

**Food and Drug Administration**

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Silver Spring, MD 20993  
301-796-5710

**CRCPD**

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Frankfort, KY 40601  
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[www.CRCPD.org](http://www.CRCPD.org)

## Adult Chest

Note: 1 mR = 0.00876 mGy	1984	1986	1994	2001*
Entrance Air Kerma (mGy)	0.14	0.14	0.14	0.13
Clinical kVp	104	87	101	109
Exposure Time (ms)	22	64	31	29
Percent using Grids	71	32	79	93
Phantom Film Optical Density	1.43	1.42	1.67	1.64

\*Results are preliminary.

## Abdomen and Lumbosacral Spine

	1987/89 Abdomen	1995 Abdomen	1987/89 LS Spine	1995 LS Spine
Entrance Air Kerma (mGy)	3.2	2.8	3.8	3.2
Clinical kVp	76	76	79	78
Exposure Time (ms)	198	145	371	247
Percent using Grids	95	97	96	96
Phantom Film Optical Density	1.79	1.74	1.20	1.32

## Fluoroscopy

	1991 Upper GI	1996 Upper GI	1996 Cardiac Cath Labs	1996 C-Arm Units
Entrance Air Kerma (mGy/min) <sup>H</sup>	43	45	38	22
Clinical kVp	102	99	82	78
Fluoroscopic Tube Current (mA)	2.1	2.3	5.1	3.0
Air Kerma Rate w/Contrast* (mGy/min) <sup>H</sup>	65	67	71	41
Maximum Air Kerma Rate <sup>H</sup>	67	70	74	44

<sup>H</sup> Determined at 1 cm off the table top and does not include contributions from over-table units.

\*Cooper is used to simulate the presence of barium contrast medium.

## Film Processing

	Processing Speed	N	% below 80**	Darkroom Fog (OD)
84 Chest (Hospitals)	96	408	18.9	N/A
85 Mammography	91	139	20.9	N/A
86 Chest (Private Practice)	86	99	40.4	N/A
87 Abdm/LS Spine (Hospitals)	88	261	37.2	N/A
88 Mammography	102	176	10.2	N/A
89 Abdm/LS Spine (Private Practice)	89	301	41.9	N/A
91 Fluoroscopy	96	349	18.6	N/A
92 Mammography	98	238	7.1	0.12
93 Dental	83	103	49.5	0.08
94 Chest (Hospitals)	115	134	4.5	0.09
94 Chest (Private Practice)	107	148	15.5	0.11
95 Abdm/LS spine (Hospitals)	98	141	7.2	0.09
95 Abdm/LS Spine (Private Practice)	92	178	27	0.12
95 Chiropractic Facilities	87	62	37.1	0.09
95 Mammography*	98	7100	5.0	0.04
96 Fluoroscopy	107	316	10.3	0.06
97 Mammography*	107	5737	1.0	0.03
98 Pediatric Chest	100	380	5.6	0.13
99 Dental	99	122	31.0	0.07
2000 Mammography*	101	9300	1.6	0.02

\* Results are from MQSA inspections

\*\* The range of acceptable processing speed is 80 to 120 (standard cycle), and 100-130 (extended cycle)

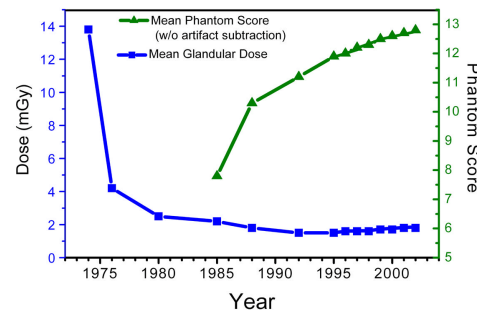
## Pediatric Chest

	1998
Entrance Air Kerma (mGy)	.05
Clinical kVp	71
Exposure Time (ms)	12
Percent Using Grids	9.0
Phantom Film Optical Density	1.83
Most Popular Patient Restraint Method	Adult
Percent AP / Percent PA	41/59

## Dental Intraoral Exam

	1993	1999
Entrance Air Kerma (mGy)	1.9	1.6
Clinical kVp	72	71
Percent Manual Film Processing	29.0	10.0
Phantom Film Optical Density	1.48	1.49
Percent using D-speed Film	90	85

## Mammography



## Computed Tomography Head Exam

	1990	2000*
MSAD (mGy)	45.9	50.3
mAs	459	355
kVp	122	127
Effective dose (mSv)	-	2

## Computed Tomography Body Exams Effective Dose (mSv)\*

	1990	2000*
Chest	-	7
Abdomen	-	7
Pelvis	-	6

\*Results are preliminary.

# Nationwide Evaluation of X-ray Trends

## Twenty-five Years of NEXT