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Radiation Dose Estimates for Radiopharmaceuticals

Prepared by:
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Oak Ridge Institute for Science and Education

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U.S. Nuclear Regulatory Commission
U.S. Department of Energy
U.S. Department of Health and Human Services

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Radiation Dose Estimates for Radiopharmaceuticals

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ABSTRACT

Tables of radiation dose estimates based on the Cristy-Eckerman adult male phantom are provided for a number of radiopharmaceuticals commonly used in nuclear medicine. Radiation dose estimates are listed for all major source organs, and several other organs of interest. The dose estimates were calculated using the MIRD Technique as implemented in the MIRDOSE3 computer code, developed by the Oak Ridge Institute for Science and Education, Radiation Internal Dose Information Center. In this code, residence times for source organs are used with decay data from the MIRD Radionuclide Data and Decay Schemes to produce estimates of radiation dose to organs of standardized phantoms representing individuals of different ages.

The adult male phantom of the Cristy-Eckerman phantom series is different from the MIRD 5, or "Reference Man" phantom (Snyder et al. 1969) in several aspects, the most important of which is the difference in the masses and absorbed fractions for the active (red) marrow. The absorbed fractions for low energy photons striking the marrow are also different. Other minor differences exist, but are not likely to significantly affect dose estimates calculated with the two phantoms. Assumptions which support each of the dose estimates appears at the bottom of the table of estimates for a given radiopharmaceutical.

In most cases, the model kinetics or organ residence times are explicitly given. The results presented here can easily be extended to include other radiopharmaceuticals or phantoms.

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EXECUTIVE SUMMARY

This document contains radiation dose estimates for a number of radiopharmaceuticals commonly used in nuclear medicine. Radiation dose estimates are listed for all major source organs, and several other organs typically of interest. All dose estimates were calculated using the well known MIRD Technique (Loevinger et al. 1991) as implemented in the MIRDOSE3 computer code, developed by the Radiation Internal Dose Information Center. In this code, residence times for source organs are used with decay data from the MIRD Radionuclide Data and Decay Schemes (1989) to produce estimates of radiation dose to organs of standardized phantoms representing individuals of different ages. This document contains dose estimates only for the adult male phantom in the Cristy-Eckerman phantom series (Cristy and Eckerman, 1987). The adult male phantom of the Cristy-Eckerman phantom series is different from the MIRD 5, or "Reference Man" phantom (Snyder et al. 1969) in several aspects, the most important of which is the difference in the masses and absorbed fractions for the active (red) marrow. The Cristy-Eckerman adult male contains only 1120 grams of red marrow, not 1500 grams as in the MIRD 5 phantom. Also, the absorbed fractions for low energy photons striking the marrow are different, as suggested by Eckerman (1986). Other minor differences (1910 gram liver in the Cristy-Eckerman phantom vs. 1800 in the MIRD 5 phantom, e.g.) exist, but are not likely to significantly affect dose estimates calculated with the two phantoms.

Assumptions which support each of the dose estimates appears at the bottom of the table of estimates for a given radiopharmaceutical. In most cases, the model kinetics or organ residence times are explicitly given. In the case where a MIRD Dose Estimate Report was used as the basis for the calculation, reference to the Dose Estimate Report may be the only citation. The use of the Cristy-Eckerman phantom is noted in each table. The tables list dose estimates for all important source organs, the red marrow, bone surfaces, ovaries, testes, and uterus. The bone, marrow, and gonads are considered important by some in considering risks of radiation exposures. The doses to the uterus may be used to estimate the dose to the embryo or fetus, up to about 6 weeks gestation. Thyroid dose estimates are typically not given for iodine-labeled pharmaceuticals; it is assumed that there is no free iodide in the product, or else that the thyroid is completely blocked. Addition of dose from free iodide may be easily done by using an assumed fraction of free iodide and adding a contribution based on the doses from sodium iodide. Similar arguments apply to free pertechnetate in Tc-99m-labeled pharmaceuticals.

Any questions about these estimates, or requests for further information about any radiopharmaceutical dosimetry matter may be directed to the Radiation Internal Dose Information Center. The Center is funded by the Department of Energy, the Food and Drug Administration and the Nuclear Regulatory Commission to provide information on these matters to requestors. The Center's phone numbers are:

Richard Toohey	423-576-3448
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March 18, 1993

Radiation Dose Estimates for H-3 Water*

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	1.5E-02	5.7E-02
Brain	1.5E-02	5.7E-02
Breasts	1.5E-02	5.7E-02
Gallbladder Wall	1.5E-02	5.7E-02
LLI Wall	1.5E-02	5.7E-02
Small Intestine	1.5E-02	5.7E-02
Stomach	1.5E-02	5.7E-02
ULI Wall	1.5E-02	5.7E-02
Heart Wall	1.5E-02	5.7E-02
Kidneys	1.5E-02	5.7E-02
Liver	1.5E-02	5.7E-02
Lungs	1.5E-02	5.7E-02
Muscle	1.5E-02	5.7E-02
Ovaries	1.5E-02	5.7E-02
Pancreas	1.5E-02	5.7E-02
Red Marrow	2.0E-02	7.5E-02
Bone Surfaces	1.4E-02	5.1E-02
Skin	1.5E-02	5.7E-02
Spleen	1.5E-02	5.7E-02
Testes	1.5E-02	5.7E-02
Thymus	1.5E-02	5.7E-02
Thyroid	1.5E-02	5.7E-02
Urinary Bladder Wall	1.6E-02	6.1E-02
Uterus	1.5E-02	5.7E-02
Effective Dose Equivalent	1.6E-02 mSv/MBq	5.9E-02 rem/mCi

* Based on model in ICRP 53.

Dynamic bladder model with 4.8-hour voiding interval

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7)

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

March 18, 1993

Radiation Dose Estimates for H-3 Inulin*

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	1.0E-04	3.8E-04
Brain	1.0E-04	3.8E-04
Breasts	1.0E-04	3.8E-04
Gallbladder Wall	1.0E-04	3.8E-04
LLI Wall	1.0E-04	3.8E-04
Small Intestine	1.0E-04	3.8E-04
Stomach	1.0E-04	3.8E-04
ULI Wall	1.0E-04	3.8E-04
Heart Wall	1.0E-04	3.8E-04
Kidneys	1.0E-03	3.8E-03
Liver	1.0E-04	3.8E-04
Lungs	1.0E-04	3.8E-04
Muscle	1.0E-04	3.8E-04
Ovaries	1.0E-04	3.8E-04
Pancreas	1.0E-04	3.8E-04
Red Marrow	1.4E-04	5.0E-04
Bone Surfaces	9.3E-05	3.4E-04
Skin	1.0E-04	3.8E-04
Spleen	1.0E-04	3.8E-04
Testes	1.0E-04	3.8E-04
Thymus	1.0E-04	3.8E-04
Thyroid	1.0E-04	3.8E-04
Urinary Bladder Wall	2.4E-02	9.0E-02
Uterus	1.0E-04	3.8E-04
Effective Dose Equivalent	1.6E-03 mSv/MBq	6.0E-03 rem/mCi

* Based on the model in ICRP 53.

Dynamic bladder model with 4.8-hour voiding interval

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7)

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

March 18, 1993

Radiation Dose Estimates for C-11 Carbon Monoxide*
Single inhalation with 20 s breathhold

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	6.1E-03	2.3E-02
Brain	1.1E-03	3.9E-03
Breasts	2.3E-03	8.7E-03
Gallbladder Wall	2.9E-03	1.1E-02
LLI Wall	2.3E-03	8.5E-03
Small Intestine	2.4E-03	9.0E-03
Stomach	2.7E-03	1.0E-02
ULI Wall	2.4E-03	8.9E-03
Heart Wall	2.0E-02	7.2E-02
Kidneys	6.8E-03	2.5E-02
Liver	4.9E-03	1.8E-02
Lungs	1.4E-02	5.2E-02
Muscle	2.2E-03	8.2E-03
Ovaries	2.4E-03	8.8E-03
Pancreas	3.2E-03	1.2E-02
Red Marrow	5.4E-03	2.0E-02
Bone Surfaces	3.2E-03	1.2E-02
Skin	1.8E-03	6.5E-03
Spleen	1.3E-02	4.8E-02
Testes	1.9E-03	7.1E-03
Thymus	3.4E-03	1.3E-02
Thyroid	4.8E-03	1.8E-02
Urinary Bladder Wall	2.2E-03	8.2E-03
Uterus	2.4E-03	8.7E-03
Effective Dose Equivalent	6.5E-03 mSv/MBq	2.4E-02 rem/mCi

* Based on model in ICRP 53.

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7)

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose
Information Center

March 18, 1993

Radiation Dose Estimates for C-11 Carbon Monoxide*
Continuous Inhalation for 1 hr

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	4.0E-03	1.5E-02
Brain	6.9E-04	2.6E-03
Breasts	1.5E-03	5.7E-03
Gallbladder Wall	1.9E-03	6.9E-03
LLI Wall	1.5E-03	5.6E-03
Small Intestine	1.6E-03	5.9E-03
Stomach	1.8E-03	6.5E-03
ULI Wall	1.6E-03	5.8E-03
Heart Wall	1.3E-02	4.7E-02
Kidneys	4.5E-03	1.7E-02
Liver	3.2E-03	1.2E-02
Lungs	9.3E-03	3.4E-02
Muscle	1.4E-03	5.4E-03
Ovaries	1.6E-03	5.8E-03
Pancreas	2.1E-03	7.8E-03
Red Marrow	3.6E-03	1.3E-02
Bone Surfaces	2.1E-03	7.7E-03
Skin	1.1E-03	4.2E-03
Spleen	8.5E-03	3.1E-02
Testes	1.2E-03	4.6E-03
Thymus	2.2E-03	8.2E-03
Thyroid	3.2E-03	1.2E-02
Urinary Bladder Wall	1.4E-03	5.4E-03
Uterus	1.6E-03	5.7E-03
Effective Dose Equivalent	4.3E-03 mSv/MBq	1.6E-02 rem/mCi

* Based on model in ICRP 53.

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7)

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose
Information Center

September 18, 1992

Radiation Dose Estimates for N-13 Ammonia

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	1.7E-03	6.2E-03
Brain	4.7E-03	1.7E-02
Breasts	1.3E-03	4.7E-03
Gallbladder Wall	1.9E-03	6.9E-03
LLI Wall	1.7E-03	6.2E-03
Small Intestine	1.7E-03	6.2E-03
Stomach	1.6E-03	5.9E-03
ULI Wall	1.7E-03	6.2E-03
Heart Wall	1.6E-03	5.9E-03
Kidneys	1.6E-03	5.9E-03
Liver	3.8E-03	1.4E-02
Lungs	1.5E-03	5.4E-03
Muscle	1.4E-03	5.3E-03
Ovaries	1.7E-03	6.4E-03
Pancreas	1.7E-03	6.4E-03
Red Marrow	1.8E-03	6.6E-03
Bone Surfaces	1.5E-03	5.6E-03
Skin	1.2E-03	4.6E-03
Spleen	1.5E-03	5.7E-03
Testes	1.4E-03	5.4E-03
Thymus	1.5E-03	5.4E-03
Thyroid	1.5E-03	5.5E-03
Urinary Bladder Wall	6.9E-03	2.6E-02
Uterus	1.8E-03	6.8E-03
Effective Dose Equivalent	2.2E-03 mSv/MBq	8.3E-03 rem/mCi

Based on distribution data gathered in human subjects by Lockwood et al. (J Clin Invest 63:449-460, 1979). Assumed distribution and retention:

Brain	6.9%	$T_b = \infty$
Liver	7.1%	$T_b = \infty$
Total Body	94%	$T_b = \infty$
	6%	T_b = 10 min

6% of material cleared through urinary bladder, T_b = 10 min. Bladder voiding interval 4.8 hours.

Dynamic bladder model with 4.8-hour voiding interval. Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7)

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose
Information Center

March 18, 1993

Radiation Dose Estimates for C-14 Inulin*

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	9.0E-04	3.3E-03
Brain	9.0E-04	3.3E-03
Breasts	9.0E-04	3.3E-03
Gallbladder Wall	9.0E-04	3.3E-03
LLI Wall	9.0E-04	3.3E-03
Small Intestine	9.0E-04	3.3E-03
Stomach	9.0E-04	3.3E-03
ULI Wall	9.0E-04	3.3E-03
Heart Wall	9.0E-04	3.3E-03
Kidneys	8.9E-03	3.3E-02
Liver	9.0E-04	3.3E-03
Lungs	9.0E-04	3.3E-03
Muscle	9.0E-04	3.3E-03
Ovaries	9.0E-04	3.3E-03
Pancreas	9.0E-04	3.3E-03
Red Marrow	1.2E-03	4.4E-03
Bone Surfaces	8.1E-04	3.0E-03
Skin	9.0E-04	3.3E-03
Spleen	9.0E-04	3.3E-03
Testes	9.0E-04	3.3E-03
Thymus	9.0E-04	3.3E-03
Thyroid	9.0E-04	3.3E-03
Urinary Bladder Wall	2.1E-01	7.9E-01
Uterus	9.0E-04	3.3E-03
Effective Dose Equivalent	1.4E-02 mSv/MBq	5.3E-02 rem/mCi

* Based on the model in ICRP 53.

Dynamic bladder model with 4.8-hour voiding interval

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

February 22, 1993

Radiation Dose Estimates for O-15 H2O

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	1.3E-03	4.8E-03
Brain	1.3E-03	4.9E-03
Breasts	3.0E-04	1.1E-03
Gallbladder Wall	4.5E-04	1.7E-03
LLI Wall	7.4E-04	2.7E-03
Small Intestine	9.3E-04	3.5E-03
Stomach	5.3E-04	1.9E-03
ULI Wall	7.0E-04	2.6E-03
Heart Wall	2.2E-03	8.2E-03
Kidneys	1.9E-03	7.2E-03
Liver	1.5E-03	5.6E-03
Lungs	1.9E-03	6.9E-03
Muscle	2.7E-04	1.0E-03
Ovaries	3.6E-04	1.3E-03
Pancreas	1.6E-03	5.9E-03
Red Marrow	9.0E-04	3.3E-03
Bone Surfaces	5.2E-04	1.9E-03
Skin	2.6E-04	9.8E-04
Spleen	1.6E-03	5.8E-03
Testes	6.7E-04	2.5E-03
Thymus	3.6E-04	1.3E-03
Thyroid	1.7E-03	6.3E-03
Urinary Bladder Wall	2.2E-04	8.1E-04
Uterus	3.4E-04	1.3E-03
Effective Dose Equivalent	1.1E-03 mSv/MBq	4.2E-03 rem/mCi

Based on data derived from a blood flow-based model of water distribution.
Assumed residence times:

Adrenals	:	3.92E-05 hr	Lungs	:	3.80E-03 hr
Brain	:	3.48E-03 hr	Muscle	:	9.72E-03 hr
LLI	:	3.22E-04 hr	Pancreas	:	2.83E-04 hr
Small Intestine	:	1.28E-03 hr	Red Marrow	:	1.59E-03 hr
Stomach	:	2.87E-04 hr	Cort Bone	:	1.50E-03 hr
ULI	:	4.22E-04 hr	Canc Bone	:	3.75E-04 hr
Heart Chambers	:	1.70E-03 hr	Spleen	:	5.50E-04 hr
Heart Wall	:	8.42E-04 hr	Testes	:	5.14E-05 hr
Kidneys	:	1.15E-03 hr	Thyroid	:	7.47E-05 hr
Liver	:	5.17E-03 hr	Urinary Bl Cont	:	9.44E-06 hr
			Remainder	:	1.63E-02 hr

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7)

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose
Information Center

February 23, 1993

Radiation Dose Estimates for O-15 O2

ORGAN	Estimated Radiation Dose mGy / MBq	rad / mCi
Adrenals	3.4E-04	1.3E-03
Brain	5.2E-04	1.9E-03
Breasts	2.8E-04	1.1E-03
Gallbladder Wall	3.0E-04	1.1E-03
LLI Wall	2.5E-04	9.4E-04
Small Intestine	2.6E-04	9.8E-04
Stomach	2.9E-04	1.1E-03
ULI Wall	2.6E-04	9.8E-04
Heart Wall	1.5E-03	5.6E-03
Kidneys	6.9E-04	2.6E-03
Liver	5.5E-04	2.0E-03
Lungs	4.6E-03	1.7E-02
Muscle	2.6E-04	9.5E-04
Ovaries	7.6E-04	2.8E-03
Pancreas	3.3E-04	1.2E-03
Red Marrow	3.3E-04	1.2E-03
Bone Surfaces	2.6E-04	9.6E-04
Skin	2.2E-04	8.1E-04
Spleen	1.1E-03	4.2E-03
Testes	3.2E-04	1.2E-03
Thymus	3.5E-04	1.3E-03
Thyroid	2.6E-04	9.7E-04
Urinary Bladder Wall	2.5E-04	9.3E-04
Uterus	2.6E-04	9.7E-04
Effective Dose Equivalent	1.1E-03 mSv/MBq	4.1E-03 rem/mCi

* Based on distribution data of Bigler and Sgouros (J Nucl Med 24(5):431-437, 1983). Cumulated activities in their Table 3 assumed to be for 8400 MBq (227 mCi).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

September 18, 1992

Radiation Dose Estimates for F-18 FDG

ORGAN	Estimated Radiation Dose mGy / MBq	rad / mCi
Adrenals	1.3E-02	4.9E-02
Brain	1.9E-02	7.0E-02
Breasts	9.2E-03	3.4E-02
Gallbladder Wall	1.4E-02	5.0E-02
LLI Wall	1.7E-02	6.1E-02
Small Intestine	1.4E-02	5.1E-02
Stomach	1.3E-02	4.7E-02
ULI Wall	1.3E-02	4.9E-02
Heart Wall	6.0E-02	2.2E-01
Kidneys	2.0E-02	7.4E-02
Liver	1.6E-02	5.8E-02
Lungs	1.7E-02	6.4E-02
Muscle	1.1E-02	4.2E-02
Ovaries	1.7E-02	6.3E-02
Pancreas	2.6E-02	9.6E-02
Red Marrow	1.3E-02	4.8E-02
Bone Surfaces	1.2E-02	4.3E-02
Skin	8.4E-03	3.1E-02
Spleen	3.7E-02	1.4E-01
Testes	1.3E-02	4.8E-02
Thymus	1.2E-02	4.4E-02
Thyroid	1.0E-02	3.9E-02
Urinary Bladder Wall	1.9E-01	7.0E-01
Uterus	2.3E-02	8.5E-02
Effective Dose Equivalent	3.0E-02 mSv/MBq	1.1E-01 rem/mCi

Based on the distribution data gathered in dogs by Gallagher et al. (JNM 18(10):990-996) and assuming a 1.83 hour effective half time, except for the brain and urinary bladder, for which the assumptions of Jones et al. (JNM 23(7):613-617), based on data gathered in human subjects, were used.

Dynamic bladder model with 4.8-hour voiding interval

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7)

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose
Information Center

February 27, 1995

Radiation Dose Estimates for F-18 Sodium Fluoride

ORGAN	Estimated Radiation Dose mGy / MBq	rad / mCi
Adrenals	6.2E-03	2.3E-02
Brain	5.6E-03	2.1E-02
Breasts	2.8E-03	1.0E-02
Gallbladder Wall	4.4E-03	1.6E-02
LLI Wall	1.2E-02	4.3E-02
Small Intestine	6.6E-03	2.5E-02
Stomach	3.8E-03	1.4E-02
ULI Wall	5.8E-03	2.1E-02
Heart Wall	3.9E-03	1.5E-02
Kidneys	1.9E-02	7.1E-02
Liver	4.0E-03	1.5E-02
Lungs	4.1E-03	1.5E-02
Muscle	6.0E-03	2.2E-02
Ovaries	1.1E-02	3.9E-02
Pancreas	4.8E-03	1.8E-02
Red Marrow	2.8E-02	1.0E-01
Bone Surfaces	6.0E-02	2.2E-01
Skin	4.0E-03	1.5E-02
Spleen	4.2E-03	1.5E-02
Testes	7.8E-03	2.9E-02
Thymus	3.5E-03	1.3E-02
Thyroid	4.4E-03	1.6E-02
Urinary Bladder Wall	2.5E-01	9.1E-01
Uterus	1.9E-02	7.0E-02
Effective Dose Equivalent	2.7E-02 mSv/MBq	1.0E-01 rem/mCi

Biological model: ICRP 53 model (data gathered in humans)

Kidney	τ = 0.025 hours		
Cortical bone	25%	T_b = 0.333 hours (uptake)	T_b = ∞ (washout)
Cancellous bone	25%	T_b = 0.333 hours (uptake)	T_b = ∞ (washout)
Total body	12.5%	T_b = 0.167 hours,	37.5% T_b = 3.2 hours
	50.0%	T_b = ∞	

Dynamic Bladder Model Used (4.80 hr void)

12.50%	T_b = 0.167 hr
37.50%	T_b = 3.2 hr

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7). Bone and marrow model of Eckerman (Aspects of dosimetry of radionuclides within the skeleton with particular emphasis on the active marrow, In Fourth International Radiopharmaceutical Dosimetry Symposium; A.T. Schlafke-Stelson and E. E. Watson eds. CONF-851113, Oak Ridge Associated Universities, Oak Ridge, TN 37831, 1986. pp 514-534.) used.

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Source: Radiation Internal Dose Information Center

February 27, 1995

Radiation Dose Estimates for P-32 Sodium Phosphate

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	7.6E-04	2.8E-03
Brain	7.6E-04	2.8E-03
Breasts	7.6E-04	2.8E-03
Gallbladder Wall	7.6E-04	2.8E-03
LLI Wall	7.6E-04	2.8E-03
Small Intestine	7.6E-04	2.8E-03
Stomach	7.6E-04	2.8E-03
ULI Wall	7.6E-04	2.8E-03
Heart Wall	7.6E-04	2.8E-03
Kidneys	7.6E-04	2.8E-03
Liver	7.6E-04	2.8E-03
Lungs	7.6E-04	2.8E-03
Muscle	7.6E-04	2.8E-03
Ovaries	7.6E-04	2.8E-03
Pancreas	7.6E-04	2.8E-03
Red Marrow	7.6E+00	2.8E+01
Bone Surfaces	1.0E+01	3.7E+01
Skin	7.6E-04	2.8E-03
Spleen	7.6E-04	2.8E-03
Testes	7.6E-04	2.8E-03
Thymus	7.6E-04	2.8E-03
Thyroid	7.6E-04	2.8E-03
Urinary Bladder Wall	7.6E-04	2.8E-03
Uterus	7.6E-04	2.8E-03
Effective Dose Equivalent	1.2E+00 mSv/MBq	4.5E+00 rem/mCi

Based on model in ICRP 30 (data gathered in humans). Assumed distribution and retention:

Cortical Bone	15%	$T_b = \infty$			
Cancellous Bone	15%	$T_b = \infty$			
Remainder	14%	T_b = 12 hr	14%	T_b = 48 hr	42% T_b = 456 hr

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7). Bone and marrow model of Eckerman (Aspects of dosimetry of radionuclides within the skeleton with particular emphasis on the active marrow, In Fourth International Radiopharmaceutical Dosimetry Symposium; A.T. Schlafke-Stelson and E. E. Watson eds. CONF-851113, Oak Ridge Associated Universities, Oak Ridge, TN 37831, 1986. pp 514-534.) used.

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose
Information Center

July 19, 1995

Radiation Dose Estimates for the Cr-51 RBCs (Erythrocytes)

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	2.0E-01	7.6E-01
Brain	3.3E-02	1.2E-01
Breasts	8.4E-02	3.1E-01
Gallbladder Wall	1.3E-01	5.0E-01
LLI Wall	8.7E-02	3.2E-01
Small Intestine	9.8E-02	3.6E-01
Stomach	1.4E-01	5.1E-01
ULI Wall	9.9E-02	3.7E-01
Heart Wall	5.0E-01	1.9E+00
Kidneys	2.2E-01	8.1E-01
Liver	2.4E-01	8.9E-01
Lungs	3.2E-01	1.2E+00
Muscle	8.3E-02	3.1E-01
Ovaries	9.2E-02	3.4E-01
Pancreas	1.9E-01	7.1E-01
Red Marrow	1.2E-01	4.4E-01
Bone Surfaces	1.2E-01	4.4E-01
Skin	5.6E-02	2.1E-01
Spleen	1.6E+00	5.8E+00
Testes	6.4E-02	2.4E-01
Thymus	1.3E-01	5.0E-01
Thyroid	1.3E-01	4.7E-01
Urinary Bladder Wall	8.2E-02	3.0E-01
Uterus	9.1E-02	3.4E-01
Total Body	9.6E-02	3.5E-01
Effective Dose Equivalent	2.6E-01 mSv/MBq	9.6E-01 rem/mCi

Biological model based on ICRP 53. The activity in cortical and trabecular bone was assumed to be distributed in the bone volume. Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7)

Residence Times:

Adrenals	3.76E-01 hr	Red Marrow	2.73E+01 hr
Brain	3.76E+00 hr	Cort Bone	1.33E+01 hr
Heart Contents	6.03E+01 hr	Trab Bone	3.00E+00 hr
Heart Wall	7.45E+00 hr	Spleen	6.24E+01 hr
Kidneys	8.46E+00 hr	Thyroid	4.40E-01 hr
Liver	5.75E+01 hr	Remainder	4.24E+02 hr
Lungs	6.39E+01 hr		

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

Radiation Dose Estimates for Co-57 Vitamin B-12 (Cyanocobalamin)

	Estimated Radiation Dose (mGy/MBq)			
	No Flushing Dose		With Flushing Dose	
ORGAN	Normals	Pernicious Anemia	Normals	Pernicious Anemia
Adrenals	4.7E+00	6.0E-01	3.1E+00	4.1E-01
Brain	6.6E-01	8.5E-02	4.4E-01	5.4E-02
Breasts	1.1E+00	1.5E-01	7.6E-01	9.7E-02
Gallbladder Wall	8.6E+00	1.1E+00	5.7E+00	7.8E-01
LLI Wall	1.3E+00	1.4E+00	9.8E-01	1.4E+00
Small Intestine	1.8E+00	4.0E-01	1.2E+00	3.3E-01
Stomach	2.0E+00	3.1E-01	1.3E+00	2.3E-01
ULI Wall	2.5E+00	8.0E-01	1.7E+00	7.0E-01
Heart Wall	2.9E+00	3.7E-01	1.9E+00	2.5E-01
Kidneys	3.4E+00	4.4E-01	2.3E+00	3.1E-01
Liver	3.5E+01	4.4E+00	2.3E+01	3.0E+00
Lungs	2.6E+00	3.3E-01	1.7E+00	2.2E-01
Muscle	1.4E+00	1.9E-01	9.0E-01	1.3E-01
Ovaries	1.3E+00	2.9E-01	8.5E-01	2.4E-01
Pancreas	4.3E+00	5.6E-01	2.9E+00	3.8E-01
Red Marrow	1.5E+00	2.2E-01	1.0E+00	1.5E-01
Bone Surfaces	2.5E+00	3.4E-01	1.6E+00	2.3E-01
Skin	8.2E-01	1.1E-01	5.5E-01	7.3E-02
Spleen	1.4E+00	1.9E-01	9.5E-01	1.3E-01
Testes	6.9E-01	1.0E-01	4.6E-01	6.8E-02
Thymus	1.3E+00	1.6E-01	8.5E-01	1.1E-01
Thyroid	8.3E-01	1.1E-01	5.6E-01	6.9E-02
Urinary Bladder Wall	9.6E-01	1.7E-01	5.8E-01	1.2E-01
Uterus	1.2E+00	2.2E-01	8.1E-01	1.7E-01
Effective Dose Equivalent (mSv/MBq)	4.4E+00	6.7E-01	3.0E+00	5.0E-01

Based on model in ICRP 53, using data from patients. Assumed distribution and retention:

		No Flushing Dose		With Flushing Dose	
		Normals	Pernicious Anemia	Normals	Pernicious Anemia
Liver	T_b = 500 days	42%	5.3%	28%	3.6%
Kidneys	T_b = 500 days	-	-	0.064%	0.0081%
Total Body	T_b = 500 days	63%	8.0%	42%	5.3%
	T_b = 1 day	7%	0.9%	42%	5.3%
	T_b = 1.7 hours	-	-	24%	3.0%
Fraction absorbed from SI		70%	8.9%	70%	8.9%

Urinary bladder receives all output from total body, bladder voiding interval 4.8 hours.

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7)

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

September 18, 1992

Radiation Dose Estimates for Co-58 Vitamin B-12 (Cyanocobalamin)

	Estimated Radiation Dose (mGy/MBq)			
	No Flushing Dose		With Flushing Dose	
ORGAN	Normals	Pernicious Anemia	Normals	Pernicious Anemia
Adrenals	1.1E+01	1.4E+00	7.3E+00	9.9E-01
Brain	1.3E+00	1.6E-01	8.3E-01	1.0E-01
Breasts	2.9E+00	3.8E-01	1.9E+00	2.5E-01
Gallbladder Wall	2.0E+01	2.7E+00	1.3E+01	1.9E+00
LLI Wall	3.3E+00	4.0E+00	2.6E+00	3.9E+00
Small Intestine	4.5E+00	1.4E+00	3.1E+00	1.2E+00
Stomach	4.9E+00	9.0E-01	3.3E+00	7.1E-01
ULI Wall	6.2E+00	2.5E+00	4.3E+00	2.2E+00
Heart Wall	6.6E+00	8.6E-01	4.4E+00	5.8E-01
Kidneys	7.8E+00	1.1E+00	5.3E+00	8.0E-01
Liver	5.3E+01	6.8E+00	3.5E+01	4.7E+00
Lungs	5.6E+00	7.2E-01	3.7E+00	4.9E-01
Muscle	3.1E+00	5.0E-01	2.1E+00	3.7E-01
Ovaries	3.1E+00	1.3E+00	2.2E+00	1.2E+00
Pancreas	9.3E+00	1.3E+00	6.2E+00	9.0E-01
Red Marrow	3.7E+00	6.4E-01	2.5E+00	4.8E-01
Bone Surfaces	3.0E+00	4.6E-01	2.0E+00	3.3E-01
Skin	2.0E+00	3.0E-01	1.4E+00	2.1E-01
Spleen	3.3E+00	5.1E-01	2.2E+00	3.7E-01
Testes	1.5E+00	2.9E-01	1.0E+00	2.2E-01
Thymus	3.0E+00	3.9E-01	2.0E+00	2.6E-01
Thyroid	1.8E+00	2.3E-01	1.2E+00	1.5E-01
Urinary Bladder Wall	2.3E+00	5.7E-01	1.6E+00	4.8E-01
Uterus	2.8E+00	7.6E-01	1.9E+00	6.4E-01
Effective Dose Equivalent (mSv/MBq)	8.5E+00	1.6E+00	5.7E+00	1.3E+00

Based on model in ICRP 53, using data from patients. Assumed distribution and retention:

		No Flushing Dose		With Flushing Dose	
		Normals	Pernicious Anemia	Normals	Pernicious Anemia
Liver	T_b = 500 days	42%	5.3%	28%	3.6%
Kidneys	T_b = 500 days	-	-	0.064%	0.0081%
Total Body	T_b = 500 days	63%	8.0%	42%	5.3%
	T_b = 1 day	7%	0.9%	42%	5.3%
	T_b = 1.7 hours	-	-	24%	3.0%
Fraction absorbed from SI		70%	8.9%	70%	8.9%

Urinary bladder receives all output from total body, bladder voiding interval 4.8 hours.

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7)

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

February 26, 1996

Radiation Dose Estimates for Fe-59 Citrate*

ORGAN	Estimated Radiation Dose (mGy/MBq) Males	Females
Adrenals	1.0E+01	1.1E+01
Brain	6.7E+00	8.9E+00
Breasts	4.7E+00	6.3E+00
Gallbladder Wall	9.7E+00	9.6E+00
LLI Wall	5.3E+00	7.2E+00
Small Intestine	6.0E+00	7.2E+00
Stomach	8.0E+00	8.9E+00
ULI Wall	6.2E+00	7.7E+00
Heart Wall	1.9E+01	2.4E+01
Kidneys	1.2E+01	1.3E+01
Liver	2.2E+01	1.9E+01
Lungs	1.4E+01	1.9E+01
Muscle	4.9E+00	6.3E+00
Ovaries	---	7.3E+00
Pancreas	1.2E+01	1.2E+01
Red Marrow	1.2E+01	1.4E+01
Bone Surfaces	8.5E+00	1.0E+01
Skin	3.4E+00	4.6E+00
Spleen	8.5E+01	5.4E+01
Testes	3.5E+00	---
Thymus	6.9E+00	9.0E+00
Thyroid	4.3E+00	5.7E+00
Urinary Bladder Wall	4.5E+00	5.1E+00
Uterus	5.2E+00	6.9E+00
Effective Dose Equivalent	1.4E+01 mSv/MBq	1.4E+01 mSv/MBq

* Calculated using the kinetic model of Thind (Health Physics 68(1):9-20, 1995. Activity in blood apportioned to brain, heart contents, kidneys, and lungs according to the model of Hui and Poston.

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7). Bone and marrow model of Eckerman (Aspects of dosimetry of radionuclides within the skeleton with particular emphasis on the active marrow, In Fourth International Radiopharmaceutical Dosimetry Symposium; A.T. Schlafke-Stelson and E. E. Watson eds. CONF-851113, Oak Ridge Associated Universities, Oak Ridge, TN 37831, 1986. pp 514-534.) used.

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Source: Radiation Internal Dose Information Center

September 18, 1992

Radiation Dose Estimates for Co-60 Vitamin B-12 (Cyanocobalamin)

	Estimated Radiation Dose (mGy/MBq)			
	No Flushing Dose		With Flushing Dose	
ORGAN	Normals	Pernicious Anemia	Normals	Pernicious Anemia
Adrenals	1.7E+02	2.2E+01	1.1E+02	1.5E+01
Brain	2.0E+01	2.5E+00	1.3E+01	1.6E+00
Breasts	4.5E+01	5.8E+00	3.0E+01	3.9E+00
Gallbladder Wall	2.9E+02	3.8E+01	2.0E+02	2.6E+01
LLI Wall	3.6E+01	1.4E+01	2.5E+01	1.2E+01
Small Intestine	6.6E+01	1.0E+01	4.4E+01	7.7E+00
Stomach	7.2E+01	9.8E+00	4.8E+01	6.8E+00
ULI Wall	9.1E+01	1.6E+01	6.1E+01	1.2E+01
Heart Wall	1.0E+02	1.3E+01	6.8E+01	8.8E+00
Kidneys	1.2E+02	1.5E+01	8.0E+01	1.1E+01
Liver	8.2E+02	1.0E+02	5.5E+02	7.1E+01
Lungs	8.6E+01	1.1E+01	5.7E+01	7.3E+00
Muscle	4.8E+01	6.4E+00	3.2E+01	4.3E+00
Ovaries	4.5E+01	7.9E+00	3.0E+01	5.9E+00
Pancreas	1.4E+02	1.8E+01	9.2E+01	1.2E+01
Red Marrow	5.5E+01	7.4E+00	3.7E+01	5.1E+00
Bone Surfaces	4.6E+01	6.1E+00	3.1E+01	4.1E+00
Skin	3.3E+01	4.3E+00	2.2E+01	2.9E+00
Spleen	5.2E+01	6.8E+00	3.5E+01	4.6E+00
Testes	2.4E+01	3.3E+00	1.6E+01	2.2E+00
Thymus	4.8E+01	6.1E+00	3.2E+01	4.1E+00
Thyroid	2.8E+01	3.6E+00	1.9E+01	2.4E+00
Urinary Bladder Wall	3.5E+01	5.2E+00	2.2E+01	3.4E+00
Uterus	4.3E+01	6.4E+00	2.9E+01	4.6E+00
Effective Dose Equivalent (mSv/MBq)	1.3E+02	1.7E+01	8.7E+01	1.2E+01

Based on model in ICRP 53, using data from patients. Assumed distribution and retention:

		No Flushing Dose		With Flushing Dose	
		Normals	Pernicious Anemia	Normals	Pernicious Anemia
Liver	T_b = 500 days	42%	5.3%	28%	3.6%
Kidneys	T_b = 500 days	-	-	0.064%	0.0081%
Total Body	T_b = 500 days	63%	8.0%	42%	5.3%
	T_b = 1 day	7%	0.9%	42%	5.3%
	T_b = 1.7 hours	-	-	24%	3.0%
Fraction absorbed from SI		70%	8.9%	70%	8.9%

Urinary bladder receives all output from total body, bladder voiding interval 4.8 hours.

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7)

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

February 27, 1995

Radiation Dose Estimates for Ga-67 Citrate

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	1.3E-01	4.7E-01
Brain	5.4E-02	2.0E-01
Breasts	4.6E-02	1.7E-01
Gallbladder Wall	8.3E-02	3.1E-01
LLI Wall	2.6E-01	9.7E-01
Small Intestine	8.6E-02	3.2E-01
Stomach	6.9E-02	2.6E-01
ULI Wall	1.5E-01	5.4E-01
Heart Wall	6.7E-02	2.5E-01
Kidneys	1.1E-01	4.2E-01
Liver	1.1E-01	4.2E-01
Lungs	6.1E-02	2.3E-01
Muscle	5.9E-02	2.2E-01
Ovaries	8.7E-02	3.2E-01
Pancreas	7.9E-02	2.9E-01
Red Marrow	1.2E-01	4.6E-01
Bone Surfaces	3.2E-01	1.2E+00
Skin	4.4E-02	1.6E-01
Spleen	1.4E-01	5.2E-01
Testes	5.5E-02	2.0E-01
Thymus	5.9E-02	2.2E-01
Thyroid	6.0E-02	2.2E-01
Urinary Bladder Wall	9.0E-02	3.3E-01
Uterus	7.9E-02	2.9E-01
Effective Dose Equivalent	1.1E-01 mSv/MBq	4.1E-01 rem/mCi

Based on the model in MIRD Dose Estimate Report No. 2 (data gathered in human subjects), J Nucl Med 14:755-756, 1973. Dynamic bladder model with 4.8-hour voiding interval.

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7). Bone and marrow model of Eckerman (Aspects of dosimetry of radionuclides within the skeleton with particular emphasis on the active marrow, In Fourth International Radiopharmaceutical Dosimetry Symposium; A.T. Schlafke-Stelson and E. E. Watson eds. CONF-851113, Oak Ridge Associated Universities, Oak Ridge, TN 37831, 1986. pp 514-534.) used.

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

March 18, 1993

Radiation Dose Estimates for Ga-68 Citrate

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	3.2E-02	1.2E-01
Brain	1.1E-02	4.2E-02
Breasts	1.1E-02	4.1E-02
Gallbladder Wall	1.7E-02	6.2E-02
LLI Wall	2.1E-02	7.8E-02
Small Intestine	8.8E-02	3.3E-01
Stomach	1.4E-02	5.3E-02
ULI Wall	6.6E-02	2.5E-01
Heart Wall	1.3E-02	4.9E-02
Kidneys	2.7E-02	9.8E-02
Liver	2.7E-02	1.0E-01
Lungs	1.2E-02	4.6E-02
Muscle	1.3E-02	4.7E-02
Ovaries	1.8E-02	6.5E-02
Pancreas	1.5E-02	5.5E-02
Red Marrow	2.1E-02	7.9E-02
Bone Surfaces	1.7E-02	6.3E-02
Skin	1.1E-02	4.0E-02
Spleen	3.6E-02	1.3E-01
Testes	1.2E-02	4.5E-02
Thymus	1.2E-02	4.6E-02
Thyroid	1.2E-02	4.5E-02
Urinary Bladder Wall	2.0E-02	7.4E-02
Uterus	1.7E-02	6.2E-02
Effective Dose Equivalent	2.6E-02 mSv/MBq	9.6E-02 rem/mCi

Biological model based on MIRD Dose Estimate Report No. 2 (data gathered in human subjects).

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7). Bone and marrow model of Eckerman (Aspects of dosimetry of radionuclides within the skeleton with particular emphasis on the active marrow, In Fourth International Radiopharmaceutical Dosimetry Symposium; A.T. Schlafke-Stelson and E. E. Watson eds. CONF-851113, Oak Ridge Associated Universities, Oak Ridge, TN 37831, 1986. pp 514-534.) used.

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

September 18, 1992

Radiation Dose Estimates for Se-75 Selenomethionine

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	3.2E+00	1.2E+01
Brain	1.4E+00	5.1E+00
Breasts	1.4E+00	5.1E+00
Gallbladder Wall	3.8E+00	1.4E+01
LLI Wall	2.4E+00	8.7E+00
Small Intestine	2.4E+00	8.9E+00
Stomach	2.5E+00	9.1E+00
ULI Wall	2.4E+00	9.0E+00
Heart Wall	2.6E+00	9.5E+00
Kidneys	5.2E+00	1.9E+01
Liver	6.0E+00	2.2E+01
Lungs	2.7E+00	9.8E+00
Muscle	2.0E+00	7.3E+00
Ovaries	2.7E+00	1.0E+01
Pancreas	3.3E+00	1.2E+01
Red Marrow	2.1E+00	7.7E+00
Bone Surfaces	3.0E+00	1.1E+01
Skin	1.2E+00	4.4E+00
Spleen	3.7E+00	1.4E+01
Testes	2.0E+00	7.5E+00
Thymus	2.0E+00	7.6E+00
Thyroid	2.6E+00	9.7E+00
Urinary Bladder Wall	2.1E+00	7.7E+00
Uterus	2.4E+00	9.0E+00
Effective Dose Equivalent	2.9E+00 mSv/MBq	1.1E+01 rem/mCi

Biological model based on MIRD Dose Estimate Report No. 1 (data gathered in human subjects).

Dynamic bladder model with a 4.8 hour voiding interval:
11.20% Tb = 1.33E+01 hr.
35.20% Tb = 1.10E+03 hr.
33.60% Tb = 5.33E+03 hr.
ICRP 30 GI model used, 15% to the small intestine

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

September 18, 1992

Radiation Dose Estimates for Kr-81m Inhalation

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	4.3E-06	1.6E-05
Brain	1.7E-07	6.1E-07
Breasts	4.3E-06	1.6E-05
Gallbladder Wall	1.4E-06	5.1E-06
LLI Wall	7.4E-08	2.7E-07
Small Intestine	2.7E-07	1.0E-06
Stomach	2.1E-06	7.9E-06
ULI Wall	3.6E-07	1.3E-06
Heart Wall	7.8E-06	2.9E-05
Kidneys	1.2E-06	4.6E-06
Liver	3.6E-06	1.3E-05
Lungs	2.0E-04	7.4E-04
Muscle	1.7E-06	6.4E-06
Ovaries	1.3E-07	5.0E-07
Pancreas	3.0E-06	1.1E-05
Red Marrow	2.1E-06	7.7E-06
Bone Surfaces	2.3E-06	8.5E-06
Skin	7.6E-07	2.8E-06
Spleen	3.0E-06	1.1E-05
Testes	1.0E-08	3.8E-08
Thymus	5.0E-06	1.9E-05
Thyroid	1.6E-06	5.9E-06
Urinary Bladder Wall	3.6E-08	1.3E-07
Uterus	9.9E-08	3.7E-07
Effective Dose Equivalent	2.7E-05 mSv/MBq	9.8E-05 rem/mCi

Assumes that all activity inhaled decays in lungs (no patient or animal data used).

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

September 18, 1992

Radiation Dose Estimates for Kr-81m Injections

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	4.5E-06	1.7E-05
Brain	9.7E-08	3.6E-07
Breasts	4.5E-06	1.7E-05
Gallbladder Wall	1.7E-06	6.4E-06
LLI Wall	8.9E-08	3.3E-07
Small Intestine	3.0E-07	1.1E-06
Stomach	2.8E-06	1.0E-05
ULI Wall	4.3E-07	1.6E-06
Heart Wall	1.9E-04	7.1E-04
Kidneys	1.2E-06	4.4E-06
Liver	3.8E-06	1.4E-05
Lungs	5.1E-05	1.9E-04
Muscle	1.6E-06	6.0E-06
Ovaries	1.2E-07	4.4E-07
Pancreas	4.3E-06	1.6E-05
Red Marrow	2.1E-06	7.6E-06
Bone Surfaces	2.2E-06	8.3E-06
Skin	6.7E-07	2.5E-06
Spleen	2.4E-06	8.7E-06
Testes	1.4E-08	5.2E-08
Thymus	1.3E-05	5.0E-05
Thyroid	1.1E-06	4.0E-06
Urinary Bladder Wall	5.1E-08	1.9E-07
Uterus	1.1E-07	4.2E-07
Effective Dose Equivalent	2.0E-05 mSv/MBq	7.5E-05 rem/mCi

Residence times based on a model in which activity clears from the blood, to the right heart, lungs, left heart, and back to blood, with 95% clearance of blood from lungs on each pass. Half times for transport are 1 minute in heart chambers, 5 minutes in lung, and 3 minutes in the body. (No patient or animal data used).

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose
Information Center

September 18, 1992

Radiation Dose Estimates for Oral Administration of Kr-81m

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	5.0E-06	1.9E-05
Brain	1.5E-08	5.4E-08
Breasts	1.1E-06	4.0E-06
Gallbladder Wall	5.4E-06	2.0E-05
LLI Wall	1.6E-06	5.8E-06
Small Intestine	3.7E-06	1.4E-05
Stomach	4.1E-04	1.5E-03
ULI Wall	4.7E-06	1.7E-05
Heart Wall	4.3E-06	1.6E-05
Kidneys	5.0E-06	1.9E-05
Liver	2.7E-06	9.9E-06
Lungs	1.9E-06	7.2E-06
Muscle	1.8E-06	6.7E-06
Ovaries	1.1E-06	4.0E-06
Pancreas	2.2E-05	8.2E-05
Red Marrow	1.5E-06	5.4E-06
Bone Surfaces	1.5E-06	5.4E-06
Skin	6.5E-07	2.4E-06
Spleen	1.4E-05	5.2E-05
Testes	7.6E-08	2.8E-07
Thymus	7.5E-07	2.8E-06
Thyroid	6.6E-08	2.4E-07
Urinary Bladder Wall	3.7E-07	1.4E-06
Uterus	9.3E-07	3.4E-06
Effective Dose Equivalent	2.8E-05 mSv/MBq	1.1E-04 rem/mCi

All activity administered assumed to decay in stomach (no patient or animal data used).

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

September 18, 1992

Radiation Dose Estimates for Rb-82

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	4.4E-04	1.6E-03
Brain	3.2E-04	1.2E-03
Breasts	3.3E-04	1.2E-03
Gallbladder Wall	4.2E-04	1.5E-03
LLI Wall	3.6E-04	1.3E-03
Small Intestine	3.8E-04	1.4E-03
Stomach	3.8E-04	1.4E-03
ULI Wall	3.8E-04	1.4E-03
Heart Wall	1.8E-03	6.7E-03
Kidneys	9.0E-03	3.3E-02
Liver	8.3E-04	3.1E-03
Lungs	1.7E-03	6.4E-03
Muscle	3.5E-04	1.3E-03
Ovaries	3.7E-04	1.4E-03
Pancreas	4.2E-04	1.6E-03
Red Marrow	4.5E-04	1.7E-03
Bone Surfaces	3.3E-04	1.2E-03
Skin	3.2E-04	1.2E-03
Spleen	4.1E-04	1.5E-03
Testes	2.6E-04	9.5E-04
Thymus	3.7E-04	1.4E-03
Thyroid	3.4E-04	1.3E-03
Urinary Bladder Wall	3.6E-04	1.3E-03
Uterus	3.7E-04	1.4E-03
Effective Dose Equivalent	1.2E-03 mSv/MBq	4.3E-03 rem/mCi

Based on data gathered in human subjects by Ryan et al., Fourth International Radiopharmaceutical Dosimetry Symposium, Oak Ridge, 1985, pp. 346-358.
Assumed residence times:

Heart Chambers	5.25×10^{-4}
Heart Wall	4.95×10^{-4}
Kidneys	3.11×10^{-3}
Liver	1.54×10^{-3}
Lungs	1.95×10^{-3}
Testes	9.00×10^{-6}
Remainder	2.24×10^{-2}

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

February 27, 1995

Radiation Dose Estimates for Sr-85 Nitrate

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	9.0E-01	3.3E+00
Brain	8.8E-01	3.2E+00
Breasts	4.0E-01	1.5E+00
Gallbladder Wall	6.0E-01	2.2E+00
LLI Wall	9.8E-01	3.6E+00
Small Intestine	6.8E-01	2.5E+00
Stomach	5.5E-01	2.0E+00
ULI Wall	6.9E-01	2.5E+00
Heart Wall	6.2E-01	2.3E+00
Kidneys	6.5E-01	2.4E+00
Liver	5.8E-01	2.1E+00
Lungs	6.3E-01	2.3E+00
Muscle	6.7E-01	2.5E+00
Ovaries	7.5E-01	2.8E+00
Pancreas	7.0E-01	2.6E+00
Red Marrow	1.4E+00	5.3E+00
Bone Surfaces	2.0E+00	7.6E+00
Skin	4.9E-01	1.8E+00
Spleen	5.8E-01	2.1E+00
Testes	5.0E-01	1.9E+00
Thymus	5.5E-01	2.0E+00
Thyroid	7.0E-01	2.6E+00
Urinary Bladder Wall	6.3E-01	2.3E+00
Uterus	6.5E-01	2.4E+00
Effective Dose Equivalent	8.3E-01 mSv/MBq	3.1E+00 rem/mCi

Biological model based on ICRP 53 (data gathered in human subjects).

Cortical bone	τ = 201.6 hour	Cancellous bone	τ = 160.8 hour
Small Intestine	τ = 0.6 hour	Upper Large Intestine	τ = 2.0 hour
Lower Large Intestine	τ = 3.6 hour	Urinary bladder	τ = 1.1 hour
Remainder of body	τ = 163.1 hour		

Dynamic bladder model with 3.5-hour voiding interval

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7). Bone and marrow model of Eckerman (Aspects of dosimetry of radionuclides within the skeleton with particular emphasis on the active marrow, In Fourth International Radiopharmaceutical Dosimetry Symposium; A.T. Schlafke-Stelson and E. E. Watson eds. CONF-851113, Oak Ridge Associated Universities, Oak Ridge, TN 37831, 1986. pp 514-534.) used.

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

September 18, 1992

Radiation Dose Estimates for Tc-99m Albumin Microspheres

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	7.3E-03	2.7E-02
Brain	1.2E-03	4.5E-03
Breasts	4.6E-03	1.7E-02
Gallbladder Wall	4.7E-03	1.8E-02
LLI Wall	7.8E-03	2.9E-02
Small Intestine	3.9E-03	1.5E-02
Stomach	1.8E-02	6.5E-02
ULI Wall	9.0E-03	3.3E-02
Heart Wall	8.7E-03	3.2E-02
Kidneys	3.6E-02	1.3E-01
Liver	5.5E-03	2.0E-02
Lungs	5.8E-02	2.2E-01
Muscle	3.2E-03	1.2E-02
Ovaries	3.4E-03	1.3E-02
Pancreas	7.5E-03	2.8E-02
Red Marrow	3.8E-03	1.4E-02
Bone Surfaces	5.6E-03	2.1E-02
Skin	1.6E-03	6.1E-03
Spleen	6.8E-03	2.5E-02
Testes	1.5E-03	5.6E-03
Thymus	5.8E-03	2.1E-02
Thyroid	1.4E-02	5.0E-02
Urinary Bladder Wall	1.0E-02	3.8E-02
Uterus	3.3E-03	1.2E-02
Effective Dose Equivalent	1.4E-02 mSv/MBq	5.4E-02 rem/mCi

Based on model in MIRD Dose Estimate Report No. 10 (data gathered in human subjects), J Nucl Med 23:915-917, 1982.

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

September 18, 1992

Radiation Dose Estimates for Tc-99m for the Adult for Disofenin, Lidofenin and Mebrofenin

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	3.6E-03	1.3E-02
Brain	6.9E-05	2.6E-04
Breasts	4.7E-04	1.7E-03
Gallbladder Wall	1.1E-01	4.0E-01
LLI Wall	6.0E-02	2.2E-01
Small Intestine	4.4E-02	1.6E-01
Stomach	5.6E-03	2.1E-02
ULI Wall	8.6E-02	3.2E-01
Heart Wall	1.4E-03	5.4E-03
Kidneys	6.0E-03	2.2E-02
Liver	1.4E-02	5.2E-02
Lungs	1.1E-03	4.2E-03
Muscle	3.0E-03	1.1E-02
Ovaries	1.9E-02	7.1E-02
Pancreas	5.6E-03	2.1E-02
Red Marrow	3.9E-03	1.5E-02
Bone Surfaces	3.8E-03	1.4E-02
Skin	9.2E-04	3.4E-03
Spleen	2.5E-03	9.3E-03
Testes	1.7E-03	6.3E-03
Thymus	3.7E-04	1.4E-03
Thyroid	1.2E-04	4.5E-04
Urinary Bladder Wall	2.7E-02	9.9E-02
Uterus	1.4E-02	5.1E-02
Effective Dose Equivalent	2.5E-02 mSv/MBq	9.3E-02 rem/mCi

Biological model based on ICRP 53 (data gathered in human subjects).

Kidneys	τ = 0.012 hour	Gallbladder contents	τ = 0.77 hour
Liver	τ = 0.80 hour	Small Intestine	τ = 1.79 hour
Upper Large Intestine	τ = 2.34 hour	Lower Large Intestine	τ = 1.14 hour
Urinary bladder	τ = 0.53 hour	Remainder of body	τ = 0.14 hour

Dynamic bladder model with 4.8-hour voiding interval

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

September 18, 1992

Radiation Dose Estimates for Tc-99m DMSA

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	1.2E-02	4.3E-02
Brain	1.3E-03	4.9E-03
Breasts	1.4E-03	5.0E-03
Gallbladder Wall	7.5E-03	2.8E-02
LLI Wall	3.3E-03	1.2E-02
Small Intestine	5.0E-03	1.9E-02
Stomach	5.2E-03	1.9E-02
ULI Wall	4.9E-03	1.8E-02
Heart Wall	2.9E-03	1.1E-02
Kidneys	1.9E-01	7.0E-01
Liver	5.7E-03	2.1E-02
Lungs	2.4E-03	9.0E-03
Muscle	2.9E-03	1.1E-02
Ovaries	3.5E-03	1.3E-02
Pancreas	8.7E-03	3.2E-02
Red Marrow	4.1E-03	1.5E-02
Bone Surfaces	5.0E-03	1.9E-02
Skin	1.6E-03	5.8E-03
Spleen	1.1E-02	4.0E-02
Testes	1.8E-03	6.8E-03
Thymus	1.8E-03	6.6E-03
Thyroid	1.6E-03	6.0E-03
Urinary Bladder Wall	1.5E-02	5.4E-02
Uterus	4.2E-03	1.6E-02
Effective Dose Equivalent	1.6E-02 mSv/MBq	6.0E-02 rem/mCi

Based on data gathered in human subjects by Arnold et al., J Nucl Med 16:357-367, 1975. Assumed distribution and retention:

Total body	80%	T_b = 72 hr	20%	T_b = 1.6 hr
Kidneys	44%	T_b = ∞		

Urinary bladder receives whole body clearance: 44.8%, T_b = 72 hr, 11.2%, T_b = 1.6 hr. Bladder voiding interval 4.8 hours.

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

September 18, 1992

Radiation Dose Estimates for Tc-99m DTPA (injection)

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	2.0E-03	7.4E-03
Brain	1.3E-03	4.7E-03
Breasts	1.1E-03	4.0E-03
Gallbladder Wall	2.2E-03	8.1E-03
LLI Wall	5.6E-03	2.1E-02
Small Intestine	3.4E-03	1.3E-02
Stomach	1.9E-03	6.9E-03
ULI Wall	2.9E-03	1.1E-02
Heart Wall	1.7E-03	6.3E-03
Kidneys	5.7E-03	2.1E-02
Liver	1.8E-03	6.6E-03
Lungs	1.5E-03	5.5E-03
Muscle	2.2E-03	8.3E-03
Ovaries	5.5E-03	2.0E-02
Pancreas	2.1E-03	7.7E-03
Red Marrow	2.2E-03	8.0E-03
Bone Surfaces	3.3E-03	1.2E-02
Skin	1.2E-03	4.6E-03
Spleen	1.9E-03	6.8E-03
Testes	3.8E-03	1.4E-02
Thymus	1.5E-03	5.6E-03
Thyroid	1.5E-03	5.6E-03
Urinary Bladder Wall	7.7E-02	2.8E-01
Uterus	1.0E-02	3.7E-02
Effective Dose Equivalent	8.2E-03 mSv/MBq	3.0E-02 rem/mCi

Based on the model in MIRD Dose Estimate Report No. 12 (data gathered in human subjects), J Nucl Med 25:503-505, 1984.

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

September 18, 1992

Radiation Dose Estimates for Tc-99m DTPA (aerosol)

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	1.9E-03	7.2E-03
Brain	6.8E-04	2.5E-03
Breasts	1.4E-03	5.2E-03
Gallbladder Wall	1.8E-03	6.7E-03
LLI Wall	5.2E-03	1.9E-02
Small Intestine	3.5E-03	1.3E-02
Stomach	2.4E-03	9.0E-03
ULI Wall	5.3E-03	2.0E-02
Heart Wall	2.5E-03	9.3E-03
Kidneys	3.0E-03	1.1E-02
Liver	1.7E-03	6.4E-03
Lungs	1.4E-02	5.3E-02
Muscle	1.5E-03	5.6E-03
Ovaries	3.3E-03	1.2E-02
Pancreas	1.9E-03	7.1E-03
Red Marrow	1.6E-03	5.9E-03
Bone Surfaces	2.4E-03	8.7E-03
Skin	7.8E-04	2.9E-03
Spleen	1.7E-03	6.2E-03
Testes	1.7E-03	6.4E-03
Thymus	1.8E-03	6.7E-03
Thyroid	1.1E-03	4.1E-03
Urinary Bladder Wall	3.2E-02	1.2E-01
Uterus	4.8E-03	1.8E-02
Effective Dose Equivalent	6.1E-03 mSv/MBq	2.2E-02 rem/mCi

Dose estimates are given per unit activity inhaled, based on an assumed 0.25 μm AMAD aerosol. Deposition fractions and kinetics based on lung model in ICRP 30, except that activity is cleared from the pulmonary region into the bloodstream with a one hour biological half time. DTPA absorbed into the bloodstream treated as in MIRD Dose Estimate No. 12 (data gathered in human subjects), J Nucl Med 25:503-505, 1984. Urinary bladder voiding interval 4.8 hours.

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose
Information Center

September 12, 1995

Radiation Dose Estimates for Tc-99m ECD*

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	2.5E-03	9.3E-03
Brain	5.5E-03	2.0E-02
Breasts	9.4E-04	3.5E-03
Gallbladder Wall	2.7E-02	1.0E-01
LLI Wall	1.5E-02	5.4E-02
Small Intestine	1.0E-02	3.7E-02
Stomach	2.5E-03	9.3E-03
ULI Wall	1.7E-02	6.2E-02
Heart Wall	1.8E-03	6.5E-03
Kidneys	7.7E-03	2.9E-02
Liver	5.4E-03	2.0E-02
Lungs	2.0E-03	7.4E-03
Muscle	2.4E-03	8.8E-03
Ovaries	7.8E-03	2.9E-02
Pancreas	2.9E-03	1.1E-02
Red Marrow	2.4E-03	9.0E-03
Bone Surfaces	3.7E-03	1.4E-02
Skin	1.2E-03	4.3E-03
Spleen	2.0E-03	7.3E-03
Testes	3.5E-03	1.3E-02
Thymus	1.2E-03	4.6E-03
Thyroid	1.3E-03	4.8E-03
Urinary Bladder Wall	7.3E-02	2.7E-01
Uterus	1.1E-02	4.1E-02
Total Body	2.7E-03	1.0E-02
Effective Dose Equivalent	1.1E-02 mSv/MBq	4.2E-02 rem/mCi

*Based on data gathered in 16 patients. Assumed distribution and retention:

Brain	4.6% T_b = 22.4 hr	2.1% T_b = 0.554 hr
Heart Wall	0.43% T_b = 1.9 hr	0.32% T_b = 0.31 hr
Kidneys	1.2% T_b = 14.4 hr	7.8% T_b = 0.4 hr
Liver	3.5% T_b = 18.6 hr	15.5% T_b = 0.42 hr
Lungs	0.97% T_b = 12.0 hr	4.7% T_b = 0.25 hr
Gallbladder:	average residence time 0.185 hr	
Total Body	30.6% T_b = 31.2 hr	69.4% T_b = 0.854 hr
Urinary Bladder	19% T_b = 68.5 hr	70% T_b = 1.11 hr
GI Tract:	11% of total activity cleared into small intestine, follows GI tract kinetics as in ICRP 30.	

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7). Bone and marrow model of Eckerman (Aspects of dosimetry of radionuclides within the skeleton with particular emphasis on the active marrow, In Fourth International Radiopharmaceutical Dosimetry Symposium; A.T. Schlafke-Stelson and E. E. Watson eds. CONF-851113, Oak Ridge Associated Universities, Oak Ridge, TN 37831, 1986. pp 514-534.) used.

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

September 18, 1992

Radiation Dose Estimates for Tc-99m Exametazime (HMPAO)

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	5.9E-03	2.2E-02
Brain	6.9E-03	2.5E-02
Breasts	1.9E-03	7.0E-03
Gallbladder Wall	5.1E-02	1.9E-01
LLI Wall	1.5E-02	5.7E-02
Small Intestine	1.2E-02	4.6E-02
Stomach	4.2E-03	1.5E-02
ULI Wall	2.2E-02	8.0E-02
Heart Wall	3.8E-03	1.4E-02
Kidneys	3.5E-02	1.3E-01
Liver	1.5E-02	5.4E-02
Lungs	1.1E-02	4.2E-02
Muscle	2.9E-03	1.1E-02
Ovaries	7.0E-03	2.6E-02
Pancreas	5.9E-03	2.2E-02
Red Marrow	3.5E-03	1.3E-02
Bone Surfaces	4.9E-03	1.8E-02
Skin	1.5E-03	5.6E-03
Spleen	4.2E-03	1.5E-02
Testes	2.3E-03	8.4E-03
Thymus	2.4E-03	8.8E-03
Thyroid	2.7E-02	1.0E-01
Urinary Bladder Wall	2.8E-02	1.0E-01
Uterus	7.1E-03	2.6E-02

Effective Dose Equivalent 1.4E-02 mSv/MBq 5.1E-02 rem/mCi

Based on data gathered in patients (see Nucl Med Comm 11:791-799, 1990.
Assumed distribution and retention:

Brain	5.1 %	T_b = 92.4	hours				
Gallbladder	4.0 %	T_b = ∞					
Kidneys	9.0 %	T_b = 27.7	hours				
Liver	10.4 %	T_b = 116	hours	11.6 %	T_b = 0.73	hours	
Lungs	8.6 %	T_b = 69	hours	1.4 %	T_b = 1.6	hours	
Thyroid	0.54 %	T_b = 54.1	hours	0.26 %	T_b = 1.07	hours	
Remainder of the body	29.4 %	T_b = 43.3	hours	16.6 %	T_b = 0.93	hours	

Dynamic Bladder Model used (4.80 hour void)
24.0 % Tb = 8.30 hours
13.0 % Tb = 0.55 hours
ICRP 30 GI Model used, with 14.0 % to the small intestine

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

September 18, 1992

Radiation Dose Estimates for Tc-99m Glucoheptonate

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	4.1E-03	1.5E-02
Brain	1.2E-03	4.6E-03
Breasts	1.1E-03	4.1E-03
Gallbladder Wall	3.4E-03	1.3E-02
LLI Wall	5.6E-03	2.1E-02
Small Intestine	3.9E-03	1.4E-02
Stomach	2.5E-03	9.4E-03
ULI Wall	3.4E-03	1.3E-02
Heart Wall	1.9E-03	7.1E-03
Kidneys	4.4E-02	1.6E-01
Liver	3.2E-03	1.2E-02
Lungs	1.7E-03	6.2E-03
Muscle	2.5E-03	9.1E-03
Ovaries	5.5E-03	2.0E-02
Pancreas	3.5E-03	1.3E-02
Red Marrow	2.6E-03	9.5E-03
Bone Surfaces	3.7E-03	1.4E-02
Skin	1.3E-03	4.8E-03
Spleen	3.7E-03	1.4E-02
Testes	3.7E-03	1.4E-02
Thymus	1.5E-03	5.6E-03
Thyroid	1.5E-03	5.5E-03
Urinary Bladder Wall	7.4E-02	2.7E-01
Uterus	9.9E-03	3.6E-02
Effective Dose Equivalent	1.0E-02 mSv/MBq	3.8E-02 rem/mCi

Based on data gathered in humans by Arnold et al., J Nucl Med 16:357-367, 1975. Assumed distribution and retention:

Kidneys 14.6% uptake T_b = 0.75 hr elimination T_b = 24 hr
Liver 1.5% T_b = ∞
Total Body 35% T_b = 89 hr 30% T_b = 2.04 hr 35% T_b = 0.333 hr
All clearance through urinary bladder, 4.8 hour bladder voiding interval.

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

February 27, 1995

Radiation Dose Estimates for Tc-99m HEDP

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	2.4E-03	8.8E-03
Brain	1.6E-03	6.0E-03
Breasts	1.0E-03	3.8E-03
Gallbladder Wall	2.1E-03	7.7E-03
LLI Wall	3.8E-03	1.4E-02
Small Intestine	2.7E-03	1.0E-02
Stomach	1.8E-03	6.5E-03
ULI Wall	2.4E-03	8.8E-03
Heart Wall	1.7E-03	6.4E-03
Kidneys	9.3E-03	3.5E-02
Liver	1.8E-03	6.6E-03
Lungs	1.6E-03	5.8E-03
Muscle	2.0E-03	7.4E-03
Ovaries	3.8E-03	1.4E-02
Pancreas	2.2E-03	8.1E-03
Red Marrow	3.7E-03	1.4E-02
Bone Surfaces	1.9E-02	7.1E-02
Skin	1.2E-03	4.4E-03
Spleen	2.0E-03	7.3E-03
Testes	2.6E-03	9.6E-03
Thymus	1.5E-03	5.5E-03
Thyroid	1.6E-03	6.0E-03
Urinary Bladder Wall	4.1E-02	1.5E-01
Uterus	6.1E-03	2.2E-02
Effective Dose Equivalent	6.1E-03 mSv/MBq	2.3E-02 rem/mCi

Based on model in MIRD Dose Estimate Report No. 13 (data gathered in human subjects), J Nucl Med 30:1117-1122, 1989. Bladder voiding interval 4.8 hr.

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7). Bone and marrow model of Eckerman (Aspects of dosimetry of radionuclides within the skeleton with particular emphasis on the active marrow, In Fourth International Radiopharmaceutical Dosimetry Symposium; A.T. Schlafke-Stelson and E. E. Watson eds. CONF-851113, Oak Ridge Associated Universities, Oak Ridge, TN 37831, 1986. pp 514-534.) used.

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

February 27, 1995

Radiation Dose Estimates for Tc-99m HMDP

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	3.1E-03	1.2E-02
Brain	2.7E-03	9.8E-03
Breasts	1.3E-03	4.8E-03
Gallbladder Wall	2.3E-03	8.4E-03
LLI Wall	3.5E-03	1.3E-02
Small Intestine	2.7E-03	1.0E-02
Stomach	2.0E-03	7.3E-03
ULI Wall	2.5E-03	9.1E-03
Heart Wall	2.2E-03	8.1E-03
Kidneys	6.0E-03	2.2E-02
Liver	2.1E-03	7.7E-03
Lungs	2.1E-03	7.9E-03
Muscle	2.4E-03	8.8E-03
Ovaries	3.4E-03	1.3E-02
Pancreas	2.6E-03	9.5E-03
Red Marrow	7.5E-03	2.8E-02
Bone Surfaces	5.2E-02	1.9E-01
Skin	1.5E-03	5.6E-03
Spleen	2.2E-03	8.1E-03
Testes	2.3E-03	8.5E-03
Thymus	1.9E-03	7.0E-03
Thyroid	2.3E-03	8.5E-03
Urinary Bladder Wall	2.2E-02	8.0E-02
Uterus	4.4E-03	1.6E-02
Effective Dose Equivalent	6.1E-03 mSv/MBq	2.3E-02 rem/mCi

Based on model in MIRD Dose Estimate Report No. 13 (data gathered in human subjects), J Nucl Med 30:1117-1122, 1989. Bladder voiding interval 4.8 hr.

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7). Bone and marrow model of Eckerman (Aspects of dosimetry of radionuclides within the skeleton with particular emphasis on the active marrow, In Fourth International Radiopharmaceutical Dosimetry Symposium; A.T. Schlafke-Stelson and E. E. Watson eds. CONF-851113, Oak Ridge Associated Universities, Oak Ridge, TN 37831, 1986. pp 514-534.) used.

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

September 18, 1992

Radiation Dose Estimates for Tc-99m HSA

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	6.0E-03	2.2E-02
Brain	7.5E-03	2.8E-02
Breasts	3.7E-03	1.4E-02
Gallbladder Wall	5.5E-03	2.1E-02
LLI Wall	4.0E-03	1.5E-02
Small Intestine	4.3E-03	1.6E-02
Stomach	4.9E-03	1.8E-02
ULI Wall	4.3E-03	1.6E-02
Heart Wall	2.1E-02	7.7E-02
Kidneys	8.6E-03	3.2E-02
Liver	8.2E-03	3.0E-02
Lungs	1.5E-02	5.6E-02
Muscle	3.6E-03	1.3E-02
Ovaries	4.2E-03	1.6E-02
Pancreas	6.3E-03	2.3E-02
Red Marrow	4.3E-03	1.6E-02
Bone Surfaces	7.0E-03	2.6E-02
Skin	2.4E-03	8.8E-03
Spleen	1.5E-02	5.7E-02
Testes	2.9E-03	1.1E-02
Thymus	6.5E-03	2.4E-02
Thyroid	3.8E-03	1.4E-02
Urinary Bladder Wall	5.3E-03	2.0E-02
Uterus	4.3E-03	1.6E-02
Effective Dose Equivalent	7.9E-03 mSv/MBq	2.9E-02 rem/mCi

Based on total body kinetic model in ICRP 53 (data gathered in human subjects), modified by the assumed fractional distribution of blood in model by Hui and Poston.

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

September 18, 1992

Radiation Dose Estimates for Tc-99m MAA

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	6.7E-03	2.5E-02
Brain	9.2E-04	3.4E-03
Breasts	5.0E-03	1.8E-02
Gallbladder Wall	5.6E-03	2.1E-02
LLI Wall	1.7E-03	6.1E-03
Small Intestine	2.0E-03	7.3E-03
Stomach	3.7E-03	1.4E-02
ULI Wall	2.2E-03	8.2E-03
Heart Wall	9.5E-03	3.5E-02
Kidneys	3.7E-03	1.4E-02
Liver	1.6E-02	5.9E-02
Lungs	6.7E-02	2.5E-01
Muscle	2.8E-03	1.1E-02
Ovaries	1.8E-03	6.7E-03
Pancreas	5.6E-03	2.1E-02
Red Marrow	3.3E-03	1.2E-02
Bone Surfaces	5.0E-03	1.9E-02
Skin	1.4E-03	5.4E-03
Spleen	4.1E-03	1.5E-02
Testes	1.1E-03	4.1E-03
Thymus	6.1E-03	2.3E-02
Thyroid	2.5E-03	9.3E-03
Urinary Bladder Wall	9.8E-03	3.6E-02
Uterus	2.3E-03	8.5E-03
Effective Dose Equivalent	1.3E-02 mSv/MBq	4.7E-02 rem/mCi

Model in ICRP 53 is adopted (data gathered in human subjects). Assumed distribution and retention:

Lungs	85% T_b = 6 hr	15% T_b = 72 hr
Liver	25% uptake T_b = 6 hr, elimination T_b = 120 hr	
Kidneys	residence time = .108 hr	

Urinary bladder receives clearance from liver and long term clearance from lung. Dynamic bladder model used with a 4.8 hour voiding interval.

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

September 18, 1992

Radiation Dose Estimates for Tc-99m MAG3

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	4.4E-04	1.6E-03
Brain	1.0E-04	3.8E-04
Breasts	1.1E-04	3.9E-04
Gallbladder Wall	6.7E-04	2.5E-03
LLI Wall	7.1E-03	2.6E-02
Small Intestine	2.9E-03	1.1E-02
Stomach	4.5E-04	1.7E-03
ULI Wall	2.1E-03	7.8E-03
Heart Wall	1.8E-04	6.8E-04
Kidneys	4.1E-03	1.5E-02
Liver	3.5E-04	1.3E-03
Lungs	1.5E-04	5.5E-04
Muscle	1.7E-03	6.3E-03
Ovaries	6.6E-03	2.5E-02
Pancreas	4.5E-04	1.7E-03
Red Marrow	1.1E-03	4.2E-03
Bone Surfaces	1.5E-03	5.6E-03
Skin	5.5E-04	2.0E-03
Spleen	4.1E-04	1.5E-03
Testes	4.6E-03	1.7E-02
Thymus	1.3E-04	5.0E-04
Thyroid	1.3E-04	4.6E-04
Urinary Bladder Wall	1.4E-01	5.1E-01
Uterus	1.5E-02	5.5E-02
Effective Dose Equivalent	1.2E-02 mSv/MBq	4.4E-02 rem/mCi

Based on the model of Stabin et al. (data gathered in human subjects), J Nucl Med 33:33-40, 1992. Residence times:

Kidneys	0.0757 hr
Urinary Bladder	3.3 hr (bladder voided every 4.8 hours)
Remainder	0.23 hr

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

February 27, 1995

Radiation Dose Estimates for Tc-99m MDP

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	2.5E-03	9.1E-03
Brain	1.9E-03	7.0E-03
Breasts	9.5E-04	3.5E-03
Gallbladder Wall	1.9E-03	6.8E-03
LLI Wall	3.4E-03	1.3E-02
Small Intestine	2.4E-03	8.9E-03
Stomach	1.6E-03	5.8E-03
ULI Wall	2.1E-03	7.9E-03
Heart Wall	1.6E-03	6.0E-03
Kidneys	8.6E-03	3.2E-02
Liver	1.6E-03	6.0E-03
Lungs	1.6E-03	5.8E-03
Muscle	1.9E-03	7.2E-03
Ovaries	3.3E-03	1.2E-02
Pancreas	2.1E-03	7.6E-03
Red Marrow	5.4E-03	2.0E-02
Bone Surfaces	3.5E-02	1.3E-01
Skin	1.2E-03	4.3E-03
Spleen	1.8E-03	6.7E-03
Testes	2.3E-03	8.4E-03
Thymus	1.4E-03	5.1E-03
Thyroid	1.7E-03	6.1E-03
Urinary Bladder Wall	3.3E-02	1.2E-01
Uterus	5.1E-03	1.9E-02
Effective Dose Equivalent	6.1E-03 mSv/MBq	2.2E-02 rem/mCi

Based on model in MIRD Dose Estimate Report No. 13 (data gathered in human subjects), J Nucl Med 30:1117-1122, 1989.

Dynamic bladder model with 4.8-hour voiding interval

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7). Bone and marrow model of Eckerman (Aspects of dosimetry of radionuclides within the skeleton with particular emphasis on the active marrow, In Fourth International Radiopharmaceutical Dosimetry Symposium; A.T. Schlafke-Stelson and E. E. Watson eds. CONF-851113, Oak Ridge Associated Universities, Oak Ridge, TN 37831, 1986. pp 514-534.) used.

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

September 18, 1992

Radiation Dose Estimates for Tc-99m Sestamibi*

ORGAN	Estimated Radiation Dose (mGy/MBq) Rest patients	Stress patients
Adrenals	4.3E-03	3.9E-03
Brain	1.8E-03	1.9E-03
Breasts	1.7E-03	1.6E-03
Gallbladder Wall	1.8E-02	2.5E-02
LLI Wall	3.7E-02	2.9E-02
Small Intestine	2.7E-02	2.2E-02
Stomach	5.2E-03	4.7E-03
ULI Wall	5.0E-02	4.0E-02
Heart Wall	4.4E-03	4.8E-03
Kidneys	1.8E-02	1.5E-02
Liver	5.1E-03	3.7E-03
Lungs	2.4E-03	2.2E-03
Muscle	3.7E-03	3.3E-03
Ovaries	1.4E-02	1.2E-02
Pancreas	5.0E-03	4.6E-03
Red Marrow	4.5E-03	4.0E-03
Bone Surfaces	5.8E-03	5.4E-03
Skin	1.9E-03	1.8E-03
Spleen	5.2E-03	4.0E-03
Testes	3.5E-03	3.1E-03
Thymus	2.3E-03	2.3E-03
Thyroid	2.2E-03	2.2E-03
Urinary Bladder Wall	3.7E-02	2.7E-02
Uterus	1.2E-02	1.0E-02
Effective Dose Equivalent (mSv/MBq)	1.5E-02	1.3E-02

* Based on data gathered in human volunteers.

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

September 18, 1992

Radiation Dose Estimates for Oral Administration of Tc-99m

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	2.8E-03	1.0E-02
Brain	2.3E-06	8.7E-06
Breasts	3.5E-04	1.3E-03
Gallbladder Wall	1.4E-02	5.1E-02
LLI Wall	8.0E-02	3.0E-01
Small Intestine	5.8E-02	2.1E-01
Stomach	3.4E-02	1.3E-01
ULI Wall	1.2E-01	4.3E-01
Heart Wall	1.3E-03	4.8E-03
Kidneys	5.6E-03	2.1E-02
Liver	3.7E-03	1.4E-02
Lungs	7.0E-04	2.6E-03
Muscle	3.2E-03	1.2E-02
Ovaries	2.4E-02	9.0E-02
Pancreas	7.4E-03	2.7E-02
Red Marrow	4.6E-03	1.7E-02
Bone Surfaces	4.1E-03	1.5E-02
Skin	9.3E-04	3.5E-03
Spleen	5.0E-03	1.8E-02
Testes	1.2E-03	4.6E-03
Thymus	2.3E-04	8.6E-04
Thyroid	2.3E-05	8.5E-05
Urinary Bladder Wall	6.6E-03	2.4E-02
Uterus	1.5E-02	5.6E-02
Effective Dose Equivalent	2.5E-02 mSv/MBq	9.3E-02 rem/mCi

Activity follows GI tract kinetics as in ICRP 30, with no absorption from small intestine (no human or animal data used).

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

September 18, 1992

Radiation Dose Estimates for Tc-99m Pertechnetate

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	3.1E-03	1.1E-02
Brain	1.8E-03	6.7E-03
Breasts	1.6E-03	5.8E-03
Gallbladder Wall	5.2E-03	1.9E-02
LLI Wall	2.7E-02	1.0E-01
Small Intestine	8.2E-03	3.0E-02
Stomach	1.3E-02	4.7E-02
ULI Wall	2.8E-02	1.0E-01
Heart Wall	2.7E-03	1.0E-02
Kidneys	3.3E-03	1.2E-02
Liver	3.0E-03	1.1E-02
Lungs	2.3E-03	8.4E-03
Muscle	2.9E-03	1.1E-02
Ovaries	8.6E-03	3.2E-02
Pancreas	4.5E-03	1.7E-02
Red Marrow	3.3E-03	1.2E-02
Bone Surfaces	4.8E-03	1.8E-02
Skin	1.7E-03	6.1E-03
Spleen	3.5E-03	1.3E-02
Testes	3.3E-03	1.2E-02
Thymus	2.2E-03	8.1E-03
Thyroid	2.3E-02	8.5E-02
Urinary Bladder Wall	3.6E-02	1.3E-01
Uterus	8.2E-03	3.0E-02
Effective Dose Equivalent	1.1E-02 mSv/MBq	3.9E-02 rem/mCi

Based on the model for "nonresting patients" in MIRD Dose Estimate Report No. 8 (data gathered in human subjects), J Nucl Med 17:74-77, 1976.

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

February 27, 1995

Radiation Dose Estimates for Tc-99m Pyrophosphate

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	3.3E-03	1.2E-02
Brain	2.6E-03	9.7E-03
Breasts	1.5E-03	5.6E-03
Gallbladder Wall	2.7E-03	1.0E-02
LLI Wall	3.9E-03	1.4E-02
Small Intestine	3.2E-03	1.2E-02
Stomach	2.4E-03	8.8E-03
ULI Wall	2.9E-03	1.1E-02
Heart Wall	2.5E-03	9.3E-03
Kidneys	6.4E-03	2.4E-02
Liver	2.4E-03	9.0E-03
Lungs	2.3E-03	8.7E-03
Muscle	2.6E-03	9.5E-03
Ovaries	3.8E-03	1.4E-02
Pancreas	2.9E-03	1.1E-02
Red Marrow	6.3E-03	2.3E-02
Bone Surfaces	3.8E-02	1.4E-01
Skin	1.6E-03	6.1E-03
Spleen	2.5E-03	9.3E-03
Testes	2.6E-03	9.8E-03
Thymus	2.2E-03	8.1E-03
Thyroid	2.5E-03	9.2E-03
Urinary Bladder Wall	2.4E-02	9.0E-02
Uterus	5.0E-03	1.9E-02
Effective Dose Equivalent	6.0E-03 mSv/MBq	2.2E-02 rem/mCi

Based on the model in MIRD Dose Estimate Report No. 13 (data gathered in human subjects), (J Nucl Med 30:1117- 1122, 1989) Dynamic bladder model with 4.8-hour voiding interval.

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

September 18, 1992

Radiation Dose Estimates for Tc-99m
Red Blood Cells - In vitro Labeling

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	5.0E-03	1.8E-02
Brain	2.6E-03	9.4E-03
Breasts	3.0E-03	1.1E-02
Gallbladder Wall	4.7E-03	1.7E-02
LLI Wall	4.5E-03	1.7E-02
Small Intestine	4.2E-03	1.6E-02
Stomach	4.2E-03	1.6E-02
ULI Wall	4.1E-03	1.5E-02
Heart Wall	1.5E-02	5.7E-02
Kidneys	6.6E-03	2.4E-02
Liver	6.1E-03	2.3E-02
Lungs	1.1E-02	4.1E-02
Muscle	3.4E-03	1.2E-02
Ovaries	4.7E-03	1.7E-02
Pancreas	5.3E-03	2.0E-02
Red Marrow	3.8E-03	1.4E-02
Bone Surfaces	6.1E-03	2.3E-02
Skin	2.2E-03	8.0E-03
Spleen	1.1E-02	4.1E-02
Testes	3.3E-03	1.2E-02
Thymus	5.3E-03	1.9E-02
Thyroid	3.3E-03	1.2E-02
Urinary Bladder Wall	2.1E-02	7.8E-02
Uterus	5.8E-03	2.1E-02
Effective Dose Equivalent	7.3E-03 mSv/MBq	2.7E-02 rem/mCi

Based on model in MIRD Dose Estimate Report No. 14 (data gathered in human subjects), J Nucl Med 31:378-380, 1990 (bladder voiding interval 4.8 hours). Blood activity distributed according to the assumed fractional distribution of blood in model by Hui and Poston.

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose
Information Center

September 18, 1992

Radiation Dose Estimates for Tc-99m
Red Blood Cells - In vivo Labeling

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	5.4E-03	2.0E-02
Brain	2.8E-03	1.0E-02
Breasts	3.3E-03	1.2E-02
Gallbladder Wall	5.1E-03	1.9E-02
LLI Wall	4.6E-03	1.7E-02
Small Intestine	4.5E-03	1.7E-02
Stomach	4.6E-03	1.7E-02
ULI Wall	4.4E-03	1.6E-02
Heart Wall	1.6E-02	5.9E-02
Kidneys	6.9E-03	2.6E-02
Liver	6.5E-03	2.4E-02
Lungs	1.2E-02	4.3E-02
Muscle	3.6E-03	1.3E-02
Ovaries	4.7E-03	1.7E-02
Pancreas	5.7E-03	2.1E-02
Red Marrow	4.1E-03	1.5E-02
Bone Surfaces	6.6E-03	2.4E-02
Skin	2.3E-03	8.7E-03
Spleen	1.2E-02	4.4E-02
Testes	3.3E-03	1.2E-02
Thymus	5.7E-03	2.1E-02
Thyroid	3.6E-03	1.3E-02
Urinary Bladder Wall	1.5E-02	5.4E-02
Uterus	5.4E-03	2.0E-02
Effective Dose Equivalent	7.2E-03 mSv/MBq	2.7E-02 rem/mCi

Based on model in MIRD Dose Estimate Report No. 14 (data gathered in human subjects), J Nucl Med 31:378-380, 1990 (bladder voiding interval 4.8 hours). Blood activity distributed according to the assumed fractional distribution of blood in model by Hui and Poston.

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose
Information Center

February 27, 1995

Radiation Dose Estimates for Intravenous Administration of Tc-99m Sulfur Colloid in Normal Patients

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	1.3E-02	4.8E-02
Brain	2.7E-04	9.9E-04
Breasts	2.1E-03	7.7E-03
Gallbladder Wall	2.4E-02	8.7E-02
LLI Wall	9.6E-04	3.5E-03
Small Intestine	3.8E-03	1.4E-02
Stomach	5.9E-03	2.2E-02
ULI Wall	5.6E-03	2.1E-02
Heart Wall	6.9E-03	2.5E-02
Kidneys	9.6E-03	3.6E-02
Liver	8.6E-02	3.2E-01
Lungs	6.2E-03	2.3E-02
Muscle	2.5E-03	9.2E-03
Ovaries	1.6E-03	5.9E-03
Pancreas	1.3E-02	5.0E-02
Red Marrow	5.2E-03	1.9E-02
Bone Surfaces	5.4E-03	2.0E-02
Skin	1.2E-03	4.4E-03
Spleen	5.3E-02	2.0E-01
Testes	2.2E-04	8.2E-04
Thymus	1.9E-03	7.1E-03
Thyroid	5.1E-04	1.9E-03
Urinary Bladder Wall	6.3E-04	2.3E-03
Uterus	1.3E-03	5.0E-03
Effective Dose Equivalent	1.4E-02 mSv/MBq	5.0E-02 rem/mCi

Based on model of MIRD Dose Estimate Report No. 3 (data gathered in human subjects), J Nucl Med 16:108A-108B, 1975.

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7). Bone and marrow model of Eckerman (Aspects of dosimetry of radionuclides within the skeleton with particular emphasis on the active marrow, In Fourth International Radiopharmaceutical Dosimetry Symposium; A.T. Schlafke-Stelson and E. E. Watson eds. CONF-851113, Oak Ridge Associated Universities, Oak Ridge, TN 37831, 1986. pp 514-534.) used.

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

February 27, 1995

Radiation Dose Estimates for Intravenous Administration of Tc-99m Sulfur Colloid in Intermediate-to-Advanced Diffuse Parenchymal Liver Disease

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	1.1E-02	4.1E-02
Brain	1.2E-03	4.3E-03
Breasts	1.9E-03	7.1E-03
Gallbladder Wall	1.2E-02	4.3E-02
LLI Wall	2.9E-03	1.1E-02
Small Intestine	4.3E-03	1.6E-02
Stomach	1.0E-02	3.7E-02
ULI Wall	4.8E-03	1.8E-02
Heart Wall	5.4E-03	2.0E-02
Kidneys	1.1E-02	4.1E-02
Liver	3.4E-02	1.3E-01
Lungs	5.0E-03	1.9E-02
Muscle	3.0E-03	1.1E-02
Ovaries	3.2E-03	1.2E-02
Pancreas	1.8E-02	6.5E-02
Red Marrow	1.6E-02	5.8E-02
Bone Surfaces	1.2E-02	4.4E-02
Skin	1.4E-03	5.2E-03
Spleen	2.2E-01	8.1E-01
Testes	8.3E-04	3.1E-03
Thymus	2.2E-03	8.2E-03
Thyroid	1.4E-03	5.1E-03
Urinary Bladder Wall	1.6E-03	6.0E-03
Uterus	2.5E-03	9.4E-03
Effective Dose Equivalent	2.2E-02 mSv/MBq	8.0E-02 rem/mCi

Based on model of MIRD Dose Estimate Report No. 3 (data gathered in human subjects), J Nucl Med 16:108A-108B, 1975.

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7). Bone and marrow model of Eckerman (Aspects of dosimetry of radionuclides within the skeleton with particular emphasis on the active marrow, In Fourth International Radiopharmaceutical Dosimetry Symposium; A.T. Schlafke-Stelson and E. E. Watson eds. CONF-851113, Oak Ridge Associated Universities, Oak Ridge, TN 37831, 1986. pp 514-534.) used.

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

September 18, 1992

Radiation Dose Estimates for Tc-99m Teboroxime

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	5.0E-03	1.8E-02
Brain	3.1E-03	1.1E-02
Breasts	2.1E-03	7.6E-03
Gallbladder Wall	3.4E-02	1.3E-01
LLI Wall	2.5E-02	9.3E-02
Small Intestine	1.9E-02	7.1E-02
Stomach	4.7E-03	1.7E-02
ULI Wall	3.6E-02	1.3E-01
Heart Wall	2.2E-02	8.0E-02
Kidneys	4.6E-03	1.7E-02
Liver	1.7E-02	6.2E-02
Lungs	7.6E-03	2.8E-02
Muscle	2.9E-03	1.1E-02
Ovaries	9.3E-03	3.5E-02
Pancreas	5.6E-03	2.1E-02
Red Marrow	3.6E-03	1.3E-02
Bone Surfaces	4.9E-03	1.8E-02
Skin	1.5E-03	5.6E-03
Spleen	3.2E-03	1.2E-02
Testes	1.9E-03	7.2E-03
Thymus	3.2E-03	1.2E-02
Thyroid	1.8E-03	6.6E-03
Urinary Bladder Wall	1.1E-02	3.9E-02
Uterus	7.1E-03	2.6E-02
Effective Dose Equivalent	1.2E-02 mSv/MBq	4.6E-02 rem/mCi

Based on data gathered in human subjects by Narra et al., J Nucl Med 33:88-93, 1992. Assumed distribution and retention:

Brain	2.03%	T_b = 173 hr		
Liver	27.8%	T_b = 6.0 hr		
Lungs	13.2%	T_b = 0.073 hr	8.02%	T_b = 6.2 hr
Heart Wall	1.19%	T_b = 3.7 hr	2.05%	T_b = 0.088 hr

Gallbladder: receives 1/3 of activity leaving the liver, voids every 6 hours. 26.07% to small intestines, follows GI tract kinetics as in ICRP 30. 71.56% to urinary bladder, T_b = 47.8 hr. Dynamic bladder model with 4.8-hour voiding interval. Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

February 27, 1995

Radiation Dose Estimates for Tc-99m White Blood Cells

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	1.0E-02	3.9E-02
Brain	1.4E-03	5.2E-03
Breasts	1.8E-03	6.8E-03
Gallbladder Wall	9.8E-03	3.6E-02
LLI Wall	3.5E-03	1.3E-02
Small Intestine	4.6E-03	1.7E-02
Stomach	8.7E-03	3.2E-02
ULI Wall	4.8E-03	1.8E-02
Heart Wall	5.0E-03	1.8E-02
Kidneys	1.0E-02	3.7E-02
Liver	2.7E-02	1.0E-01
Lungs	4.7E-03	1.7E-02
Muscle	2.9E-03	1.1E-02
Ovaries	3.8E-03	1.4E-02
Pancreas	1.5E-02	5.7E-02
Red Marrow	2.3E-02	8.7E-02
Bone Surfaces	1.6E-02	6.0E-02
Skin	1.4E-03	5.1E-03
Spleen	1.8E-01	6.8E-01
Testes	8.4E-04	3.1E-03
Thymus	2.3E-03	8.4E-03
Thyroid	1.5E-03	5.7E-03
Urinary Bladder Wall	1.8E-03	6.8E-03
Uterus	3.0E-03	1.1E-02
Effective Dose Equivalent	2.0E-02 mSv/MBq	7.4E-02 rem/mCi

Based on assumed model for WBC's, from data gathered in patients in several sources (ICRP 53; Goodwin et al., Third Int. Radiopharm. Dosimetry Symposium, Oak Ridge, TN, 1980, p. 88-101; Marcus et al. Nucl Med Comm 9:249-254, 1988; Thakur et al. Semin Nucl Med 14:107-117, 1984; Weiblen et al. J Lab Clin Med 94:246-255, 1979). Assumed distribution and retention:

Liver	25%	$T_b = \infty$
Spleen	25%	$T_b = \infty$
Marrow	40%	$T_b = \infty$
Remainder	10%	$T_b = \infty$

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7). Bone and marrow model of Eckerman (Aspects of dosimetry of radionuclides within the skeleton with particular emphasis on the active marrow, In Fourth International Radiopharmaceutical Dosimetry Symposium; A.T. Schlafke-Stelson and E. E. Watson eds. CONF-851113, Oak Ridge Associated Universities, Oak Ridge, TN 37831, 1986. pp 514-534.) used.

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

September 18, 1992

Radiation Dose Estimates for In-111 DTPA

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	6.2E-03	2.3E-02
Brain	4.8E-03	1.8E-02
Breasts	3.8E-03	1.4E-02
Gallbladder Wall	7.2E-03	2.7E-02
LLI Wall	2.8E-02	1.0E-01
Small Intestine	1.4E-02	5.4E-02
Stomach	7.0E-03	2.6E-02
ULI Wall	1.2E-02	4.4E-02
Heart Wall	5.6E-03	2.1E-02
Kidneys	1.4E-02	5.3E-02
Liver	5.0E-03	1.9E-02
Lungs	4.6E-03	1.7E-02
Muscle	8.3E-03	3.1E-02
Ovaries	2.5E-02	9.4E-02
Pancreas	6.7E-03	2.5E-02
Red Marrow	8.2E-03	3.0E-02
Bone Surfaces	1.0E-02	3.8E-02
Skin	4.6E-03	1.7E-02
Spleen	4.8E-03	1.8E-02
Testes	1.9E-02	6.9E-02
Thymus	4.6E-03	1.7E-02
Thyroid	4.5E-03	1.7E-02
Urinary Bladder Wall	4.3E-01	1.6E+00
Uterus	5.4E-02	2.0E-01
Effective Dose Equivalent	4.1E-02 mSv/MBq	1.5E-01 rem/mCi

Based on data gathered in dogs by McAfee et al., J Nucl Med 20:1273,1278, 1979. Assumed distribution and retention:

Liver	2.68%	T_b = 0.17 hr	0.28%	T_b = 17.3 hr
Kidneys	4.18%	T_b = 0.17 hr	0.39%	T_b = 13.8 hr
Spleen	0.226%	T_b = 0.40 hr	0.009%	T_b = 38.5 hr
Small Intestine	3.57%	T_b = 0.23 hr	0.06%	T_b = 27.7 hr
Stomach	1.49%	T_b = 0.87 hr	0.013%	T_b = 31.5 hr
Muscle	21.2%	T_b = 0.54 hr	0.6%	T_b = 7.7 hr
Total Body	79.7%	T_b = 0.51 hr	20.3%	T_b = 7.86 hr

Clearance through urinary bladder. Bladder voiding interval 4.8 hours.

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

February 27, 1995

Radiation Dose Estimates for In-111 Platelets

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	2.8E-01	1.1E+00
Brain	8.3E-02	3.1E-01
Breasts	9.0E-02	3.3E-01
Gallbladder Wall	2.7E-01	1.0E+00
LLI Wall	1.4E-01	5.0E-01
Small Intestine	1.6E-01	6.0E-01
Stomach	3.1E-01	1.1E+00
ULI Wall	1.7E-01	6.2E-01
Heart Wall	1.8E-01	6.5E-01
Kidneys	3.1E-01	1.1E+00
Liver	5.6E-01	2.1E+00
Lungs	1.6E-01	6.1E-01
Muscle	1.3E-01	4.7E-01
Ovaries	1.4E-01	5.3E-01
Pancreas	4.9E-01	1.8E+00
Red Marrow	1.7E-01	6.3E-01
Bone Surfaces	2.1E-01	7.7E-01
Skin	7.5E-02	2.8E-01
Spleen	5.2E+00	1.9E+01
Testes	9.0E-02	3.3E-01
Thymus	1.1E-01	4.2E-01
Thyroid	1.0E-01	3.7E-01
Urinary Bladder Wall	1.8E-01	6.7E-01
Uterus	1.4E-01	5.3E-01
Effective Dose Equivalent	5.1E-01 mSv/MBq	1.9E+00 rem/mCi

Based on data gathered in patients by Goodwin et al., Third Int. Radiopharm. Dosimetry Symposium, Oak Ridge, TN, 1980, p. 88-101. Assumed distribution and retention: Initial uptake:
Liver 8.5%, Spleen 23.5%
Platelets have a 9 day survival time, and then are transported to destruction sites, where they have a 10 day biological half time:
Liver 50%, Spleen 25%, Marrow 25%
After leaving the destruction sites, activity is cleared through the urinary bladder with a 6.6 day biological half time. Bladder voiding interval 4.8 hours.

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7). Bone and marrow model of Eckerman (Aspects of dosimetry of radionuclides within the skeleton with particular emphasis on the active marrow, In Fourth International Radiopharmaceutical Dosimetry Symposium; A.T. Schlafke-Stelson and E. E. Watson eds. CONF-851113, Oak Ridge Associated Universities, Oak Ridge, TN 37831, 1986. pp 514-534.) used.

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

February 27, 1995

Radiation Dose Estimates for In-111 Red Blood Cells

ORGAN	Estimated Radiation Dose mGy / MBq	rad / mCi
Adrenals	1.9E-01	7.0E-01
Brain	1.3E-01	4.7E-01
Breasts	1.1E-01	4.0E-01
Gallbladder Wall	1.9E-01	7.0E-01
LLI Wall	1.8E-01	6.7E-01
Small Intestine	1.9E-01	6.9E-01
Stomach	1.9E-01	6.9E-01
ULI Wall	1.8E-01	6.7E-01
Heart Wall	1.7E-01	6.3E-01
Kidneys	1.8E-01	6.7E-01
Liver	1.7E-01	6.5E-01
Lungs	1.5E-01	5.6E-01
Muscle	1.4E-01	5.2E-01
Ovaries	1.9E-01	7.0E-01
Pancreas	2.2E-01	8.3E-01
Red Marrow	1.5E-01	5.4E-01
Bone Surfaces	2.2E-01	8.3E-01
Skin	9.6E-02	3.5E-01
Spleen	7.6E-01	2.8E+00
Testes	1.4E-01	5.0E-01
Thymus	1.5E-01	5.6E-01
Thyroid	1.5E-01	5.6E-01
Urinary Bladder Wall	1.7E-01	6.5E-01
Uterus	1.9E-01	7.0E-01
Effective Dose Equivalent	2.0E-01 mSv/MBq	7.5E-01 rem/mCi

Based on model in humans for Cr-51 RBC's by Powsner and Raeside, Diagnostic Nuclear Medicine, 1971, p. 184. Assumed distribution and retention:

100% to blood, T_b = 35 days
Of material removed from blood:
Liver 40% T_b = 50 days
Spleen 40% T_b = 50 days
Marrow 20% T_b = 50 days
Clearance through urinary bladder. Bladder voiding interval 4.8 hours.

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7). Bone and marrow model of Eckerman (Aspects of dosimetry of radionuclides within the skeleton with particular emphasis on the active marrow, In Fourth International Radiopharmaceutical Dosimetry Symposium; A.T. Schlafke-Stelson and E. E. Watson eds. CONF-851113, Oak Ridge Associated Universities, Oak Ridge, TN 37831, 1986. pp 514-534.) used.

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

February 27, 1995

Radiation Dose Estimates for In-111 White Blood Cells

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	3.6E-01	1.3E+00
Brain	5.1E-02	1.9E-01
Breasts	6.7E-02	2.5E-01
Gallbladder Wall	3.4E-01	1.2E+00
LLI Wall	1.2E-01	4.6E-01
Small Intestine	1.6E-01	5.7E-01
Stomach	2.9E-01	1.1E+00
ULI Wall	1.6E-01	6.0E-01
Heart Wall	1.7E-01	6.2E-01
Kidneys	3.5E-01	1.3E+00
Liver	9.0E-01	3.3E+00
Lungs	1.6E-01	6.0E-01
Muscle	1.0E-01	3.9E-01
Ovaries	1.3E-01	4.8E-01
Pancreas	5.5E-01	2.0E+00
Red Marrow	6.5E-01	2.4E+00
Bone Surfaces	4.6E-01	1.7E+00
Skin	5.0E-02	1.9E-01
Spleen	5.9E+00	2.2E+01
Testes	3.0E-02	1.1E-01
Thymus	7.9E-02	2.9E-01
Thyroid	5.4E-02	2.0E-01
Urinary Bladder Wall	6.4E-02	2.4E-01
Uterus	1.0E-01	3.8E-01
Effective Dose Equivalent	6.4E-01 mSv/MBq	2.4E+00 rem/mCi

Based on assumed model for WBC's, from data gathered in patients in several sources (ICRP 53; Goodwin et al., Third Int. Radiopharm. Dosimetry Symposium, Oak Ridge, TN, 1980, p. 88-101; Marcus et al. Nucl Med Comm 9:249-254, 1988; Thakur et al. Semin Nucl Med 14:107-117, 1984; Weiblen et al. J Lab Clin Med 94:246-255, 1979). Assumed distribution and retention:

Liver	25%	$T_b = \infty$
Spleen	25%	$T_b = \infty$
Marrow	40%	$T_b = \infty$
Remainder	10%	$T_b = \infty$

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7). Bone and marrow model of Eckerman (Aspects of dosimetry of radionuclides within the skeleton with particular emphasis on the active marrow, In Fourth International Radiopharmaceutical Dosimetry Symposium; A.T. Schlafke-Stelson and E. E. Watson eds. CONF-851113, Oak Ridge Associated Universities, Oak Ridge, TN 37831, 1986. pp 514-534.) used.

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

September 18, 1992

Radiation Dose Estimates for I-123 Hippuran

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	7.7E-04	2.8E-03
Brain	1.7E-04	6.1E-04
Breasts	1.7E-04	6.4E-04
Gallbladder Wall	1.0E-03	3.8E-03
LLI Wall	1.1E-02	4.2E-02
Small Intestine	4.1E-03	1.5E-02
Stomach	7.0E-04	2.6E-03
ULI Wall	3.1E-03	1.1E-02
Heart Wall	2.8E-04	1.0E-03
Kidneys	9.9E-03	3.7E-02
Liver	5.6E-04	2.1E-03
Lungs	2.4E-04	8.8E-04
Muscle	2.8E-03	1.1E-02
Ovaries	1.0E-02	3.7E-02
Pancreas	7.2E-04	2.6E-03
Red Marrow	1.7E-03	6.1E-03
Bone Surfaces	2.0E-03	7.4E-03
Skin	9.0E-04	3.3E-03
Spleen	7.3E-04	2.7E-03
Testes	7.0E-03	2.6E-02
Thymus	2.1E-04	7.8E-04
Thyroid	1.9E-04	7.1E-04
Urinary Bladder Wall	3.0E-01	1.1E+00
Uterus	2.6E-02	9.5E-02
Effective Dose Equivalent	2.4E-02 mSv/MBq	8.8E-02 rem/mCi

Based on data gathered in patients by Lindmo et al. (Med Phys 1(4):193-197, 1974). Assumed distribution and retention:

Total body 49% T_b = 0.285 hr 51% T_b = 0.0392 hr
Kidney Residence time = 6.2 minutes
All activity cleared through urinary bladder. Dynamic bladder model with 4.8-hour voiding interval

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

September 18, 1992

Radiation Dose Estimates for I-123 IMP

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	1.3E-02	4.6E-02
Brain	1.9E-02	7.1E-02
Breasts	8.9E-03	3.3E-02
Gallbladder Wall	1.2E-02	4.4E-02
LLI Wall	1.4E-02	5.0E-02
Small Intestine	1.3E-02	4.7E-02
Stomach	1.2E-02	4.3E-02
ULI Wall	1.2E-02	4.4E-02
Heart Wall	1.4E-02	5.1E-02
Kidneys	1.1E-02	4.0E-02
Liver	9.0E-03	3.3E-02
Lungs	4.2E-02	1.6E-01
Muscle	1.0E-02	3.8E-02
Ovaries	1.4E-02	5.1E-02
Pancreas	1.3E-02	4.8E-02
Red Marrow	1.1E-02	4.1E-02
Bone Surfaces	1.9E-02	7.0E-02
Skin	7.1E-03	2.6E-02
Spleen	1.2E-02	4.4E-02
Testes	1.0E-02	3.8E-02
Thymus	1.2E-02	4.3E-02
Thyroid	1.1E-02	4.1E-02
Urinary Bladder Wall	5.7E-02	2.1E-01
Uterus	1.6E-02	6.0E-02
Effective Dose Equivalent	1.9E-02 mSv/MBq	7.1E-02 rem/mCi

Based on data gathered in six human volunteers. Average residence times:

Brain	0.60 hr
Liver	0.165 hr
Lungs	1.46 hr
Remainder	11.5 hr

Urinary bladder: 100%, T_b = 34.1 hr. Bladder voiding interval 4.8 hours. Dynamic bladder model with 4.8-hour voiding interval

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose
Information Center

September 18, 1992

Radiation Dose Estimates for I-123 mIBG

ORGAN	Estimated Radiation Dose mGy/MBq		rad/mCi	
Adrenals	1.6E-02		5.9E-02	
Brain	4.8E-03		1.8E-02	
Breasts	5.2E-03		1.9E-02	
Gallbladder Wall	2.2E-02		8.0E-02	
LLI Wall	9.8E-03		3.6E-02	
Small Intestine	9.3E-03		3.4E-02	
Stomach	8.6E-03		3.2E-02	
ULI Wall	9.9E-03		3.6E-02	
Heart Wall	1.8E-02		6.7E-02	
Kidneys	1.1E-02		3.9E-02	
Liver	7.3E-02		2.7E-01	
Lungs	9.3E-03		3.4E-02	
Muscle	7.1E-03		2.6E-02	
Ovaries	9.9E-03		3.7E-02	
Pancreas	1.3E-02		4.9E-02	
Red Marrow	7.1E-03		2.6E-02	
Bone Surfaces	1.2E-02		4.3E-02	
Salivary Glands	2.5E-02		9.4E-02	
Skin	4.4E-03		1.6E-02	
Spleen	2.1E-02		7.7E-02	
Testes	6.9E-03		2.6E-02	
Thymus	6.6E-03		2.5E-02	
Thyroid	4.7E-03		1.7E-02	
Urinary Bladder Wall	9.4E-02		3.5E-01	
Uterus	1.4E-02		5.4E-02	
Effective Dose Equivalent	1.9E-02	mSv/MBq	7.1E-02	rem/mCi

Based on data gathered in patients - Jacobsson et al, 4th International Radiopharmaceutical Dosimetry Symposium, CONF-851113, pp. 389-398. Assumed distribution and retention:

Total body	63 %	T_b = 32.8	hours	36 %	T_b = 3.05	hours
	1 %	T_b = ∞				
Liver	21 %	T_b = 32.8	hours	15 %	T_b = 3.05	hours
	0.3 %	T_b = ∞				
Spleen	0.6 %	T_b = 178	hours			
Sal. glands	0.04 %	T_b = 32.8	hours			
Thyroid	0.005 %	T_b = 168	hours			
Adrenals	0.02 %	T_b = 48.6	hours			
Heart wall	0.8 %	T_b = 120	hours			

Dynamic Bladder Model used (4.80 hour void)
36 % T_b = 3.00 hours 63 % T_b = 33.6 hours

Dose to salivary glands is self-dose only, based on 77 g mass and photon absorbed fractions from MIRD Pamphlet No. 8. Salivary gland activity did not contribute to other organ doses. Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

September 18, 1992

Radiation Dose Estimates for I-123 Sodium Iodide

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	5.1E-03	1.9E-02
Brain	4.7E-03	1.8E-02
Breasts	3.0E-03	1.1E-02
Gallbladder Wall	7.3E-03	2.7E-02
LLI Wall	1.1E-02	4.0E-02
Small Intestine	3.3E-02	1.2E-01
Stomach	5.5E-02	2.0E-01
ULI Wall	1.4E-02	5.0E-02
Heart Wall	5.1E-03	1.9E-02
Kidneys	5.5E-03	2.0E-02
Liver	4.9E-03	1.8E-02
Lungs	4.9E-03	1.8E-02
Muscle	6.8E-03	2.5E-02
Ovaries	1.2E-02	4.4E-02
Pancreas	1.0E-02	3.8E-02
Red Marrow	5.8E-03	2.2E-02
Bone Surfaces	9.8E-03	3.6E-02
Skin	3.3E-03	1.2E-02
Spleen	7.3E-03	2.7E-02
Testes	5.1E-03	1.9E-02
Thymus	5.6E-03	2.1E-02
Thyroid	3.4E+00	1.3E+01
Urinary Bladder Wall	9.6E-02	3.6E-01
Uterus	1.6E-02	5.9E-02
Effective Dose Equivalent	1.2E-01 mSv/MBq	4.5E-01 rem/mCi

Based on model in MIRD Dose Estimate Report No. 5 (data gathered in human subjects), J Nucl Med 16:857-860, 1975 (25% thyroid uptake).

Dynamic bladder model with 4.8-hour voiding interval

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

March 18, 1993

Radiation Dose Estimates for I-124 Sodium Iodide

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	5.8E-02	2.1E-01
Brain	1.5E-01	5.7E-01
Breasts	6.2E-02	2.3E-01
Gallbladder Wall	7.1E-02	2.6E-01
LLI Wall	7.9E-02	2.9E-01
Small Intestine	2.8E-01	1.0E+00
Stomach	4.5E-01	1.7E+00
ULI Wall	9.9E-02	3.7E-01
Heart Wall	8.4E-02	3.1E-01
Kidneys	5.4E-02	2.0E-01
Liver	9.7E-02	3.6E-01
Lungs	1.1E-01	4.1E-01
Muscle	1.4E-01	5.3E-01
Ovaries	8.8E-02	3.2E-01
Pancreas	8.8E-02	3.3E-01
Red Marrow	1.1E-01	4.2E-01
Bone Surfaces	1.3E-01	4.7E-01
Skin	7.2E-02	2.7E-01
Spleen	6.6E-02	2.4E-01
Testes	4.3E-02	1.6E-01
Thymus	1.7E-01	6.3E-01
Thyroid	2.1E+02	7.8E+02
Urinary Bladder Wall	7.9E-01	2.9E+00
Uterus	1.1E-01	4.2E-01
Effective Dose Equivalent	6.5E+00 mSv/MBq	2.4E+01 rem/mCi

Based on model in MIRD Dose Estimate Report No. 5 (data gathered in human subjects), J Nucl Med 16:857-860, 1975 (25% thyroid uptake).

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose
Information Center

March 25, 1993

Radiation Dose Estimates for I-125 Fibrinogen*

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	5.8E-02	2.1E-01
Brain	6.0E-02	2.2E-01
Breasts	4.4E-02	1.6E-01
Gallbladder Wall	6.8E-02	2.5E-01
LLI Wall	6.0E-02	2.2E-01
Small Intestine	8.7E-02	3.2E-01
Stomach	1.1E-01	4.1E-01
ULI Wall	6.2E-02	2.3E-01
Heart Wall	5.6E-02	2.1E-01
Kidneys	5.4E-02	2.0E-01
Liver	1.3E-01	4.9E-01
Lungs	6.9E-02	2.5E-01
Muscle	1.3E-01	4.8E-01
Ovaries	6.0E-02	2.2E-01
Pancreas	6.3E-02	2.3E-01
Red Marrow	5.4E-02	2.0E-01
Bone Surfaces	1.9E-01	7.0E-01
Skin	5.0E-02	1.9E-01
Spleen	5.5E-02	2.1E-01
Testes	4.8E-02	1.8E-01
Thymus	6.9E-02	2.6E-01
Thyroid	2.1E+02	7.8E+02
Urinary Bladder Wall	1.7E-01	6.1E-01
Uterus	6.3E-02	2.3E-01
Effective Dose Equivalent rem/mCi	6.4E+00 mSv/MBq	2.4E+01

* Based on kinetic model in Wootton and Hammond (Brit J Radiol 51:265-272, 1978).
Free iodide treated as in MIRD Dose Estimate Report No. 5 (J Nucl Med 16:857-860, 1975).

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7). Bone and marrow model of Eckerman (Aspects of dosimetry of radionuclides within the skeleton with particular emphasis on the active marrow, In Fourth International radiopharmaceutical Dosimetry Symposium; A.T. Schlafke-Stelson and E. E. Watson eds. CONF-851113, Oak Ridge Associated Universities, Oak Ridge, TN. 37831, 1986. pp 514-534.) used.

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

September 18, 1992

Radiation Dose Estimates for I-125 IMP

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	2.0E-02	7.3E-02
Brain	2.8E-02	1.0E-01
Breasts	1.6E-02	6.1E-02
Gallbladder Wall	1.9E-02	7.0E-02
LLI Wall	2.2E-02	8.1E-02
Small Intestine	2.1E-02	7.6E-02
Stomach	2.0E-02	7.3E-02
ULI Wall	2.0E-02	7.2E-02
Heart Wall	2.1E-02	7.9E-02
Kidneys	1.8E-02	6.8E-02
Liver	9.4E-03	3.5E-02
Lungs	7.2E-02	2.7E-01
Muscle	1.9E-02	6.9E-02
Ovaries	2.1E-02	7.9E-02
Pancreas	2.0E-02	7.5E-02
Red Marrow	1.5E-02	5.7E-02
Bone Surfaces	3.9E-02	1.5E-01
Skin	1.4E-02	5.0E-02
Spleen	2.0E-02	7.4E-02
Testes	1.8E-02	6.5E-02
Thymus	1.9E-02	7.1E-02
Thyroid	2.0E-02	7.2E-02
Urinary Bladder Wall	1.4E-01	5.0E-01
Uterus	2.5E-02	9.4E-02
Effective Dose Equivalent	3.4E-02 mSv/MBq	1.3E-01 rem/mCi

Based on data gathered in six human volunteers. Average residence times:

Brain	1.34 hr
Liver	0.349 hr
Lungs	3.45 hr
Remainder	42.9 hr

Urinary bladder: 100%, T_b = 34.1 hr. Dynamic bladder model with 4.8-hour voiding interval.

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

September 18, 1992

Radiation Dose Estimates for I-125 mIBG

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	4.2E-02	1.6E-01
Brain	1.4E-02	5.3E-02
Breasts	1.2E-02	4.5E-02
Gallbladder Wall	4.3E-02	1.6E-01
LLI Wall	1.7E-02	6.1E-02
Small Intestine	1.6E-02	5.9E-02
Stomach	1.7E-02	6.4E-02
ULI Wall	1.7E-02	6.2E-02
Heart Wall	8.3E-02	3.1E-01
Kidneys	2.0E-02	7.4E-02
Liver	2.2E-01	8.2E-01
Lungs	2.3E-02	8.3E-02
Muscle	1.6E-02	5.8E-02
Ovaries	1.6E-02	5.9E-02
Pancreas	2.6E-02	9.6E-02
Red Marrow	1.2E-02	4.4E-02
Bone Surfaces	3.1E-02	1.2E-01
Salivary Glands	7.0E-02	2.6E-01
Skin	1.1E-02	3.9E-02
Spleen	1.6E-01	5.9E-01
Testes	1.3E-02	4.8E-02
Thymus	1.5E-02	5.7E-02
Thyroid	4.6E-02	1.7E-01
Urinary Bladder Wall	1.4E-01	5.1E-01
Uterus	2.0E-02	7.5E-02
Effective Dose Equivalent	5.1E-02 mSv/MBq	1.9E-01 rem/mCi

Based on data gathered in patients - Jacobsson et al, 4th International Radiopharmaceutical Dosimetry Symposium, CONF-851113, pp. 389-398. Assumed distribution and retention:

Total body	63 %	T_b = 32.8	hours	36 %	T_b = 3.05	hours
	1 %	T_b = ∞				
Liver	21 %	T_b = 32.8	hours	15 %	T_b = 3.05	hours
	0.3 %	T_b = ∞				
Spleen	0.6 %	T_b = 178	hours			
Sal. glands	0.04 %	T_b = 32.8	hours			
Thyroid	0.005 %	T_b = 168	hours			
Adrenals	0.02 %	T_b = 48.6	hours			
Heart wall	0.8 %	T_b = 120	hours			

Dynamic Bladder Model used (4.80 hour void)
36 % T_b = 3.00 hours 63 % T_b = 33.6 hours
Dose to salivary glands is self-dose only, based on 77 g mass and photon absorbed fractions from MIRD Pamphlet No. 8. Salivary gland activity did not contribute to other organ doses. Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

September 18, 1992

Radiation Dose Estimates for I-125 Sodium Iodide

ORGAN	Estimated Radiation Dose mGy / MBq	rad / mCi
Adrenals	1.1E-02	4.0E-02
Brain	1.3E-02	4.7E-02
Breasts	6.2E-03	2.3E-02
Gallbladder Wall	1.9E-02	6.8E-02
LLI Wall	1.1E-02	4.2E-02
Small Intestine	3.7E-02	1.4E-01
Stomach	6.4E-02	2.4E-01
ULI Wall	1.5E-02	5.5E-02
Heart Wall	9.1E-03	3.4E-02
Kidneys	8.6E-03	3.2E-02
Liver	8.6E-02	3.2E-01
Lungs	1.9E-02	7.1E-02
Muscle	8.6E-02	3.2E-01
Ovaries	1.1E-02	4.1E-02
Pancreas	1.3E-02	4.9E-02
Red Marrow	1.7E-02	6.3E-02
Bone Surfaces	9.9E-02	3.6E-01
Skin	1.7E-02	6.4E-02
Spleen	8.4E-03	3.1E-02
Testes	6.5E-03	2.4E-02
Thymus	2.4E-02	8.9E-02
Thyroid	2.1E+02	7.8E+02
Urinary Bladder Wall	1.2E-01	4.4E-01
Uterus	1.4E-02	5.2E-02
Effective Dose Equivalent	6.4E+00 mSv/MBq	2.4E+01 rem/mCi

Based on model in MIRD Dose Estimate Report No. 5, J Nucl Med 16:857-860, 1975 (25% thyroid uptake).

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

March 18, 1993

Radiation Dose Estimates for I-126 Sodium Iodide

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	4.9E-02	1.8E-01
Brain	1.7E-01	6.4E-01
Breasts	6.0E-02	2.2E-01
Gallbladder Wall	5.7E-02	2.1E-01
LLI Wall	4.6E-02	1.7E-01
Small Intestine	2.0E-01	7.5E-01
Stomach	3.1E-01	1.2E+00
ULI Wall	5.9E-02	2.2E-01
Heart Wall	8.1E-02	3.0E-01
Kidneys	4.2E-02	1.6E-01
Liver	1.5E-01	5.6E-01
Lungs	1.2E-01	4.4E-01
Muscle	1.6E-01	5.8E-01
Ovaries	5.1E-02	1.9E-01
Pancreas	6.2E-02	2.3E-01
Red Marrow	1.2E-01	4.4E-01
Bone Surfaces	1.5E-01	5.4E-01
Skin	7.5E-02	2.8E-01
Spleen	4.7E-02	1.8E-01
Testes	2.8E-02	1.0E-01
Thymus	1.9E-01	7.0E-01
Thyroid	4.2E+02	1.6E+03
Urinary Bladder Wall	5.4E-01	2.0E+00
Uterus	6.4E-02	2.3E-01
Effective Dose Equivalent	1.3E+01 mSv/MBq	4.7E+01 rem/mCi

Based on model in MIRD Dose Estimate Report No. 5 (data gathered in human subjects), J Nucl Med 16:857-860, 1975 (25% thyroid uptake).

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose
Information Center

March 18, 1993

Radiation Dose Estimates for I-130 Sodium Iodide

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	5.1E-02	1.9E-01
Brain	4.7E-02	1.7E-01
Breasts	3.1E-02	1.2E-01
Gallbladder Wall	7.1E-02	2.6E-01
LLI Wall	9.9E-02	3.7E-01
Small Intestine	3.2E-01	1.2E+00
Stomach	5.2E-01	1.9E+00
ULI Wall	1.2E-01	4.6E-01
Heart Wall	5.0E-02	1.9E-01
Kidneys	5.4E-02	2.0E-01
Liver	5.0E-02	1.9E-01
Lungs	4.7E-02	1.7E-01
Muscle	6.4E-02	2.3E-01
Ovaries	1.1E-01	4.1E-01
Pancreas	9.6E-02	3.6E-01
Red Marrow	6.2E-02	2.3E-01
Bone Surfaces	5.4E-02	2.0E-01
Skin	3.5E-02	1.3E-01
Spleen	7.0E-02	2.6E-01
Testes	5.0E-02	1.9E-01
Thymus	5.6E-02	2.1E-01
Thyroid	3.1E+01	1.1E+02
Urinary Bladder Wall	8.9E-01	3.3E+00
Uterus	1.5E-01	5.5E-01
Effective Dose Equivalent	1.1E+00 mSv/MBq	4.0E+00 rem/mCi

Based on model in MIRD Dose Estimate Report No. 5 (data gathered in human subjects), J Nucl Med 16:857-860, 1975 (25% thyroid uptake).

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

September 18, 1992

Radiation Dose Estimates for I-131 Hippuran

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	2.1E-03	7.7E-03
Brain	5.5E-04	2.1E-03
Breasts	6.7E-04	2.5E-03
Gallbladder Wall	3.0E-03	1.1E-02
LLI Wall	2.6E-02	9.5E-02
Small Intestine	1.0E-02	3.8E-02
Stomach	2.1E-03	7.7E-03
ULI Wall	8.0E-03	2.9E-02
Heart Wall	9.0E-04	3.3E-03
Kidneys	4.5E-02	1.7E-01
Liver	1.7E-03	6.4E-03
Lungs	7.7E-04	2.8E-03
Muscle	6.7E-03	2.5E-02
Ovaries	2.3E-02	8.6E-02
Pancreas	2.1E-03	7.7E-03
Red Marrow	4.8E-03	1.8E-02
Bone Surfaces	3.6E-03	1.3E-02
Skin	2.6E-03	9.6E-03
Spleen	2.0E-03	7.5E-03
Testes	1.7E-02	6.4E-02
Thymus	7.3E-04	2.7E-03
Thyroid	6.4E-04	2.4E-03
Urinary Bladder Wall	1.4E+00	5.3E+00
Uterus	5.4E-02	2.0E-01
Effective Dose Equivalent	1.0E-01 mSv/MBq	3.7E-01 rem/mCi

Based on data gathered in patients by Lindmo et al. (Med Phys 1(4):193-197, 1974).
Assumed distribution and retention:

Total body 49% T_b = 0.285 hr 51% T_b = 0.0392 hr
Kidney Residence time = 6.2 minutes
All activity cleared through urinary bladder. Bladder voiding interval 4.8 hours.

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose
Information Center

September 18, 1992

Radiation Dose Estimates for I-131 HSA

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	5.3E-01	2.0E+00
Brain	1.0E+00	3.8E+00
Breasts	4.0E-01	1.5E+00
Gallbladder Wall	5.0E-01	1.9E+00
LLI Wall	4.1E-01	1.5E+00
Small Intestine	4.3E-01	1.6E+00
Stomach	4.7E-01	1.7E+00
ULI Wall	4.3E-01	1.6E+00
Heart Wall	3.0E+00	1.1E+01
Kidneys	1.2E+00	4.6E+00
Liver	9.6E-01	3.6E+00
Lungs	2.5E+00	9.3E+00
Muscle	3.9E-01	1.4E+00
Ovaries	4.2E-01	1.5E+00
Pancreas	5.5E-01	2.0E+00
Red Marrow	4.9E-01	1.8E+00
Bone Surfaces	4.4E-01	1.6E+00
Skin	3.2E-01	1.2E+00
Spleen	2.4E+00	9.0E+00
Testes	3.5E-01	1.3E+00
Thymus	5.6E-01	2.1E+00
Thyroid	4.0E-01	1.5E+00
Urinary Bladder Wall	5.2E-01	1.9E+00
Uterus	4.2E-01	1.6E+00
Effective Dose Equivalent	1.1E+00 mSv/MBq	4.0E+00 rem/mCi

Based on total body kinetic model in ICRP 53 (data gathered in human subjects), modified by assumed fractional distribution of blood in model of Hui and Poston.

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

September 18, 1992

Radiation Dose Estimates for I-131 MAA

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	1.8E-01	6.7E-01
Brain	2.2E-02	8.2E-02
Breasts	8.3E-02	3.1E-01
Gallbladder Wall	2.5E-01	9.4E-01
LLI Wall	3.8E-02	1.4E-01
Small Intestine	6.1E-02	2.2E-01
Stomach	8.4E-02	3.1E-01
ULI Wall	7.8E-02	2.9E-01
Heart Wall	1.6E-01	5.9E-01
Kidneys	1.4E-01	5.3E-01
Liver	2.0E+00	7.5E+00
Lungs	2.3E+00	8.5E+00
Muscle	6.0E-02	2.2E-01
Ovaries	4.4E-02	1.6E-01
Pancreas	1.5E-01	5.6E-01
Red Marrow	7.3E-02	2.7E-01
Bone Surfaces	6.3E-02	2.3E-01
Skin	3.8E-02	1.4E-01
Spleen	7.3E-02	2.7E-01
Testes	2.7E-02	1.0E-01
Thymus	9.0E-02	3.3E-01
Thyroid	4.1E-02	1.5E-01
Urinary Bladder Wall	4.9E-01	1.8E+00
Uterus	5.2E-02	1.9E-01
Effective Dose Equivalent	5.0E-01 mSv/MBq	1.8E+00 rem/mCi

Model in ICRP 53 is adopted (data gathered in human subjects). Assumed distribution and retention:

Lungs	85% T_b = 6 hr	15% T_b = 72 hr
Liver	25% uptake T_b = 6 hr, elimination T_b = 120 hr	
Kidneys	residence time = .108 hr	

Urinary bladder receives clearance from liver and long term clearance from lung. Bladder voiding interval 4.8 hours.

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

September 18, 1992

Radiation Dose Estimates for I-131 mIBG (i.v. injection)

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	2.1E-01	7.6E-01
Brain	4.7E-02	1.7E-01
Breasts	5.4E-02	2.0E-01
Gallbladder Wall	1.4E-01	5.2E-01
LLI Wall	7.2E-02	2.7E-01
Small Intestine	7.5E-02	2.8E-01
Stomach	7.8E-02	2.9E-01
ULI Wall	7.9E-02	2.9E-01
Heart Wall	3.8E-01	1.4E+00
Kidneys	8.8E-02	3.3E-01
Liver	7.8E-01	2.9E+00
Lungs	7.4E-02	2.7E-01
Muscle	6.2E-02	2.3E-01
Ovaries	7.4E-02	2.7E-01
Pancreas	1.1E-01	3.9E-01
Red Marrow	7.4E-02	2.7E-01
Bone Surfaces	6.5E-02	2.4E-01
Salivary glands	2.4E-01	8.8E-01
Skin	4.8E-02	1.8E-01
Spleen	5.8E-01	2.2E+00
Testes	5.8E-02	2.2E-01
Thymus	6.4E-02	2.4E-01
Thyroid	9.0E-02	3.3E-01
Urinary Bladder Wall	7.6E-01	2.8E+00
Uterus	8.9E-02	3.3E-01

Effective Dose Equivalent 2.1E-01 mSv/MBq 7.8E-01 rem/mCi

Based on data gathered in patients - Jacobsson et al, 4th International Radiopharmaceutical Dosimetry Symposium, CONF-851113, pp. 389-398. Assumed distribution and retention:

Total body	63 %	T_b = 32.8	hours	36 %	T_b = 3.05	hours	1 %	T_b = ∞
Liver	21 %	T_b = 32.8	hours	15 %	T_b = 3.05	hours	0.3 %	T_b = ∞
Spleen	0.6 %	T_b = 178	hours					
Sal. glands	0.04 %	T_b = 32.8	hours					
Thyroid	0.005 %	T_b = 168	hours					
Adrenals	0.02 %	T_b = 48.6	hours					
Heart wall	0.8 %	T_b = 120	hours					

Dynamic Bladder Model used (4.80 hour void)
36 % T_b = 3.00 hours 63 % T_b = 33.6 hours
Dose to salivary glands is self-dose only, based on 77 g mass and photon absorbed fractions from MIRD Pamphlet No. 8. Salivary gland activity did not contribute to other organ doses. Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

September 18, 1992

Radiation Dose Estimates for I-131 Rose Bengal

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	3.0E-02	1.1E-01
Brain	5.4E-04	2.0E-03
Breasts	5.2E-03	1.9E-02
Gallbladder Wall	6.6E-01	2.5E+00
LLI Wall	8.4E+00	3.1E+01
Small Intestine	8.2E-01	3.0E+00
Stomach	7.2E-02	2.7E-01
ULI Wall	3.2E+00	1.2E+01
Heart Wall	1.2E-02	4.6E-02
Kidneys	5.8E-02	2.1E-01
Liver	1.9E-01	7.1E-01
Lungs	9.6E-03	3.6E-02
Muscle	4.4E-02	1.6E-01
Ovaries	3.7E-01	1.4E+00
Pancreas	4.5E-02	1.7E-01
Red Marrow	7.1E-02	2.6E-01
Bone Surfaces	3.6E-02	1.4E-01
Skin	1.5E-02	5.6E-02
Spleen	3.1E-02	1.1E-01
Testes	3.7E-02	1.4E-01
Thymus	4.2E-03	1.5E-02
Thyroid	1.2E-03	4.6E-03
Urinary Bladder Wall	1.7E-01	6.3E-01
Uterus	1.7E-01	6.4E-01
Effective Dose Equivalent	9.0E-01 mSv/MBq	3.3E+00 rem/mCi

Based on model in MIRD Dose Estimate Report No. 7 (data gathered in human subjects), J Nucl Med 16:1214-1217, 1975.

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

September 18, 1992

Radiation Dose Estimates for I-131 Sodium Iodide

ORGAN	Estimated Radiation Dose mGy / MBq	rad / mCi
Adrenals	3.9E-02	1.4E-01
Brain	1.1E-01	4.1E-01
Breasts	4.2E-02	1.6E-01
Gallbladder Wall	4.5E-02	1.7E-01
LLI Wall	4.3E-02	1.6E-01
Small Intestine	2.4E-01	8.8E-01
Stomach	3.6E-01	1.3E+00
ULI Wall	5.2E-02	1.9E-01
Heart Wall	5.7E-02	2.1E-01
Kidneys	3.6E-02	1.3E-01
Liver	1.1E-01	3.9E-01
Lungs	7.9E-02	2.9E-01
Muscle	1.0E-01	3.7E-01
Ovaries	4.7E-02	1.8E-01
Pancreas	5.2E-02	1.9E-01
Red Marrow	8.3E-02	3.1E-01
Bone Surfaces	1.0E-01	3.7E-01
Skin	5.1E-02	1.9E-01
Spleen	4.1E-02	1.5E-01
Testes	2.8E-02	1.0E-01
Thymus	1.2E-01	4.4E-01
Thyroid	3.4E+02	1.3E+03
Urinary Bladder Wall	6.2E-01	2.3E+00
Uterus	5.9E-02	2.2E-01
Effective Dose Equivalent	1.1E+01 mSv/MBq	3.9E+01 rem/mCi

Based on model in MIRD Dose Estimate Report No. 5 (data gathered in human subjects), J Nucl Med 16:857-860, 1975 (25% thyroid uptake).

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

April 12, 1996

Radiation Dose Estimates for I-131 Sodium Iodide
In the Reference Adult - Athyroid Patient*

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	2.3E-02	8.4E-02
Brain	1.1E-02	4.0E-02
Breasts	1.2E-02	4.5E-02
Gallbladder Wall	3.3E-02	1.2E-01
LLI Wall	3.7E-02	1.4E-01
Small Intestine	2.3E-01	8.6E-01
Stomach	3.5E-01	1.3E+00
ULI Wall	4.2E-02	1.6E-01
Heart Wall	1.9E-02	6.9E-02
Kidneys	2.3E-02	8.4E-02
Liver	9.6E-02	3.6E-01
Lungs	1.5E-02	5.7E-02
Muscle	1.9E-02	6.9E-02
Ovaries	4.0E-02	1.5E-01
Pancreas	3.6E-02	1.3E-01
Red Marrow	1.9E-02	7.1E-02
Bone Surfaces	1.8E-02	6.6E-02
Skin	1.3E-02	4.6E-02
Spleen	2.5E-02	9.3E-02
Testes	2.1E-02	7.9E-02
Thymus	1.4E-02	5.0E-02
Urinary Bladder Wall	8.1E-01	3.0E+00
Uterus	5.6E-02	2.1E-01
Total Body	2.4E-02	8.8E-02
Effective Dose Equivalent	1.1E-01 mSv/MBq	4.0E-01 rem/mCi

* Model in MIRD Dose Estimate Report No. 5 (J Nucl Med 16:857-860, 1975) used, except total body clearance assumed to be 100%, T_b = 6 hr. Assumed residence times:

Small Intestine	1.50E+00 hr
Stomach	1.33E+00 hr
Liver	1.16E+00 hr
Urinary Bladder Contents	2.53E+00 hr
Remainder	4.40E+00 hr

Estimate calculated using phantoms of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7). Bone and marrow model of Eckerman (Aspects of dosimetry of radionuclides within the skeleton with particular emphasis on the active marrow, In Fourth International Radiopharmaceutical Dosimetry Symposium; A T. Schlafke-Stelson and E. E. Watson eds. CONF-851113, Oak Ridge Associated Universities, Oak Ridge, TN 37831, 1986. pp 514-534.) used.

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risks to individual patients and should not be applied to situations involving radiation therapy.

Source: Radiation Internal Dose
Information Center

September 18, 1992

Radiation Dose Estimates for Inhalation of Xe-127 (Breathhold)

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	1.3E-04	4.6E-04
Brain	8.3E-05	3.1E-04
Breasts	8.5E-05	3.2E-04
Gallbladder Wall	1.2E-04	4.4E-04
LLI Wall	1.1E-04	4.2E-04
Small Intestine	1.2E-04	4.3E-04
Stomach	1.1E-04	4.2E-04
ULI Wall	1.1E-04	4.2E-04
Heart Wall	1.4E-04	5.0E-04
Kidneys	1.1E-04	3.9E-04
Liver	1.2E-04	4.3E-04
Lungs	3.6E-04	1.3E-03
Muscle	9.5E-05	3.5E-04
Ovaries	1.2E-04	4.4E-04
Pancreas	1.3E-04	4.7E-04
Red Marrow	1.0E-04	3.9E-04
Bone Surfaces	1.5E-04	5.7E-04
Skin	6.5E-05	2.4E-04
Spleen	1.1E-04	4.2E-04
Testes	8.7E-05	3.2E-04
Thymus	1.1E-04	4.2E-04
Thyroid	1.0E-04	3.8E-04
Urinary Bladder Wall	1.1E-04	4.1E-04
Uterus	1.2E-04	4.4E-04
Effective Dose Equivalent	1.4E-04 mSv/MBq	5.3E-04 rem/mCi

Based on the model in MIRD Dose Estimate Report No. 9 (data gathered in human subjects), J Nucl Med 21:459-465, 1980.

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

September 18, 1992

Radiation Dose Estimates for Inhalation of Xe-127
(5 minute rebreathing)

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	7.8E-04	2.9E-03
Brain	5.9E-04	2.2E-03
Breasts	5.0E-04	1.8E-03
Gallbladder Wall	8.2E-04	3.0E-03
LLI Wall	8.0E-04	3.0E-03
Small Intestine	8.2E-04	3.0E-03
Stomach	7.5E-04	2.8E-03
ULI Wall	7.9E-04	2.9E-03
Heart Wall	7.6E-04	2.8E-03
Kidneys	7.2E-04	2.7E-03
Liver	7.4E-04	2.7E-03
Lungs	8.2E-04	3.0E-03
Muscle	6.3E-04	2.3E-03
Ovaries	8.3E-04	3.1E-03
Pancreas	8.3E-04	3.1E-03
Red Marrow	6.9E-04	2.6E-03
Bone Surfaces	1.0E-03	3.8E-03
Skin	4.4E-04	1.6E-03
Spleen	7.3E-04	2.7E-03
Testes	6.2E-04	2.3E-03
Thymus	6.9E-04	2.5E-03
Thyroid	6.9E-04	2.5E-03
Urinary Bladder Wall	7.8E-04	2.9E-03
Uterus	8.4E-04	3.1E-03
Effective Dose Equivalent	7.6E-04 mSv/MBq	2.8E-03 rem/mCi

Based on the model in MIRD Dose Estimate Report No. 9 (data gathered in human subjects), J Nucl Med 21:459-465, 1980.

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose
Information Center

September 18, 1992

Radiation Dose Estimates for Inhalation of Xe-127
(10 minute rebreathing)

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	1.3E-03	4.7E-03
Brain	9.5E-04	3.5E-03
Breasts	7.9E-04	2.9E-03
Gallbladder Wall	1.3E-03	4.9E-03
LLI Wall	1.3E-03	4.8E-03
Small Intestine	1.3E-03	4.9E-03
Stomach	1.2E-03	4.5E-03
ULI Wall	1.3E-03	4.7E-03
Heart Wall	1.2E-03	4.5E-03
Kidneys	1.2E-03	4.3E-03
Liver	1.2E-03	4.4E-03
Lungs	1.1E-03	4.0E-03
Muscle	1.0E-03	3.7E-03
Ovaries	1.4E-03	5.0E-03
Pancreas	1.3E-03	5.0E-03
Red Marrow	1.1E-03	4.1E-03
Bone Surfaces	1.6E-03	6.1E-03
Skin	7.1E-04	2.6E-03
Spleen	1.2E-03	4.4E-03
Testes	1.0E-03	3.7E-03
Thymus	1.1E-03	4.1E-03
Thyroid	1.1E-03	4.1E-03
Urinary Bladder Wall	1.3E-03	4.7E-03
Uterus	1.4E-03	5.0E-03
Effective Dose Equivalent	1.2E-03 mSv/MBq	4.4E-03 rem/mCi

Based on the model in MIRD Dose Estimate Report No. 9 (data gathered in human subjects), J Nucl Med 21:459-465, 1980.

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose
Information Center

September 18, 1992

Radiation Dose Estimates for Inhalation of Xe-133
(Breathhold)

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	1.0E-04	3.8E-04
Brain	9.7E-05	3.6E-04
Breasts	9.5E-05	3.5E-04
Gallbladder Wall	1.0E-04	3.8E-04
LLI Wall	1.0E-04	3.7E-04
Small Intestine	1.0E-04	3.7E-04
Stomach	1.0E-04	3.7E-04
ULI Wall	1.0E-04	3.7E-04
Heart Wall	1.1E-04	3.9E-04
Kidneys	9.8E-05	3.6E-04
Liver	1.0E-04	3.8E-04
Lungs	8.2E-04	3.0E-03
Muscle	9.7E-05	3.6E-04
Ovaries	1.0E-04	3.7E-04
Pancreas	1.0E-04	3.8E-04
Red Marrow	1.2E-04	4.4E-04
Bone Surfaces	1.2E-04	4.5E-04
Skin	9.0E-05	3.3E-04
Spleen	1.0E-04	3.7E-04
Testes	9.5E-05	3.5E-04
Thymus	1.0E-04	3.7E-04
Thyroid	9.9E-05	3.7E-04
Urinary Bladder Wall	1.0E-04	3.7E-04
Uterus	1.0E-04	3.7E-04
Effective Dose Equivalent	1.9E-04 mSv/MBq	7.1E-04 rem/mCi

Based on the model in MIRD Dose Estimate Report No. 9 (data gathered in human subjects), J Nucl Med 21:459-465, 1980.

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose
Information Center

September 18, 1992

Radiation Dose Estimates for Inhalation of Xe-133
(5 minute rebreathing)

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	6.9E-04	2.6E-03
Brain	6.7E-04	2.5E-03
Breasts	6.4E-04	2.4E-03
Gallbladder Wall	7.0E-04	2.6E-03
LLI Wall	7.0E-04	2.6E-03
Small Intestine	7.0E-04	2.6E-03
Stomach	6.9E-04	2.5E-03
ULI Wall	6.9E-04	2.6E-03
Heart Wall	6.9E-04	2.6E-03
Kidneys	6.8E-04	2.5E-03
Liver	6.9E-04	2.5E-03
Lungs	1.1E-03	4.2E-03
Muscle	6.6E-04	2.5E-03
Ovaries	7.0E-04	2.6E-03
Pancreas	7.1E-04	2.6E-03
Red Marrow	8.3E-04	3.1E-03
Bone Surfaces	8.2E-04	3.0E-03
Skin	6.2E-04	2.3E-03
Spleen	6.9E-04	2.5E-03
Testes	6.6E-04	2.4E-03
Thymus	6.8E-04	2.5E-03
Thyroid	6.8E-04	2.5E-03
Urinary Bladder Wall	6.9E-04	2.6E-03
Uterus	7.1E-04	2.6E-03
Effective Dose Equivalent	7.6E-04 mSv/MBq	2.8E-03 rem/mCi

Based on the model in MIRD Dose Estimate Report No. 9 (data gathered in human subjects), J Nucl Med 21:459-465, 1980.

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose
Information Center

September 18, 1992

Radiation Dose Estimates for Xe-133 Injections

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	3.8E-05	1.4E-04
Brain	3.8E-06	1.4E-05
Breasts	4.2E-05	1.5E-04
Gallbladder Wall	1.2E-05	4.4E-05
LLI Wall	3.7E-06	1.4E-05
Small Intestine	4.5E-06	1.7E-05
Stomach	2.2E-05	8.0E-05
ULI Wall	4.8E-06	1.8E-05
Heart Wall	1.8E-03	6.5E-03
Kidneys	1.0E-05	3.8E-05
Liver	3.9E-05	1.4E-04
Lungs	7.1E-03	2.6E-02
Muscle	2.1E-05	7.7E-05
Ovaries	3.7E-06	1.4E-05
Pancreas	3.0E-05	1.1E-04
Red Marrow	1.9E-05	7.0E-05
Bone Surfaces	4.3E-05	1.6E-04
Skin	8.6E-06	3.2E-05
Spleen	2.9E-05	1.1E-04
Testes	3.2E-06	1.2E-05
Thymus	6.8E-05	2.5E-04
Thyroid	1.2E-05	4.6E-05
Urinary Bladder Wall	3.5E-06	1.3E-05
Uterus	3.7E-06	1.4E-05
Effective Dose Equivalent	9.9E-04 mSv/MBq	3.6E-03 rem/mCi

Residence times based on a model in which activity clears from the blood, to the right heart, lungs, left heart, and back to blood, with 95% clearance of blood from lungs on each pass. Half times for transport are 1 minute in heart chambers, 5 minutes in lung, and 3 minutes in the body. (No human or animal data used.)

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

September 18, 1992

Radiation Dose Estimates for Inhalation of Xe-133
(10 minute rebreathing)

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	1.2E-03	4.3E-03
Brain	1.1E-03	4.1E-03
Breasts	1.1E-03	3.9E-03
Gallbladder Wall	1.2E-03	4.3E-03
LLI Wall	1.2E-03	4.3E-03
Small Intestine	1.2E-03	4.3E-03
Stomach	1.1E-03	4.2E-03
ULI Wall	1.2E-03	4.3E-03
Heart Wall	1.1E-03	4.2E-03
Kidneys	1.1E-03	4.2E-03
Liver	1.1E-03	4.2E-03
Lungs	1.2E-03	4.4E-03
Muscle	1.1E-03	4.1E-03
Ovaries	1.2E-03	4.3E-03
Pancreas	1.2E-03	4.3E-03
Red Marrow	1.4E-03	5.1E-03
Bone Surfaces	1.4E-03	5.0E-03
Skin	1.0E-03	3.8E-03
Spleen	1.1E-03	4.2E-03
Testes	1.1E-03	4.0E-03
Thymus	1.1E-03	4.1E-03
Thyroid	1.1E-03	4.2E-03
Urinary Bladder Wall	1.1E-03	4.2E-03
Uterus	1.2E-03	4.3E-03
Effective Dose Equivalent	1.2E-03 mSv/MBq	4.4E-03 rem/mCi

Based on the model in MIRD Dose Estimate Report No. 9 (data gathered in human subjects), J Nucl Med 21:459-465, 1980.

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose
Information Center

February 27, 1995

Radiation Dose Estimates for Hg-197 Chlormerodrin

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	4.1E-02	1.5E-01
Brain	2.8E-03	1.0E-02
Breasts	4.1E-03	1.5E-02
Gallbladder Wall	4.4E-02	1.6E-01
LLI Wall	6.1E-03	2.2E-02
Small Intestine	1.3E-02	4.7E-02
Stomach	1.4E-02	5.3E-02
ULI Wall	1.4E-02	5.4E-02
Heart Wall	1.1E-02	4.1E-02
Kidneys	2.2E+00	8.1E+00
Liver	3.5E-01	1.3E+00
Lungs	1.1E-02	4.1E-02
Muscle	1.1E-02	4.1E-02
Ovaries	9.3E-03	3.4E-02
Pancreas	3.1E-02	1.1E-01
Red Marrow	2.3E-02	8.4E-02
Bone Surfaces	2.7E-01	9.8E-01
Skin	4.2E-03	1.6E-02
Spleen	2.8E-02	1.0E-01
Testes	6.0E-03	2.2E-02
Thymus	4.2E-03	1.6E-02
Thyroid	3.0E-03	1.1E-02
Urinary Bladder Wall	1.3E-01	4.9E-01
Uterus	8.6E-03	3.2E-02
Effective Dose Equivalent	1.8E-01 mSv/MBq	6.7E-01 rem/mCi

Based on model in MIRD Dose Estimate Report No. 6 (data gathered in human subjects). Dynamic bladder model with 4.8-hour voiding interval

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7). Bone and marrow model of Eckerman (Aspects of dosimetry of radionuclides within the skeleton with particular emphasis on the active marrow, In Fourth International Radiopharmaceutical Dosimetry Symposium; A.T. Schlafke-Stelson and E. E. Watson eds. CONF-851113, Oak Ridge Associated Universities, Oak Ridge, TN 37831, 1986. pp 514-534.) used.

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

February 27, 1995

Radiation Dose Estimates for Au-198 Colloid

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	4.1E-01	1.5E+00
Brain	4.5E-02	1.7E-01
Breasts	9.9E-02	3.7E-01
Gallbladder Wall	6.4E-01	2.4E+00
LLI Wall	7.7E-02	2.9E-01
Small Intestine	1.5E-01	5.5E-01
Stomach	2.2E-01	8.3E-01
ULI Wall	1.9E-01	7.1E-01
Heart Wall	2.2E-01	8.2E-01
Kidneys	3.2E-01	1.2E+00
Liver	7.8E+00	2.9E+01
Lungs	2.0E-01	7.3E-01
Muscle	1.1E-01	4.1E-01
Ovaries	9.5E-02	3.5E-01
Pancreas	4.3E-01	1.6E+00
Red Marrow	8.8E-01	3.3E+00
Bone Surfaces	5.5E-01	2.0E+00
Skin	7.1E-02	2.6E-01
Spleen	1.1E+01	3.9E+01
Testes	4.2E-02	1.6E-01
Thymus	9.3E-02	3.4E-01
Thyroid	5.5E-02	2.0E-01
Urinary Bladder Wall	6.2E-02	2.3E-01
Uterus	8.4E-02	3.1E-01
Effective Dose Equivalent	1.4E+00 mSv/MBq	5.1E+00 rem/mCi

Based on model in ICRP 53 (data gathered in human subjects). Liver receives 70%, spleen 10%, marrow and remainder receive 15% each, all with $T_b = \infty$.

Dynamic bladder model with 4.8-hour voiding interval.

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7). Bone and marrow model of Eckerman (Aspects of dosimetry of radionuclides within the skeleton with particular emphasis on the active marrow, In Fourth International Radiopharmaceutical Dosimetry Symposium; A.T. Schlafke-Stelson and E. E. Watson eds. CONF-851113, Oak Ridge Associated Universities, Oak Ridge, TN 37831, 1986. pp 514-534.) used.

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

February 15, 1995

Radiation Dose Estimates for Tl-201 Chloride (plus contaminants)

ORGAN	Estimated Radiation Dose mGy/MBq	rad/mCi
Adrenals	6.3E-02	2.3E-01
Brain	5.9E-02	2.2E-01
Breasts	3.6E-02	1.3E-01
GB Wall	8.3E-02	3.1E-01
LLI Wall	3.4E-01	1.2E+00
Small Intestine	4.5E-01	1.7E+00
Stomach	1.9E-01	6.9E-01
ULI Wall	3.3E-01	1.2E+00
Heart Wall	2.8E-01	1.0E+00
Kidneys	4.6E-01	1.7E+00
Liver	9.9E-02	3.7E-01
Lungs	4.7E-02	1.7E-01
Muscle	4.6E-02	1.7E-01
Ovaries	1.0E-01	3.7E-01
Pancreas	7.4E-02	2.7E-01
Red Marrow	5.5E-02	2.0E-01
Bone Surfaces	8.8E-02	3.3E-01
Skin	3.3E-02	1.2E-01
Spleen	1.8E-01	6.5E-01
Testes	2.0E-01	7.3E-01
Thymus	4.6E-02	1.7E-01
Thyroid	6.2E-01	2.3E+00
Urinary Bladder Wall	5.2E-02	1.9E-01
Uterus	8.5E-02	3.1E-01
Effective Dose Equivalent	1.6E-01 mSv/MBq	6.0E-01 rem/mCi

Based on data gathered in humans by Krahwinkel et al. (J Nucl Med 29(9):1582-1586, 1988) and data on testicular uptake and clearance gathered in humans by Thomas et al. (personal communication, 1994). Assumed distribution and retention:

Brain	1.76%	$T_b = \infty$		
LLI	3.6%	T_b = 191 hr (Activity in wall)		
Small Int	14.4%	T_b = 191 hr (Activity in wall)		
Stomach	2.8%	T_b = 205 hr (Activity in wall)		
ULI	4.7%	T_b = 191 hr (Activity in wall)		
Heart Wall	3.4%	T_b = 179 hr		
Kidneys	4.5%	T_b = 260 hr	0.97%	T_b = 27 hr
Liver	4.6%	T_b = 218 hr		
Spleen	0.74%	T_b = 640 hr	0.28%	T_b = 37 hr
Testes	residence time 0.26 hr			
Thyroid	0.29%	T_b = 350 hr	0.24%	T_b = 166 hr
Total Body	31%	T_b = 146 hr	69%	T_b = 502 hr

Urinary Bladder Clearance: 6.2% T_b = 146 hr, 13.8% T_b = 502 hr
Bladder voiding interval 4.8 hr. Contaminants assumed: Tl-200 (1%), Tl-202 (0.33%), Pb-201(0.33%), Pb-203(0.33%). Includes dose from Tl-201 Auger electrons.

Estimate calculated using phantom of Cristy & Eckerman (Report ORNL/TM-8381/V1 & V7).

The effective dose equivalent is a quantity which may be suitable for comparing risks of different procedures in nuclear medicine, radiology, and other applications involving ionizing radiation, but should not be construed to give information about risk to individual patients.

Source: Radiation Internal Dose Information Center

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10. SUPPLEMENTARY NOTES

D. Howe, NRC Project Manager

11. ABSTRACT

Tables of radiation dose estimates based on the Cristy-Eckerman adult male phantom are provided for a number of radiopharmaceuticals commonly used in nuclear medicine. Radiation dose estimates are listed for all major source organs, and several other organs of interest. The dose estimates were calculated using the MIRD Technique as implemented in the MIRDOSE3 computer code, developed by the Oak Ridge Institute for Science and Education, Radiation Internal Dose Information Center. In this code, residence times for source organs are used with decay data from the MIRD Radionuclide Data and Decay Schemes to produce estimates of radiation dose to organs of standardized phantoms representing individuals of different ages.

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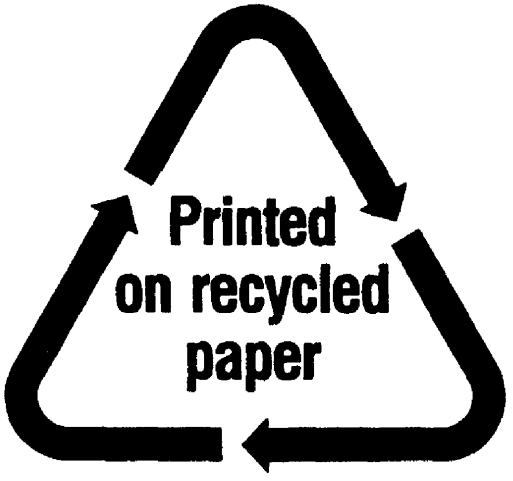

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