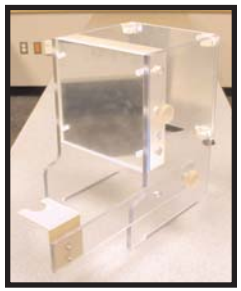
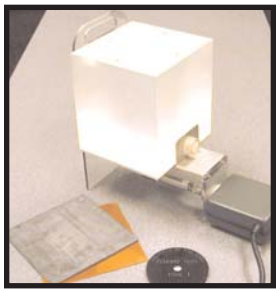
What's *NEXT*?

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 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 now eight phantoms in the *NEXT* family: adult PA chest, adult abdomen-lumbosacral spine, adult fluoroscopy, pediatric chest, dental, mammography, and computed tomography (CT) adult head and body. The mammography phantom used in past *NEXT* surveys is commercially available and is approximately equivalent to a 4.2 cm compressed breast. The CT head phantom used in the 1990 and 2000 surveys conforms to the specifications in CFR 1020.33(b)(6). A new phantom was developed by CDRH staff to survey CT units that are equipped with technology that adjusts the dose based on the patient's size, similar to conventional radiographic automatic exposure control (AEC). This new phantom is comprised of three sections approximately equivalent to standard adult chest, abdomen, and pelvis, and the 2005 *NEXT* survey of CT will report results based on this new phantom.



***NEXT* Adult Chest Phantom**



***NEXT* Fluoroscopy Phantom**

The *NEXT* surveys today capture comprehensive data on the practice of diagnostic radiology, including patient exposure, the evaluation of film processing quality and 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 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.

***NEXT* Dental Phantom**

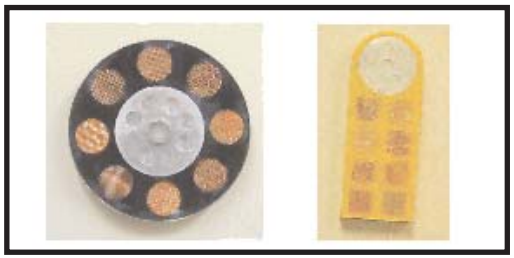


Image Quality Test Tools

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 has published reference exposure values for common diagnostic exams, many of which are based on *NEXT* data.

NEXT Sample Statistics

Adult Chest

Note: 1 mR = 0.00876 mGy	2001 All	2001 SF	2001 DR	2001 CR
Entrance Air Kerma (mGy)	0.12	0.12	0.11	0.17
Clinical kVp	107	107	127	112
Exposure Time (ms)	23	23	9	14
Percent using Grids	91.3	91.4	100	98.3
Facility Weekly Workload	112	104	515	380

Abdomen and Lumbosacral Spine

	2002 Abdomen	1995 Abdomen	2002 LS Spine	1995 LS Spine
Entrance Air Kerma (mGy)	2.7	2.8	3.4	3.2
Clinical kVp	75	76	78	78
Exposure Time (ms)	121	145	217	247
Percent using Grids	95	97	96	96
Facility Weekly Workload	42	70	24	51

Fluoroscopy - Upper GI Exam & Special Topics

	2003 Upper GI	1996 Upper GI	1996 C-Arm Units	1996 Cardiac Cath Labs
Skin Entrance Air Kerma Rate†	41	45	22	38
Fluoroscopic kVp	95	99	78	82
Fluoroscopic Tube Current (mA)	2.2	2.3	3.0	5.1
Air Kerma Rate w/Contrast*†	68	67	41	71
Maximum Air Kerma Rate†	71	70	44	74

† mGy/min. Determined at 1 cm off the table top and does not include contributions from over-table units.
* Copper 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	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
2001 Chest	102	215	7.0	0.08
2002 Abdomen (All)	108	134	1.0	0.06
2002 LS Spine (All)	102	213	3.3	0.09

* Results are from MQSA inspections
** The range of acceptable processing speed is 80 to 120 (standard cycle), and 100-130 (extended cycle)

Tabulated values are averages unless otherwise indicated.

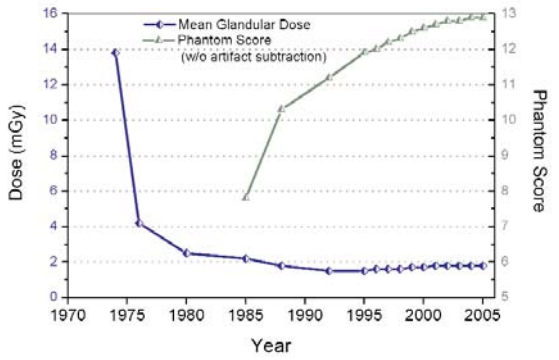
Pediatric Chest

	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

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

Mammography



2000 Computed Tomography (Median Values)

Routine Procedure (*adult*)	Clinical kVp	Clinical mAs per rotation	CTDI vol (mGy)	Effective Dose (mSv)
Brain + Posterior Fossa (*axial scanning*)	120	340	58	1.7
Abdomen + Pelvis (*helical scanning*)	120	240	15	13

For more information on *NEXT* contact:

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