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| **Radiopharmaceutical-Technetium Labeled** | **Trade Name “Common name”** | **Clinical Use** | **Dosages\***  **(mCi)** |
| **99mTc Physical Half-life (P) 6h**  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 dependent 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 |
| 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 |

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| **Radiopharmaceutical-Technetium Labeled** | **Trade Name “Common name”** | **Clinical Use** | **Dosages\***  **(mCi)** |
| Tc99m-succimer | “DMSA” Nephroscan 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 nuclear medicine and molecular imaging. 2015; Available at: <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/RefLevels-NucMed.pdf>.

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| **Radiopharmaceutical** | **Trade Name “Common name”** | **Clinical Use** | **Dosages (mCi)** |
| 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) | **DETECTNET** (Curium) Available everyday & Friday after 10:30 Pass-through until Jan 1 2024; A9592 $1003.61/1 mCi; 69945-0064-01; WAC $3850; AWP $4620 | Somatostatin receptor positive neuroendocrine tumors | 4.4 |
| Flourine-18 florbetaben  (P = 109 min) | **NEURACEQ** 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 | 8 |
| Flourine-18 florbetapir | **AMYVID** (Lilly) Contract manufacturing Distributed by Petnet and some Cardinal PET facilities; A9586 up to 10 mCi | Risk of Alzheimer’s | 10 |
| Fluorine-18 flortaucipir (5/20) | **TAUVID**™ (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) | **POSLUMA** (Blue Earth Diag.) Distributed by PetNet-Dallas & Tulsa; A9608 $614.78/mCi | 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 | **AXUMIN** (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 $446.88/mCi | Suspected parkinsonian syndromes-CMP or ANDA | 5 |
| Fluorine-18 fluoroestradiol (5/20) | **CERIANNA™ (GE** 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) | **FLYRCADO (GE)** | myocardial blood flow (MBF) 2.5 to 3 mCi rest/9 to 9.5 stress (1 hr apart); if pharmalogic use 6 to 6.5 mCi for stress (0.5 hr apart) | 3/9 |
| Fourine-18 flutemetamole (10/13) | **VIZAMYL (GE)** Contract manufacturing Distributed by Pharmalogic and Cardinal PET facilities Q9982 Up to 5 mCi | Risk of Alzheimer’s | 5 |
| Fluorine-18 piflufolastat (PSMA) (5/21) | **PYLARIFY (GE** 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 $580.35/mCi | Prostate cancer initial and recurrence | 8-10 |
| Flourine-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; WAC $3000; AWP $3600 | Somatostatin receptor positive neuroendocrine tumors  Pass-through ended Jan 2022 | 5.4 |

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| **Radiopharmaceutical** | **Trade Name “Common name”** | **Clinical Use** | **Dosages (mCi)** |
| Gallium-68 PSMA – CALI-cGMP 212 (approved 12/2020)  Gallium-68 PSMA (KIT) | CALI-cGMP under 212: PSMA-11 with HBED-CC chelator; A9594 per $789.30/1 mCi  FDA approved: Telix: Feb 2022 68Ga-HBED-PSMA-11 (gozetotide- **Illuccix**); A9596 $995.31/mCi; 74725-0100-25; WAC $4920; AWP $5904  Novartis/AAA: Mar 2022 68Ga-HBED-PSMA-11 (gozetotide-**Locametz**) A9800 $873.44/mCi; 69488-0017-61; WAC $5768; AWP $6921  Not approved yet: Theragnostics/GE: now AAA agreement distribution: (GalliProst) 68Ga-THP-PSMA THP-no heating | Prostate-specific membrane antigen (PSMA) positive lesions in men with prostate cancer with suspected metastasis who are candidates for initial definitive therapy or with suspected recurrence based on elevated 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 |
| Cyclotron Products non-PET |  |  |  |
| 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 (metaiodobenzylguanidine) (P=13.2h) A9582 | Adreview-GE (AWP/ASP $4,195); A9582 up to 15 mCi; 17156-0235-01; AWP $5838 | Neuroendocrine tumor imaging 78803 ($1.327.27)  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 ($1,324.27) | 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 mcrCi | Thyroid imaging and uptake | 0.3 |
| Thallium-201 Chloride (P=73h)  Thallous 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 |
| Naturally Radioactive Products |  |  |  |
| 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 |

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| **Radiopharmaceutical** | **Trade Name “Common name”** | **Clinical Use** | **Dosages (mCi)** |
| Reactor Products |  |  |  |
| Strontium-89 (P=52.7d) | Metastron (GE DC MF FEB 2019; available BioMed through Triad-Drax 2020); A9600 $3975/mCi | 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 $23.73/per mCi | 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 |
| Yittrium-90 ibitumomab (P=64h) | ZEVALIN (Spectrum); A9543 $65,476.58 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 $157.91/mcrCi | 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 $/mCi | 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 $229.76/mCi | 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 an age and weight bases. ACR–SPR (American College of Radiology-Society of Pediatric Radiology) Technical Standard for Diagnositic 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>.

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| **Investigational Radiopharmaceuticals** |  | **Indication** |
| F-18 | 126 FDA registered ongoing clinical trials  FLT (AML) and FMISO (hypoxia) | 18F-flurpiridaz (MBF) -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) |

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| **Brachytherapy Devices** | **Trade Name “Common name”** | **Indication** |
| Iodine-125 iodohydroxybenzenesulfonate (LIQUID) &  Cecium-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 |

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| **Discontinued Radiopharmaceuticals** | **Trade Name “Common name”** | **FDA Indication and off label uses** |
| Chromium-51 sodium chromate (P=27.7d) | Chromitope | Labeling RBC's (DC MFG 2011) |
| Cobalt-57 cyanocobalamin (P=270d) | Rubratope | Detection of pernicious anemia (DC MFG 2006) |
| Cobalt -57 & -58 cyanocobalamin | Dicopac | Detection of pernicious anemia |
| Indium-111 capromab pendetide | ProstaScint – Ayto Bio distributed by Cardinal | Monoclonal antibody for imaging prostate cancer DC MFG 5 2018 |
| Indium-111 Imciromab | Myoscint | MAB for diagnosis of myocardial necrosis |
| Indium-111 satumomab pendetide | OncoScint CR/OV | MAB Colorectal and ovarian cancer |
| Iodine-131 iodohippurate | Hippuran | Renal imaging and function studies (ERPF) |
| Iodine-131 metaiodobenzylguanidine (7/2018) | AZEDRA (Lantheus owns Progenics) A9590 per $338.06/1 mCi | TX Pheochromocytomas and neuroblastomas Diagnostic (DC MFG 3/2024) (±2.5) mL of solution with a total radioactivity  of 240–413 mCi/vial |
| Krypton-81m gas (Rb-81 generator) (P=13s) |  | Pulmonary ventilation imaging |
| Phosphorus-32 Chromic phosphate | P-32 Phosphocol | TX intracavitary malignancies DC MFG 2009 |
| Phosphrous-32 Sodium phosphate | “P-32” | Therapy of polycythemia vera DC MFG 2009 |
| Samarium-153 lexidronam (EDTMP) | Quadramet (Lantheus)(Jazz) | Palliative treatment of bone pain of skeletal metastases DC MFG 10/2021 |
| Technetium-99m-pertechnetate (from Molybdenum-99 generator) Low Specific Activity from Mo98 (Feb 2018) Northstar | Radiogenix | Same as U235 source (DC MFG Nov 2023) |
| Tc99m-albumin colloid | Microlite | Imaging RES (liver/spleen) |
| Tc99m-arcitumomab | CEA-Scan | Monoclonal antibody for colorectal cancer  DC MFG 2007 |
| Tc99m-apcitide | AcuTect | Peptide imaging of DVT DC MFG 2006 |
| Tc99m-depreotide | Neotect | Somatostatin receptor-bearing pulmonary masses (NSCLC) |
| Tc99m-fanolesomab | NeutroSpec | MAB Infection-DC MFG 11/05 |
| Tc99m-gluceptate | “Gluco” | Renal cortical imaging DC MFG 12/08 |
| Tc99m-human serum albumin | “HSA” | Imaging of cardiac chambers |
| Tc99m-lidofenin | “HIDA” | Hepatobiliary imaging |
| Tc99m-nofetumomab merpentan | Verluma | MAB Fab fragment for imaging SCLC |
| Tc99m-teboroxime | Cardiotec | Myocardial perfusion imaging |
| Iodine-131 tositumomab | Bexxar | Treatment of Non-Hodgkin's Lymphoma DC MFG 2/2014 (112 to 168 mCi with avg 110 mCi) |

**CMS Payment Status**

**TABLE 35: DRUGS AND BIOLOGICALS FOR WHICH PASS - THROUGH PAYMENT STATUS WILL END BY DECEMBER 31, 2023**

A9591 Fluoroestradiol F 18, diagnostic, 1 millicurie - G -9370 - 10/01/2020 to 09/30/2023

C9067 Gallium ga-68, dotatoc, diagnostic, 0.01 mCi - G - 9323 10/01/2020 to 09/30/2023

A9592 Copper Cu-64, dotatate, diagnostic, 1 millicurie - G 9383 01/01/2021 to 12/31/2023

**TABLE 36: DRUGS AND BIOLOGICALS WITH PASS-THROUGH PAYMENT STATUS EXPIRING IN CY 2024**

**2023 HCPS code/2024 HCPS code G= Status Indicator 2023 APC Pass-through dates**

A9593 Gallium ga-68 psma-11, diagnostic, (ucsf), 1 millicurie G 9409 07/01/2021 to 06/30/2024

A9594 Gallium ga-68 psma-11, diagnostic, (ucla), 1 millicurie G 9410 07/01/2021 to 06/30/2024

A9595 Piflufolastat f-18, diagnostic, 1 millicurie G 9430 01/01/2022 to 12/31/2024

**TABLE 37: DRUGS AND BIOLOGICALS WITH PASS-THROUGH PAYMENT STATUS EXPIRING AFTER CY 2024**

A9596 Gallium ga-68 gozetotide, diagnostic, (illuccix), 1 millicurie G 9443 07/01/2022 to 06/30/2025

A9800 Gallium ga-68 gozetotide, diagnostic, (locametz), 1 millicurie G 9055 10/01/2022 to 09/30/2025

A9607 Lutetium lu 177 vipivotide tetraxetan, therapeutic, 1 millicurie G 9054 10/01/2022 09/30/2025

A9602 Fluorodopa f-18, diagnostic, per millicurie G 9053 10/01/2022 to 09/30/2025

Q9969 non-HEU sourced Tc-99m per dose through 2025