GUIDELINES FOR BREASTFEEDING MOTHERS IN NUCLEAR MEDICINE

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Please note that the area code changes from 423 to 865 effective 1 October 1999.

Table 1

Summary of the Effective Dose Equivalents to Newborns and One-Year-Olds Used in This Report

Radiopharmaceutical	Effective Dose Equivalent* (rem/mCi) Newborn	One-Year-Old
Ga-67 Citrate	6.7	2.69
Tc-99m DTPA	0.13	0.056
Tc-99m MAA	0.63	0.26
Tc-99m Pertechnetate	0.41	0.19
I-131 Sodium Iodide (NaI)	20000**	14000**
Cr-51 EDTA	0.11	0.048
Tc-99m DISIDA	0.85	0.41
Tc-99m glucoheptonate	0.16	0.36
Tc-99m HAM	0.56	0.23
Tc-99m MIBI	0.52	0.24
Tc-99m MDP	0.41	0.16
Tc-99m PYP	0.28	0.12
Tc-99m RBC - in vivo labeling	0.30	0.14
Tc-99m RBC - in vitro labeling	0.31	0.14
Tc-99m Sulfur Colloid	0.74	0.36
In-111 White Blood Cells	33	13
I-123 Sodium Iodide (NaI)	5.9	4.1
I-123 OIH	0.24	0.10
I-123 mIBG	5.9	4.1
I-125 OIH	0.89	0.36
I-131 OIH	1.1	0.44
Tc-99m DTPA Aerosol	0.28	0.12
Tc-99m MAG3	0.12	0.052
Tc-99m White Blood Cells	0.41	0.19
Tl-201 Chloride	15	8.5

* Effective dose equivalent to the infant per unit activity administered intravenously to the infant.

** Dose to the infant's thyroid per unit activity administered intravenously (or orally) to the infant (rad/mCi).

Table 2

Classification of Radiopharmaceuticals

Class A	Class B	Class C
Ga-67 Citrate	Cr-51 EDTA	Tc-99m DTPA Aerosol
Tc-99m DTPA	Tc-99m DISIDA	Tc-99m MAG3
Tc-99m pertechnetate (TcO_4^-)	Tc-99m glucoheptonate	Tc-99m WBC
Tc-99m MAA	Tc-99m HAM	Xe-133 gas
I-131 NaI	Tc-99m MDP/HDP	
	Tc-99m MIBI	
	Tc-99m PYP	
	Tc-99m RBC	
	Tc-99m sulphur colloid	
	In-111 WBC	
	I-123 NaI	
	I-123 OIH	
	I-123 mIBG	
	I-125 OIH	
	I-131 OIH	
	Tl-201 chloride	

Table 3

Biokinetic Parameters for Radiopharmaceuticals Excreted in Breast Milk

Class A	Excretion Fraction* Lowest	Highest	T_B (h)	Reference
Ga-67 Citrate		9.5E-5 (72)	216	TO76
	2.7E-5 (38)	3.7E-5 (58)	82-385	RUB94
		5.6E-5 (96)		LA71
		1.0E-4 (88)		GR83
		4.3E-5 (48)		WWE94
	3.16E-2§§	9.9E-2§§	20-390	RUB94
Tc-99m DTPA		7.2E-7 (2.2)	15	MO84‡
		6.0E-7 (2.8)	15	MO85
	5.0E-4§§	2.4E-3§§	6.5-30	RUB94
		~5.0E-7 (~3)	9.6	AH85
Tc-99m MAA		1.4E-4 (2.2)	20	MO84
	7.1E-6 (5)	3.1E-4 (7)	5.2-45	MA81
		2.4E-5 (4)	5.3	BE73
		1.4E-4 (3.5)	12**	CRA85
		7.0E-6 (6)	~12	HEA79
	4.0E-3§§	5.2E-2§§	7.3-18	AH85
Tc-99m pertechnetate		~6.7E-6 (8.5)		RUM78
	2.6E-5 (10)	6.4E-5 (2)	9-66	WY73
		1.4E-4 (22)	20	VA71
		~1.3E-5 (3)		PI79
	7.19E-3 (2.4)	1.7E-2 (2)		OG83†
		~5.0E-4 (~5)	6.9	AH85
		1.7E-4 (8.2)	6	MO87
		1.4E-4 (~3)	5.2	HED86
I-131 NaI	1.4E-5 (24)	4.0E-5 (6)	~9.9	NU52
		6.7E-4 (6)		WEA60
		6.6E-4	12	DY88 (2 comp
		+ 1.6E-5	526	model)
		3.0E-2 (18)	~9.4	RUB88
		~5.0E-4	13	ROB94 (diag.)
			11	ROB94 (ther.
			235	2 comp model
		2.3E-1§§	117	RUB94
	2.5E-1§§	4.6E-1§§	7.6-12	MO89a

Table 3 (Cont'd)

Biokinetic Parameters for Radiopharmaceuticals Excreted in Breast Milk

Class B	Excretion Fractions* Lowest	Highest	T_B (h)	Reference (see ref)
Cr-51 EDTA	1.5E-4§§	6.5E-4§§	5.0-7.0	AH85
Tc-99m DISIDA	1.0E-3§§	2.8E-3§§	10-(9.1)††	RUB94
Tc-99m glucoheptonate		1.4E-3§§	9.0	RUB94
		2.6E-6	12	MO87
Tc-99m HAM	8.8E-3§§	1.1E-2§§	6.0-(7.0)††	RUB94
Tc-99m MIBI		1.4E-6 (3.3)	23	RUB91§
	1.0E-4§§	3.0E-4§§	18-(6.7)††	RUB94
Tc-99m MDP/HDP		~1.6E-6 (~4)	8.4-34	AH85
Tc-99m PYP	1.5E-3§§	4.4E-3§§	8.4-(6.8)††	RUB94
Tc-99m RBC - in vivo	6.0E-3§§	1.0E-2§§	(7.7)††	ROS90
		4.5E-5 (8)	(6.8)††	ROS90
		~1.0E-7 (~4)	(7)††	AH85
Tc-99m RBC - in vitro	2.0E-4§§	3.0E-4§§	(7.8-9.0)††	RUB94
Tc-99m Sulphur Colloid	1.6E-3§§	1.5E-2§§	35-(8.3)††	RUB94
In-111 WBC		3.3E-7 (13)	(85.3)††	MO85
		7.3E-7 (16)	(140)††	HES88
		2.4E-7 (20)		BU86
I-123 NaI		2.6E-2§§	10.4	HED86
		6.5E-5	10.4	HED86
I-123 OIH		6.0E-5	4.8	MO89
	1.2E-02§§	3.5E-2§§	8.1-10.2	ROS90
		1.5E-4 (4)	8.3	ROS90
I-123 mIBG★		7.2E-6 (8)	85	KE94
I-125 OIH		2.4E-2§§	4.8	AH85
I-131 OIH	1.8E-2§§	4.9E-2§§	2.2-6.0	AH95
Tl-201 Chloride		2.2E-6	43	MU89#
		+ 1.9E-7	(362)††	
		1.8E-6	13	JO95#
		+ 9.8E-7	164	

Table 3 (Cont'd)

Biokinetic Parameters for Radiopharmaceuticals Excreted in Breast Milk

Class C

Tc-99m DTPA Aerosol	Fraction of administered aerosol assumed to reach bloodstream (0.406) treated as Tc-99m DTPA
Tc-99m MAG3	Treated as Tc-99m DTPA (renal agent for which data exist)
Tc-99m WBC	Treated as Tc-99m pertechnetate, as fraction of free Tc-99m is highly variable
Xe-133 gas	See text

* Peak fraction per ml of milk. All values corrected to the time of activity administration. The number in parenthesis is the time (h) at which this maximum was observed. "Lowest" is the lowest concentration observed at peak, and "Highest" is the highest concentration observed at peak, in an individual patient. If data from only one patient are reported, they are given under the "Highest" column.

** Pooled data from 4 patients

† Patient admitted for study of enlarged thyroid.

‡ Conservative value chosen due to anecdotal report (n=1) (see addendum of MO84

§ Data in Table 1 of RUB91 recalculated due to possible errors in derived values for the percent excreted in milk.

§§ Total fraction excreted - milk concentrations not given

(t)†† Effective half-time > T_P indicates continued activity accumulation

★ Speciation tests indicated that the activity excreted was most likely in the form of NaI, not mIBG.

\# 2 Compartment Model

Table 4

Cumulative Activity Ingested and Radiation Doses Received from the Radiopharmaceuticals Considered in this Report Under Different Interruption Schedules

Interruption Time (hr)	Cumulative Activity Ingested		Effective Dose Equivalent (mrem)	
	mCi	percent	Newborn	1-Yr-Old
Ga-67 Citrate, A(0) = 5 mCi, min concentration, half-time:				
3	4.09E-02	8.17E-01	2.72E+02	1.04E+02
12	2.76E-02	5.52E-01	1.84E+02	7.05E+01
24	1.64E-02	3.28E-01	1.09E+02	4.18E+01
48	5.77E-03	1.15E-01	3.84E+01	1.47E+01
96	7.14E-04	1.43E-02	4.76E+00	1.82E+00
120	2.51E-04	5.03E-03	1.67E+00	6.42E-01
168	3.11E-05	6.23E-04	2.07E-01	7.95E-02
336	2.08E-08	4.17E-07	1.39E-04	5.32E-05
672	9.27E-15	1.85E-13	6.17E-11	2.37E-11
Ga-67 Citrate, A(0) = 5 mCi, max concentration, half-time:				
3	1.99E+00	3.98E+01	1.33E+04	5.08E+03
12	1.81E+00	3.62E+01	1.20E+04	4.62E+03
24	1.59E+00	3.18E+01	1.06E+04	4.06E+03
48	1.23E+00	2.47E+01	8.21E+03	3.15E+03
96	7.40E-01	1.48E+01	4.93E+03	1.89E+03
120	5.73E-01	1.15E+01	3.82E+03	1.46E+03
168	3.44E-01	6.88E+00	2.29E+03	8.78E+02
336	5.76E-02	1.15E+00	3.83E+02	1.47E+02
672	1.61E-03	3.23E-02	1.07E+01	4.12E+00
Tc-99m DTPA, A(0) = 20 mCi, min concentration, half-time:				
3	2.57E-03	1.29E-02	3.23E-01	1.43E-01
12	3.49E-04	1.74E-03	4.39E-02	1.94E-02
24	2.43E-05	1.22E-04	3.06E-03	1.35E-03
48	1.18E-07	5.92E-07	1.49E-05	6.57E-06
96	2.80E-12	1.40E-11	3.52E-10	1.55E-10
120	1.36E-14	6.80E-14	1.71E-12	7.55E-13
168	0.00E+00	0.00E+00	0.00E+00	0.00E+00
336	0.00E+00	0.00E+00	0.00E+00	0.00E+00
672	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tc-99m DTPA, A(0) = 20 mCi, max concentration, half-time:				
3	4.78E-02	2.39E-01	6.02E+00	2.65E+00
12	1.38E-02	6.88E-02	1.73E+00	7.64E-01
24	2.61E-03	1.31E-02	3.29E-01	1.45E-01
48	9.43E-05	4.72E-04	1.19E-02	5.24E-03
96	1.23E-07	6.14E-07	1.55E-05	6.82E-06
120	4.43E-09	2.22E-08	5.58E-07	2.46E-07
168	5.77E-12	2.89E-11	7.26E-10	3.20E-10
336	0.00E+00	0.00E+00	0.00E+00	0.00E+00
672	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 4 (cont'd)

Cumulative Activity Ingested and Radiation Doses Received from the Radiopharmaceuticals Considered in this Report Under Different Interruption Schedules

Interruption Time (hr)	Cumulative Activity Ingested		Effective Dose Equivalent (mrem)	
	mCi	percent	Newborn	1-Yr-Old
Tc-99m MAA, A(0) = 4 mCi, min concentration, half-time:				
3	6.66E-03	1.66E-01	4.19E+00	1.70E+00
12	7.11E-04	1.78E-02	4.47E-01	1.81E-01
24	3.60E-05	9.00E-04	2.26E-02	9.19E-03
48	9.23E-08	2.31E-06	5.81E-05	2.36E-05
96	6.07E-13	1.52E-11	3.82E-10	1.55E-10
120	1.54E-15	3.85E-14	9.69E-13	3.93E-13
168	0.00E+00	0.00E+00	0.00E+00	0.00E+00
336	0.00E+00	0.00E+00	0.00E+00	0.00E+00
672	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tc-99m MAA, A(0) = 4 mCi, max concentration, half-time:				
3	4.78E-01	1.19E+01	3.01E+02	1.22E+02
12	1.47E-01	3.68E+01	9.27E+01	3.76E+01
24	3.07E-02	7.68E-01	1.93E+01	7.84E+00
48	1.33E-03	3.33E-02	8.38E-01	3.40E-01
96	2.51E-06	6.28E-05	1.58E-03	6.41E-04
120	1.09E-07	2.73E-06	6.86E-05	2.78E-05
168	2.06E-10	5.14E-09	1.29E-07	5.25E-08
336	0.00E+00	0.00E+00	0.00E+00	0.00E+00
672	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tc-99m O4, A(0) = 30 mCi, min concentration, half-time:				
3	4.78E-02	1.59E-01	1.95E+01	9.02E+00
12	5.10E-03	1.70E-02	2.08E+00	9.63E-01
24	2.58E-04	8.61E-04	1.05E-01	4.88E-02
48	6.63E-07	2.21E-06	2.70E-04	1.25E-04
96	4.36E-12	1.45E-11	1.77E-09	8.23E-10
120	1.11E-14	3.69E-14	4.50E-12	2.09E-12
168	0.00E+00	0.00E+00	0.00E+00	0.00E+00
336	0.00E+00	0.00E+00	0.00E+00	0.00E+00
672	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tc-99m O4, A(0) = 30 mCi, max concentration, half-time:				
3	2.03E+00	6.76E+00	8.25E+02	3.83E+02
12	6.54E-01	2.18E+00	2.66E+02	1.23E+02
24	1.44E-01	4.81E-01	5.88E+01	2.73E+01
48	7.05E-03	2.35E-02	2.87E+00	1.33E+00
96	1.68E-05	5.61E-05	6.84E-03	3.17E-03
120	8.21E-07	2.74E-06	3.34E-04	1.55E-04
168	1.96E-09	6.53E-09	7.97E-07	3.69E-07
336	0.00E+00	0.00E+00	0.00E+00	0.00E+00
672	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 4 (cont'd)

Cumulative Activity Ingested and Radiation Doses Received from the Radiopharmaceuticals Considered in this Report Under Different Interruption Schedules

Interruption Time (hr)	Cumulative Activity Ingested		Effective Dose Equivalent (mrem)	
	mCi	percent	Newborn	1-Yr-Old
I-131 NaI, A(0) = 150 mCi, min concentration, half-time:				
3	1.06E+00	7.07E-01	2.08E+07*	1.53E+07*
12	4.52E-01	3.01E-01	8.86E+06*	6.52E+06*
24	1.45E-01	9.66E-02	2.84E+06*	2.09E+06*
48	1.49E-02	9.94E-03	2.92E+05*	2.15E+05*
96	1.58E-04	1.05E-04	3.10E+03*	2.28E+03*
120	1.62E-05	1.08E-05	3.18E+02*	2.33E+02*
168	1.71E-07	1.14E-07	3.35E+00*	2.47E+00*
336	1.92E-14	1.28E-14	3.76E-07*	2.77E-07*
672	0.00E+00	0.00E+00	0.00E+00*	0.00E+00*
I-131 NaI, A(0) = 150 mCi, max concentration, half-time:				
3	7.50E+01	5.00E+01	1.47E+09*	1.08E+09*
12	7.50E+01	5.00E+01	1.47E+09*	1.08E+09*
24	7.50E+01	5.00E+01	1.47E+09*	1.08E+09*
48	7.50E+01	5.00E+01	1.47E+09*	1.08E+09*
96	7.50E+01	5.00E+01	1.47E+09*	1.08E+09*
120	7.50E+01	5.00E+01	1.47E+09*	1.08E+09*
168	7.50E+01	5.00E+01	1.47E+09*	1.08E+09*
336	1.88E+01	1.25E+01	3.69E+08*	2.71E+08*
672	7.68E-01	5.12E-01	1.51E+07*	1.11E+07*
Cr-51 EDTA, A(0) = .05 mCi, min concentration, half-time:				
3	7.71E-06	1.54E-02	8.85E-04	3.71E-04
12	3.14E-06	6.27E-03	3.60E-04	1.51E-04
24	9.44E-07	1.89E-03	1.08E-04	4.54E-05
48	8.55E-08	1.71E-04	9.81E-06	4.11E-06
96	7.02E-10	1.40E-06	8.06E-08	3.38E-08
120	6.37E-11	1.27E-07	7.30E-09	3.06E-09
168	5.23E-13	1.05E-09	6.00E-11	2.51E-11
336	1.56E-20	3.12E-17	1.79E-18	7.50E-19
672	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cr-51 EDTA, A(0) = .05 mCi, max concentration, half-time:				
3	3.37E-05	6.75E-02	3.87E-03	1.62E-03
12	1.37E-05	2.74E-02	1.57E-03	6.60E-04
24	4.13E-06	8.26E-03	4.74E-04	1.99E-04
48	3.74E-07	7.48E-04	4.29E-05	1.80E-05
96	3.07E-09	6.15E-06	3.53E-07	1.48E-07
120	2.79E-10	5.57E-07	3.19E-08	1.34E-08
168	2.29E-12	4.58E-09	2.62E-10	1.10E-10
336	6.82E-20	1.36E-16	7.82E-18	3.28E-18
672	0.00E+00	0.00E+00	0.00E+00	0.00E+00

* Dose to the infant thyroid, mrad.

Table 4 (cont'd)

Cumulative Activity Ingested and Radiation Doses Received from the Radiopharmaceuticals Considered in this Report Under Different Interruption Schedules

Interruption Time (hr)	Cumulative Activity Ingested		Effective Dose Equivalent (mrem)	
	mCi	percent	Newborn	1-Yr-Old
Tc-99m DISIDA, A(0) = 8 mCi, min concentration, half-time:				
3	5.64E-03	7.05E-02	4.80E+00	2.30E+00
12	1.07E-03	1.34E-02	9.12E-01	4.36E-01
24	1.17E-04	1.46E-03	9.95E-02	4.76E-02
48	1.39E-06	1.74E-05	1.18E-03	5.67E-04
96	1.97E-10	2.47E-09	1.68E-07	8.03E-08
120	2.35E-12	2.94E-11	2.00E-09	9.57E-10
168	3.21E-16	4.02E-15	2.73E-13	1.31E-13
336	0.00E+00	0.00E+00	0.00E+00	0.00E+00
672	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tc-99m DISIDA, A(0) = 8 mCi, max concentration, half-time:				
3	2.25E-02	2.82E-01	1.92E+01	9.17E+00
12	1.13E-02	1.42E-01	9.66E+00	4.62E+00
24	4.55E-03	5.69E-02	3.87E+00	1.85E+00
48	7.32E-04	9.15E-03	6.23E-01	2.98E-01
96	1.89E-05	2.36E-04	1.61E-02	7.70E-03
120	3.04E-06	3.80E-05	2.59E-03	1.24E-03
168	7.86E-08	9.83E-07	6.69E-05	3.20E-05
336	2.18E-13	2.73E-12	1.86E-10	8.89E-11
672	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tc-99m gluco, A(0) = 20 mCi, min concentration, half-time:				
3	1.48E-02	7.41E-02	2.30E+00	5.38E+00
12	2.63E-03	1.31E-02	4.08E-01	9.52E-01
24	2.61E-04	1.31E-03	4.06E-02	9.48E-02
48	2.59E-06	1.29E-05	4.02E-04	9.38E-04
96	2.53E-10	1.27E-09	3.94E-08	9.19E-08
120	2.51E-12	1.25E-11	3.90E-10	9.10E-10
168	2.21E-16	1.11E-15	3.44E-14	8.03E-14
336	0.00E+00	0.00E+00	0.00E+00	0.00E+00
672	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tc-99m gluco, A(0) = 20 mCi, max concentration, half-time:				
3	3.02E-02	1.51E-01	4.70E+00	1.10E+01
12	6.37E-03	3.19E-02	9.90E-01	2.31E+00
24	7.99E-04	3.99E-03	1.24E-01	2.90E-01
48	1.25E-05	6.27E-05	1.95E-03	4.55E-03
96	3.10E-09	1.55E-08	4.81E-07	1.12E-06
120	4.87E-11	2.43E-10	7.56E-09	1.76E-08
168	1.19E-14	5.97E-14	1.86E-12	4.33E-12
336	0.00E+00	0.00E+00	0.00E+00	0.00E+00
672	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 4 (cont'd)

Cumulative Activity Ingested and Radiation Doses Received from the Radiopharmaceuticals Considered in this Report Under Different Interruption Schedules

Interruption Time (hr)	Cumulative Activity Ingested		Effective Dose Equivalent (mrem)	
	mCi	percent	Newborn	1-Yr-Old
Tc-99m HAM, A(0) = 8 mCi, min concentration, half-time:				
3	3.60E-02	4.50E-01	2.00E+01	8.13E+00
12	4.51E-03	5.64E-02	2.50E+00	1.02E+00
24	2.83E-04	3.54E-03	1.57E-01	6.38E-02
48	1.11E-06	1.39E-05	6.17E-04	2.51E-04
96	1.72E-11	2.14E-10	9.52E-09	3.87E-09
120	6.73E-14	8.42E-13	3.74E-11	1.52E-11
168	0.00E+00	0.00E+00	0.00E+00	0.00E+00
336	0.00E+00	0.00E+00	0.00E+00	0.00E+00
672	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tc-99m HAM, A(0) = 8 mCi, max concentration, half-time:				
3	8.95E-02	1.12E+00	4.97E+01	2.02E+01
12	3.67E-02	4.59E-01	2.04E+01	8.29E+00
24	1.12E-02	1.40E-01	6.21E+00	2.53E+00
48	1.04E-03	1.30E-02	5.77E-01	2.35E-01
96	8.98E-06	1.12E-04	4.98E-03	2.03E-03
120	8.35E-07	1.04E-05	4.63E-04	1.88E-04
168	7.21E-09	9.01E-08	4.00E-06	1.63E-06
336	3.00E-16	3.75E-15	1.66E-13	6.76E-14
672	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tc-99m MIBI, A(0) = 30 mCi, min concentration, half-time:				
3	2.23E-03	7.44E-03	1.16E+00	5.37E-01
12	5.59E-04	1.86E-03	2.90E-01	1.34E-01
24	8.83E-05	2.94E-04	4.57E-02	2.12E-02
48	2.20E-06	7.34E-06	1.14E-03	5.30E-04
96	1.37E-09	4.56E-09	7.09E-07	3.29E-07
120	3.41E-11	1.14E-10	1.77E-08	8.21E-09
168	2.12E-14	7.08E-14	1.10E-11	5.11E-12
336	0.00E+00	0.00E+00	0.00E+00	0.00E+00
672	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tc-99m MIBI, A(0) = 30 mCi, max concentration, half-time:				
3	1.97E-02	6.56E-02	1.02E+01	4.73E+00
12	7.76E-03	2.59E-02	4.02E+00	1.87E+00
24	2.24E-03	7.47E-03	1.16E+00	5.39E-01
48	1.87E-04	6.24E-04	9.70E-02	4.51E-02
96	1.31E-06	4.36E-06	6.77E-04	3.14E-04
120	1.09E-07	3.64E-07	5.66E-05	2.63E-05
168	7.62E-10	2.54E-09	3.95E-07	1.83E-07
336	0.00E+00	0.00E+00	0.00E+00	0.00E+00
672	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 4 (cont'd)

Cumulative Activity Ingested and Radiation Doses Received from the Radiopharmaceuticals Considered in this Report Under Different Interruption Schedules

Interruption Time (hr)	Cumulative Activity Ingested		Effective Dose Equivalent (mrem)	
	mCi	percent	Newborn	1-Yr-Old
Tc-99m MDP, A(0) = 20 mCi, min concentration, half-time:				
3	8.94E-03	4.47E-02	3.64E+00	1.39E+00
12	1.51E-03	7.53E-03	6.13E-01	2.34E-01
24	1.40E-04	7.02E-04	5.71E-02	2.18E-02
48	1.22E-06	6.09E-06	4.95E-04	1.89E-04
96	9.16E-11	4.58E-10	3.73E-08	1.42E-08
120	7.94E-13	3.97E-12	3.23E-10	1.23E-10
168	4.15E-17	2.08E-16	1.69E-14	6.45E-15
336	0.00E+00	0.00E+00	0.00E+00	0.00E+00
672	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tc-99m MDP, A(0) = 20 mCi, max concentration, half-time:				
3	1.20E-02	5.98E-02	4.87E+00	1.86E+00
12	3.53E-03	1.76E-02	1.44E+00	5.48E-01
24	6.92E-04	3.46E-03	2.82E-01	1.08E-01
48	2.67E-05	1.33E-04	1.09E-02	4.14E-03
96	3.96E-08	1.98E-07	1.61E-05	6.15E-06
120	1.52E-09	7.62E-09	6.20E-07	2.37E-07
168	2.26E-12	1.13E-11	9.20E-10	3.51E-10
336	0.00E+00	0.00E+00	0.00E+00	0.00E+00
672	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tc-99m PYP, A(0) = 20 mCi, min concentration, half-time:				
3	1.73E-02	8.66E-02	4.81E+00	2.05E+00
12	2.92E-03	1.46E-02	8.10E-01	3.46E-01
24	2.72E-04	1.36E-03	7.55E-02	3.22E-02
48	2.36E-06	1.18E-05	6.54E-04	2.79E-04
96	1.77E-10	8.87E-10	4.92E-08	2.10E-08
120	1.54E-12	7.70E-12	4.27E-10	1.82E-10
168	8.05E-17	4.02E-16	2.23E-14	9.53E-15
336	0.00E+00	0.00E+00	0.00E+00	0.00E+00
672	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tc-99m PYP, A(0) = 20 mCi, max concentration, half-time:				
3	8.73E-02	4.37E-01	2.42E+01	1.03E+01
12	3.49E-02	1.74E-01	9.68E+00	4.13E+00
24	1.03E-02	5.14E-02	2.85E+00	1.22E+00
48	8.90E-04	4.45E-03	2.47E-01	1.05E-01
96	6.68E-06	3.34E-05	1.85E-03	7.91E-04
120	5.79E-07	2.90E-06	1.61E-04	6.86E-05
168	4.35E-09	2.17E-08	1.21E-06	5.15E-07
336	4.20E-17	2.10E-16	1.17E-14	4.97E-15
672	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 4 (cont'd)

Cumulative Activity Ingested and Radiation Doses Received from the Radiopharmaceuticals Considered in this Report Under Different Interruption Schedules

Interruption Time (hr)	Cumulative Activity Ingested		Effective Dose Equivalent (mrem)	
	mCi	percent	Newborn	1-Yr-Old
Tc-99m RBC vivo, A(0) = 20 mCi, min concentration, half-time:				
3	9.49E-04	4.75E-03	2.88E-01	1.30E-01
12	3.79E-04	1.90E-03	1.15E-01	5.19E-02
24	1.12E-04	5.58E-04	3.39E-02	1.53E-02
48	9.67E-06	4.84E-05	2.94E-03	1.32E-03
96	7.26E-08	3.63E-07	2.20E-05	9.94E-06
120	6.29E-09	3.15E-08	1.91E-06	8.62E-07
168	4.73E-11	2.36E-10	1.43E-08	6.47E-09
336	4.57E-19	2.28E-18	1.39E-16	6.25E-17
672	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tc-99m RBC vivo, A(0) = 20 mCi, max concentration, half-time:				
3	4.38E-01	2.19E+00	1.33E+02	5.99E+01
12	1.80E-01	8.98E-01	5.45E+01	2.46E+01
24	5.48E-02	2.74E-01	1.66E+01	7.50E+00
48	5.09E-03	2.54E-02	1.54E+00	6.96E-01
96	4.39E-05	2.20E-04	1.33E-02	6.01E-03
120	4.08E-06	2.04E-05	1.24E-03	5.59E-04
168	3.52E-08	1.76E-07	1.07E-05	4.82E-06
336	1.47E-15	7.33E-15	4.45E-13	2.01E-13
672	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tc-99m RBC vitro, A(0) = 20 mCi, min concentration, half-time:				
3	3.53E-03	1.76E-02	1.10E+00	4.83E-01
12	1.58E-03	7.92E-03	4.93E-01	2.17E-01
24	5.46E-04	2.73E-03	1.70E-01	7.47E-02
48	6.47E-05	3.24E-04	2.01E-02	8.86E-03
96	9.10E-07	4.55E-06	2.83E-04	1.25E-04
120	1.08E-07	5.39E-07	3.35E-05	1.48E-05
168	1.52E-09	7.58E-09	4.71E-07	2.08E-07
336	4.95E-16	2.48E-15	1.54E-13	6.78E-14
672	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tc-99m RBC vitro, A(0) = 20 mCi, max concentration, half-time:				
3	6.06E-03	3.03E-02	1.88E+00	8.30E-01
12	3.03E-03	1.52E-02	9.42E-01	4.15E-01
24	1.20E-03	6.01E-03	3.74E-01	1.65E-01
48	1.90E-04	9.48E-04	5.89E-02	2.59E-02
96	4.70E-06	2.35E-05	1.46E-03	6.44E-04
120	7.41E-07	3.71E-06	2.30E-04	1.01E-04
168	1.84E-08	9.20E-08	5.72E-06	2.52E-06
336	4.43E-14	2.22E-13	1.38E-11	6.07E-12
672	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 4 (cont'd)

Cumulative Activity Ingested and Radiation Doses Received from the Radiopharmaceuticals Considered in this Report Under Different Interruption Schedules

Interruption Time (hr)	Cumulative Activity Ingested		Effective Dose Equivalent (mrem)	
	mCi	percent	Newborn	1-Yr-Old
Tc-99m SC, A(0) = 12 mCi, min concentration, half-time:				
3	1.26E-02	1.05E-01	9.33E+00	4.57E+00
12	3.74E-03	3.11E-02	2.76E+00	1.35E+00
24	7.38E-04	6.15E-03	5.46E-01	2.68E-01
48	2.88E-05	2.40E-04	2.13E-02	1.05E-02
96	4.40E-08	3.67E-07	3.26E-05	1.60E-05
120	1.72E-09	1.43E-08	1.27E-06	6.23E-07
168	2.62E-12	2.19E-11	1.94E-09	9.51E-10
336	0.00E+00	0.00E+00	0.00E+00	0.00E+00
672	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tc-99m SC, A(0) = 12 mCi, max concentration, half-time:				
3	1.76E-01	1.47E+00	1.30E+02	6.38E+01
12	8.30E-02	6.92E-01	6.14E+01	3.01E+01
24	3.05E-02	2.54E-01	2.26E+01	1.11E+01
48	4.11E-03	3.42E-02	3.04E+00	1.49E+00
96	7.47E-05	6.22E-04	5.53E-02	2.71E-02
120	1.01E-05	8.39E-05	7.45E-03	3.65E-03
168	1.83E-07	1.53E-06	1.35E-04	6.64E-05
336	1.48E-13	1.23E-12	1.09E-10	5.36E-11
672	0.00E+00	0.00E+00	0.00E+00	0.00E+00
In-111 WBC, A(0) = .5 mCi, min concentration, half-time:				
3	6.21E-04	1.24E-01	2.04E+01	8.04E+00
12	5.77E-04	1.15E-01	1.90E+01	7.47E+00
24	5.23E-04	1.05E-01	1.72E+01	6.77E+00
48	4.30E-04	8.60E-02	1.42E+01	5.57E+00
96	2.91E-04	5.82E-02	9.58E+00	3.77E+00
120	2.39E-04	4.78E-02	7.88E+00	3.10E+00
168	1.62E-04	3.23E-02	5.32E+00	2.09E+00
336	4.11E-05	8.22E-03	1.35E+00	5.32E-01
672	2.66E-06	5.31E-04	8.75E-02	3.44E-02
In-111 WBC, A(0) = .5 mCi, max concentration, half-time:				
3	3.10E-03	6.19E-01	1.02E+02	4.01E+01
12	2.96E-03	5.92E-01	9.75E+01	3.83E+01
24	2.79E-03	5.58E-01	9.19E+01	3.61E+01
48	2.48E-03	4.95E-01	8.16E+01	3.21E+01
96	1.95E-03	3.91E-01	6.43E+01	2.53E+01
120	1.73E-03	3.47E-01	5.71E+01	2.25E+01
168	1.37E-03	2.74E-01	4.50E+01	1.77E+01
336	5.95E-04	1.19E-01	1.96E+01	7.71E+00
672	1.13E-04	2.26E-02	3.72E+00	1.46E+00

Table 4 (cont'd)

Cumulative Activity Ingested and Radiation Doses Received from the Radiopharmaceuticals Considered in this Report Under Different Interruption Schedules

Interruption Time (hr)	Cumulative Activity Ingested		Effective Dose Equivalent (mrem)	
	mCi	percent	Newborn	1-Yr-Old
I-123 NaI, A(0) = .4 mCi, min concentration, half-time:				
3	1.03E-02	2.58E+00	6.11E+01	4.20E+01
12	3.53E-03	8.83E-01	2.09E+01	1.44E+01
24	8.45E-04	2.11E-01	5.00E+00	3.44E+00
48	4.84E-05	1.21E-02	2.87E-01	1.97E-01
96	1.59E-07	3.98E-05	9.42E-04	6.48E-04
120	9.12E-09	2.28E-06	5.40E-05	3.71E-05
168	3.00E-11	7.49E-09	1.77E-07	1.22E-07
336	0.00E+00	0.00E+00	0.00E+00	0.00E+00
672	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-123 NaI, A(0) = .4 mCi, max concentration, half-time:				
3	1.08E-02	2.70E+00	6.40E+01	4.40E+01
12	3.70E-03	9.25E-01	2.19E+01	1.51E+01
24	8.86E-04	2.22E-01	5.25E+00	3.61E+00
48	5.08E-05	1.27E-02	3.01E-01	2.07E-01
96	1.67E-07	4.17E-05	9.88E-04	6.79E-04
120	9.56E-09	2.39E-06	5.66E-05	3.89E-05
168	3.14E-11	7.85E-09	1.86E-07	1.28E-07
336	0.00E+00	0.00E+00	0.00E+00	0.00E+00
672	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-123 OIH, A(0) = 2 mCi, min concentration, half-time:				
3	1.63E-02	8.13E-01	3.85E+00	1.62E+00
12	2.76E-03	1.38E-01	6.54E-01	2.76E-01
24	2.60E-04	1.30E-02	6.16E-02	2.60E-02
48	2.31E-06	1.15E-04	5.47E-04	2.31E-04
96	1.82E-10	9.08E-09	4.30E-08	1.82E-08
120	1.61E-12	8.06E-11	3.82E-10	1.61E-10
168	8.79E-17	4.40E-15	2.08E-14	8.78E-15
336	0.00E+00	0.00E+00	0.00E+00	0.00E+00
672	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-123 OIH, A(0) = 2 mCi, max concentration, half-time:				
3	1.24E-01	6.18E+00	2.93E+01	1.24E+01
12	4.18E-02	2.09E+00	9.91E+00	4.18E+00
24	9.86E-03	4.93E-01	2.33E+00	9.85E-01
48	5.48E-04	2.74E-02	1.30E-01	5.47E-02
96	1.69E-06	8.45E-05	4.00E-04	1.69E-04
120	9.38E-08	4.69E-06	2.22E-05	9.37E-06
168	2.89E-10	1.45E-08	6.85E-08	2.89E-08
336	0.00E+00	0.00E+00	0.00E+00	0.00E+00
672	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 4 (cont'd)

Cumulative Activity Ingested and Radiation Doses Received from the Radiopharmaceuticals Considered in this Report Under Different Interruption Schedules

Interruption Time (hr)	Cumulative Activity Ingested		Effective Dose Equivalent (mrem)	
	mCi	percent	Newborn	1-Yr-Old
I-123 mIBG, A(0) = 10 mCi, min concentration, half-time:				
3	5.41E-02	5.41E-01	3.20E+02	2.20E+02
12	3.13E-02	3.13E-01	1.86E+02	1.28E+02
24	1.51E-02	1.51E-01	8.96E+01	6.16E+01
48	3.53E-03	3.53E-02	2.09E+01	1.44E+01
96	1.92E-04	1.92E-03	1.14E+00	7.82E-01
120	4.48E-05	4.48E-04	2.65E-01	1.82E-01
168	2.44E-06	2.44E-05	1.44E-02	9.92E-03
336	9.15E-11	9.15E-10	5.42E-07	3.73E-07
672	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-123 mIBG, A(0) = 10 mCi, max concentration, half-time:				
3	5.41E-02	5.41E-01	3.20E+02	2.20E+02
12	3.13E-02	3.13E-01	1.86E+02	1.28E+02
24	1.51E-02	1.51E-01	8.96E+01	6.16E+01
48	3.53E-03	3.53E-02	2.09E+01	1.44E+01
96	1.92E-04	1.92E-03	1.14E+00	7.82E-01
120	4.48E-05	4.48E-04	2.65E-01	1.82E-01
168	2.44E-06	2.44E-05	1.44E-02	9.92E-03
336	9.15E-11	9.15E-10	5.42E-07	3.73E-07
672	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-125 OIH, A(0) = .01 mCi, min concentration, half-time:				
3	2.52E-04	2.52E+00	2.24E-01	9.04E-02
12	6.84E-05	6.84E-01	6.07E-02	2.45E-02
24	1.20E-05	1.20E-01	1.07E-02	4.31E-03
48	3.72E-07	3.72E-03	3.30E-04	1.33E-04
96	3.55E-10	3.55E-06	3.15E-07	1.27E-07
120	1.10E-11	1.10E-07	9.75E-09	3.94E-09
168	1.05E-14	1.05E-10	9.32E-12	3.77E-12
336	0.00E+00	0.00E+00	0.00E+00	0.00E+00
672	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-125 OIH, A(0) = .01 mCi, max concentration, half-time:				
3	2.52E-04	2.52E+00	2.24E-01	9.04E-02
12	6.84E-05	6.84E-01	6.07E-02	2.54E-02
24	1.20E-05	1.20E-01	1.07E-02	4.31E-03
48	3.72E-07	3.72E-03	3.30E-04	1.33E-04
96	3.55E-10	3.55E-06	3.15E-07	1.27E-07
120	1.10E-11	1.10E-07	9.75E-09	3.94E-09
168	1.05E-14	1.05E-10	9.32E-12	3.77E-12
336	0.00E+00	0.00E+00	0.00E+00	0.00E+00
672	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 4 (cont'd)

Cumulative Activity Ingested and Radiation Doses Received from the Radiopharmaceuticals Considered in this Report Under Different Interruption Schedules

Interruption Time (hr)	Cumulative Activity Ingested		Effective Dose Equivalent (mrem)	
	mCi	percent	Newborn	1-Yr-Old
I-131 OIH, A(0) = .3 mCi, min concentration, half-time:				
3	2.62E-03	8.73E-01	2.91E+00	1.16E+00
12	1.49E-04	4.96E-02	1.65E-01	6.61E-02
24	3.26E-06	1.09E-03	3.61E-03	1.45E-03
48	1.56E-09	5.19E-07	1.73E-06	6.91E-07
96	3.48E-16	1.16E-13	3.86E-13	1.54E-13
120	0.00E+00	0.00E+00	0.00E+00	0.00E+00
168	0.00E+00	0.00E+00	0.00E+00	0.00E+00
336	0.00E+00	0.00E+00	0.00E+00	0.00E+00
672	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-131 OIH, A(0) = .3 mCi, max concentration, half-time:				
3	1.50E-02	4.99E+00	1.66E+01	6.65E+00
12	5.13E-03	1.71E+00	5.69E+00	2.28E+00
24	1.23E-03	4.09E-01	1.36E+00	5.45E-01
48	7.05E-05	2.35E-02	7.82E-02	3.13E-02
96	2.32E-07	7.73E-05	2.58E-04	1.03E-04
120	1.33E-08	4.44E-06	1.48E-05	5.91E-06
168	4.38E-11	1.46E-08	4.86E-08	1.95E-08
336	0.00E+00	0.00E+00	0.00E+00	0.00E+00
672	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tl-201 Cl, A(0) = 3 mCi, min concentration, $t_{1/2}$:				
3	1.22E-02	4.08E-01	1.84E+02	1.04E+02
12	9.72E-03	3.24E-01	1.46E+02	8.26E+01
24	7.49E-03	2.50E-01	1.12E+02	6.36E+01
48	4.92E-03	1.64E-01	7.38E+01	4.18E+01
96	2.45E-03	8.17E-02	3.68E+01	2.08E+01
120	1.76E-03	5.86E-02	2.64E+01	1.50E+01
168	9.10E-04	3.03E-02	1.36E+01	7.74E+00
336	9.11E-05	3.04E-03	1.37E+00	7.74E-01
672	9.13E-07	3.04E-05	1.37E-02	7.76E-03
Tl-201 Cl, A(0) = 3 mCi, max concentration, $t_{1/2}$:				
3	2.37E-02	7.91E-01	3.55E+02	2.01E+02
12	2.12E-02	7.08E-01	3.18E+02	1.80E+02
24	1.86E-02	6.21E-01	2.79E+02	1.58E+02
48	1.51E-02	5.04E-01	2.26E+02	1.28E+02
96	1.16E-02	3.88E-01	1.74E+02	9.86E+01
120	1.07E-02	3.56E-01	1.60E+02	9.10E+01
168	9.41E-03	3.14E-01	1.41E+02	8.00E+01
336	6.71E-03	2.24E-01	1.01E+02	5.70E+01
672	3.53E-03	1.18E-01	5.30E+01	3.00E+01

Table 4 (cont'd)

Cumulative Activity Ingested and Radiation Doses Received from the Radiopharmaceuticals Considered in this Report Under Different Interruption Schedules

Interruption Time (hr)	Cumulative Activity Ingested		Effective Dose Equivalent (mrem)	
	mCi	percent	Newborn	1-Yr-Old
Tc-99m DTPA Aer, A(0) = 1 mCi, min concentration, half-time:				
3	5.14E-05	5.14E-03	1.43E-02	6.09E-03
12	6.98E-06	6.98E-04	1.94E-03	8.26E-04
24	4.87E-07	4.87E-05	1.35E-04	5.76E-05
48	2.37E-09	2.37E-07	6.57E-07	2.80E-07
96	5.60E-14	5.60E-12	1.55E-11	6.63E-12
120	2.72E-16	2.72E-14	7.55E-14	3.22E-14
168	0.00E+00	0.00E+00	0.00E+00	0.00E+00
336	0.00E+00	0.00E+00	0.00E+00	0.00E+00
672	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tc-99m DTPA Aer, A(0) = 1 mCi, max concentration, half-time:				
3	9.93E-04	9.93E-02	2.76E-01	1.18E-01
12	2.86E-04	2.86E-02	7.93E-02	3.38E-02
24	5.43E-05	5.43E-03	1.51E-02	6.43E-03
48	1.96E-06	1.96E-04	5.44E-04	2.32E-04
96	2.55E-09	2.55E-07	7.08E-07	3.02E-07
120	9.21E-11	9.21E-09	2.56E-08	1.09E-08
168	1.20E-13	1.20E-11	3.33E-11	1.42E-11
336	0.00E+00	0.00E+00	0.00E+00	0.00E+00
672	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tc-99m MAG3, A(0) = 10 mCi, min concentration, half-time:				
3	1.29E-03	1.29E-02	1.52E-01	6.66E-02
12	1.74E-04	1.74E-03	2.07E-02	9.04E-03
24	1.22E-05	1.22E-04	1.44E-03	6.30E-04
48	5.92E-08	5.92E-07	7.00E-06	3.06E-06
96	1.40E-12	1.40E-11	1.66E-10	7.25E-11
120	6.80E-15	6.80E-14	8.05E-13	3.52E-13
168	0.00E+00	0.00E+00	0.00E+00	0.00E+00
336	0.00E+00	0.00E+00	0.00E+00	0.00E+00
672	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tc-99m MAG3, A(0) = 10 mCi, max concentration, half-time:				
3	2.39E-02	2.39E-01	2.83E+00	1.24E+00
12	6.88E-03	6.88E-02	8.15E-01	3.56E-01
24	1.31E-03	1.31E-02	1.55E-01	6.77E-02
48	4.72E-05	4.72E-04	5.58E-03	2.44E-03
96	6.14E-08	6.14E-07	7.27E-06	3.18E-06
120	2.22E-09	2.22E-08	2.62E-07	1.15E-07
168	2.89E-12	2.89E-11	3.42E-10	1.50E-10
336	0.00E+00	0.00E+00	0.00E+00	0.00E+00
672	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 4 (cont'd)

Cumulative Activity Ingested and Radiation Doses Received from the Radiopharmaceuticals Considered in this Report Under Different Interruption Schedules

Interruption Time (hr)	Cumulative Activity Ingested		Effective Dose Equivalent (mrem)	
	mCi	percent	Newborn	1-Yr-Old
Tc-99m WBC, A(0) = 30 mCi, min concentration, half-time:				
3	4.78E-02	1.59E-01	1.95E+01	9.02E+00
12	5.10E-03	1.70E-02	2.08E+00	9.63E-01
24	2.58E-04	8.61E-04	1.05E-01	4.88E-02
48	6.63E-07	2.21E-06	2.70E-04	1.25E-04
96	4.36E-12	1.45E-11	1.77E-09	8.23E-10
120	1.11E-14	3.69E-14	4.50E-12	2.09E-12
168	0.00E+00	0.00E+00	0.00E+00	0.00E+00
336	0.00E+00	0.00E+00	0.00E+00	0.00E+00
672	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tc-99m WBC, A(0) = 30 mCi, max concentration, half-time:				
3	2.03E+00	6.76E+00	8.25E+02	3.83E+02
12	6.54E-01	2.18E+00	2.66E+02	1.23E+02
24	1.44E-01	4.81E-01	5.88E+01	2.73E+01
48	7.05E-03	2.35E-02	2.87E+00	1.33E+00
96	1.68E-05	5.61E-05	6.84E-03	3.17E-03
120	8.21E-07	2.74E-06	3.34E-04	1.55E-04
168	1.96E-09	6.53E-09	7.97E-07	3.69E-07
336	0.00E+00	0.00E+00	0.00E+00	0.00E+00
672	0.00E+00	0.00E+00	0.00E+00	0.00E+00