

SNMMI clinical guidelines

<http://www.snmmi.org/ClinicalPractice/content.aspx?ItemNumber=10817&navItemNumber=10786>

Pediatric activity should follow image gently guidelines <https://www.imagegently.org/Procedures/Nuclear-Medicine>

Radiopharmaceutical- Technetium Labeled	Trade Name "Common name"	Clinical Use	Dosages* (mCi)
<b><u>99mTc Physical Half-life (P) 6h</u></b> Technetium-99m-pertechnetate (from Molybdenum-99 generator) High Specific Activity from LEU of U235 fission Q9969 \$10	"Tech" "TcO4" "Tc99m" "99mTc"	Labeling chelates Thyroid Imaging Salivary gland function Dacryoscintigraphy Cystography Meckel's	Range 10 10 0.1 1 10
Tc99m pertechnetate labeled carbon sys.	Technegas aerosol, 9/2023 Cyclomedica; C9150 per study dose	Ventilation	30
Tc99m-bicisate (ECD)	Neurolite Lantheus; A9557 per study dose; up to 25 mCi	Brain perfusion imaging	25
Tc99m-disofenin (DISIDA)	Hepatolite (Pharma is DC Dec 2019)	Hepatobiliary Imaging Gallbladder EF	5
Tc99m-exametazine (HMPAO)	Ceretec-available from DraxImage and GE; A9521 up to 25 mCi A9569 WBC per study dose	Brain perfusion imaging- stabilized Infection WBC label- unstabilized	25 Range
Tc99m-macroaggregated albumin	"MAA" Curium and DraxImage; A9540 up to 10 mCi	Pulmonary perfusion and embolism, Pre Y-90 SIR Spheres distribution test	Particle dependen t 3-5
Tc99m-mebrofenin	Choletec "Mebro" Bracco, Sun Pharma; A9537 up to 15 mCi	Hepatobiliary Imaging Gallbladder EF	5
Tc99m-medronate	"MDP" DraxImage MDP-25; Cardinal Health, Sun Pharma A9503	Bone imaging	25
Tc99m-mertiatide	"MAG3" Curium, DraxImage, Sun Pharma; A9562 up to 15 mCi	Renal imaging (ERPF)	10
Tc99m-oxidronate	"HDP" Curium; A9561; up to 30 mCi	Bone imaging	25
Tc99m-pentetate Pentetate Kit Jubilant-Drax (12/89)	"DTPA" DraxImage; A9539 up to 25 mCi A9567 up to 75 mCi	Renal imaging (GFR function, renal flow studies) Lung Ventilation for matching with MAA Cardiac first pass Cerebral-Peritoneal shunt	3, 10 35-75 25 1

**SNMMI clinical guidelines**

<http://www.snmmi.org/ClinicalPractice/content.aspx?ItemNumber=10817&navItemNumber=10786>

Pediatric activity should follow image gently guidelines <https://www.imagegently.org/Procedures/Nuclear-Medicine>

<b>Radiopharmaceutical- Technetium Labeled</b>	<b>Trade Name “Common name”</b>	<b>Clinical Use</b>	<b>Dosages* (mCi)</b>
Tc99m-pyrophosphate Cis-Pyro Sun Pharm (6/87) Technescan PYP Kit Curium (5/74)	“Hot pyp” A9538 up to 25 mCi “Cold pyp” or “pyp”	Amyloidosis TTR-CM (transthyretin- cardiomyopathy) Myocardial infarct imaging Cisternography-2013 Tin used for labeling RBC	15  25 1 0
Tc99m-red blood cells	Ultratag Curium; A9560; per study dose; up to 30 mCi	GI bleeds Hemangioma ENVG (MUGA) RNVG (MUGA) L to R shunt Spleen (heat damaged RBC’s)	30 30 30 30 30 30
Tc99m-sestamibi Cardinal Health, Curium, DraxImage, Lantheus, Sun Pharma A9500 Per study dose up to 40 mCi	Cardiolite, “Sestamibi” or “mibi”	Myocardial perfusion Breast tumor Parathyroid	10/30 25 25

Tc99m-succimer	“DMSA” Nephroskan Feb 2022 Theragnostics Distributed by GE; A9551 up to 10 mCi	Renal cortical imaging	5 0.1 to 0.05 ped
Tc99m-sulfur colloid AN-Sulfur Colloid Sun Pharm (4/79) Sulfur Colloid Kit Jubilant-Drax (11/23)	“Sulfur colloid”	Liver-spleen, Bone marrow Lymphoscintigraphy Gastric emptying Gastric reflux Aspiration/Salivagram Cystography (augmented bladder) Peritoneo-venous shunt (LeVeen shunt)	5 0.4 1 0.3 0.2 1 0.5
Tc99m-tetrofosmin Myoview GE (2/96 – 0.23 mg) Myoview 30 GE (3/05 - 0.69 mg)	Myoview A9502 Per study dose	Myocardial perfusion imaging	10/30
Tc99m-tilmanocept	Lymphoseek (Cardinal Health 2017) A9520 up to 0.5 mCi	Lymphoscintigraphy	0.5

\*ACR–SPR (American College of Radiology-Society of Pediatric Radiology) Technical Standard for Diagnostic Procedures Using Radiopharmaceuticals. Available at: <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/Radiopharmaceuticals.pdf>. Revised 2016. American College of Radiology. ACR-AAPM practice parameter for reference levels and achievable administered activity for

**SNMMI clinical guidelines**

<http://www.snmmi.org/ClinicalPractice/content.aspx?ItemNumber=10817&navItemNumber=10786>

Pediatric activity should follow image gently guidelines <https://www.imagegently.org/Procedures/Nuclear-Medicine>

nuclear medicine and molecular imaging. 2015; Available at: <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/RefLevels-NucMed.pdf>.

<b>Radiopharmaceutical Cyclotron PET Prod.</b>	<b>Trade Name “Common name”</b>	<b>Clinical Use</b>	<b>Dosages (mCi)</b>
Carbon-11 choline (2013) (P = 20 min)	Mayo Clinic-Rochester, Minn, Zevacor ANDA A9515 up to 20 mCi	Prostate cancer recurrence	10-20
Copper (Cu)-64 dotatate (8/20) (P = 12.6hr)	<b>DETECTNET</b> (Curium) Available everyday & Friday after 10:30 Pass- through until Jan 1 2024; 69945- 0064-01;	Somatostatin receptor positive neuroendocrine tumors	4.4
Flourine-18 florbetaben (P = 109 min)	<b>NEURACEQ</b> Life Molecular Imaging (Primal) Contract manufacturing Distributed by SOFIE-DALLAS – TU/WED/TH after 1200 Q9983 up to 8.1 mCi	Risk of Alzheimer’s Imaging 45-130 min post admin.	8.1
Flourine-18 florbetapir	<b>AMYVID</b> (Lilly) Contract manufacturing Distributed by Petnet and some Cardinal PET facilities; A9586 up to 10 mCi	Risk of Alzheimer’s Imaging 50 min post admin.	10
Fluorine-18 flortaucipir (5/20)	<b>TAUVID™</b> (Avid Radiopharmaceuticals, Inc bought by Lilly) Contract Manufacturing Distributed by Petnet and some Cardinal PET facilities; A9601 per 1 mCi	Risk of Alzheimer’s	10
Fluorine-18 flotufolastat (5/23)	<b>POSLUMA</b> (Blue Earth Diag.) Distributed by PetNet-Dallas & Tulsa; A9608 =	Prostate cancer initial or recurrence	8
Fluorine-18 fludeoxyglucose	“FDG” Various ANDA; A9552 up to 45 mCi	Primarily metastasis, but all metabolism and glycolysis, e.g., active inflammation, tissue repair	10
Fluorine-18 fluciclovine (5/16)—Replaced by Posluma	<b>AXUMIN</b> (Blue Earth Diagnostics) Distributed by Petnet: Tulsa said they need to get it from Dallas.; A9588 per 1 mCi	Prostate cancer recurrence	10
Fluorine-18 fluorodopa (1/22)	Feinstein Institute, Manhasset, NY (Tom Chaly); NDA 200655 must have ANDA - GE FASTLAB 2 HPLC+). CMS has removed the NCD, PET centers could get the coverage for Fluorodopa PET studies through the local CMS contractors. A9602 =	Suspected parkinsonian syndromes-CMP or ANDA	5

**SNMMI clinical guidelines**

<http://www.snmmi.org/ClinicalPractice/content.aspx?ItemNumber=10817&navItemNumber=10786>

Pediatric activity should follow image gently guidelines <https://www.imagegently.org/Procedures/Nuclear-Medicine>

Fluorine-18 fluoroestradiol (5/20)	<b>CERIANNA™ (GE)</b> bought Zionexa, US) Contract manufacturing through PETNET – Dallas making on Monday and Wednesday; A9591 per 1 mCi	Estrogen receptor (ER)-positive lesions as an adjunct to biopsy in patients with recurrent or metastatic breast cancer	6
Fluorine-18 flurpiridaz (10/2024)	<b>FLYRCADO (GE)</b>	myocardial blood flow (MBF) 2.5 to 3 mCi rest/9 to 9.5 stress (1 hr apart); if pharmacologic use 6 to 6.5 mCi for stress (0.5 hr apart)	3/9
Fluorine-18 flutemetamol (10/13)	<b>VIZAMYL (GE)</b> Contract manufacturing Distributed by Pharmalogic and Cardinal PET facilities Q9982 Up to 5 mCi	Risk of Alzheimer's Imaging 90 min post admin.	5
Fluorine-18 piflufolastat (PSMA) (5/21)	<b>PYLARIFY (GE)</b> owned Progenics) Distributed by any contract manufacturer – right now Sofie DALLAS –delivery starting at 1 pm to OKC and PetNet in Tulsa (July 2023) A9595 =	Prostate cancer initial and recurrence	8-10
Fluorine-18 sodium fluoride	"NaF" Various ANDA; A9580 up to 30 mCi	Bone metastasis	5
Gallium-68 dotatoc (8/19) (P = 68 min)	Univ of Iowa Hosp & Clinics; Various ANDA	Somatostatin receptor positive neuroendocrine tumors	4
Gallium-68 dotatate (6/16)	NETSPOT (Advanced Accelerator Applications- Novartis) Generator distribution various; A9587 per 0.1 mCi; 69488-0001-40; =	Somatostatin receptor positive neuroendocrine tumors Pass-through ended Jan 2022	5.4
Gallium-68 PSMA – CALI-cGMP 212 (approved 12/2020)  Gallium-68 PSMA (KIT)	CALI-cGMP under 212: PSMA-11 with HBED-CC chelator; A9594 <u>FDA approved: Telix: Feb 2022</u> <sup>68</sup> Ga- HBED-PSMA-11 (gozetotide- <b>Illucix</b> ); A9596 <u>Novartis/AAA: Mar 2022</u> <sup>68</sup> Ga-HBED- PSMA-11 (gozetotide- <b>Locametz</b> ) A9800 69488-0017-61; Not approved yet: <u>Theragnostics/GE:</u> <u>now AAA agreement distribution:</u> (GalliProst) <sup>68</sup> Ga-THP-PSMA THP-no heating	Prostate-specific membrane antigen (PSMA) positive lesions in men with prostate cancer with suspected metastasis who are candidates for <u>initial definitive</u> <u>therapy</u> or with suspected recurrence based on <u>elevated</u> serum prostate-specific antigen (PSA) level	3-7 PI 3-5 reg \$ 6 =\$\$ 7 =\$\$\$
Nitrogen-13 ammonia (P = 10m)	"Ammonia" Various ANDA; A9526 up to 40 mCi	Myocardial perfusion	10-20
Rubidium-82 Chloride (Sr-82 generator) (P = 75s)	Cardio-Gen-82 (Bracco) Ruby-Fill (DraxImage); A9555 up to 60 mCi per study dose	PET cardiac perfusion imaging	30-60

SNMMI clinical guidelines

<http://www.snmmi.org/ClinicalPractice/content.aspx?ItemNumber=10817&navItemNumber=10786>

Pediatric activity should follow image gently guidelines <https://www.imagegently.org/Procedures/Nuclear-Medicine>

Radiopharmaceutical Cyclotron Prod. NON- PET	Trade Name "Common name"	Clinical Use	Dosages (mCi)
Gallium-67 citrate (P=78h)	"Gallium" (Lantheus DC 2022); A9556 per mCi	Soft-tissue tumor Inflammatory process imaging	7
Indium-111 chloride (P=68h)	Indiclor (Curium)	Labeling monoclonal antibodies and peptides	3 to 9
Indium-111 pentetate MPI Indium DTPA GE (2/82)	Indium DTPA (GE) A9548 per 0.5 mCi	Cerebral Spinal Fluid (CSF) kinetics	0.5
Indium-111 oxyquinoline	Indium Oxine (GE 12/85) and (BWXT 7/2018); A9547 per 0.5 mCi; A9570 WBC per study dose	Labeling leukocytes and platelets	0.7
Indium-111 pentetreotide	Octreoscan (Covidian); A9572 up to 6 mCi	Imaging neuroendocrine tumors	6
Iodine-123 iobenguane (metaiodobenzylguanid ine) (P=13.2h) A9582	Adreview-GE; A9582 up to 15 mCi; 17156-0235-01;	Neuroendocrine tumor imaging 78803 Sympathetic nerve activity in heart failure 0332T	7.5
Iodine-123 ioflupane (A9584)	DatScan -GE; 17156-0210-01; AWP \$2961 ioflupane-Curium (3/2022) M-F early delivery; A9584 up to 5 mCi;	Dopamine receptor imaging for Parkinson's disease 78803	5
Iodine-123 sodium iodide	"123 caps" Curium, Cardinal A9509 Use for 1-4 mCi doses of I-123 for whole body imaging for less than 1 mCi and thyroid imaging see A9516 100 to 999 mCi	Thyroid imaging and uptake	0.3
Thallium-201 Chloride (P=73h) Thallos Chloride Curium (10/79)	"Thallium" (Lantheus DC 2022); (Curium Not Returned to market 12/2022) TRACE (Discontinued Mount Sinai Medical Center, FL. 11/2001)	Myocardial perfusion imaging Parathyroid Tumor imaging	4

Radiopharmaceutical Naturally Occurring Radionuclides	Trade Name "Common name"	Clinical Use	Dosages (mCi)
Carbon-14 Urea (P=5,730y)	Pytest TriMed 2023 (from AVENT DC Dec 2023) 510-947-6828 trimedamericas.com	Detection of H. Pylori infection	0.001

**SNMMI clinical guidelines**

<http://www.snmmi.org/ClinicalPractice/content.aspx?ItemNumber=10817&navItemNumber=10786>

Pediatric activity should follow image gently guidelines <https://www.imagegently.org/Procedures/Nuclear-Medicine>

<b>Radiopharmaceutical Reactor Products</b>	<b>Trade Name "Common name"</b>	<b>Clinical Use</b>	<b>Dosages (mCi)</b>
Strontium-89 (P=52.7d)	Metastron (GE DC MF FEB 2019; available BioMed through Triad-Drax 2020); A9600	Palliative treatment of bone pain of skeletal metastases	4
Iodine-125 human serum albumin (P=60d)	Jeanatope, "RISA" (IsoTex); A9532 per 5 mcrCi	Plasma volume determination	0.005 – 0.01
Iodine-125 iothalamate	Glofil (IsoTex)	Measurement of glomerular filtration	0.01-0.03
Iodine-131 human serum albumin (P=8d)	Megatope (IsoTex); A9524 per 5 mcrCi	Vascular volume studies-protein turnover studies	0.01
Iodine-131 metaiodobenzylguanidine	I-131 MIBG;	Pheochromocytomas and neuroblastomas Diagnostic	0.5
Iodine-131 sodium iodide	"Iodine" Draximage, International Isotopes; A9517	Whole Body Scan Thyroid therapy	2 10 - 200
Xenon-133 gas (5.2d)	"Xenon" Curium, Lantheus ; A9558 per 10 mCi	Pulmonary ventilation imaging	10-20
Yttrium-90 ibritumomab (P=64h)	ZEVALIN (Spectrum); A9543 up to 40 mCi	Non-Hodgkin's lymphoma	32 max
Radium-223 dichloride (P=11.4d) Ac227>Th227>Ra223	XOFIGO (Bayer distributed by Cardinal Health-DENVER)-A9606	CRPC with symptomatic bone metastases 4-apha decays with gamma 81 keV (15%), 84 (24%), and 154 5%	About 0.14 total x6
Lutetium Lu-177 dotatate (P=6.6d)	LUTAHERA (AAA) Feb 2018 (DISTRIBUTED TO HOSPITAL IN VIAL) Lu-177m (Tp1/2 160 days) contaminant [Lu-176(n,g)Lu177 & Lu177m] A9513	NE Tumors with somatostatin receptors	200 q8 wks x 4 doses
Lutetium Lu-177 vipivotide tetraxetan (March 2022)	Pluvicto -Endocyte/Novartis/AAA lutetium-177 (Lu-177) PSMA 617 [n.c.a Yb-177(n,g) Lu-177] A9607	Metastatic Prostate Treatment -	200 q6wks x6 doses

\*Usual dosage range of radiopharmaceutical used, dosages are adjusted for patients weight, sex, and clinical diagnosis. Pediatric doses are appropriately lowered on age and weight bases. ACR–SPR (American College of Radiology–Society of Pediatric Radiology) Technical Standard for Diagnostic Procedures Using Radiopharmaceuticals. Available at: <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/Radiopharmaceuticals.pdf>. Revised 2016. American College of Radiology. ACR–AAPM practice parameter for reference levels and achievable administered activity for nuclear medicine and molecular imaging. 2015; Available at: <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/RefLevels-NucMed.pdf>.

**SNMMI clinical guidelines**

<http://www.snmmi.org/ClinicalPractice/content.aspx?ItemNumber=10817&navItemNumber=10786>

Pediatric activity should follow image gently guidelines <https://www.imagegently.org/Procedures/Nuclear-Medicine>

Investigational Radiopharmaceuticals		Indication
F-18	126 FDA registered ongoing clinical trials <b>FLT (AML) and FMISO (hypoxia)</b>	<b>18F-flurpiridaz (MBF)</b> -NOS (inflammation in every disease state)-FMAU (uracil agent –cancer) –FEOBV (Parkinson) -FTT (PARP inhibitor breast/ovarian) –FAZA (lung) –FCH (hepatocarcinoma) –TFB (thyroid) -CETO (primary aldosteronism) –FSPG (liver) -PSS232 (amyotrophic lateral sclerosis)
Zr-89	7	-panitumumab (squamous cell head and neck) –DFO-YS5 (multiple myeloma) –Df crefmirlimab (CD8 Tcells) –AP-101 (ALS)
Ac-225	15	-FPI (neurotensin receptor tumors) –daratumumab (AML)
Lu-177	55	-dotatate (Breast, pancreatic, meningioma, CNS) – PMSA (prostate)

Brachytherapy Devices	Trade Name “Common name”	Indication
Iodine-125 iodohydroxybenzenesulfonate (LIQUID) & Cesium-131 Chloride in NS (LIQUID)	Iotrex Cesitrex	Use in GliaSite device for recurrent malignant gliomas – MFG change now IsoRay in Richland, WA (2014)
Ir-192 (P=74d)	Checkmate	Decrease in-stent restenosis
Sr-90 (P=29y)	Novoste BetaCath	Decrease in-stent restenosis
P-32 (P=14d)	Guidant Galileo	Decrease in-stent restenosis
Y-90 glass (64h)	TheraSphere	Hepatocarcinoma
Y-90 resin-polymer	SIR-Spheres	Hepatocarcinoma/Colorectal mets 27-81 mCi