

RSF-035 Human Use of Radiation Guidance Table of Contents

- I. Application Forms
 - 1. Form RSF-021 – Radioisotopes in human research
 - 2. Form RSF-022 – External radiation in human research
 - 3. Form RSF-023 – Continuing Review

- II. Definitions

- III. Dosimetry

- IV. Consent Forms
 - 1. Radiation exposure for diagnostic test
 - 2. Radiation therapy treatments
 - 3. Risk to an Embryo, Fetus, or Breast-Fed Infant
 - 4. Pregnancy Concerns

- V. Risk Statements
 - 1. Diagnostic Risk Statements
 - 2. Radiation Therapy Risk Statements

- VI. Tables
 - 1. Table A - Standard of Care Radiation Therapy Risk Statements

- VII. Tables – Comparison of Detriment with Other Activities
 - 1. Table 1 – Special Radiographic Procedures
 - 2. Table 2 – Radiographic Procedures
 - 3. Table 3 – Nuclear Medicine Procedures For Adult
 - 4. Table 4 – Nuclear Medicine Procedures. For Child (15 yr – 55.2 kg)
 - 5. Table 5 - Nuclear Medicine Procedures. For Child (10 yr -32.0 kg)
 - 6. Table 6 - Nuclear Medicine Procedures. For Child (5 yr -18.2 kg)
 - 7. Table 7 - Nuclear Medicine Procedures. For Child (1 yr – 9.8kg)

Revised March 13, 2007

RSF-035 Human Use of Radiation Application Guide

Instructions to complete information for the applications and consent forms.

Radiation Safety Human Use Research Sub-Committee approval must be obtained for human research that involves any form of radiation, including standard of care (medically indicated). Application must be signed and dated by Principal Investigator (PI) and Department Chairman.

Radiation Safety is available for further assistance at (214)648-2250, ask for Human Use or contact Samantha Sorrells @ 214-648-2292 or Sylvia Revell @ 214-648-2493.

I. Choose proper application form(s):

Type of review	Forms/Application		Items submitted
Initial	<u>RSF-022 Form</u> External radiation in human research	<u>RSF-021 Form</u> Radioisotopes in human research	<u>Original and 11 copies</u> RSF-022 and/or RSF-021 forms; And <u>11 copies of the following:</u> IRB Form NR1 Project Summary Consent Form Protocol/Investigators Brochure
	To be completed when any external radiation (x-ray) is used in conjunction with a research protocol	To be completed when any FDA approved radioisotope or radiopharmaceutical is used in conjunction with a research protocol. Non-FDA approved radioactive research drugs must be submitted to the RDRC.	
	If submitting a study that uses both external radiation and radioisotopes both the RSF-022 and RSF-021 need to be submitted. Both forms need to be signed by the investigator and the department chairman.		
Annual (Continuing)	<u>RSF-023 Form</u> Radiation in human research (Continuing Review)		<u>Original and one copy</u> RSF-023 form; and <u>One copy of the following</u> Updated consent form IRB Form CR IRB Form MOD (if applicable) Project Summary
	To be completed in conjunction with the IRB annual review of research protocols that include radiation.		
Closing	RSF-023 Radiation in human research (Continuing Review)		<u>Original</u> RSF-023 form
	In the comments section please note: "The study is closed" or "Closed to enrollment" and "Participants have completed all radiation exposure. Request closure with SHUR committee".		

Note: Forms can be found on the UT Southwestern Web site EH&S Departmental Home Page under Radiation Safety Program

<http://www8.utsouthwestern.edu/utsw/cda/dept145569/files/146385.html>

- ***RSC/SHUR approval may be submitted concurrently with IRB review***
- ***Committee meets every first and third Tuesday of the month***
- ***Deadline for submission is noon the Tuesday prior to the meeting***
- ***IRB approval is contingent on SHUR Committee approval***
- ***Send applications to Radiation Safety, Mail Code 9053.***

II. Definitions:

Area Scanned – Part of the body that will be in the x-ray beam. Used on RSF-022 under the heading for computed tomography.

1. **Slices, thickness and spacing** – If not defined in the protocol, information should be obtained from the person performing the exam in the CT department; unless it is a special procedure to be defined by the physician.

Area Viewed – Sections of the body that will be in the x-ray beam during a fluoroscopic procedure. Used on RSF-022 form under the heading for fluoroscopy

1. **Percent of additional time for research** – The percentage of radiation that is needed for the research (additional time)
2. **Percent of time medically indicated** – Percentage of radiation the patient receives as standard of care.

Critical organ – Organ that is most susceptible to radiation damage due to a radioisotopic procedure. Used on RSF-021 form; all information for the RSF-021 can be found on the comparison table(s).

Critical organ absorbed dose – The amount of energy absorbed by the critical organ. Needs to be provided on the RSF-021 form; information can be found on the RSF-035 form comparison table(s).

IRB – Institutional Review Board

Non-Patient/Normal – Study participants that do not have the disease being studied, but who will be exposed to radiation as part of the study.

Patients – Patients who have the disease being studied and who will receive the experimental treatment. These individuals will be exposed to the radiation involved in the research protocol.

Patient Controls – Patients who have the disease being studied, but who receive standard of care treatment or a placebo rather than the experimental treatment. These individuals will be exposed to the radiation involved in the research protocol.

RDRC – Radioactive Drug Research Committee

RSC – Radiation Safety Committee

SHUR – Sub committee for the Human Use of Radiation in Research

Standard of Care (Medically Indicated) – Radiographic examinations that would be performed for the disease process being studied even if the participant was not enrolled in a research study.

View – The positions of the body relative to the x-ray beam. Used on the RSF-022 under the heading for radiographic procedure. (Example: AP, PA, Lat, Oblique)

III. Dosimetry:

RSF-022

1. Radiographic Procedure, Fluoroscopic Procedure and Computed Tomography (CT)

- Dosimetry reference (**effective dose**) is provided on the RSF-035 form
 - i. Table 1 – Comparison of Detriment of Special Radiographic Procedures to Other Activities
 - ii. Table 2 – Comparison of Detriment of Radiographic Procedures to Other Activities
 - iii. These tables provide reference for adults only.
 - iv. If one exam contains multiple views for example: DEXA (l-spine, Hip and forearm)] add all effective doses (one effective dose equals 30 mrem).
- Total Effective Dose – Calculate total effective dose by multiplying the effective dose by the number of exams performed.
- If pediatric doses are needed, phone Dr. Thomas Lane (214)648-6780 or Dr. Jon Anderson (214)648-7996.

2. Radiation Therapy

- There is no comparison table available
- References to dose may be provided by the radiation oncologist involved with the study.
- Some study protocols will provide information on the dose and booster dose.

RSF-021

1. Radioisotope Procedure

- All needed dose information is provided on the RSF-035 form
- Comparison of Detriment of Nuclear Medicine Procedures with Other Activities
 - i. Table 3 – Adult
 - ii. Table 4 – Child (15 yr – 55.2 kg)
 - iii. Table 5 – Child (10 yr – 32.0 kg)
 - iv. Table 6 – Child (5 yr – 18.2 kg)
 - v. Table 7 - Infant (1 yr – 9.8 kg)
- Dose references can also be obtained from the Nuclear Medicine package insert

Dosimetry Reference

- Requested on both RSF-022 and RSF-021 forms (must be included)
- Provide where dosimetry numbers were obtained from for example:
 - i. Comparative table – include table number
 - ii. Nuclear Medicine packet insert
 - iii. Radiation oncologist name
 - iv. UTSWMC Medical Physics – provide Medical physicist name

IV. Consent Forms:

The IRB provides a template of a standard consent form for research. Some areas require additional information based on the research protocol while other areas of the consent require deletions. In the template, the IRB consent addresses all types of exams that could be performed and some of the wording may not be needed.

1. Radiation exposure for diagnostic test

- Add in an appropriate risk statement
 - i. If radiation is standard of care – use statement from Section 1.A, under heading **Diagnostic risk statements**
 - ii. If radiation is part of research – choose an appropriate statement from section 1.B, under heading **Diagnostic risk statements** based on total effective dose.
- Do not change wording of radiation risk statement(s)
- All required information for the radiation risk statement can be located on the Comparative Tables – Use the same table that was used to obtain effective dose.

2. Radiation Therapy Treatments

- If participants receive radiation therapy;
 - i. As standard of care – use statement from Section 2.A, under heading **Radiation therapy risk statements** and insert the table of side effects for the appropriate site – Table A
 - ii. As part of research – use statement from section 2.B, under heading **Radiation therapy risk statements**

3. Pregnancy Concerns

- Pregnancy is of special concern and should be addressed if the study includes females with child-bearing potential (minor children, adolescent or mature.) It is suggested that the 10-day rule and/or pregnancy test be used to exclude pregnancy if radioisotopes or radiopharmaceuticals are used. If x-rays are being used, proper shielding of the abdomen may be used for pregnant females.

4. Exclusion Criteria

- It should be determined whether a person has been exposed to radiation from any other research project in the past twelve months which should be considered under exclusion criteria..

RISK STATEMENTS

1. Diagnostic Risk Statements

For diagnostic radiation exposure greater than 5000 mrem, please contact Radiation Safety at 214 648-2250.

A. Radiation Exposure as Part of Standard of Care

The radiation dose that you will get from diagnostic tests is medically indicated for your condition and it is the same that you would get if you were not involved in this research study.

B. Radiation Exposure in Addition to Standard of Care

1. Total Effective Dose: <350 mrem from Research

This research study includes exposure to radiation from diagnostic tests in addition to that which you would receive from standard of care. The additional radiation dose you will get is about (insert percentage from table) % of the average radiation dose from all sources (natural background radiation, consumer appliances, radon gas, medical tests, etc.) that a person in the United States receives each year.

2. Total Effective Dose: >350 mrem from Research

This research study includes exposure to radiation from diagnostic tests in addition to that which you would receive from standard of care. The risk of harm to your body from this radiation can be compared to risks from everyday activities. For example, the risk of developing fatal cancer during your lifetime from this radiation is comparable to the risk of suffering a fatal car crash while driving XX miles in an automobile. The average household in the United States drives 23,000 miles per year (2001 data).

2. Radiation Therapy Risk Statements

A. Standard of Care

The radiation therapy used in this research is the standard radiation therapy for your health problem; therefore, the risk of harm to your body is the same. Your radiation doctor will discuss the known risks of radiation therapy with you and ask you to sign a separate specific treatment site consent form.

Possible side effects of radiation therapy to the (site) include: (select the appropriate short and long term effects from Table A below and include them in the consent form)

B. Research

The radiation therapy in this research is different from the standard radiation therapy for your health problem. The radiation dose that will be used is (more/less/given in a different way) than the standard treatment. The potential risks of this dose include: (consult with radiation oncologist for assistance).

Table A
Standard of Care Radiation Therapy Risk Statements

Site	Short term effects	Long term effects
Total Body Irradiation (Bone Marrow)	<ol style="list-style-type: none"> 1. Loss of appetite, nausea, vomiting. 2. Diarrhea 3. Reduced and sticky saliva, swelling o the salivary gland(s), loss of taste. 4. Hair loss. 5. Sore mouth and throat, difficulty swallowing 6. Permanent destruction of bone marrow leading to infection, bleeding, and possible death. 7. Inflammation of the lung with fever, dry cough and difficulty breathing with possible fatal lung failure. 8. Damage to liver with possible fatal liver failure. 9. In children, there reactions are likely to be intensified by chemotherapy before, during and after radiation therapy. 10. In children, depression of blood counts leading to increased risk of infection and/or bleeding is more common. 	<ol style="list-style-type: none"> 1. Lung scarring causing shortness of breath, infection, and fatal lung failure. 2. Cataract formation in the eyes. Possible loss of vision. 3. Testicular damage in males causing sterility 4. Ovarian damage in females causing premature menopause and sterility. 5. Increased risk of secondary cancer.

Site	Short term effects	Long term effects
Head/Neck	<ol style="list-style-type: none"> 1. Reduced and sticky saliva, loss of taste and appetite, altered sense of smell, nausea. 2. Sore throat, difficulty swallowing, weight loss, fatigue. 3. Skin changes: redness, irritation, scaliness, blistering or ulceration, color change, thickening, hair loss. 4. Hoarseness, cough, loss of voice, and swelling of the airway. 5. Blockage and crusting of nasal passages. 6. Inflammation of ear canal, feeling of stopped-up ear, hearing loss, dizziness. 7. Dry and irritable eye(s). 8. In children, these reactions are likely to be intensified by chemotherapy before, during, or after radiation therapy. 9. In children, depression of blood counts leading to increased risk of infection and/or bleeding is more common. 	<ol style="list-style-type: none"> 1. Dry mouth and altered sense or loss of taste. 2. Tooth decay and gum changes. 3. Bone damage, especially in jaws. 4. Stiffness and limitation of jaw movement. 5. Changes in skin texture and/or coloration, permanent hair loss, and scarring of skin. 6. Swelling of tissues, particularly under the chin. 7. Throat damage causing hoarseness, pain, or difficulty breathing or swallowing 8. Eye damage causing dry eye(s), cataract, loss of vision, or loss of eye(s). 9. Ear damage causing dryness of ear canal, fluid collection in middle ear, hearing loss 10. Brain, spinal cord, or nerve damage causing alteration of thinking ability or memory and/or loss of strength, feeling, or coordination in any part of the body. 11. Pituitary or thyroid gland damage requiring long-term hormone replacement therapy. 12. In children, there may be additional late reactions as follows: <ol style="list-style-type: none"> a. Disturbances of bone and tissue growth. b. Bone damage to face, causing abnormal development c. Brain Damage causing a loss of intellectual ability, learning capacity, and reduced intelligence quotient (I.Q.) d. Secondary cancers developing in irradiated area.

Site	Short term effects	Long term effects
Lung	<ol style="list-style-type: none"> 1. Skin changes: redness, irritation, scaliness, ulceration, coloration, thickening, hair loss. 2. Inflammation of esophagus causing pain on swallowing, heartburn, or sense of obstruction. 3. Loss of appetite, nausea, vomiting. 4. Weight loss, weakness, vomiting. 5. Inflammation of the lung with pain, fever, and cough. 6. Inflammation of the heart sac with chest pain and palpitations. 7. Bleeding or creation of a fistula resulting from tumor destruction. 8. Depression of blood counts leading to increased risk of infections and/or bleeding 9. Intermittent electric shock-like feelings in the lower spine or legs on bending the neck. 10. In children, there reactions are likely to be intensified by chemotherapy before, during, and after radiation therapy. 11. In children, depression of blood counts leading to increased risk of infection and/ or bleeding is more common. 	<ol style="list-style-type: none"> 1. Changes in skin texture and/or coloration, permanent hair loss, and scarring of the skin. 2. Lung scarring or shrinkage causing shortness of breath. 3. Narrowing of esophagus causing swallowing problems. 4. Constriction of heart sac which may require surgical correction 5. Damage to heart muscle or arteries leading to heart failure. 6. Fracture of ribs. 7. Nerve damage causing pain, loss of strength or feeling in arms. 8. Spinal cord damage causing loss of strength or feeling in arms and legs and/or loss of control of bladder and rectum. 9. In children, there may be additional late reactions as follows: <ol style="list-style-type: none"> a. Disturbances of bone and tissue growth. b. Bone damage to spine causing stunting of growth, curvature, and/or reduction in height. c. Underdevelopment or absence of development of female breast. d. Secondary cancers developing in the irradiated area.

Site	Short term effects	Long term effects
Abdomen	<ol style="list-style-type: none"> 1. Skin changes: redness, irritation, scaliness, blistering, ulceration, coloration, thickening, hair loss 2. Loss of appetite, nausea, vomiting 3. Weight loss, weakness, fatigue 4. Inflammation of bowel causing cramping and diarrhea 5. Inflammation of stomach causing indigestion, heartburn and ulcers. 6. Depression of blood counts leading to increased risk of infections and/or bleeding 7. In children, these reactions are likely to be intensified by chemotherapy before, during and after radiation therapy. 8. In children, depression of blood counts leading to increased risk of infection and/or bleeding is more common. 	<ol style="list-style-type: none"> 1. changes in skin texture and/or coloration, permanent hair loss, and scarring of the skin 2. Stomach damage causing persistent indigestion, pain, and bleeding 3. Bowel damage causing narrowing or adhesions of bowel with obstruction, ulceration, or bleeding which may require surgical correction, chronic diarrhea, or poor absorption of food elements. 4. Kidney damage leading to kidney failure and/or high blood pressure. 5. Liver damage leading to liver failure. 6. Spinal cord or nerve damage causing loss of strength or feeling in legs and/ or loss of control of bladder and/or rectum. 7. In children, there may be additional late reaction as follows: <ol style="list-style-type: none"> a. Disturbances of bone and tissue growth b. Bone damage to spine causing stunting of growth, curvature, and/or reduction in height. c. Bone damage to pelvis causing stunting of bone growth and/or abnormal development. d. Secondary cancers developing in the irradiated area.

Site	Short term effects	Long term effects
Breast	<ol style="list-style-type: none"> 1. Skin changes: redness, irritation, scaliness, blistering, ulceration, coloration, thickening, hair loss 2. Breast changes, including swelling, tightness, or tenderness. 3. Inflammation of the esophagus causing pain on swallowing, heartburn, or sense of obstruction. 4. Lung inflammation with cough. 5. Inflammation of heart sac with chest pain and palpitations. 	<ol style="list-style-type: none"> 1. Changes in skin texture and/or coloration, permanent hair loss, scarring of the skin 2. Breast changes, including thickening, firmness, tenderness, shrinkage. 3. Swelling of the arm 4. Stiffness and discomfort in shoulder joint. 5. Rib or lung damage causing pain, loss of strength or feeling in the arm. 6. Damage to heart muscle or arteries or heart sac leading to heart failure. 7. Nerve damage causing pain, loss of strength or feeling in the arm.

Site	Short term effects	Long term effects
Prostate/Testicular	<ol style="list-style-type: none"> 1. Inflammation of bowel causing cramping and diarrhea. 2. Inflammation of rectum and anus causing pain, spasm, discharge, bleeding. 3. Bladder inflammation causing burning, frequency, spasm, pain, and/or bleeding. 4. Skin changes: redness, irritation, scaliness, blistering or ulceration, coloration, thickening, hair loss, 5. Depression of blood counts leading to increased risk of infection and/or bleeding. 6. In children, these reactions are likely to be intensified by chemotherapy before, during, or after radiation therapy. 7. In children, depression of blood counts leading to increased risk of infection and/or bleeding is more common. 	<ol style="list-style-type: none"> 1. Bowel damage causing narrowing or adhesions of the bowel with obstruction, ulceration, bleeding, chronic diarrhea, or poor absorption of food elements and may require surgical correction or colostomy. 2. Bladder damage with loss of capacity, frequency of urination, blood in urine, recurrent urinary infections, pain, or spasm which may require urinary diversion and/or removal of bladder. 3. Changes in skin texture and/or coloration, permanent hair loss, and scarring of skin/ 4. Bone damage leading to fractures. 5. Testicular damage causing reduced sperm counts, infertility, sterility, or risk of birth defects. 6. Impotence (loss of erection) or sexual dysfunction. 7. Swelling of the genitalia or legs. 8. Nerve damage causing pain, loss of strength or feeling in legs, and/or loss of control of bladder or rectum 9. Fistula between the bowel and other organs. 10. In children, there may be additional late reactions as follows: <ol style="list-style-type: none"> a. Disturbances of bone and tissue growth. b. Bone damage to pelvis and hips, causing stunting of bone growth and/or abnormal development. c. Secondary cancers developing in the irradiated areas.

Site	Short term effects	Long term effects
Female Pelvis	<ol style="list-style-type: none"> 1. Inflammation of bowel causing cramping and diarrhea. 2. Inflammation of rectum and anus causing pain, spasm, discharge, bleeding. 3. Bladder inflammation causing burning, frequency, spasm, pain, bleeding. 4. Skin changes: redness, irritation, scaliness, blistering or ulceration, coloration, thickening, hair loss. 5. Disturbance of menstrual cycle. 6. Vaginal discharge, pain, irritation, bleeding. 7. Depression of blood counts leading to increased risk of infection and/or bleeding. 8. In children, these reactions are likely to be intensified by chemotherapy before, during, or after radiation therapy. 9. In children, depression of blood counts leading to increased risk of infection and/or bleeding is more common. 	<ol style="list-style-type: none"> 1. 1. Bowel damage causing narrowing or adhesions of the bowel with obstruction, ulceration, bleeding, chronic diarrhea, or poor absorption of food elements and may require surgical correction or colostomy. 2. Bladder damage with loss of capacity, frequency of urination, blood in urine, recurrent urinary infections, pain, or spasm which may require urinary diversion and/or removal of bladder. 3. Changes in skin texture and/or coloration, permanent hair loss, and scarring of skin. 4. Bone damage leading to fractures. 5. Ovarian damage causing infertility, sterility, or premature menopause. 6. Vaginal damage leading to dryness, shrinkage, pain, bleeding, or sexual dysfunction 7. Swelling of the genitalia or legs. 8. Nerve damage causing pain, loss of strength or feeling in legs, and/or loss of control of bladder or rectum. 9. Fistula between the bladder and/or bowel and/or vagina. 10. In children, there may be additional late reaction as follows: <ol style="list-style-type: none"> a. Disturbances of bone and tissue growth. b. Bone damage to pelvis and hips, causing stunting. c. Secondary cancers developing in the irradiated area.

Site	Short term effects	Long term effects
Other	Contact Radiation Oncologist	Contact Radiation Oncologist

Table 1. Comparison of Detriment of *Special* Radiographic Procedures to Other Activities.

(Based on Standard Reference Man)

For Children's data, consult Medical Physics @ 214-648-2298.

Procedure	Effective Dose (mrem)	Percentage of Annual US Avg. Natural Background	No. of Cigarettes Smoked	No. of Miles Driven/Ridden
Cholecystography	100	28%	75	95
Barium Swallow	330	92%	245	305
Barium Enema	710	-	520	655
Cine Fluoro Screening (per min)	120 per min.	33% per min.	90	115
Digital Subtraction Angiography				
Carotoid	400	-	295	370
Femoral	400	-	295	370
Hepatic	2200	-	1610	2025
Renal	1400	-	1025	1290
Coronay Angiogram	3000	-	2190	2760

Table 2. Comparison of Detriment of Radiographic Procedures to Other Activities.

(Based on Standard Reference Man)

For Children's data, consult Medical Physics @ 214-648-2298.

Procedure	Effective Dose (mrem)	Annual US Avg. Natural Background	No. of Cigarettes Smoked	No. of Miles Driven/Ridden
Mammogram	35	10%	30	35
Chest X-ray				
PA + LAT	5	1%	4	5
PA	3	1%	2	3
Skull X-ray				
Series	15	4%	15	15
AP	6	2%	4	6
LAT	3	1%	2	3
Cervical Spine	20	6%	15	20
Thoracic Spine				
Series	90	25%	70	85
AP	48	13%	40	45
LAT	29	8%	25	30
Lumbar Spine				
Series	230	64%	170	215
AP	90	25%	70	85
LAT	53	15%	40	50
L5 - S1	50	14%	40	50
Pelvis X-ray (AP)	150	42%	110	140
Hip X-ray	83	23%	65	80
Extremity X-ray (hands, feet)	1	0%	1	1
Skeletal Survey	350	97%	260	325
Abdomen (KUB)	140	39%	105	130
CT				
Head/Neck	200	56%	150	185
Chest	740	206%	545	685
Abdomen/Kidney	860	239%	630	795
Lumbar Spine	730	203%	535	675
DEXA Scan				
Lumbar spine	10	3%	8	10
Hip	10	3%	8	10
Lateral spine	35	10%	26	33
Forearm	10	3%	8	10
Whole body	1.5	0%	2	2

**Table 3. Comparison of Detriment of Nuclear Medicine Procedures with other Activities
Based on ICRP 60 Meth. For Adult**

Procedure	Activity (mCi)	Effective Dose {*A} (mrem)	Critical Organ {*B}	Critical Organ Dose {*B} (mrad)	Ovaries Dose {*B} (mrad)	Testes Dose {*B} (mrad)	% Annual US Avg Nat Bkgd	No. cigs smoked	No. miles driven
F-18 FDG tumor localization	20	1785	{*D} bladder wall	14,060	1,260	965	-	1305	1645
Ga-67 Citrate abscess scan/infection	8	2960	bone surface	19,240	2,340	1,540	-	2165	2725
I-123 Iodide thyroid scan	0.2	150	thyroid	2,520	10	5	45	110	140
I-125 sodium iothalamate glofil {*C}	0.03	0.14	kidneys	3.3	1.0	4.2	5	5	5
I-131 Iodide thyroid or TB scan	3	2045	thyroid	3,774,000	535	315	-	1495	1885
I-131 MIBG tumor localization	0.5	280	liver	1,445	140	110	80	205	260
In-111 DTPA CSF leak/cisternogram	1.5	200	{*D} bladder wall	2,390	140	110	60	150	185
In-111 OctreoScan neuro endo.tumor	6	1810		ND	ND	ND	-	1325	1670
In-111 ProstaScint prost. Cancer {*F}	5	30	liver	18,500	n/a	5,600	10	25	30
In-111 WBC infection localization	0.5	760	spleen	10,915	245	60	-	555	700
Tc-99m Choletec hepatobiliary {*D}	6	555	gallbladder	2,445	425	380	-	410	515
Tc-99m DMSA renal scan	6	205	kidneys	4,220	80	40	60	150	190
Tc-99m DTPA renal scan	20	525	bladder wall	5,700	410	285	-	385	485
Tc-99m ECD-neurolite brain scan {*B}	30	1225	bladder wall	8,105	870	390	-	895	1130
Tc-99m HMPAO brain scan	30	1210	gallbladder	5,665	780	260	-	885	1115
Tc-99m Lung ventilation DTPA aerosol	20	430	bladder wall	3,700	335	195	-	315	400
Tc-99m MAA lung perfusion	5	225	lungs	1,240	35	25	65	165	210
Tc-99m MAG3 renal scan	10	370	bladder wall	5,180	250	175	-	275	345
Tc-99m MDP bone scan	25	440	bladder	5,460	310	205	-	325	405
Tc-99m Pertechnetate Meckel's scan	15	635	ULI	1,555	480	180	-	465	585
Tc-99m Pertechnetate thyroid scan	5	215	ULI	520	160	60	60	160	200
Tc-99m PYP myo. infarct. scan	25	460	{*D} bone surf.	3,515	355	2,405	-	340	425
Tc-99m RBC GI Bleed & MUGA	25	570	spleen	1,025	430	310	-	420	525
Tc-99m Sestamibi myo. perfusion	30	1190	ULI	5,550	1,555	390	-	870	1095
Tc-99m Sestamibi parathyroid	20	795	ULI	3,700	1,040	260	-	585	735
Tc-99m Sulfur colloid bone marrow	15	450	liver	4,775	90	15	-	330	415
Tc-99m Sulfur colloid gastric empty	1	100	ULI	445	90	5	30	75	95
Tc-99m Sulfur colloid liver scan	6	180	liver	1,910	40	5	50	135	170
Tc-99m Sulfur colloid lymphoscint {*E}	2	40	lymph nodes	6,660	ND	ND	15	30	40
Tl-201 Chloride myocardial perfusion	3.5	3550	testes	10,360	1,235	10,360	-	2595	3270
Xe-133 Inhalation brain scan	60	70	lungs	185	25	25	20	55	65
Xe-133 Inhalation lung scan	20	25	lungs	65	10	10	10	20	25

*A - Comparative Analysis of Dosimetry Parameters for Nuclear Medicine (Effective Dose-ICRP 60) - Toohey & Stabin

*B - Radiation Dose Estimates to Adults and Children from Various Radiopharmaceuticals. April 30, 1996 RIDIC Oak Ridge Inst. For Science & Education

*C - Gofcil-125 Iso-Tex Diagnostics Package Insert - A Schema for Absorbed Dose Calculation for Biologically Distributed Radionuclides. Sup. No. 1, MIRP Pamphlet No. 1, J. Nuc Med., p 7, 1968.

*D - Radiation Dose Estimates for Radiopharmaceuticals. M. Stabin, J. Stubbs, and R. Toohey April 30, 1996. RIDIC Oak Ridge Inst. For Science and Education.

*E - Radiopharmaceuticals for Lymphoscintigraphy: Including Dosimetry and Radiation Considerations. - D. Eshima, T. Tauconnier, L. Eshirna, J. Thornback. Seminars in Nuc. Med., Vol.XXX, No.1 Jan. 2000 pg. 2!

*F - ProstaScint Product Information. Cytogen Corporation. Data Supplied by Oak Ridge Associated Universities. Radiopharmaceutical Internal Dose Information, 1984.

ND - Not Determined

Table 4. Comparison of Detriment of Nuclear Medicine Procedures with other Activities Based on ICRP 60 Meth. For Child (15 Yr - 55.2 kg)

Procedure	Activity (mCi)	Effective Dose {*A} (mrem)	Critical Organ {*B}	Critical Organ Dose {*B} (mrad)	Ovaries Dose {*B} (mrad)	Testes Dose {*B} (mrad)	% Annual US Avg Nat Bkgd	No. cigs smoked	No. miles driven
F-18 FDG tumor localization {*D}		0	bladder	0	0	0	0	0	0
Ga-67 Citrate abscess scan	4.6	2115	bone surf.	14,300	1,685	1,090	-	1545	1950
I-123 Iodide thyroid scan	0.2	235	thyroid	4,070	15	10	70	175	220
I-125 sodium iothalamate glofil {*C}	0.02	0.01	kidneys	5	5	5	5	5	5
I-131 Iodide thyroid or TB scan	1.6	179970	thyroid	3,374,400	360	215	-	131380	165575
I-131 MIBG tumor localization	0.2	525	liver	740	70	60	-	385	485
In-111 DTPA {*D}	0.9	105	bladder	1,035	75	60	30	80	100
In-111 WBC infection localization	0.46	890	spleen	13,960	275	75	-	650	820
Tc-99m DMSA renal scan	4.6	195	kidneys	3,915	80	45	55	145	180
Tc-99m DTPA renal scan	9.2	305	blad. wall	3,305	235	180	85	225	285
Tc-99m ECD-neurolite brain scan	18.4	785	blad. wall	6,335	675	330	-	575	725
Tc-99m HMPAO brain scan	18.4	940	gallbladder	3,950	610	205	-	690	865
Tc-99m Lung ventilation	4.6	135	bladder wall	1,090	100	65	40	100	125
Tc-99m MAA lung perfusion	4.6	290	lung	1,670	40	25	85	215	270
Tc-99m MAG3 renal scan	4.5	210	bladder wall	2,835	145	110	60	155	195
Tc-99m MDP bone scan	18.4	405	bladder	5,175	290	205	-	300	375
Tc-99m Pertechnetate Meckel's scan	9.2	535	ULI	1,230	375	150	-	395	495
Tc-99m Pertechnetate thyroid scan	4.6	270	ULI	615	190	75	75	200	250
Tc-99m RBC GI Bleed & MUGA	18.4	545	spleen	1,840	410	280	-	400	505
Tc-99m Sestamibi myo. perfusion	23	1440	ULI	5,450	1,535	395	-	1055	1325
Tc-99m Sestamibi parathyroid	23	1440	ULI	5,450	1,535	395	-	1055	1325
Tc-99m Sulfur colloid gastric empty	1	120	ULI	555	115	10	35	90	115
Tc-99m Sulfur colloid liver scan	4.6	180	liver	1,875	40	10	50	135	170
Tl-201 Chloride myocardial perfusion	3.7	3615	testes	26,015	1,645	26,015	-	2640	3330
Xe-133 Inhalation brain scan	27.6	30	lung	125	15	15	10	25	30
Xe-133 Inhalation lung scan	27.6	30	lung	125	15	15	10	25	30

*A - Comparative Analysis of Dosimetry Parameters for Nuclear Medicine (Effective Dose-ICRP 60) - Toohey & Stabin

*B - Radiation Dose Estimates to Adults and Children from Various Radiopharmaceuticals. April 30, 1996 RIDIC Oak Ridge Inst. For Science & Education

*C - Golfil-125 Iso-Tex Diagnostics Package Insert - A Schema for Absorbed Dose Calculation for Biologically Distributed Radionuclides.

Supplement No. 1, MIRD Pamphlet No. 1, J. Nuc Med., p 7, 1968.

*D - Annals of the ICRP Publication 53. Radiation Dose to Patients from Radiopharmaceuticals 1993.

Table 5. Comparison of Detriment of Nuclear Medicine Procedures with other Activities Based on ICRP 60 Meth. For Child (10 Yr - 32.0 kg)

Procedure	Activity (mCi)	Effective Dose {*A} (mrem)	Critical Organ {*B}	Critical Organ Dose {*B} (mrad)	Ovaries Dose {*B} (mrad)	Testes Dose {*B} (mrad)	% Annual US Avg Nat Bkgd	No. cigs smoked	No. miles driven
F-18 FDG tumor localization {*D}		0	bladder	0	0	0	0	0	0
Ga-67 Citrate abscess scan	3.2	2335	bone surf.	16,580	1,780	1,185	-	1705	2150
I-123 Iodide thyroid scan	0.2	355	thyroid	6,220	15	10	100	260	330
I-125 sodium iothalamate glofil {*C}	0.02	0.01	kidneys	5	5	3	5	5	5
I-131 Iodide thyroid or TB scan	1.2	209125	thyroid	3,907,200	375	225	-	152665	192395
I-131 MIBG tumor localization	0.32	475	liver	1,895	170	135	-	350	440
In-111 DTPA {*D}	0.6	100	bladder	980	75	70	30	75	95
In-111 WBC infection localization	0.32	920	spleen	14,210	275	80	-	675	850
Tc-99m DMSA renal scan	3.2	180	kidneys	3,675	80	40	50	135	170
Tc-99m DTPA renal scan	6.3	170	bladder wall	1,355	145	115	50	125	160
Tc-99m ECD-neurolite brain scan	12.6	550	bladder wall	2,565	515	220	-	405	510
Tc-99m HMPAO brain scan	12.6	890	gallbladder	3,450	560	180	-	650	820
Tc-99m Lung ventilation	3.2	105	bladder wall	585	80	50	30	80	100
Tc-99m MAA lung perfusion	3.2	290	lung	1,660	45	30	85	215	270
Tc-99m MAG3 renal scan	3	100	bladder wall	1,225	65	60	30	75	95
Tc-99m MDP bone scan	12.6	425	bladder	5,595	280	220	-	315	395
Tc-99m Pertechnetate Meckel's scan	6.3	525	ULI	1,400	330	130	-	385	485
Tc-99m Pertechnetate thyroid scan	3.2	270	ULI	715	170	65	75	200	250
Tc-99m RBC GI Bleed & MUGA	12.6	555	spleen	1,820	405	300	-	410	515
Tc-99m Sestamibi myo. perfusion	15.8	1545	ULI	5,850	1,520	445	-	1130	1425
Tc-99m Sestamibi parathyroid	15.8	1545	ULI	5,850	1,520	445	-	1130	1425
Tc-99m Sulfur colloid gastric empty	0.6	110	ULI	535	100	10	35	85	105
Tc-99m Sulfur colloid liver scan	3.2	190	liver	1,895	50	10	55	140	175
Tl-201 Chloride myocardial perfusion	2.5	9345	testes	138,750	1,760	138,750	-	6825	8600
Xe-133 Inhalation brain scan	18.9	30	lung	130	15	15	10	25	30
Xe-133 Inhalation lung scan	18.9	30	lung	130	15	15	10	25	30

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Supplement No. 1, MIRP Pamphlet No. 1, J. Nuc Med., p 7, 1968.

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Table 6. Comparison of Detriment of Nuclear Medicine Procedures with other Activities Based on ICRP 60 Meth. For Child (5 Yr - 18.2 kg)

Procedure	Activity (mCi)	Effective Dose {*A} (mrem)	Critical Organ {*B}	Critical Organ Dose {*B} (mrad)	Ovaries Dose {*B} (mrad)	Testes Dose {*B} (mrad)	% Annual US Avg Nat Bkgd	No. cigs smoked	No. miles driven
F-18 FDG tumor localization {*D}		0	bladder	0	0	0	0	0	0
Ga-67 Citrate abscess scan	2.2	2475	bone surf.	18,725	1,795	1,305	-	1810	2280
I-123 Iodide thyroid scan	0.1	380	thyroid	6,660	15	10	-	280	350
I-125 sodium iothalamate glofil {*C}	0.02	0.01	kidneys	5	5	10	5	5	5
I-131 Iodide thyroid or TB scan	0.98	387985	thyroid	7,252,000	475	300	-	283230	356950
I-131 MIBG tumor localization	0.22	210	liver	1,955	180	150	60	155	195
In-111 DTPA {*D}	0.49	125	bladder	1,180	90	85	35	95	115
In-111 WBC infection localization	0.22	970	spleen	15,470	265	85	-	710	895
Tc-99m DMSA renal scan	2.2	180	kidneys	3,665	85	45	50	135	170
Tc-99m DTPA renal scan	4.3	175	bladder wall	1,370	145	125	50	130	165
Tc-99m ECD-neurolite brain scan	8.6	580	bladder wall	2,645	510	240	-	425	535
Tc-99m HMPAO brain scan	8.6	1015	gallbladder	4,140	575	205	-	745	935
Tc-99m Lung ventilation	2.2	110	bladder wall	635	85	60	35	85	105
Tc-99m MAA lung perfusion	2.2	300	lung	1,710	50	35	85	220	280
Tc-99m MAG3 renal scan	2.45	115	bladder wall	1,545	80	75	35	85	110
Tc-99m MDP bone scan	8.6	455	bladder	6,685	285	235	-	335	420
Tc-99m Pertechnetate Meckel's scan	4.3	560	thyroid	1,910	335	140	-	410	520
Tc-99m Pertechnetate thyroid scan	2.2	285	thyroid	980	175	75	80	210	265
Tc-99m RBC GI Bleed & MUGA	8.6	555	spleen	1,850	415	320	-	410	515
Tc-99m Sestamibi myo. perfusion	10.8	1675	ULI	6,395	1,520	480	-	1225	1545
Tc-99m Sestamibi parathyroid	10.8	1675	ULI	6,395	1,520	480	-	1225	1545
Tc-99m Sulfur colloid gastric empty	0.5	150	ULI	685	115	15	45	110	140
Tc-99m Sulfur colloid liver scan	2.2	190	liver	1,875	60	15	55	140	175
Tl-201 Chloride myocardial perfusion	1.7	8430	testes	113,220	1,825	113,220	-	6155	7760
Xe-133 Inhalation brain scan	12.9	35	lung	135	20	20	10	30	35
Xe-133 Inhalation lung scan	12.9	35	lung	135	20	20	10	30	35

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Table 7. Comparison of Detriment of Nuclear Medicine Procedures with other Activities Based on ICRP 60 Meth. For Infant (1 Yr - 9.8 kg)

Procedure	Activity (mCi)	Effective Dose {*A} (mrem)	Critical Organ {*B}	Critical Organ Dose {*B} (mrad)	Ovaries Dose {*B} (mrad)	Testes Dose {*B} (mrad)	% Annual US Avg Nat Bkgd	No. cigs smoked	No. miles driven
F-18 FDG tumor localization {*D}		0	bladder	0	0	0	0	0	0
Ga-67 Citrate abscess scan	1.45	2615	bone surf.	28,435	1,990	1,560	-	1910	2410
I-123 Iodide thyroid scan	0.1	710	thyroid	12,580	20	10	-	520	655
I-125 sodium iothalamate glofil {*C}	0.02	0.01	kidneys	5	5	5	5	5	5
I-131 Iodide thyroid or TB scan	0.4	304880	thyroid	5,772,000	360	225	-	222565	280490
I-131 MIBG tumor localization	0.15	110	liver	2,500	230	185	35	85	105
In-111 DTPA {*D}	0.2	90	bladder	890	65	70	25	70	85
In-111 WBC infection localization	0.15	1205	spleen	17,760	275	100	-	880	1110
Tc-99m DMSA renal scan	1.45	200	kidneys	4,185	100	50	60	150	185
Tc-99m DTPA renal scan	2.9	150	bladder wall	850	130	110	45	110	140
Tc-99m ECD-neurolite brain scan	5.8	560	gallbladder	4,940	410	215	-	410	520
Tc-99m HMPAO brain scan	5.8	1170	gallbladder	9,445	520	215	-	855	1080
Tc-99m Lung ventilation	1.45	120	bladder wall	755	90	65	35	90	115
Tc-99m MAA lung perfusion	1.45	370	lung	2,150	60	40	-	275	345
Tc-99m MAG3 renal scan	1	45	bladder wall	555	30	30	15	35	45
Tc-99m MDP bone scan	5.8	565	bladder	10,520	325	280	-	415	520
Tc-99m Pertechnetate Meckel's scan	2.9	665	thyroid	2,470	365	155	-	490	615
Tc-99m Pertechnetate thyroid scan	1.45	335	thyroid	1,235	185	80	95	245	310
Tc-99m RBC GI Bleed & MUGA	5.8	675	spleen	0	495	390	-	495	625
Tc-99m Sestamibi myo. perfusion	7.25	1755	ULI	4,295	1,235	485	-	1285	1615
Tc-99m Sestamibi parathyroid	7.25	1735	ULI	4,295	1,235	485	-	1270	1600
Tc-99m Sulfur colloid gastric empty	0.2	90	LLI	475	55	10	25	70	85
Tc-99m Sulfur colloid liver scan	1.45	230	liver	2,200	70	20	65	170	215
Tl-201 Chloride myocardial perfusion	1.2	9240	testes	106,560	2,355	106,560	-	6750	8505
Xe-133 Inhalation brain scan	8.7	45	lung	185	25	25	15	35	45
Xe-133 Inhalation lung scan	8.7	45	lung	185	25	25	15	35	45

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