October 7, 2009

Regional Administrator
NRC Region III
2443 Warrenville Road
Lisle, Illinois, 60532

Dear Sir,

Based on NRC Confirmatory Order (IA-09-026) issued to me on July 28, 2009, I have agreed within 45 days following each periodic (quarterly) Radiation Safety Committee meeting, to provide minutes of the meeting to the permitee, the NHPP, and the NRC. Enclosed is a copy of the signed minutes from the August 27, 2009 Radiation Safety Committee meeting with attachments.

If you have any questions, please contact me at 859-381-5929.

Sincerely,

Michael T. Hackett, MS

Enclosure

cc: Director, VA Medical Center, Lexington, Kentucky (electronic copy)
Director, National Health Physics Program (electronic copy)

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Radiation Safety Committee (RSC) Minutes
August 27, 2009

Action & Follow Up Required

Action Complete – No Follow Up

AGENDA ITEM	DISCUSSION	ACTION	TARGET
Current Old Business			
1. Review of Previous Meetings' Minutes – Dr. Baker (2 minutes)	**Minutes from June 4, 2009 meeting** (reviewed by RSC prior to obtaining signatures - presented at July 2009 Environment of Care Council) RSC Signed Minutes Link to minutes with attachments Minutes were approved by all Committee members present (7).	No longer required.	Complete – Aug 2009
2. Smoke Tests – Dr. Baker & M. Hackett (2 minutes)	**Monthly Smoke Tests in Nuclear Medicine** AFM and Spill Clearance Times Additional tests were performed two times since the last RSC meeting along with the regularly scheduled semi-annual testing and all demonstrated adequate air flow (i.e., negative air flow). The permanent air handlers were installed in June before the above noted testing. The exhaust rates have increased with the new permanent air handlers thus increasing the negative pressure (i.e., improved air flow); therefore, all Committee members present (7) agreed the monthly smoke tests will no longer be needed.	No longer required.	Complete – Aug 2009
3. Footprint Management – Dr. Baker & M. Hackett (2 minutes)	**Footprint Management Procedure** Revision of the draft Footprint Management procedure was not available for review at this meeting; therefore, a new revision will be submitted for RSC review via e-mail before the RSC meeting.	Revise the draft procedure for RSC review via e-mail before the next meeting – M. Hackett/Dr. Brown	Oct 2009
4. Reporting Noncompliance – Dr. Brown & M. Hackett (2 minutes)	**Reporting Noncompliance Procedures** RSC approved SOPs posted in "Radiation Safety" folder (i.e., "Policies & SOPs" subfolder) on the Public drive FYI. It was noted that this is part of one of the RSC Performance Goals for this year – "Further develop access to radiation safety information".	No longer required.	Complete – Aug 2009

Radiation Safety Committee (RSC) Minutes
August 27, 2009

Action & Follow Up Required

Action Complete – No Follow Up

AGENDA ITEM	DISCUSSION	ACTION	TARGET
5. Annual Review – Dr. Baker & M. Hackett (5 minutes)	**Comprehensive Radiation Safety Program Annual Review (CY08)** (initial review at June 4, 2009 RSC meeting and then e-mail review by RSC prior to obtaining signatures - presented at July 2009 Environment of Care Council) Signed RS Program Annual Review Link to annual review with attachments Discussed completion of RSC Performance Goals for 2009: RSC Performace Goals for 2009	Continue to track completion of performance goals during qtrly meetings – M. Hackett	Dec 2009
6. Follow up on previous Qtrly Audits – Dr. Baker & M. Hackett (10 minutes) a. Research lab issue - O-D 2008 Audits	**Radioactive Use Approval** Dr. Smyth does not have any immediate plans for radioactive work; therefore, her Research Authorized User application will be presented at the next quarterly RSC meeting if she decides to assume responsibility of this research lab.	Report on status at next RSC meeting – M. Hackett	Dec 2009
b. Cath lab doses - O-D 2008 Audits & J-M 2009 Audits	**Accuracy of Cath Lab Patient Doses Values** Cath Lab Dose Meter Comparison Special testing was completed by Bluegrass Radiological Physics in June 2009. They evaluated the stated estimated skin dose that is given for each patient to the actual measured dose. Both cath lab units overestimated the skin dose by ~20% when compared to the measured dose. After some discussion, the Committee agreed that the quarterly audits should reflect this overestimation and this dose evaluation be included with annual testing of the cath lab. Note that the Radiology angio unit was also evaluated and estimated skin dose was within ~2% of the measured dose.	Include overestimation calculations for the next quarterly audit – M. Hackett	Dec 2009

Radiation Safety Committee (RSC) Minutes
August 27, 2009

Action & Follow Up Required

Action Complete – No Follow Up

AGENDA ITEM	DISCUSSION	ACTION	TARGET
c. CT Protocols - J-M 2009 Audits	**CT Acquisition Protocol Review** CT chest without contrast, CTA aorta, and CT liver acquisition protocols were reviewed with assistance from the manufacturer and imaging parameters were changed to lower patient doses. CT spine acquisition protocols were also reviewed.	Review these protocols in 1st Qtr of 2010 – M. Hackett	May 2010
7. Draft VHA Handbook – Dr. Baker (2 minutes)	**Draft VHA Fluoroscopy Handbook** No follow up information to review at this time.	Report any follow up at next RSC meeting – Dr. Baker	Dec 2009
Current New Business			
1. PET/CT Consult Template – Dr. Baker (2 minutes)	**Fee Consult PET/CT Exam Template** Fee Consult PET-CT Exam It was noted that through the work done by Dr. Baker, Dr. Shih, and Vickie Kiefer, a fee consult for PET/CT exam template was set up in CPRS. This eliminated the chance of physicians ordering diagnostic CTs along with the PET/CT (i.e., requires only a non-diagnostic CT used for localization) thus minimizing the patient dose and fee cost.	None required – Informational.	Complete – Aug 2009
2. Qtly Audits – Dr. Baker & M. Hackett (10 minutes)	**Quarterly Radiation Safety Audits for Apr-Jun 2009** Combined Trending Report with Summaries with Detailed Areas Audits Qtrly Trending Report; Nuclear Medicine; Research; Rad-Fluoro; ALARA-Rad Exp Discussion included all items found on the trending report's deficiency summary which included any action taken. These actions were approved by all Committee members present (7) with no further action required except for:	Continue to monitor as part of the qtrly audit – M. Hackett	Dec 2009

Action & Follow Up Required

Action Complete – No Follow Up

AGENDA ITEM	DISCUSSION	ACTION	TARGET
	a. It appears our CT doses are higher than other facilities for CT abdomen without contrast, CT pelvis without contrast, CT lumbar spine without contrast, and CT thoracic spine without contrast protocols. The spine protocols have been reviewed and the acquisition parameters have been changed to lower the patient dose (as noted above – Old Business 6.c.). Some of the higher values are due to the fact that multiple exams are being done at one time and the dose reflects the total of these exams not just the one being reviewed. The quarterly audit should be modified to better reflect this.	Modify qtrly audit to reflect multiple exams – M. Hackett Review these protocols in 2nd Qtr of 2010 – M. Hackett	Dec 2009 Aug 2010
	b. As noted in the previous two quarterly audits, there was a question in regards to the Cath lab machinery overestimating the patient dose. See Old Business 6.b. for more discussion. It was noted that of the 3 cath lab patients in 2009 that had total dose readings over 10 Gy, based on the confirmed 20% overestimation, each patient would actually be below 10 Gy. These values are still assumed to be an overestimation since they assume the radiation field was over the same patient area for the entire case which normally does not occur. In review of these 3 patients' medical records, no skin issues associated with x-rays (i.e., early transient erythema @ 3 Gy within hours) were noted on nursing skin assessments during the first 24hrs post procedure.	Include overestimation calculations for the next quarterly audit – M. Hackett	Dec 2009
3. Prostate Brachytherapy – Dr. Baker & M. Hackett (5 minutes)	**Prostate Brachytherapy Review (i.e., VA Patients Sent Out for Therapy)** NRC Fact Sheet Pts - 10.2007 to 06.2009 Brachytherapy Med Review With the recent VA incidents involving prostate brachytherapy, a review (10/01/07 – 6/30/09) of all 10 patients from our VA who were sent to a non-VA hospital for prostate brachytherapy was performed. The medical review performed by a VA Urologist indicated no major complications were identified other than some minor, but expected routine complications that are quite common with brachytherapy seed implants for prostate cancer. The Committee agreed that a quarterly audit of prostate brachytherapy should be developed for review by this Committee.	Develop a qtrly audit for prostate brachytherapy – M. Hackett	Dec 2009
4. New Research Authorized User Applications – Dr. Baker & M. Hackett (10 minutes)	**New Research Authorized User (AU) Applications** Due to meeting time constraints, this item (Drs. Greenberg and Tannock applications) was briefly discussed at this meeting. The Committee agreed that the applications with summaries be sent via e-mail to the Committee for further review and voting after all the training and room air flow evaluations had been completed. The results of this RSC voting are as follows:		

Radiation Safety Committee (RSC) Minutes
August 27, 2009

Action & Follow Up Required

Action Complete – No Follow Up

AGENDA ITEM	DISCUSSION	ACTION	TARGET
	Application Templates: If application(s) does not open, use the link or file below to the InfoPath templates (i.e., blank application), close blank form without saving and then re-open the application. Authorized User Application or Authorized User Application Staff Application or Staff Application		
	a. Dr. Richard Greenberg - New Research AU Application: On 09/16/2009, 6 of the 9 RSC members had voted for approval with no changes to the applications (i.e., 3 had not cast a vote); therefore, RSC approval has been given to Dr. Greenberg per the below approved applications: RSC Approved AU/ Staff Applications; RSC Approval via e-mail; Summary of AU Application; Summary of Staff Application; D316 Air Flow Evaluation	None required – Informational.	Complete – Sep 2009
	b. Dr. Lisa Tannock - New Research AU Application: On 09/16/2009, 5 of the 9 RSC members had voted for approval with no changes to the applications with 1 additional member voting for approval on 09/17/09 (i.e., 3 had not cast a vote); therefore, RSC approval has been given to Dr. Tannock per the below approved applications: RSC Approved AU/ Staff Applications; RSC Approval via e-mail; Summary of AU Application; Summary of Staff Application; D322 Air Flow Evaluation	None required – Informational.	Complete – Sep 2009
5. NRC Request on Tritium Exit Signs – M. Hackett	**NRC Requests Organizations to Report on Tritium Exit Signs in Their Possession** Due to meeting time constraints, this item will be carried over as new business at the next RSC meeting.	Discuss at next meeting – M. Hackett	Dec 2009
6. RSO Memo – Dr. Baker & M. Hackett	**VHA Memo Concerning Radiation Safety Officers** Due to meeting time constraints, this item will be carried over as new business at the next RSC meeting.	Discuss at next meeting – M. Hackett	Dec 2009

Radiation Safety Committee (RSC) Minutes
August 27, 2009

Action & Follow Up Required

Action Complete – No Follow Up

AGENDA ITEM	DISCUSSION	ACTION	TARGET
7. NRC Exemption – M. Hackett	**NRC Exemption from Requirements on Procurement and Transfer of Tc-99m and Calibration on Equipment using Tc-99m** Due to meeting time constraints, this item will be carried over as new business at the next RSC meeting.	Discuss at next meeting – M. Hackett	Dec 2009

Items Referred for Higher Level/Council Review and/or Other Committee Review

- The minutes from this meeting are regularly scheduled to be presented during the October 2009 Environment of Care Council meeting.

Next Meeting's Tentative Agenda – December 3, 2009 @ 11:30 am in Nuclear Medicine Conference Room, B101A
(Normally would be on November 26 which is a federal holiday; therefore, rescheduled for the following week.)

Next Meeting's Tentative Old Business including items from current agenda requiring further action (see above).

1. Review of Previous Meeting's Minutes – Dr. Baker			
2. Footprint Management – Dr. Baker & M. Hackett			
3. RSC Performance Goals for 2009 – Dr. Baker & M. Hackett			
4. Follow up on previous Qtrly Audits – Dr. Baker & M. Hackett a. Research lab issue - O-D 2008 Audits			

Radiation Safety Committee (RSC) Minutes
August 27, 2009

Action & Follow Up Required

Action Complete – No Follow Up

AGENDA ITEM	DISCUSSION	ACTION	TARGET
b. Cath lab doses - O-D 2008, J-M 2009, & A-J 2009 Audits			
c. CT Protocols - J-M 2009 & A-J 2009 Audits		Plus to be carried over: Protocols re-reviews in 1st Qtr of 2010 & In 2nd Qtr of 2010 – M. Hackett	May 2010 Aug 2010
5. Draft VHA Handbook – Dr. Baker			
6. Prostate Brachytherapy – Dr. Baker & M. Hackett			
Next Meeting's Tentative New Business			
1. Qtly Audits – Dr. Baker & M. Hackett			
2. NRC Request on Tritium Exit Signs – M. Hackett			
3. RSO Memo – Dr. Baker & M. Hackett			
4. NRC Exemption – M. Hackett			

Radiation Safety Committee (RSC) Minutes
August 27, 2009

Action & Follow Up Required

Action Complete – No Follow Up

AGENDA ITEM	DISCUSSION	ACTION	TARGET
Attendance: Sign In Sheet RSC Attendance for 2009 Reviews	**Meeting Time:** 11:30 am – 12:50 pm	**Recorder:** Michael T. Hackett, MS	

Recommend Approval / ~~Disapproval~~ Michael T. Hackett, M.S., Radiation Safety Officer	Recommend Approval / Disapproval Cheryl D. Baker, M.D. Chief of Radiology/RSC Chair
Recommend Approval / ~~Disapproval~~ Donna K. Jacobs, FACHE, Associate Director/RSC Management Representative	Approved / Disapproved 10-6-09 Sandy J. Nielsen, FACHE, Director

Radiation Safety Committee (RSC) Minutes
June 4, 2009

AGENDA ITEM	DISCUSSION	ACTION	TARGET
Current Old Business			
1. Review of Previous Meetings' Minutes – Dr. Baker (5 minutes)	**Minutes from November 24, 2008 meeting** (reviewed 02/26/09 meeting but were pending signatures) RSC Signed Minutes Link minutes to with attachments **Minutes from February 26, 2009 meeting** (reviewed by RSC prior to obtaining signatures) RSC Signed Minutes Link minutes to with attachments Minutes were approved by all Committee members present (8).	None required.	Complete – Jun 2009
2. Smoke Tests – Dr. Baker & M. Hackett (5 minutes)	**Monthly Smoke Tests in Nuclear Medicine** AFM and Spill Clearance Times Additional tests were performed three times since the last RSC meeting and all demonstrated adequate air flow (i.e., negative air flow). Temporary air handlers were installed in April and the last two tests demonstrated visual improvement with the negative air flow. The permanent air handlers should be installed shortly and actual air flow measurements will be measured as part of the semi-annual testing that is due in June.	Continue to monitor and report at the next RSC meeting – M. Hackett	Aug 2009
3. Patient Instructions – Dr. Baker & M. Hackett (5 minutes)	**Patient Instructions for I-131 Therapies** Staff Training on Pt I-131 Instructions The updated patient instructions that were approved by the RSC in February were reviewed with the Nuclear Medicine staff in their March staff meeting and put into use. Additional staff training was provided on this subject and was completed in May/June.	None required.	Complete – Jun 2009

Radiation Safety Committee (RSC) Minutes
June 4, 2009

AGENDA ITEM	DISCUSSION	ACTION	TARGET
4. Footprint Management – Dr. Baker & M. Hackett (5 minutes)	**Footprint Management Procedure** Revision of the draft Footprint Management procedure was not available for review at this meeting; therefore, a new revision will be presented at the next RSC meeting.	Revise the draft procedure for the next RSC meeting – M. Hackett	Aug 2009
5. Reporting Noncompliance – Dr. Brown & M. Hackett (5 minutes)	**Reporting Noncompliance Procedure** Reporting Requirements Investigating Allegations Both draft procedures for reporting noncompliance and investigating allegations were reviewed and discussed. The procedures were approved by all Committee members present (8) with the following change to the investigating allegations procedure: replace Chair Elect with RSC Management Representative.	Make the change to the investigating allegations procedure, and format and post both procedures on the on the public drive – M. Hackett	Jul 2009
6. Annual Review – Dr. Baker & M. Hackett (10 minutes)	**Comprehensive Radiation Safety Program Annual Review (FY08)** Comprehensive Review for 2008 The comprehensive radiation safety program annual review has been updated (i.e., change from FY to CY). All the deficiencies, actions taken, and additional actions needed in this review have been discussed by the RSC during previous meetings (i.e., November 2008 for the FY review & February 2009 for the Oct-Dec 2008 audit review). The annual review will be sent out to the Committee for final review and approval before submitting it to the Director for review and approval.	Send updated annual review to RSC and then to the Director plus set up a tracking grid for items still requiring action – M. Hackett	Jul 2009

7. Follow up on action from O-D 2008 Audits: Dr. Baker & M. Hackett (10 minutes) a. Research lab issue	**Radioactive Use Approval** RSC Letter to AU Director Letter to ORO The Morris' lab has not been used since December 2008 and is still under radiation safety's control (i.e., re-keyed to RSO in Dec). This issue was reported to the ORO as required. Since Dr. Morris's approval as a Research Authorized User has ended effective in May, Dr. Smyth is considering applying as a Research Authorized User to continue radioactive use in this lab sometime in the future. If she decides not to apply, this lab will be deactivated as part of the footprint management procedure that is being developed.	Follow up with Dr. Smyth on completion of Research Authorized User application – M. Hackett	Aug 2009
b. Cath lab doses	**Accuracy of Cath Lab Patient Doses Values** X-Ray Dose Info from GE A PO has been issued for special testing that has been scheduled for later in June.	Follow up on special testing results – M. Hackett	Jul 2009
c. Add CT cases	**Additional Sampling of Routine CT cases** Additional high, average, and low volume CT case reviews have been added to Rad-Fluoro Use Reviews for Jan-Mar 2009. See Quarterly Radiation Safety Audit for Jan-Mar 2009 in Current New Business (item 1).	Continue to monitor as part of the qtrly audit – M. Hackett	Complete – Jun 2009
8. Draft VHA Handbook – Dr. Baker (5 minutes)	**Draft VHA Fluoroscopy Handbook** No follow up information to review. Dr. Baker will be attending the VA-wide Radiology Summit Leadership meeting later in June.	Report any follow up from radiology meeting at next RSC meeting – C. Baker	Aug 2009

Radiation Safety Committee (RSC) Minutes
June 4, 2009

Current New Business			
1. Qtly Audits – Dr. Baker & M. Hackett (15 minutes)	**Quarterly Radiation Safety Audits for Jan-Mar 2009** Combined Trending Report with Summaries with Detailed Areas Audits Qtrly Trending Report Nuclear Medicine Research Rad-Fluoro ALARA-Rad Exp Discussion included all items found on the trending report's deficiency summary which included any action taken. These actions were approved by all Committee members present (8) with no further action required except for: a. It appears our CT doses are higher than other facilities for CT chest without contrast, CTA aorta, and CT liver protocol. These protocols should be reviewed for possible changes to the acquisition parameters to lower the patient dose. b. As noted in the previous quarterly audit (i.e., December data from Oct-Dec 2008audit), there was a question in regards to the Cath lab machinery overestimating the patient dose. See Accuracy of Cath Lab Patient Doses Values in Current Old Business (item 7.b.) for action and follow up.	Continue to monitor as part of the qtrly audit – M. Hackett Review protocols and report at next RSC meeting – Radiology/C. Baker See Current Old Business (item 7.b.)	Aug 2009 Aug 2009 N/A
2. NRC NOV – Dr. Baker (5 minutes)	**NRC Notice of Violation (NOV) and Relpy** NRC NOV NRC NOV Reply In April, we received an additional NOV from the NRC based on the NHPP inspection in September 2007. This NOV deals with the failure to provide the Radiation Safety Officer adequate time to perform required duties. The corrective action for this NOV has already been taken based on the NHPP inspection and its NOVs.	None required.	Complete – May 2009

Radiation Safety Committee (RSC) Minutes
June 4, 2009

Items Referred for Higher Level/Council Review and/or Other Committee Review
• The minutes from this meeting are regularly scheduled to be presented during the July 2009 Environment of Care Council meeting.

Next Meeting's Tentative Agenda – August 27, 2009 @ 11:30 am in Nuclear Medicine Conference Room, B101A			
Next Meeting's Old Business including items from current agenda requiring further action (see above).			
1. Review of Previous Meeting's Minutes – Dr. Baker (5 minutes)			
2. Smoke Tests – Dr. Baker & M. Hackett (5 minutes)			
3. Footprint Management – Dr. Baker & M. Hackett (5 minutes)			
4. Reporting Non-Compliance – M. Hackett (5 minutes)			
5. Annual Review – M. Hackett (5 minutes)			
6. Follow up on action from O-D 2008 Audits: Dr. Baker & M. Hackett (5 minutes) a. Research lab issue b. Cath lab doses			

7. Draft VHA Handbook – Dr. Baker (5 minutes)			
8. Follow up on action from J-M 2008 Audits: Dr. Baker & M. Hackett (5 minutes) a. CT b. See 6.b.			
Next Meeting's New Business			
1. Qtly Audits – Dr. Baker & M. Hackett (15 minutes)			

Attendance: Sign In Sheet RSC Attendance for 2009 Reviews	**Meeting Time:** 9:00 am – 10:05 am	**Recorder(s):** **Michael T. Hackett**

Recommend Approval / ~~Disapproval~~ Michael T. Hackett, M.S., Radiation Safety Officer	Recommend Approval / ~~Disapproval~~ Cheryl D. Baker, M.D. Chief of Radiology/RSC Chair
Recommend Approval / ~~Disapproval~~ Donna K. Jacobs, FACHE, Associate Director/RSC Management Representative	Approved / Disapproved 7-23-09 Sandy J. Nielsen, FACHE, Director

Monthly Smoke Tests

Month	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Date of Testing	10/07/08	11/04/08	12/31/08	01/23/09	02/25/09	03/31/09	04/28/09	05/26/09	06/29/09	07/31/09	08/17/09
Did smoke tests @ exit door confirm the Hot Lab (A152A) was under negative pressure?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Did smoke tests @ exit doors (4) confirm the Imaging Room (A153) was under negative pressure?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Performed by	M Hackett RSO	M Hackett RSO	A Rogers ENG SVC	M Hackett RSO	M Hackett RSO	M Hackett RSO	M Hackett RSO	M Hackett RSO	A Rogers ENG SVC	M Hackett RSO	M Hackett RSO

A/C 3 temporary exhaust switch was on April 18, 2009

A/C 3 new exhaust switch was on June 6, 2009

Air Flow Measurements - Hot Lab A152A

Date of Testing See Comments Below	01/22/08	06/04/08 *	12/31/08	06/29/09	Average
Supply Vents (4, measured CFM values in italic): #1 2'x4'	*65*	*65*	*130*	*60*	*80*
#2 2'x4'	*65*	*65*	*120*	*60*	*78*
#3 2'x2'	*55*	*55*	*50*	*50*	*53*
#4 6"x6"	*40*	*40*	*110*	*30*	*55*
Total Supply in CFM	**225**	**225**	**410**	**200**	**265**
Fume Hood (measured CFM value in italic)	*620*	*710*	*700*	*700*	*683*
Total Exhaust in CFM	**620**	**710**	**700**	**700**	**683**
Room Pressure **(i.e., Total Supply - Total Exhaust)**	**-395**	**-485**	**-290**	**-500**	**-418**

Click Here for Room Diagram

Spilled Xe-133 Gas Clearance Time - Hot Lab A152A

Evacuation Time (t) in Minutes	**5.1**	**4.5**	**4.5**	**4.5**	**4.7**

Where $t = (-V/Q) \times \ln(C \times V/A)$

$V = 1.11 \times 10^8$ ml - room volume

Q = measured exhaust flow rate in ml/min
(i.e., **Total Exhaust in CFM** x 28,317 ml/ft^3)

$C = 1 \times 10^{-4}$ µCi/ml - DAC (derived air concentration - occupational value)

$A = 2.5 \times 10^4$ µCi - maximum ^{133}Xe activity (based on spillage from a full vial)

Smoke Test Performed - Hot Lab A152A

Date of Testing	N/A	06/05/08	12/31/08	06/29/09
Did smoke tests @ exit door confirm room at negative pressure?	N/A	Yes	Yes	Yes

Comments:

* 05/16/08 - Removed HEPA filter from fume hood exhaust that was not required.

Air Flow Measurements - Imaging Room A153

Date of Testing	01/22/08	06/04/08	12/31/08	06/29/09	Average
See Comments Below		*		**	
Supply Vents (8, measured CFM values in italic) #1 2'x2'	*230*	*230*	*200*	*210*	*218*
#2 2'x2'	*250*	*240*	*220*	*220*	*233*
#3 2'x2'	*250*	*230*	*220*	*220*	*230*
#4 2'x2'	*230*	*230*	*220*	*220*	*225*
#5 2'x2'	*190*	*175*	*170*	*110*	*161*
#6 2'x2'	*185*	*175*	*200*	*120*	*170*
#7 2'x2'	*170*	*155*	*185*	*190*	*175*
#8 2'x2'	*170*	*155*	*185*	*190*	*175*
Total Supply in CFM	**1,675**	**1,590**	**1,600**	**1,480**	**1,586**
Return Vents (3, measured CFM values in italic): #1 2'x2'	*360*	*340*	*330*	*400*	*358*
#2 2'x2'	*390*	*410*	*450*	*500*	*438*
#3 2'x2'	*320*	*320*	*330*	*400*	*343*
Total Return Vents in CFM	1,070	1,070	1,110	1,300	1,138
Return Hoses (3, measured FPM values in italic): #1 6" Round	*1,400*	*810*	*930*	*820*	*990*
#2 6" Round	*1,605*	*1,420*	*1,420*	*1,410*	*1,464*
#3 6" Round	*1,050*	*600*	*820*	*1,080*	*888*
Total Return Hoses in FPM	4,055	2,830	3,170	3,310	3,341
Total Return Hoses in CFM (i.e., Total Return Hoses in FPM x area of circle (πr^2) in ft^2, where r = radius of the hose = 0.25 ft)	796	556	622	650	656
Total Exhaust in CFM (i.e., Total Return Vents + Total Return Hoses in CFM)	**1,866**	**1,626**	**1,732**	**1,950**	**1,794**
Room Pressure (i.e., Total Supply - Total Exhaust)	**-191**	**-36**	**-132**	**-470**	**-207**

Click Here for Room Diagram

Spilled Xe-133 Gas Clearance Time - Imaging Room A153

Evacuation Time (t) in Minutes	**-5.4**	**-6.2**	**-5.8**	**-5.1**	**-5.6**

Where $t = (-V/Q) \times \ln(C \times V/A)$

$V = 4.62 \times 10^8$ ml - room volume

Q = measured exhaust flow rate in ml/min (i.e., **Total Exhaust in CFM** x 28,317 ml/ft^3)

$C = 1 \times 10^{-4}$ µCi/ml - DAC (derived air concentration - occupational value)

$A = 2.5 \times 10^4$ µCi - maximum ^{133}Xe activity (based on spillage from a full vial)

Smoke Test Performed - Imaging Room A153

Date of Testing	N/A	06/05/08	12/31/08	06/29/09
Did smoke tests @ 4 exit doors confirm room at negative pressure?	N/A	Yes	Yes	Yes

Comments:

* 06/03/08 - Modified exhaust (i.e., decrease to NM, increase to Pharmacy).

** 04/18/09 - A/C 3 temporary exhaust switch

** 06/06/09 - A/C 3 new exhaust switch

Radiation Safety Committee
Comprehensive Radiation Safety Program Annual Review for 2008

- The last comprehensive radiation safety program annual review was for FY2008 (i.e., Oct 1, 2007 – Sep 30 2008). It was presented to the Radiation Safety Committee (RSC) on November 24, 2008. The minutes from this meeting were submitted and approved by the Director. This review was also presented at the January 9, 2009 Environment of Care (EOC) Committee meeting.

- Since the EOC Committee has changed their reporting period from the fiscal year (FY) to the calendar year (CY) effective January 1, 2009, the RSC decided during the February 26, 2009 RSC meeting to change their reporting period to coincide with the EOC Committee (i.e., calendar year). The review following review will include 9 months (i.e., Jan 1, 2008 – Sep 30 2008) from the previous annual review plus the last 3 months of 2008 which in part was reviewed during the quarterly audit review during the February 26, 2009 RSC meeting.

- The RSC has met at least quarterly (see attached) to review the 2008 quarterly radiation safety audits and findings from these meetings have been presented for review at the Environment of Care Committee.

RSC Dates and Attendance for 2008

- The comprehensive quarterly radiation safety audits for Nuclear Medicine Service, Research labs, and staff radiation exposure have been enhanced for this year by the development of trending reports (see attached) that were also supplemented by deficiency and notable changes & updates summaries.

Trending Report 2008.xls

- Radiation safety training materials (see attached) that are available on the public drive have been enhanced but training materials for radiographic/fluoroscopic use need to be developed.

Radiation Safety Training 2008.xls

- Research user application process was updated and re-approval of existing research users was initiated.

- VHA National Health Physics Program's unannounced inspection in August 2008 resulted in with no violations noted.

- Items addressed in 2008 that require completion in 2009:
  - Develop core performance indicators and performance goals
  - Update patient instructions for I-131 therapies
  - Finalize footprint management procedure for the Medical Center
  - Deactivate of several inactive labs in Research
  - Complete of the re-approval process of Authorized Users in Research
  - Further develop radiographic-fluoroscopic use quarterly audit
  - Further enhance radiation safety training to include radiographic-fluoroscopic use areas
  - Further develop access to radiation safety information

- See the following 2008 deficiency and notable changes & update summaries for:
  - Nuclear Medicine Service
  - Research Service
  - Radiographic-Fluoroscopic Use
  - ALARA-Radiation Exposure

Radiation Safety Committee

Comprehensive Radiation Safety Program Annual Review for 2008

Nuclear Medicine Service

Deficiency Summary:

Some deficiencies may include notable changes (i.e., decrease compared to 2007) as noted by the 2-color highlight (2008 in yellow with *2007 in green*).

Radiation Safety Issue	Cause	Corrective Action & Any Other Notable Action Taken
1. Daily Radiation Surveys:		
• Surveys not performed daily as required: 1 time – 3Q *(2007:1)*	Procedures were not followed. Radioactivity used that day but no use that required a written directive.	• Additional staff training concerning performing surveys daily was performed in October 2008.
• Surveys greater than trigger level: 27 times – 1Q, 2Q, 3Q, 4Q *(2007:35)*	All initial readings although above trigger level (TL) were fairly low and were in areas where increased radiation levels may be seen.	• Prompt and appropriate action to lower these levels below TL was taken. • Additional staff training concerning proper surveying techniques was performed in January 2008. • Found in the stress area regular trash (monitored before being removed by EMS) and/or the non-radioactive sharps container (before being disposed as routine biohazard waste). These were due to minor back flow into IV items that should not normally be contaminated with radioactivity (e.g., IV tubing, used syringes). Corrective action (disposal of IV line & added shielding to sharps container) was phased into use in 1Q 2008 and was added to the quarterly trending data. Additional staff training on this subject was performed in February 2008 and again in October 2008. ○ 6 times – 1Q, 2Q, 3Q *(2007:15)* • Contamination on the injection table pad has increased; therefore, it was added to the quarterly trending data. Additional staff training on this subject was performed in October 2008 and was also discussed in the November 2008 staff meeting. ○ 11 times – 1Q, 2Q, 3Q, 4Q *(2007:4)*
2. Weekly Radiation Wipes:		
• Wipes greater than trigger level: 5 times – 1Q, 3Q *(2007:17)*	All initial wipes although above trigger level were fairly low and were in areas where increased contamination levels may be seen.	• Prompt and appropriate action to lower these levels was taken. • Additional staff training concerning wipes was performed in May/June 2008. • One-on-one training with the two non-senior technologists was done in August 2008 to supplement the above noted training.

Radiation Safety Committee

Comprehensive Radiation Safety Program Annual Review for 2008

Nuclear Medicine Service

Deficiency Summary:

Some deficiencies may include notable changes (i.e., decrease compared to 2007) as noted by the 2-color highlight (2008 in yellow with *2007 in green*).

Radiation Safety Issue	Cause	Corrective Action & Any Other Notable Action Taken
10. Monthly Xenon Machine Quality Control Checks: • Quality control checks not within limits : 1 time – 4Q *(2007:0)*	Xenon trap alarm: The actual activation distance was not within the excepted limits. The xenon trap was removed and imaged to check to see if the trap needed to be replaced (i.e., 8 distinct spots seen). Two of the 8 chambers could be barely seen; therefore, the xenon trap replacement was not indicated. Troubleshooting guide suggested replacement of the detector board or the GM tube if the trap replacement was not needed.	• A new replacement xenon system had been received; therefore, repair of the old system's alarm was not warranted since its use would be limited (i.e., until activation of the new system pending testing & training which occurred in January 2009).
16. Reported Radioactive Spills: • Reported radioactive spill occurred: 1 time – 1Q *(2007:1)*	During a treadmill test with Tc-99m there was some leakage (several μCi) at the IV site (i.e., where intracath went into skin not at the connection of the intracath and the IV line; therefore, not preventable).	• Spill was minor and well contained. Good and prompt response to the spill (e.g., use of mini-spill kits). Minor contamination of staff clothing which was promptly removed for decay but no actual personnel contamination. The spill was discussed with the staff involved. • Additional staff spill training was performed in May/June 2008. • Restocked replacement items in the radiation spill kit/mini-radiation spill kits in December 2008.
17. Quarterly Review of In-coming Radionuclide Receiving Records: • Package receiving problems noted: 3 times – 3Q, 4Q *(2007:0)*	• I-131 therapy shipment from local radiopharmacy had very minor contamination noted for the inner package (i.e., foam securing the I-131 dose) although the external wipes & surveys were within limits.	• The return package (i.e., with used I-131 container) had external wipes & surveys well within limits and the radiopharmacy will handle this package and used I-131 container as contaminated.

Radiation Safety Committee

Comprehensive Radiation Safety Program Annual Review for 2008

Nuclear Medicine Service

Deficiency Summary:

Some deficiencies may include notable changes (i.e., decrease compared to 2007) as noted by the 2-color highlight (2008 in yellow with *2007 in green*).

Radiation Safety Issue	Cause	Corrective Action & Any Other Notable Action Taken
	• Tc-99m shipment from local radiopharmacy left unsecured outside hot lab door @ ~6:40 am while the technologist was in the hot lab.	• Upon discovery (i.e., shortly after it was left), the technologist promptly secured the sealed package and notified the RSO. The RSO then discussed this situation with the radiopharmacy manager. The manager stated that he would discuss this with their driver and stress to all drivers that shipments made when Nuclear Medicine is open are to be placed in the hot lab via access by the nuclear medicine staff.
	• I-123 shipment was delivered in error by the manufacturer. The shipment was meant for the VAMC in White River Junction, VT but had our shipping address.	• The RSO discussed this issue with the manufacturer. The material was retained and held for decay.
18. Quarterly Review of Out-going Radionuclide/Return Package Records:		
• Out-going records were missing pertinent info: 1 time – 2Q *(2007:2)*	Shipping paper not retained for return Mo-99/Tc-99m generator.	• Courier should not have picked up the return if shipping paper was not present and the returns company did not notify us that shipping paper was not present upon its receipt. Discussed this issue with the technologist involved.

Nuclear Medicine Service

Notable Changes & Updates:

Some notable changes may be on the Deficiency Summary as noted by the 2-color highlight.

Radiation Safety Issue	Notable Change/Update	Any Other Notable Action Taken
3. Mo-99/Tc-99m Assays (discontinued use in June 2008 due revised USP <797>):		
• Mo-99m/Tc-99m assays not performed for each pt.-use elution:	2008: 0 *(2007:1)*	• Additional staff training concerning Mo-99/Tc99m assays was performed in March 2008.

Radiation Safety Committee

Comprehensive Radiation Safety Program Annual Review for 2008

Nuclear Medicine Service		
Notable Changes & Updates: Some notable changes may be on the Deficiency Summary as noted by the 2-color highlight.		
Radiation Safety Issue	**Notable Change/Update**	**Any Other Notable Action Taken**
4. Daily Dose Calibrator (DC) Constancy Checks (2 dose calibrators):		
• Constancy checks not performed daily if used for pts as required:	2008: 0 *(2007:2)*	• Added reminder labels to the dose calibrator & L-shield concerning daily constancy checks in October 2008. • Additional staff training concerning constancy checks was performed in November 2008. • Several times on the non-Tc-99m dose calibrator which is used infrequently (i.e., not every day for patient doses), the constancy checks had not been performed or partially done on days not used for patients. Tracking of this issue was added to the quarterly trending data to check how effective the above action was. ○ # of times constancy checks on non-Tc-99m DC not performed or partially done but not used for patients that day: 5 times – 1Q, 2Q, 3Q *(2007:11)*
8. Daily Thyroid Probe/Well Counter and Multi-Well Counter Constancy Checks:		
• Constancy checks not performed daily (i.e., when used) as required:	2008: 0 *(2007:4)*	• In February 2008, started using 5 stds for daily multi-well daily constancy checks instead of 1 to avoid missing checks on wells 2-5 when used. • Additional staff training concerning this change was also done at that time.
11. Semi-Annual Air Flow Measurements (AFM)/Fume Hood Certification and Xenon Spill Clearance Time Calculations:		
• Semi-annual (Jun & Dec) AFM not performed as required:	2008: 0 *(2007:1)*	• AFM forms were developed in January 2008 which included supply and exhaust locations/results that are color coded and numbered so they can be tracked over time (i.e., Excel file started in June 2008). • Added extension hose to the exhaust by imaging camera-E.cam 2 in March 2008 that can be used during lung vent studies in case of Xe-133 leakage. • Semi-annual AFM was set up on a recurring PM schedule (i.e., no work order required) starting in June 2008. • In June 2008, the imaging room's exhaust was temporarily decreased due to an increased exhaust need in another area of the hospital. Semi-annual smoke tests were added at all doorways to confirm that both rooms (i.e., imaging room & hot lab) are under negative pressure. In October 2008, monthly smoke tests were also added and tracked on the quarterly trending data.

Radiation Safety Committee

Comprehensive Radiation Safety Program Annual Review for 2008

Nuclear Medicine Service		
Notable Changes & Updates: Some notable changes may be on the Deficiency Summary as noted by the 2-color highlight.		
Radiation Safety Issue	**Notable Change/Update**	**Any Other Notable Action Taken**
12. Annual Survey Meter Calibrations:		
• Annual calibration (Mar)/post repair not performed as required:	2008: 0 *(2007:1)*	• In March, enhanced electronic inventory on P-drive of all survey meters (e.g., color coded priority of use, manual links, hard copy, etc.). • Additional staff training on survey meters was performed in January and April 2008.
13. Quarterly/Annual Radionuclide Sealed Source Inventory:		
• See "Any Other Notable Action Taken"	N/A	• In April 2008, 2 sealed sources (no longer used) were recovered through the Los Alamos National Laboratory's *Off-Site Source Recovery Project.* • Also in April, added a secondary locking mechanism to cabinet used to store some sealed sources.
18. Quarterly Review of Out-going Radionuclide/Return Package Records:		

• In-coming shipments from local radiopharm. that did not have out-going documentation:	2008: 0 *(2007:8)*	• In late 2007, action was taken to reduce the incidence of this.
		  ○ Modified return package process and additional staff training on return packages was performed in October 2007.
		  ○ Updated return labels in November 2007.
		• Action taken in 2007 was very successful even though the number of in-coming shipments from the local radiopharmacy actually increased significantly in 2008 (i.e., 430 in 2008 compared to only 103 in 2007) which was due to the discontinued use of in-house preparations in June 2008 as result from the revised USP <797>.

19. Written Directive (WD) Audits for Nuclear Medicine:		
• Problems noted:	2008: 0 *(2007:1)*	• N/A
21. Radiation Safety Improvements and/or Additional Comments/Problems:		
• See "Any Other Notable Action Taken" for items not included above.	N/A	• In December 2008, updated and enhanced required annual radiation safety training (e.g., tests, RS info boards, Homeland Security). See training report for links to actual training. • In December 2008, posted the revised NRC Form 3: Notice to Employees (10-2008).

Radiation Safety Committee

Comprehensive Radiation Safety Program Annual Review for 2008

Research Service

Deficiency Summary:

Some deficiencies may include notable changes (i.e., decrease compared to 2007) as noted by the 2-color highlight (2008 in yellow with *2007 in green*).

Radiation Safety Issue	Cause	Corrective Action & Any Other Notable Action Taken
2. Annual Radiation Surveys/Wipes of each Authorized User Lab/Room done by RSO:		
• Surveys/wipes greater than trigger level: 1 time – 4Q *(2007:0)*	Minor P-32 contamination was found on the bench top and the floor from a contaminated pipet tip. The contamination was from lab work done a few days earlier that had not yet been monitored by the lab.	• Some items were held for decay to background levels before reuse. The bench top covering was quickly decontaminated to background levels. The isolated contamination on the floor was decontaminated to lower levels and covered to decay to background levels prior to reuse. The room was secured (i.e., re-keyed to radiation safety key to prevent access, e.g., housekeeping, research staff) and posted as "Do Not Enter". This incident coupled with inconsistent monitoring of the lab which has been an issue in the past (see item 3 below), the Radiation Safety Committee voted to disallow this user from further use of radioactive materials at this VA facility.
3. Quarterly Record Audit of Weekly Radiation Wipes Performed by each Authorized User Labs:		
• Wipes not been performed as required: 4 times – 1Q, 2Q, 4Q *(2007:8)*	Procedures were not followed.	• Wipe procedures/requirements were reviewed via refresher training in August 2008 (i.e., taken in part from training done in December 2007). Also at that time, the lab changed their monitoring responsibilities to address this issue.
• Wipes greater than trigger level: 2 times – 3Q *(2007:0)*	All initial wipes although above trigger level (TL) were fairly low and were in areas where increased contamination levels may be seen.	• Prompt and appropriate action to lower these levels below TL was taken.
13. Quarterly Review of In-coming Radionuclide Receiving Reports:		
• Package receiving problems noted: 1 time – 2Q *(2007:3)*	The shipping label did not note the proper delivery point.	• The delivery point was noted as Research and it did not require any DOT labeling. It was picked up by Research who promptly notified the RSO. The RSO discussed the proper shipping address with person who placed the order.

Research Service

Notable Changes & Updates:

Some notable changes may be on the Deficiency Summary as noted by the 2-color highlight.

Radiation Safety Issue	Notable Change/Update	Any Other Notable Action Taken
9. Annual Survey Meter Calibrations:		
• Annual calibration (Mar)/post repair not performed as required:	2008: 0 *(2007:1)*	• In March, Enhanced electronic inventory on P-drive of all survey meters (e.g., color coded priority of use, manual links, hard copy, etc.).

Radiation Safety Committee

Comprehensive Radiation Safety Program Annual Review for 2008

Research Service		
Notable Changes & Updates: Some notable changes may be on the Deficiency Summary as noted by the 2-color highlight.		
Radiation Safety Issue	**Notable Change/Update**	**Any Other Notable Action Taken**
11. Monthly Beta Counter (2) Normalization, Chi-Square, and Constancy Checks and Gamma Counter (2) Peak, % Resolution, Chi-Square, Constancy, and Efficiency Checks:		
• Above checks not within limits:	2008: 0 *(2007:1)*	• N/A
16. Radiation Safety Improvements and/or Additional Comments/Problems:		
• See "Any Other Notable Action Taken" for items not included above.	N/A	• In August 2008, restocked replacement items in the radiation spill kits. • In December 2008, updated and enhanced required annual radiation safety training (e.g., tests, RS info boards). See training report for links to actual training. • In December 2008, posted the revised NRC Form 3: Notice to Employees (10-2008). • In December 2008, updated radiation spill kit contents listing & location notice to include the location of a backup survey meter.

Radiation Safety Committee

Comprehensive Radiation Safety Program Annual Review for 2008

Radiographic-Fluoroscopic Use

Deficiency Summary:

Some deficiencies may include notable changes (i.e., decrease compared to 2007) as noted by the 2-color highlight (2008 in yellow with *2007 in green*).

Radiation Safety Issue	Cause	Corrective Action & Any Other Notable Action Taken
2. Patient radiation dose from Interventional Fluoroscopy (Specials B180):		
• Cases with total Air Kerma dose > 3 Gy but < 15 Gy: 1 time – Dec *(2007:N/A)*	Patient dose is dependent on length and complexity of the case.	• Data collection was started in December 2008 and will require further data collection & analysis to evaluate if corrective action is needed.
3. Patient radiation dose from Cardiac Cath (A233 & A235):		
• Cases with total Air Kerma dose > 3 Gy but < 15 Gy: 19 times – Dec *(2007:N/A)*	Patient dose is dependent on length and complexity of the case.	• Data collection was started in December 2008 and will require further data collection & analysis to evaluate if corrective action is needed. Some of these readings may be possible falsely high; therefore, the equipment will be checked for the accuracy of these readings.

Radiographic-Fluoroscopic Use

Notable Changes & Updates:

Some notable changes may be on the Deficiency Summary as noted by the 2-color highlight.

Radiation Safety Issue	Notable Change/Update	Any Other Notable Action Taken
N/A	N/A	• Started to collect initial data in Dec 2008.

Radiation Safety Committee
Comprehensive Radiation Safety Program Annual Review for 2008

ALARA-Radiation Exposure

Deficiency Summary:

Some deficiencies may include notable changes (i.e., decrease compared to 2007) as noted by the 2-color highlight (2008 in yellow with *2007 in green*).

Radiation Safety Issue	Cause	Corrective Action & Any Other Notable Action Taken
1. Personnel Exposure Records/ALARA Investigational Levels:		
A. Radioactive Materials Use:		
• Exceeded the ALARA Quarterly Investigational Level I (10% of ¼ annual limit): 7 times – 1Q, 2Q, 3Q *(2007:12)*	Occupational radiation exposure from clinical use of radioactive materials.	• These levels of exposure are not unusual in nuclear medicine.
B. Radiographic-Fluoroscopic Use:		
• Exceeded the ALARA Quarterly Investigational Level I (10% of ¼ annual limit): 10 times – 1Q, 3Q, 4Q *(2007:4)*	Occupational radiation exposure from clinical use of x-rays.	• These levels of exposure are not unusual in areas where radiographic/ fluoroscopic procedures are performed.
2. I-125/I-131 Bioassay Results:		
• Bioassays not performed within 6-72 hours post administration: 1 time – 1Q *(2007:0)*	One administration on a Friday that should have had a bioassay performed on the following Monday was overlooked until Wednesday.	• Staff to add note on the patient schedule and/or on staff Outlook calendar as a reminder when a bioassay is needed.

ALARA-Radiation Exposure

Notable Changes & Updates:

Some notable changes may be on the Deficiency Summary as noted by the 2-color highlight.

Radiation Safety Issue	Notable Change/Update	Any Other Notable Action Taken
N/A	N/A	• Added monitoring of personnel exposure from radiographic-fluoroscopic use to the audit process starting with July 2008 data.

Radiation Safety Committee

Comprehensive Radiation Safety Program Annual Review for 2008

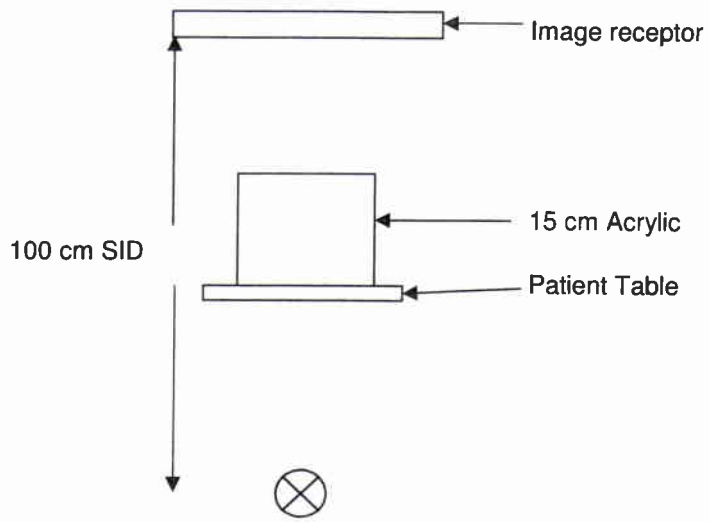
Recommend Approval / ~~Disapproval~~ Michael T. Hackett, M.S., Radiation Safety Officer	Recommend Approval / ~~Disapproval~~ Cheryl D. Baker, M.D. Chief of Radiology/RSC Chair
Recommend Approval / ~~Disapproval~~ Donna K. Jacobs, FACHE, Associate Director/RSC Management Representative	Approved / Disapproved Sandy J. Nielsen, FACHE, Director

Performance Goal Completed
Performance Goal Partially Completed
Performance Goal Not Completed

Radiation Safety Committee Performance Goals for 2009

Performance Goal	Status as of 08/27/2009	Target Date	Completed Date
Develop core performance indicators and performance goals	Core performance indicators still need to be developed. Will discuss in the upcoming December 2009 Radiation Safety Committee (RSC) meeting for implementation in 2010.	Dec-09	
	Performance goals taken from Comprehensive Radiation Safety Program Annual Review for 2008 that was reviewed during the June 2009 RSC meeting.	N/A	Jun-09
Update patient instructions for I-131 therapies	The updated patient instructions that were approved by the RSC in February 2009 were reviewed with the Nuclear Medicine staff in their March 2009 staff meeting and put into use. Additional staff training was provided on this subject and was completed in May/June 2009.	N/A	Jun-09
Finalize footprint management procedure for the Medical Center	The draft footprint management procedure still needs some changes. Radiation Safety Officer and Research Safety Manager will work together on these changes for submission for RSC review via e-mail.	Oct-09	
Deactivate of several inactive labs in Research	Pending final footprint management procedure.	Dec-09	
Complete of the re-approval process of Authorized Users in Research	The majority of applications have been received. Summaries need to be completed for presentation to RSC.	Nov-09	
Further develop radiographic-fluoroscopic use quarterly audit	Additional high, average, and low volume CT case reviews have been added to Rad-Fluoro Use Reviews starting with the Jan-Mar 2009 trending report which was reviewed during the June 2009 RSC meeting. A detailed quarterly audit was also added along with references concerning patient doses to both the trending reports and the detailed audits.	N/A	Jun-09
Further enhance radiation safety training to include radiographic-fluoroscopic use areas	Enhancement of radiation safety training for the radiographic-fluoroscopic use areas is still under development. The goal is make this training similar to the radioactive material training that is locally available on-line with a test for training credit that can be submitted via e-mail.	Dec-09	
Further develop access to radiation safety information	The goal is centrally locate on the local public drive applicable radiation safety information (e.g., SOPs, forms, etc.) that all local VA staff will have access to.	Dec-09	

VA Medical Center
Comparison of machine stated skin dose with measured dose.



GE Cardiac Cath Lab

Chamber was placed at 55.5 centimeters as stated by GE as the measurment point of the internal dose meter. Fifteen cm of acrylic was used as phantom and the AEC system chose the techniques. After several minutes of fluoro the results below were obtained:

GE Cath Lab 1

Measurements in mGy

Stated	Measured	% Diff
31	25	19%

GE Cath Lab 2

Measurements in mGy

Stated	Measured	% Diff
46	37	20%

Philips Angio Lab

Chamber was placed at 66 centimeters as stated by Philips as the measurment point of the internal dose meter. Fifteen cm of acrylic was used as phantom and the AEC system chose the techniques. After several minutes of fluoro the results below were obtained:

Measurements in mGy

Stated	Measured	% Diff
50.3	51.4	2%

Service Prerequisites - FEE CONSULT PET/CT EXAM

Print | Continue | Cancel Order

Current Standard of Care is for PET to be performed as a Fused PET/CT exam. A separate order for CT does NOT need to be entered.

The Lexington VAMC will not be responsible for any costs incurred to outside institutions, or to patients, that have not been approved through the electronic consult process.

Elective or Urgent conditions will be referred to another VA facility with the available services. Emergent conditions will be referred to a contracted local facility with the available services. The Chief of Staff must approve fee-basis authorization prior to the patient transferring to another facility at VA expense. During non-administrative hours contact the Administrative Officer of the Day (AOD) at x4950.

Template: FEE CONSULT PET/CT EXAM

☐ **PET/CT SCAN NOTE - all fields must be completed to process Fee Consult**

Date of any previous PET-CT: ◉ N/A

Requested exam - PET/CT Fusion with Non Diagnostic CT

All | None | * Indicates a Required Field | Preview | OK | Cancel

Radiation Safety Committee

Trending Quarterly Audit for 2nd Qtr 2009

Deficiency Summary

Click on the highlighted area links below for more information concerning these deficiencies via the area trending and/or detailed audits. Some deficiencies may include notable changes as noted by the 2-color highlight (yellow-green).		Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	2009 Qtrly Average	2009 Total	*2008 Qtrly Average*	*2008 Total*
Nuclear Medicine Service									
1. Daily Radiation Surveys:									
# of times surveys greater than trigger level	D	2	2			2.0	4	*6.8*	*27*
2. Weekly Radiation Wipes:									
# of times wipes greater than trigger level	D	2	1			1.5	3	*1.3*	*5*
18. Quarterly Review of Out-going Radionuclide/Return Package Records:									
# of in-coming shipments from local radiopharm. that did not have out-going documentation	D	0	1			0.5	1	*0.0*	*0*
Research Service									
N/A	N/A	N/A	N/A			N/A	N/A	*N/A*	*N/A*
Radiographic-Fluoroscopic Use									
3. Patient radiation dose from Cardiac Cath (A233 & A235):									
# of these cases with total dose ≥ 3 Gy but < 10 Gy	D	70	72			71.0	142	*N/A*	*19 Dec Only*
# of these cases with total dose ≥ 10 Gy but < 15 Gy	D	1	2			1.5	3	*N/A*	*0 Dec Only*
ALARA-Radiation Exposure									
N/A	N/A	N/A	N/A			N/A	N/A	*N/A*	*N/A*

D = Discrepancy/Problem Indicator V = Volume Indicator

Radiation Safety Committee

Trending Quarterly Audit for 2nd Qtr 2009

Notable Changes & Updates

Click on the highlighted area links below for more information concerning these notable changes & updates via the area trending and/or detailed audits. Some notable changes may be on the Deficiency Summary as noted by the 2-color highlight.		Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	2009 Qtrly Average	2009 Total	*2008 Qtrly Average*	*2008 Total*
Nuclear Medicine Service									
21. Radiation Safety Improvements and/or Additional Comments/Problems:									
Raised & modified the position of the Tc-99m shielded sharps container in the hot lab to reduce radiation exposure	N/A	N/A	in May			N/A	in May	*N/A*	*N/A*
Mounted locked shielded sharps container in the imaging room (1) to the wall to better secure radioactive/biohazard waste	N/A	N/A	in Jun			N/A	in Jun	*N/A*	*N/A*
Research Service									
16. Radiation Safety Improvements and/or Additional Comments/Problems:									
Worked w/ Research Safety Manager to update safety training for all research staff & lab entrance poster (both included radiation safety)	N/A	N/A	in Apr			N/A	in Apr	*N/A*	*N/A*
Radiographic-Fluoroscopic Use									
4. Radiation Safety Improvements and/or Additional Comments/Problems:									
Special dose (i.e., air kerma) evaluation done on Specials & Cardiac Cath equipment	N/A	N/A	in Jun				in Jun	*N/A*	*N/A*
ALARA-Radiation Exposure									
1. Personnel Exposure Records/ALARA Investigational Levels (see below):									
B. Radiographic-Fluoroscopic Use:									
b) # of times ALARA Quarterly Investigational Level I (10% of ¼ annual limit) was exceeded	D	2	0			1.0	2	*2.5*	*10*

D = Discrepancy/Problem Indicator V = Volume Indicator

Radiation Safety Committee

Trending Quarterly Audit for 2nd Qtr 2009

Nuclear Medicine Service

Click on the links to the right for the detailed Quarterly Nuclear Medicine Service Radiation Safety Audits in 2009 or the Trending Report for 2008 (on far right) which includes links to 2008 detailed audits.		Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	2009 Qtrly Average	2009 Total	2008 Qtrly Average	2008 Total
1. Daily Radiation Surveys:									
# of times surveys not performed daily as required	D	0	0			0.0	0	0.3	1
# of times surveys greater than trigger level	D	2	2			2.0	4	6.8	27
By area: Hot Lab	D	0	0			0.0	0	0.0	0
Imaging Room	D	0	2			1.0	2	3.8	15
Within the Imaging Room - in regular trash and/or non-radioactive sharps	D	0	1			0.5	1	1.5	6
Injection Room	D	2	0			1.0	2	3.0	12
Within the Injection Room - on injection table pad	D	1	0			0.5	1	2.8	11
# of times appropriate action was not taken to decrease levels below trigger level	D	0	0			0.0	0	0.0	0
2. Weekly Radiation Wipes:									
# of times wipes not performed weekly as required	D	0	0			0.0	0	0.0	0
# of times wipes greater than trigger level	D	2	1			1.5	3	1.3	5
By area: Hot Lab	D	1	1			1.0	2	0.8	3
Imaging Room	D	1	0			0.5	1	0.3	1
Injection Room	D	0	0			0.0	0	0.3	1
# of times appropriate action was not taken to decrease levels below trigger level	D	0	0			0.0	0	0.0	0
3. Mo-99/Tc-99m Assays (discontinued use in June 2008 due revised USP <797>):									
# of times Mo-99m/Tc-99m assays not performed for each pt.-use elution	D	N/A	N/A			N/A	N/A	0.0	0
# of times Mo-99m/Tc-99m concentration not within limits	D	N/A	N/A			N/A	N/A	0.0	0
# of Tc-99m elutions	V	N/A	N/A			N/A	N/A	67.0	134
Total Tc-99m activity in mCi from all elutions	V	N/A	N/A			N/A	N/A	51,786.4	103,572.7
4. Daily Dose Calibrator (DC) Constancy Checks (2 dose calibrators):									
# of times constancy checks not performed daily if used for pts as required	D	0	0			0.0	0	0.0	0
# of times constancy checks on non-Tc-99m DC not performed daily but not used for patients	D	0	1			0.5	1	0.8	3
# of times constancy checks on non-Tc-99m DC incompletely performed but not used for patients	D	0	0			0.0	0	0.5	2
# of times quarterly full constancy check not performed	D	0	0			0.0	0	0.0	0
# of times constancy checks not within limits	D	0	0			0.0	0	0.0	0
5. Quarterly Dose Calibrator Linearity Checks (2 dose calibrators):									
# of times linearity checks not performed quarterly/post repair as required	D	0	0			0.0	0	0.0	0
# of times linearity checks not within limits	D	0	0			0.0	0	0.0	0
6. Annual Dose Calibrator Accuracy Checks (2 dose calibrators):									
# of times accuracy checks not performed annually (Sep)/post repair as required	D	N/A	N/A			N/A	N/A	0.0	0
# of times accuracy checks not within limits	D	N/A	N/A			N/A	N/A	0.0	0
7. Dose Calibrator Geometry Checks (2 dose calibrators):									
# of times geometry checks not performed post repair as required	D	N/A	N/A			N/A	N/A	N/A	N/A
# of times geometry checks not within limits	D	N/A	N/A			N/A	N/A	N/A	N/A
8. Daily Thyroid Probe/Well & Multi-Well Counters Constancy Checks:									
# of times constancy checks not performed daily (i.e., when used) as required	D	0	0			0.0	0	0.0	0
# of times constancy checks not within limits	D	0	0			0.0	0	0.0	0
9. Quarterly Thyroid Probe/Well Counter & Multi-Well Counter Checks:									
# of times quarterly checks not performed as required	D	0	0			0.0	0	0.0	0
# of times quarterly checks not within limits	D	0	0			0.0	0	0.0	0
10. Monthly Xenon Machine Quality Control Checks:									
# of times monthly/quarterly quality control checks not performed as required	D	0	0			0.0	0	0.0	0
# of times quality control checks not within limits	D	0	0			0.0	0	0.3	1

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Nuclear Medicine Service

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11. Semi-Annual Air Flow Measurements (AFM)/Fume Hood Certification & Xenon Spill Clearance Time Calculations									
# of times semi-annual (Jun & Dec) AFM not performed as required	D	N/A	0			0.0	0	0.0	0
# of times imaging room & hot lab found not to be under negative pressure based on above AFM	D	N/A	0			0.0	0	0.0	0
# of times smoke test did not confirm that the room was under negative pressure	D	N/A	0			0.0	0	0.0	0
# of times Xenon spill clearance times not calculated and not posted for above AFM	D	N/A	0			0.0	0	0.0	0
# of times semi-annual (Feb & Aug) fume hood certification not performed as required	D	0	N/A			0.0	0	0.0	0
# of times fume hood sash level not noted for above certification	D	0	N/A			0.0	0	0.0	0
12. Annual Survey Meter Calibrations:									
# of times annual calibration (Mar)/post repair not performed as required	D	0	N/A			0.0	0	0.0	0
# of survey meters calibrated (note change from one cluster pancake probe to single probe due to loose internal connection)	V	6	N/A			6.0	6	3.5	7
13. Quarterly/Annual Radionuclide Sealed Source Inventory:									
# of times quarterly inventories not performed as required	D	0	0			0.0	0	0.0	0
# of unaccounted for sealed sources	D	0	0			0.0	0	0.0	0
# of sealed sources on inventory	V	138	137			137.5	N/A	136.0	N/A
# of sealed sources added to inventory during the quarter (may/may not be in above total due to when received)	V	0	0			0.0	0	0.3	1
# of sealed sources removed from inventory during the quarter (may/may not be in above total due to when shipped)	V	1	0			0.5	1	1.5	6
# of times monthly check of Cs-137 calibration source not performed	D	0	0			0.0	0	0.0	0
# of times annual (Mar) NHPP sealed source verification not performed as required	D	0	N/A			N/A	0	N/A	0
# of sealed sources on NHPP inventory	V	2	N/A			N/A	2	N/A	4
14. Semi-Annual Radionuclide Sealed Source Leak Testing:									
# of times semi-annual (Jan & Jul) leak test not performed as required	D	0	N/A			0.0	0	0.0	0
# of sealed sources leak tested	V	4	N/A			4.0	N/A	6.0	N/A
# of leak tests with leakage detected above required limits	D	0	N/A			0.0	0	0.0	0
15. Reportable or Recordable Events/Incidents:									
# of times a reportable or recordable event/incident occurred	D	0	0			0.0	0	0.0	0
16. Reported Radioactive Spills:									
# of times a reported radioactive spill occurred	D	1	0			0.5	1	0.3	1
# of times appropriate action to the spill was not taken	D	0	0			0.0	0	0.0	0
17. Quarterly Review of In-coming Radionuclide Receiving Records:									
# of times receiving records were missing pertinent info (e.g., survey/wipe results)	D	1	0			0.5	1	0.0	0
# of times package receiving problems noted (e.g., contamination, wrong material)	D	6	0			3.0	6	0.8	3
Total # of in-coming shipments	V	200	237			218.5	437	132.5	530
# of in-coming shipments noted above that were from the local radiopharmacy	V	181	192			186.5	373	107.5	430
# of C-14 in-coming shipments	V	0	0			0.0	0	0.3	1
# of C-14 in-coming shipments noted above that were from the local radiopharmacy	V	0	0			0.0	0	0.3	1
Total C-14 activity in mCi contained in the above shipments	V	0.000	0.000			0.0000	0.000	0.0005	0.002
# of Co-57 in-coming shipments	V	0	0			0.0	0	0.3	1
Total Co-57 activity in mCi contained in the above shipments	V	0.0	0.0			0.0	0.0	3.8	15.0
# of Ga-67 in-coming shipments	V	1	0			0.5	1	2.0	8
# of Ga-67 transfers from UK (i.e., not included as a shipment)	V	0	0			0.0	0	0.3	1
Total Ga-67 activity in mCi contained in the above shipments/transfers	V	12.2	0.0			6.1	12.2	27.3	109.3
# of I-123 in-coming shipments	V	0	0			0.0	0	0.3	1
Total I-123 activity in mCi contained in the above shipments	V	0.0	0.0			0.0	0.0	0.2	0.6

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# of I-131 (C = capsule) in-coming shipments	V	10	5			7.5	15	10.8	43
# of I-131 (C) in-coming shipments noted above that were from the local radiopharmacy	V	10	5			7.5	15	10.8	43
Total I-131 (C) activity in mCi contained in the above shipments	V	304.2	175.6			239.9	479.8	260.4	1,041.5
# of I-131 (S = solution) in-coming shipments	V	0	0			0.0	0	0.3	1
# of I-131 (S) in-coming shipments noted above that were from the local radiopharmacy	V	0	0			0.0	0	0.3	1
Total I-131 (S) activity in mCi contained in the above shipments	V	0.0	0.0			0.0	0.0	1.3	5.1
# of In-111 in-coming shipments	V	1	5			3.0	6	1.0	4
# of In-111 in-coming shipments noted above that were from the local radiopharmacy	V	1	1			1.0	2	0.8	3
Total In-111 activity in mCi contained in the above shipments	V	6.5	11.8			9.2	18.3	3.2	12.8
# of Mo-99 in-coming shipments	V	0	0			0.0	0	5.5	22
Total Mo-99 activity in mCi contained in the above shipments	V	0.0	0.0			0.0	0.0	10,080.0	40,320.0
# of Sm-153 in-coming shipments	V	0	0			0.0	0	0.5	2
Total Sm-153 activity in mCi contained in the above shipments	V	0.0	0.0			0.0	0.0	54.9	219.5
# of Tc-99m in-coming shipments	V	168	192			180.0	360	94.0	376
# of Tc-99m in-coming shipments noted above that were from the local radiopharmacy	V	168	192			180.0	360	94.0	376
Total Tc-99m activity in mCi contained in the above shipments	V	24,578.6	27,402.7			25,990.7	51,981.3	14,367.2	57,468.6
# of Tl-201 in-coming shipments	V	6	15			10.5	21	3.5	14
# of Tl-201 in-coming shipments noted above that were from the local radiopharmacy	V	2	5			3.5	7	1.5	6
Total Tl-201 activity in mCi contained in the above shipments	V	76.8	228.2			152.5	305.0	42.2	168.7
# of Xe-133 in-coming shipments	V	14	20			17.0	34	14.3	57
# of Xe-133 in-coming shipments noted above that were from the local radiopharmacy	V	0	1			0.5	1	0.0	0
Total Xe-133 activity in mCi contained in the above shipments	V	632.7	763.3			698.0	1,396.0	561.8	2,247.3
18. Quarterly Review of Out-going Radionuclide/Return Package Records:									
# of times out-going records were missing pertinent info (e.g., survey/wipe results)	D	0	0			0.0	0	0.3	1
# of times out-going package problems noted (e.g., contamination)	D	0	0			0.0	0	0.0	0
# of out-coming shipments	V	169	203			186.0	372	114.8	459
# of out-coming shipments noted above that were Mo-99/Tc-99m used generator returns	V	0	0			0.0	0	6.3	25
# of out-coming shipments noted above that were return packages to local radiopharmacy	V	168	203			185.5	371	107.5	430
# of out-coming shipments noted above that were sealed sources returns	V	1	0			0.5	1	1.0	4
# of in-coming shipments from local radiopharm. that did not have out-going documentation	D	0	1			0.5	1	0.0	0
19. Written Directive (WD) Audits for Nuclear Medicine:									
# of total written directives used for the quarter	V	8	5			6.5	13	9.3	37
# of written directives that were for I-131 thyroid uptake	V	0	0			0.0	0	0.3	1
# of written directives that were for I-131 whole body imaging	V	3	4			3.5	7	4.8	19
# of written directives that were for I-131 therapy for hyperthyroidism	V	3	0			1.5	3	2.5	10
# of written directives that were for I-131 therapy for thyroid cancer	V	2	1			1.5	3	1.5	6
# of written directives that were for Sm-153 therapy for bone pain	V	0	0			0.0	0	0.3	1
# of problem noted	D	0	0			0.0	0	0.0	0
20. Training (Include all staff if dealing with clinical use of radionuclides.):									
Total # of radiation safety training hours provided	V	39.50	6.25			22.88	45.75	34.25	137.00
# radiation safety training hours provided to Nuclear Medicine staff	V	10.50	3.50			7.00	14.00	6.31	25.25
# radiation safety training hours provided to AOD staff	V	0.00	0.00			0.00	0.00	1.25	5.00
# radiation safety training hours provided to EMS staff	V	16.50	0.00			8.25	16.50	12.19	48.75
# radiation safety training hours provided to VA Police staff	V	1.00	0.00			0.50	1.00	8.44	33.75
# radiation safety training hours provided to Warehouse staff	V	0.00	0.00			0.00	0.00	2.38	9.50
# radiation safety training hours provided as FYI training (e.g., Radiation Safety, Safety Office staff)	V	11.50	2.75			7.13	14.25	3.69	14.75
# of times DOT HAZMAT training not done as required (i.e., new staff w/i 90 days; 3yr refresher due by 9/21/10 - last done 9/21/07)	D	N/A	N/A			N/A	N/A	N/A	N/A

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Nuclear Medicine Service

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21. Radiation Safety Improvements and/or Additional Comments/Problems:									
Modified the position of the Tc-99m shielded sharps container in the hot lab & added splash guard to help prevent spills	N/A	in Feb	N/A			N/A	in Feb	*N/A*	*N/A*
Replaced Cs-137 dose calibrator standard's shielding and labeling	N/A	in Feb	N/A			N/A	in Feb	*N/A*	*N/A*
Raised & modified the position of the Tc-99m shielded sharps container in the hot lab to reduce radiation exposure	N/A	N/A	in May			N/A	in May	*N/A*	*N/A*
Mounted locked shielded sharps container in the imaging room (1) to the wall to better secure radioactive/biohazard waste	N/A	N/A	in Jun			N/A	in Jun	*N/A*	*N/A*

D = Discrepancy/Problem Indicator V = Volume Indicator

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Research Service

Click on the links to the right for the detailed Quarterly Research Service Radiation Safety Audits in 2009 or the Trending Report for 2008 (on far right) which includes links to 2008 detailed audits.		Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	2009 Qtrly Average	2009 Total	2008 Qtrly Average	2008 Total
1. Monthly Radiation Surveys/Wipes of Core Labs, Waste, Common Areas done by RSO:									
# of times surveys/wipes not performed monthly as required	D	0	0			0.0	0	0.0	0
# of times surveys/wipes greater than trigger level	D	0	0			0.0	0	0.0	0
# of times appropriate action was not taken to decrease levels below trigger level	D	N/A	N/A			N/A	N/A	N/A	N/A
2. Annual Radiation Surveys/Wipes of each Authorized User Lab/Room done by RSO:									
# of times surveys/wipes not performed annually (Dec) as required	D	N/A	N/A			N/A	N/A	N/A	0
# of times surveys/wipes greater than trigger level	D	N/A	N/A			N/A	N/A	N/A	1
# of times appropriate action was not taken to decrease levels below trigger level	D	N/A	N/A			N/A	N/A	N/A	0
# of rooms monitored	V	N/A	N/A			N/A	N/A	N/A	12
# of Authorized Users	V	N/A	N/A			N/A	N/A	N/A	9
3. Quarterly Record Audit of Weekly Radiation Wipes Performed by each Authorized User Labs:									
# of times wipes not performed weekly as required	D	0	0			0.0	0	1.0	4
By Authorized User: AM	D	0	0			0.0	0	1.0	4
# of times wipes greater than trigger level	D	0	0			0.0	0	0.5	2
By Authorized User-Room: FB/DV-D427	D	0	0			0.0	0	0.5	2
# of times appropriate action was not taken to decrease levels below trigger level	D	N/A	N/A			N/A	N/A	0.0	0
# of rooms monitored	V	12	12			12.0	N/A	12.0	N/A
# of labs Authorized Users	V	9	9			9.0	N/A	9.0	N/A
4. Quarterly/Annual Radionuclide Sealed Source Inventory of Labs and Core Labs done by RSO:									
# of times quarterly inventories not performed as required	D	0	0			0.0	0	0.0	0
# of unaccounted for sealed sources	D	0	0			0.0	0	0.0	0
# of sealed sources on inventory	V	17	17			17.0	N/A	17.0	N/A
# of sealed sources added to inventory during the quarter (may/may not be in above total due to when received)	V	0	0			0.0	0	0.0	0
# of sealed sources removed from inventory during the quarter (may/may not be in above total due to when shipped)	V	0	0			0.0	0	0.0	0
# of times annual (Mar) NHPP sealed source verification not performed as required	D	0	N/A			N/A	0	N/A	0
# of sealed sources on NHPP inventory	V	2	N/A			N/A	2	N/A	2
5. Semi-Annual Radionuclide Sealed Source Leak Testing by RSO:									
# of times semi-annual (Jan & Jul) leak test not performed as required	D	0	N/A			0.0	0	0.0	0
# of sealed sources leak tested	V	2	N/A			2.0	N/A	2.0	N/A
# of leak tests with leakage detected above required limits	D	0	N/A			0.0	0	0.0	0
6. Quarterly Radionuclide (Unsealed) Inventory of each Authorized User Lab done by RSO:									
# of times quarterly inventories (based on first date of quarters possession) not performed as required	D	0	0			0.0	0	0.0	0
# of unaccounted for unsealed sources	D	0	0			0.0	0	0.0	0
# of times Authorized User was over their possession limits	D	0	0			0.0	0	0.0	0
# of Authorized Users	V	9	9			9.0	N/A	9.0	N/A
7. Reported Radioactive Spills:									
# of times a reported radioactive spill occurred	D	0	0			0.0	0	0.0	0
# of times appropriate action to the spill was not taken	D	N/A	N/A			N/A	N/A	N/A	N/A
8. Authorized User Lab Closings:									
# of labs closed out (i.e., monitored and released for general use)	V	0	0			0.0	0	0.0	0
9. Annual Survey Meter Calibrations:									
# of times annual calibration (Mar)/post repair not performed as required	D	0	N/A			0.0	0	0.0	0
# of survey meters calibrated (2 older meters w/end probes taken out of use & replaced w/new meter w/pancake probe; 1 meter taken out of use)	V	3	N/A			3.0	3	5.0	5
10. Annual Beta Counter (2) Quench Curve and Gamma Counter (2) Calibration:									
# of times Quench Curve and Gamma Calibration not performed annually (Jan)/post repair as required	D	0	N/A			0.0	0	0.0	0

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Research Service

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11. Monthly Beta Counter (2) Normalization, Chi-Square, and Constancy Checks and Gamma Counter (2) Peak, % Resolution, Chi-Square, Constancy, and Efficiency Checks:									
# of times above checks not performed monthly as required	D	0	0			0.0	0	*0.0*	*0*
# of times above checks not within limits	D	0	0			0.0	0	*0.0*	*0*
12. Authorized User Approval by the RSC:									
# of authorized user approvals by the RSC	V	0	0			0.0	0	*0.3*	*1*
13. Quarterly Review of In-coming Radionuclide Receiving Records:									
# of times shipments received that were not pre-approved by the RSO	D	0	0			0.0	0	*0.0*	*0*
# of times receiving records were missing pertinent info (e.g., survey/wipe results)	D	0	0			0.0	0	*0.0*	*0*
# of times package receiving problems noted (e.g., contamination, wrong material)	D	0	0			0.0	0	*0.3*	*1*
By Problem: Shipping label did reflect RSO as delivery point	D	0	0			0.0	0	*0.3*	*1*
Total # of in-coming shipments	V	1	1			1.0	2	*2.5*	*10*
# of C-14 in-coming shipments	V	0	0			0.0	0	*0.3*	*1*
Total C-14 activity in mCi contained in the above shipments	V	0.00	0.00			0.00	0.00	*0.06*	*0.25*
# of Cr-51 in-coming shipments	V	0	0			0.0	0	*0.3*	*1*
Total Cr-51 activity in mCi contained in the above shipments	V	0.00	0.00			0.00	0.00	*1.88*	*7.50*
# of H-3 in-coming shipments	V	0	1			0.5	1	*0.5*	*2*
Total H-3 activity in mCi contained in the above shipments	V	0.00	5.00			2.50	5.00	*0.31*	*1.25*
# of P-32 in-coming shipments	V	1	0			0.5	1	*1.3*	*5*
Total P-32 activity in mCi contained in the above shipments	V	1.27	0.00			0.64	1.27	*5.75*	*22.98*
# of S-35 in-coming shipments	V	0	0			0.0	0	*0.3*	*1*
Total S-35 activity in mCi contained in the above shipments	V	0.00	0.00			0.00	0.00	*0.30*	*1.20*
14. Quarterly Review of Out-going Radionuclide/Return Package Records:									
# of times out-going records were missing pertinent info (e.g., survey/wipe results)	D	N/A	N/A			N/A	N/A	N/A	N/A
# of times out-going package problems noted (e.g., contamination)	D	N/A	N/A			N/A	N/A	N/A	N/A
# of out-coming shipments	V	0	0			0.0	0	0.0	0
15. Training (Include all staff if dealing with research use of radionuclides.): See Nuclear Medicine audits for support staff (e.g., EMS, Police, etc.)									
Total # of radiation safety training hours provided	V	3.00	1.25			2.13	4.25	2.00	8.00
# radiation safety training hours provided to Research staff	V	2.25	0.75			1.50	3.00	*1.63*	*6.50*
# radiation safety training hours provided as FYI training (e.g., Radiation Safety, Safety Office staff)	V	0.75	0.50			0.63	1.25	*0.38*	*1.50*
16. Radiation Safety Improvements and/or Additional Comments/Problems:									
Worked w/ Research Safety Manager to update safety training for all research staff & lab entrance poster (both included radiation safety)	N/A	N/A	in Apr			N/A	in Apr	*N/A*	*N/A*

D = Discrepancy/Problem Indicator V = Volume Indicator

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Radiographic-Fluoroscopic Use

Click on the links to the right for detailed Quarterly Radiographic-Fluoroscopic Use Radiation Safety Audits in 2009 with links to case-by-case breakdown - started preliminary data collection in Dec 2008.		1st Qtr 2009			2nd Qtr 2009			3rd Qtr 2009			4th Qtr 2009			Mon Ave	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Qtr Ave	2009 Total	2008 Dec
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec								
1. Patient radiation dose from CT (B152 only):																					
See reference tables/links at end of this audit related to patient effective doses.																					
Total # of CT exams	V	895	872	1051	1075	1094	1013							1000.0	2818	3182			3000.0	6000	992
Total # of CT procedures	V	47	52	44	54	47	48							48.7	58	60			59.0	58	52
# Exams/procedure (note: patient may have multiple procedures; dose may reflect all exams done)	V	19.0	16.8	23.9	19.9	23.3	21.1							20.5	48.6	53.0			50.8	103.4	19.1
A. Interventional CT Exams:																					
# of Interventional CT exams with CPRS documented ~ pt radiation dose (i.e., DLP)	V	11	18	11	12	11	9							12.0	40	32			36.0	72	19
% of total # of CT exams	V	1.2%	2.1%	1.0%	1.1%	1.0%	0.9%							1.2%	1.4%	1.0%			1.2%	1.2%	1.9%
Average patient effective dose (mSv) for these exams	V	10.3	13.4	7.1	7.6	10.5	6.7							9.7	10.8	8.4			9.7	9.7	17.4
# of these exams with pt effective dose ≥ 10 mSv but ≤ 100 mSv	V	5	8	2	2	4	0							3.5	15	6			10.5	21	9
% of exams with pt effective dose ≥ 10 mSv but ≤ 100 mSv compared to total	V	45%	44%	18%	17%	36%	0%							29%	38%	19%			29%	29%	47%
# of these exams with pt effective dose > 100 mSv	D	0	0	0	0	0	0							0.0	0	0			0.0	0	0
(1) Further broken down by CCTA Exams:																					
# of these Interventional CT exams that were for CCTA W/WO, QUAN CALCIUM	V	11	16	10	12	11	9							11.5	37	32			34.5	69	10
% of total # of CT exams	V	1.2%	1.8%	1.0%	1.1%	1.0%	0.9%							1.2%	1.3%	1.0%			1.2%	1.2%	1.0%
Average patient effective dose (mSv) for these CCTA exams	V	10.3	13.4	6.8	7.6	10.5	6.7							9.6	10.7	8.4			9.6	9.6	9.2
# of these exams with pt effective dose ≥ 10 mSv but ≤ 100 mSv	V	5	7	1	2	4	0							3.2	13	6			9.5	19	2
% of exams with pt effective dose ≥ 10 mSv but ≤ 100 mSv compared to total	V	45%	44%	10%	17%	36%	0%							28%	35%	19%			28%	28%	20%
# of these CCTA exams with pt effective dose > 100 mSv	D	0	0	0	0	0	0							0.0	0	0			0.0	0	0
B. High Volume Exams (different procedures reviewed each qtr):															← See Monthly						
(1) Broken down by Procedure Type:		CT HEAD W/O CONTRAST			CT ABDOMEN W/O CONTRAST										← Breakdown For						
															← Procedure Reviewed						
# of these CT exams documented as being performed	V	122	114	134	103	117	92							N/A	370	312			N/A	N/A	N/A
% of total # of CT exams	V	14%	13%	13%	10%	11%	9%							N/A	13%	10%			N/A	N/A	N/A
# of these exams reviewed (i.e., 10% w/ 10min) for ~ pt radiation dose (i.e., DLP)	V	12	11	13	10	12	10							N/A	36	32			N/A	N/A	N/A
% of total # of CT exams	V	1.3%	1.3%	1.2%	0.9%	1.1%	1.0%							N/A	1.3%	1.0%			N/A	N/A	N/A
Average patient effective dose (mSv) for these exams	V	2.2	2.2	2.1	17.4	17.0	21.7							N/A	2.1	18.6			N/A	N/A	N/A
# of these exams with pt effective dose ≥ 10 mSv but ≤ 100 mSv	V	0	0	0	8	8	8							N/A	0	24			N/A	N/A	N/A
% of exams with pt effective dose ≥ 10 mSv but ≤ 100 mSv compared to total	V	0%	0%	0%	80%	67%	80%							N/A	0%	75%			N/A	N/A	N/A
# of these exams with pt effective dose > 100 mSv	D	0	0	0	0	0	0							N/A	0	0			N/A	N/A	N/A
(2) Broken down by Procedure Type:		CT CHEST W/O CONTRAST			CT PELVIS W/O CONTRAST										← See Monthly						
															← Breakdown For						
															← Procedure Reviewed						
# of these CT exams documented as being performed	V	111	94	109	94	116	92							N/A	314	302			N/A	N/A	N/A
% of total # of CT exams	V	12%	11%	10%	9%	11%	9%							N/A	11%	9%			N/A	N/A	N/A
# of these exams reviewed (i.e., 10% w/ 10min) for ~ pt radiation dose (i.e., DLP)	V	11	10	11	10	12	10							N/A	32	32			N/A	N/A	N/A
% of total # of CT exams	V	1.2%	1.1%	1.0%	0.9%	1.1%	1.0%							N/A	1.1%	1.0%			N/A	N/A	N/A
Average patient effective dose (mSv) for these exams	V	16.4	18.7	11.6	12.6	20.0	17.3							N/A	15.4	16.8			N/A	N/A	N/A
# of these exams with pt effective dose ≥ 10 mSv but ≤ 100 mSv	V	9	7	3	6	9	7							N/A	19	22			N/A	N/A	N/A
% of exams with pt effective dose ≥ 10 mSv but ≤ 100 mSv compared to total	V	82%	70%	27%	60%	75%	70%							N/A	59%	69%			N/A	N/A	N/A
# of these exams with pt effective dose > 100 mSv	D	0	0	0	0	0	0							N/A	0	0			N/A	N/A	N/A

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Radiographic-Fluoroscopic Use

Click on the links to the right for detailed Quarterly Radiographic-Fluoroscopic Use Radiation Safety Audits in 2009 with links to case-by-case breakdown - started preliminary data collection in Dec 2008.		1st Qtr 2009			2nd Qtr 2009			3rd Qtr 2009			4th Qtr 2009			Mon Ave	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Qtr Ave	2009 Total	2008 Dec
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec								
C. Average Volume Exams (different procedures reviewed each qtr):															← See Monthly						
(1) Broken down by Procedure Type:		CT SINUSES ENT PROTOCOL W/O CONTRAST			CT LUMBAR SPINE W/O CONTRAST										← Breakdown For						
															← Procedure Reviewed						
# of these CT exams documented as being performed	V	17	21	29	19	13	11							N/A	67	43			N/A	N/A	N/A
% of total # of CT exams	V	1.9%	2.4%	2.8%	1.8%	1.2%	1.1%							N/A	2.4%	1.4%			N/A	N/A	N/A
# of these exams reviewed (i.e., 10% w/ 10min) for ~ pt radiation dose (i.e., DLP)	V	10	10	10	10	10	10							N/A	30	30			N/A	N/A	N/A
% of total # of CT exams	V	1.1%	1.1%	1.0%	0.9%	0.9%	1.0%							N/A	1.1%	0.9%			N/A	N/A	N/A
Average patient effective dose (mSv) for these exams	V	1.6	1.5	1.5	30.8	22.0	26.2							N/A	1.5	26.3			N/A	N/A	N/A
# of these exams with pt effective dose ≥ 10 mSv but ≤ 100 mSv	V	0	0	0	8	8	8							N/A	0	24			N/A	N/A	N/A
% of exams with pt effective dose ≥ 10 mSv but ≤ 100 mSv compared to total	V	0%	0%	0%	80%	80%	80%							N/A	0%	80%			N/A	N/A	N/A
# of these exams with pt effective dose > 100 mSv	D	0	0	0	0	0	0							N/A	0	0			N/A	N/A	N/A
(2) Broken down by Procedure Type:		CTA AORTA W/RUNOFF			CT NECK SOFT TISSUE W/ CONTRAST										← See Monthly						
															← Breakdown For						
															← Procedure Reviewed						
# of these CT exams documented as being performed	V	23	20	22	18	26	22							N/A	65	66			N/A	N/A	N/A
% of total # of CT exams	V	2.6%	2.3%	2.1%	1.7%	2.4%	2.2%							N/A	2.3%	2.1%			N/A	N/A	N/A
# of these exams reviewed (i.e., 10% w/ 10min) for ~ pt radiation dose (i.e., DLP)	V	10	10	10	10	10	10							N/A	30	30			N/A	N/A	N/A
% of total # of CT exams	V	1.1%	1.1%	1.0%	0.9%	0.9%	1.0%							N/A	1.1%	0.9%			N/A	N/A	N/A
Average patient effective dose (mSv) for these exams	V	42.9	32.9	33.2	2.7	2.8	3.1							N/A	36.3	2.8			N/A	N/A	N/A
# of these exams with pt effective dose ≥ 10 mSv but ≤ 100 mSv	V	10	10	10	0	0	0							N/A	30	0			N/A	N/A	N/A
% of exams with pt effective dose ≥ 10 mSv but ≤ 100 mSv compared to total	V	100%	100%	100%	0%	0%	0%							N/A	100%	0%			N/A	N/A	N/A
# of these exams with pt effective dose > 100 mSv	D	0	0	0	0	0	0							N/A	0	0			N/A	N/A	N/A
D. Low Volume Exams (different procedures reviewed each qtr):															← See Monthly						
(1) Broken down by Procedure Type:		CT ABDOMEM ADRENAL ADENOMA			CT THORACIC SPINE W/O CONTRAST										← Breakdown For						
															← Procedure Reviewed						
# of these CT exams documented as being performed - all reviewed for ~ pt radiation dose (i.e., DLP)	V	2	5	4	5	5	3							N/A	11	13			N/A	N/A	N/A
% of total # of CT exams	V	0.2%	0.6%	0.4%	0.5%	0.5%	0.3%							N/A	0.4%	0.4%			N/A	N/A	N/A
Average patient effective dose (mSv) for these exams	V	17.6	10.8	3.2	33.0	15.6	37.9							N/A	9.3	27.5			N/A	N/A	N/A
# of these exams with pt effective dose ≥ 10 mSv but ≤ 100 mSv	V	2	3	0	5	5	2							N/A	5	12			N/A	N/A	N/A
% of exams with pt effective dose ≥ 10 mSv but ≤ 100 mSv compared to total	V	100%	60%	0%	100%	100%	67%							N/A	45%	92%			N/A	N/A	N/A
# of these exams with pt effective dose > 100 mSv	D	0	0	0	0	0	0							N/A	0	0			N/A	N/A	N/A
(2) Broken down by Procedure Type:		CT ABDOMEM W & W/O CONTRAST LIVER PROTOCOL			CT TRAUMA FACE										← See Monthly						
															← Breakdown For						
															← Procedure Reviewed						
# of these CT exams documented as being performed - all reviewed for ~ pt radiation dose (i.e., DLP)	V	4	5	2	6	2.0	3							N/A	11	11			N/A	N/A	N/A
% of total # of CT exams	V	0.4%	0.6%	0.2%	0.6%	0.2%	0.3%							N/A	0.4%	0.3%			N/A	N/A	N/A
Average patient effective dose (mSv) for these exams	V	33.7	56.0	30.3	2.0	1.9	1.8							N/A	43.3	1.9			N/A	N/A	N/A
# of these exams with pt effective dose ≥ 10 mSv but ≤ 100 mSv	V	4	5	2	0	0.0	0							N/A	11	0			N/A	N/A	N/A
% of exams with pt effective dose ≥ 10 mSv but ≤ 100 mSv compared to total	V	100%	100%	100%	0%	0%	0%							N/A	100%	0%			N/A	N/A	N/A
# of these exams with pt effective dose > 100 mSv	D	0	0	0	0	0	0							N/A	0	0			N/A	N/A	N/A

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Radiographic-Fluoroscopic Use

Click on the links to the right for detailed Quarterly Radiographic-Fluoroscopic Use Radiation Safety Audits in 2009 with links to case-by-case breakdown - started preliminary data collection in Dec 2008.		1st Qtr 2009			2nd Qtr 2009			3rd Qtr 2009			4th Qtr 2009			Mon Ave	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Qtr Ave	2009 Total	2008 Dec
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec								
2. Patient radiation dose from Interventional Fluoroscopy (Specials B180): See reference table/link at end of this audit related to patient skin doses.																					
# of Specials exams with documented ~ pt radiation dose (i.e., Air Kerma)	V	32	29	24	36	24	26							28.5	85	86			85.5	171	36
Average fluoro time (min) for these exams	V	7.0	4.7	3.6	10.3	3.3	5.3							6.0	5.3	6.8			6.0	6.0	7.0
Average total Air Kerma dose (Gy) for these exams	V	0.3	0.3	0.2	0.5	0.2	0.2							0.3	0.3	0.3			0.3	0.3	0.4
# of these exams with total dose ≥ 3 Gy but < 10 Gy	D	0	0	0	0	0	0							0.0	0	0			0.0	0	1
% of cases with total dose ≥ 3 Gy but < 10 Gy compared to total	D	0%	0%	0%	0%	0%	0%							0%	0%	0%			0%	0%	3%
# of these exams with total dose ≥ 10 Gy but < 15 Gy	D	0	0	0	0	0	0							0.0	0	0			0.0	0	0
% of exams with total dose ≥ 10 Gy but < 15 Gy compared to total	D	0%	0%	0%	0%	0%	0%							0%	0%	0%			0%	0%	0%
# of these exams with total Air Kerma dose ≥ 15 Gy	D	0	0	0	0	0	0							0.0	0	0			0.0	0	0
3. Patient radiation dose from Cardiac Cath (A233 & A235): See reference table/link at end of this audit related to patient skin doses.																					
# of Cardiac Cath exams with documented ~ pt radiation dose (i.e., Dose = Air Kerma)	V	81	66	64	79	78	69							72.8	211	226			218.5	437	76
Average fluoro time (min) for these exams	V	14.6	14.5	13.9	19.4	12.9	12.3							14.7	14.3	15.0			14.7	14.7	12.8
Average total dose (Gy) for these exams	V	2.6	2.4	2.2	2.9	2.3	2.4							2.5	2.4	2.6			2.5	2.5	2.1
# of these exams with total dose ≥ 3 Gy but < 10 Gy	D	30	20	20	29	23.0	20							23.7	70	72			71.0	142	19
% of exams with total dose ≥ 3 Gy but < 10 Gy compared to total	D	37%	30%	31%	37%	29%	29%							32%	33%	32%			32%	32%	25%
# of these exams with total dose ≥ 10 Gy but < 15 Gy	D	1	0	0	1	0	1							0.5	1	2			1.5	3	0
% of exams with total dose ≥ 10 Gy but < 15 Gy compared to total	D	1.2%	0.0%	0.0%	1.3%	0.0%	1.4%							0.7%	0.5%	0.9%			0.7%	0.7%	0.0%
# of these exams with total dose ≥ 15 Gy	D	0	0	0	0	0	0							0.0	0	0			0.0	0	0
A. Broken down by:																					
# of these exams that were in **A233 (EP Lab - EPL)**	V	31	25	26	28	20	23							25.5	82	71			76.5	153	28
Average fluoro time (min) for these exams	V	17.8	12.7	16.3	22.3	15.5	10.5							16.1	15.8	16.6			16.1	16.1	14.6
Average total dose (Gy) for these exams	V	2.4	1.4	2.0	1.8	2.0	1.8							1.9	2.0	1.9			1.9	1.9	1.2
# of these exams with total dose ≥ 3 Gy but < 10 Gy	D	13	4	7	8	4	5							6.8	24	17			20.5	41	4
% of exams with total dose ≥ 3 Gy but < 10 Gy compared to total	D	42%	16%	27%	29%	20%	22%							27%	29%	24%			27%	27%	14%
# of these exams with total dose ≥ 10 Gy but < 15 Gy	D	1	0	0	0	0	0							0.2	1	0			0.5	1	0
% of exams with total dose ≥ 10 Gy but < 15 Gy compared to total	D	3.2%	0.0%	0.0%	0.0%	0.0%	0.0%							0.7%	1.2%	0.0%			0.7%	0.7%	0.0%
# of these exams with total dose > 15 Gy	D	0	0	0	0	0	0							0.0	0	0			0.0	0	0
B. Broken down by:																					
# of these exams that were in **A235 (Cardiac Cath Lab - CCL)**	V	50	41	38	51	58	46							47.3	129	155			142.0	284	48
Average fluoro time (min) for these exams	V	12.6	15.5	12.2	17.8	12.1	13.2							13.9	13.4	14.3			13.9	13.9	11.8
Average total dose (Gy) for these exams	V	2.7	3.0	2.3	3.6	2.4	2.8							2.8	2.7	2.9			2.8	2.8	2.6
# of these exams with total dose ≥ 3 Gy but < 10 Gy	D	17	16	13	21	19	15							16.8	46	55			50.5	101	15
% of exams with total dose ≥ 3 Gy but < 10 Gy compared to total	D	34%	39%	34%	41%	33%	33%							36%	36%	35%			36%	36%	31%
# of these exams with total dose ≥ 10 Gy but < 15 Gy	D	0	0	0	1	0	1							0.3	0	2			1.0	2	0
% of exams with total dose ≥ 10 Gy but < 15 Gy compared to total	D	0.0%	0.0%	0.0%	2.0%	0.0%	2.2%							0.7%	0.0%	1.3%			0.7%	0.7%	0.0%
# of these exams with total dose > 15 Gy	D	0	0	0	0	0	0							0.0	0	0			0.0	0	0
4. Radiation Safety Improvements and/or Additional Comments/Problems:																					
Additional monitoring started (i.e., pt radiation dose from CT from high to low volume exams: 1.B.-D.)	N/A		in Jan-Mar				N/A							N/A	N/A	N/A			N/A	in 1 Qtr	N/A
Special dose (i.e., air kerma) evaluation done on Specials & Cardiac Cath equipment	N/A			N/A			in Jun							N/A	N/A	N/A			N/A	in Jun	N/A

D = Discrepancy/Problem Indicator V = Volume Indicator

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Radiographic-Fluoroscopic Use

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec								

References for Section 1 above

Table 1. Relative radiation level designations along with common example examinations for each classification

Relative Radiation Level*	Effective Dose Estimate Range	Example Examinations
None	0	Ultrasound, MRI
Minimal	<0.1 mSv	Chest radiographs, hand radiographs
Low	0.1-1 mSv	Pelvis radiographs, mammography
Medium	1-10 mSv	Abdomen CT, barium enema, nuclear medicine bone scan
High	10-100 mSv	Abdomen CT without and with contrast, whole body PET

*RRL assignments are not included for some examinations. These are designated as IP (in progress) or NS (not specified). The RRL assignments for the IP examinations will be available in future releases. The RRL assignments for the NS examinations cannot be made because the RRL depends on the region of the body exposed to ionizing radiation, and the body part will vary as a function of the clinical situation.

Taken from ACR Appropriateness Criteria® Radiation Dose Assessment Introduction (Relative Radiation Level Information)

Table 2

Adult Effective Doses for Various CT Procedures

Examination	Average Effective Dose (mSv)	Values Reported in Literature (mSv)
Head	2	0.9–4.0
Neck	3	-
Chest	7	4.0–18.0
Chest for pulmonary embolism	15	13–40
Abdomen	8	3.5–25
Pelvis	6	3.3–10
Three-phase liver study	15	-
Spine	6	1.5–10
Coronary angiography	16	5.0–32
Calcium scoring	3	1.0–12
Virtual colonoscopy	10	4.0–13.2

Taken from Mettler FA, Jr., Huda W, Yoshizumi TT, Mahesh M. Effective doses in radiology and diagnostic nuclear medicine: a catalog. Radiology 2008; 248(1):254-263.

Reference for Sections 2 & 3 above

Table II. Radiation-Induced Skin Injuries

Effect	Typical Threshold Absorbed Dose (Gy)*	Hours of Fluoroscopic "On Time" to Reach Threshold† at: Usual Fluoro Dose Rate of 0.02 Gy/min (2 rad/min)	High-Level Dose Rate of 0.2 Gy/min (20 rad/min)	Time to Onset of Effect**
Early transient erythema	2	1.7	0.17	hours
Temporary epilation	3	2.5	0.25	3 wk
Main erythema	6	5.0	0.50	10 d
Permanent epilation	7	5.8	0.58	3 wk
Dry desquamation	10	8.3	0.83	4 wk
Invasive fibrosis	10	8.3	0.83	
Dermal atrophy	11	9.2	0.92	>14 wk
Telangiectasia	12	10.0	1.00	>52 wk
Moist desquamation	15	12.5	1.25	4 wk
Late erythema	15	12.5	1.25	6-10 wk
Dermal necrosis	18	15.0	1.50	>10 wk
Secondary ulceration	20	16.7	1.67	>6 wk

* The unit for absorbed dose is the gray (Gy) in the International System of units. One Gy is equivalent to 100 rad in the traditional system of radiation units.
† Time required to deliver the typical threshold dose at the specified dose rate.
** Time after single irradiation to observation of effect.

(Table adapted from Ref. 4.)

Taken from FDA's Avoidance of Serious X-ray Induced Skin Injuries to Patients During Fluoroscopically Guided Procedures

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ALARA-Radiation Exposure

Click on the link to the right for the detailed Quarterly ALARA-Radiation Exposure Audits in 2009 or the Trending Report for 2008 (on far right) which includes links to 2008 detailed reviews.		Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	2009 Qtrly Average	2009 Total	2008 Qtrly Average	2008 Total
1. Personnel Exposure Records/ALARA Investigational Levels (see below):									
A. Radioactive Materials Use:									
a) Follow-up on previous quarter's review (see detailed reports above or summaries below)									
b) # of times ALARA Quarterly Investigational Level I (10% of ¼ annual limit) was exceeded	D	0	0			0.0	0	1.8	7
By Type: **# of times Whole Body Deep Dose Equivalent ALARA I @ 125 mrem was exceeded**	D	0	0			0.0	0	0.8	3
Then by Employee: Nuclear Medicine Technologist - Badge # 269 qtrly total in mrem	D	82	91			87	173	141	565
Nuclear Medicine Technologist - Badge # 1033 qtrly total in mrem	D	108	92			100	200	118	473
By Type: **# of times Extremity Shallow Dose Equivalent ALARA I @ 1,250 mrem was exceeded**	D	0	0			0.0	0	1.0	4
Then by Employee: Nuclear Medicine Technologist - Badge # 271 qtrly total in mrem	D	410	400			405	810	863	3,450
Nuclear Medicine Technologist - Badge # 1027 qtrly total in mrem	D	530	600			565	1,130	1,778	7,110
Nuclear Medicine Technologist - Badge # 1033 qtrly total in mrem	D	500	470			485	970	793	3,170
c) # of times ALARA Quarterly Investigational Level II (30% of ¼ annual limit) was exceeded	D	0	0			0.0	0	0	0
B. Radiographic-Fluoroscopic Use:									
a) Follow-up on previous quarter's review (see detailed reports above or summaries below)									
b) # of times ALARA Quarterly Investigational Level I (10% of ¼ annual limit) was exceeded	D	2	0			1.0	2	2.5	10
By Type: **# of times Whole Body Effective Dose Equivalent ALARA I @ 125 mrem was exceeded**	D	1	0			0.5	1	0.8	3
Then by Employee: RN/Cath Lab - Badge # 534 qtrly total in mrem	D	112	100			106	212	119	476
Cardiologist/Cath Lab - Badge # 984 qtrly total in mrem	D	107	82			95	189	111	443
Anesthesiologist/Pain Clinic - Badge # 1048 qtrly total in mrem	D	130	61			96	191	83	332
By Type: **# of times Lens Dose Equivalent ALARA I @ 375 mrem was exceeded**	D	1	0			0.5	1	1.8	7
Then by Employee: RN/Cath Lab - Badge # 534 qtrly total in mrem	D	372	334			353	706	396	1,585
Physician Assistant/Pain Clinic - Badge # 972 qtrly total in mrem	D	23	7			15	30	102	407
Cardiologist/Cath Lab - Badge # 984 qtrly total in mrem	D	360	275			318	635	372	1,488
Anesthesiologist/Pain Clinic - Badge # 1048 qtrly total in mrem	D	434	218			326	652	290	1,158
c) # of times ALARA Quarterly Investigational Level II (30% of ¼ annual limit) was exceeded	D	0	0			0.0	0	0	0
2. I-125/I-131 Bioassay Results:									
a) Nuclear Medicine									
# of employees having bioassays	V	2	1			1.5	3	3.0	12
# of times bioassays performed	V	4	1			2.5	5	4.8	19
# of administrations > 1 mCi of I-131 as NaI in solution	V	0	0			0.0	0	0.5	2
# of administrations > 10 mCi of I-131 as NaI in capsule	V	4	1			2.5	5	2.8	11
# of times bioassays not performed within 6-72 hours post administration	D	0	0			0.0	0	0.3	1
# of times bioassay results were > minimal detectable activity (MDA) of the counting system	D	0	0			0.0	0	0.0	0
# of times bioassay results required action and/or inclusion in Total Effective Dose Equivalent	D	0	0			0.0	0	0.0	0
b) Research - Not performing iodinations at this time - no bioassays done	V	N/A	N/A			N/A	N/A	N/A	N/A

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Trending Quarterly Audit for 2nd Qtr 2009

ALARA-Radiation Exposure

Click on the link to the right for the detailed Quarterly ALARA-Radiation Exposure Audits in 2009 or the Trending Report for 2008 (on far right) which includes links to 2008 detailed reviews.		Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	2009 Qtrly Average	2009 Total	*2008 Qtrly Average*	*2008 Total*
3. Pregnant Radiation Workers:									
# of declared pregnant radiation workers	V	0	0			0.0	0	*0.8*	*1*
4. Quarterly Area Monitors Involving Radioactive Materials:									
NM2 monitor - wall in main hallway outside Nuclear Medicine (i.e., outer wall of hot lab) qtrly total in mrem	V	8	6			7.0	14	*17.8*	*71*
NM3 monitor - wall in main hallway outside Nuclear Medicine (i.e., outer wall of hot lab) qtrly total in mrem	V	0	0			0.0	0	*0.0*	*0*
RES1 monitor - doorway of research radioactive waste storage room qtrly total in mrem	V	0	0			0.0	0	*0.0*	*0*
# of area monitors with readings > 100 mrem for the current calendar year (i.e., 2009)	D	N/A	N/A			N/A	0	*N/A*	*0*
5. Sanitary Sewer Disposal of Radioactive Material: none at this time	V	N/A	N/A			N/A	N/A	*N/A*	*N/A*
6. Radiation Safety Improvements and/or Additional Comments/Problems:									
N/A	N/A	N/A	N/A			N/A	N/A	*N/A*	*N/A*

D = Discrepancy/Problem Indicator V = Volume Indicator

Quarterly ALARA Levels & Annual Limits are expressed in mrem	ALARA Quarterly Investigational Levels		
	Level I (10% of ¼ annual limits)	Level II (30% of ¼ annual limits)	Annual Limits*
Whole Body (WB) Deep Exposure (DDE = Deep Dose Equivalent) (if lead/lead equivalent apron not used)	125	375	5,000
Whole Body Effective Dose Equivalent (WB EDE) = 0.3 x DDE (due to use of lead/lead equivalent apron)	125	375	5,000
Lens of Eye Exposure (LDE = Lens Dose Equivalent)	375	1,125	15,000
WB Shallow (Skin) Exposure (SDE = Shallow Dose Equivalent)	1,250	3,750	50,000
Extremity Shallow Exposure (SDE = Shallow Dose Equivalent)	1,250	3,750	50,000

* Annual Occupational Dose Limits for Adults based on NRC Regulations

Radiation Safety Committee
Detailed Quarterly Audit for Apr - Jun 2009
Nuclear Medicine Service

1. **Daily Radiation Surveys:**
   - Performed daily as required including weekend/holiday studies: Yes — If no, explain below.
   - Any areas greater than trigger level (TL): Yes x2 — If yes, explain below.
     - Hot Lab - 0 times, Imaging Room - 2 times, Injection Room - 0 times:
       - 04/20 - Imaging Room: minor contamination found in soiled linen (i.e., sheet) @ 0.08 mR/hr (TL >0.05 mR/hr); removed to radioactive waste for decay and area re-survey <TL (0.01 mR/hr).
       - 04/20 - Imaging Room: minor contamination found in stress area trash @ 0.06 mR/hr (TL >0.05 mR/hr); removed to radioactive waste for decay and area re-survey <TL (0.01 mR/hr).
         - All initial readings although above trigger level were fairly low (i.e., all areas ≤0.1 mR/hr) and were in areas where increased radiation levels may be seen. Prompt and appropriate action to lower these levels was taken.
   - If areas were greater than TL, was appropriate action taken to decrease radiation levels below TL: Yes — If no, explain below.

2. **Weekly Radiation Wipes:**
   - Performed weekly as required: Yes — If no, explain below.
   - Any areas greater than trigger level (TL): Yes x1 — If yes, explain below.
     - Hot Lab - 1 time, Imaging Room - 0 time, Injection Room - 0 times:
       - 05/29 - Hot Lab: non-Tc-99m dose calibrator area (sharps safe, dose calibrator dipper and well liner, and vial shield) @ 11,534 dpm using conservative efficiency (TL >2,000 dpm); re-wipes isolated contamination to the dose calibrator dipper and well liner which were removed for decay and replaced; other re-wipes <TL (≤1,279 dpm using conservative efficiency).
         - Initial wipe test although above trigger level was fairly low (i.e., <12,000 dpm using conservative efficiency) and was in an area where increased contamination levels may be seen. Prompt and appropriate action to lower this level was taken.
   - If areas were greater than TL, was appropriate action taken to decrease radiation levels below TL: Yes — If no, explain below

3. **Mo-99/Tc-99m Assays (currently not using Mo-99/Tc-99m generators):**
   - Performed for each pt.-use elution of the Mo-99/Tc-99m generator: N/A — If no, explain below.
   - Mo-99/Tc-99m concentrations were within required limits: N/A — If no, explain below.

4. **Daily Dose Calibrator Constancy Checks (for Capintec CRC-15R & CRC-35R dose calibrators):**
   - Performed daily if used for pts as required including weekend/holiday studies: Yes * — If no, explain below.
     - * 06/26 - The CRC-15R dose calibrator that is used infrequently (i.e., not every day for patient doses) for non-Tc-99m doses had not had its constancy check done that workday but based on the patient schedule, this dose calibrator had not been used for patient doses (i.e., no non-Tc-99m doses used) on this day; therefore, constancy testing was not required. The technologist involved was reminded that the testing should still be done each workday in case the dose calibrator is used later that day (e.g., non-Tc-99m study added onto the schedule).
   - Performed quarterly full constancy check: Yes — If no, explain below.
   - Constancy checks were within established limits: Yes — If no, explain below.

5. **Quarterly Dose Calibrator Linearity Checks (for Capintec CRC-15R & CRC-35R dose calibrators):**
   - Performed quarterly (due 1st month of qtr) or after repair as required: Yes — If no, explain below.
   - Linearity checks were within established limits: Yes — If no, explain below.

6. **Annual Dose Calibrator Accuracy Checks (for Capintec CRC-15R & CRC-35R dose calibrators):**
   - Performed annually as required (due in Sept. or after repair): N/A — If no, explain below.
   - Accuracy checks were within established limits: N/A — If no, explain below.

7. **Dose Calibrator Geometry Checks (for Capintec CRC-15R & CRC-35R dose calibrators):**
   - Performed as required (after repair): N/A — If no, explain below.
   - Accuracy checks were within established limits: N/A — If no, explain below.

Radiation Safety Committee
Detailed Quarterly Audit for Apr - Jun 2009
Nuclear Medicine Service

8. Daily Thyroid Probe/Well Counter and Multi-Well Counter Constancy Checks:

- Performed daily as required (i.e., when used): Yes — If no, explain below.
- Constancy checks were within established limits: Yes — If no, explain below.

9. Quarterly Thyroid Probe/Well Counter (MDA, chi-square) and Multi-Well Counter (normalized, chi-square) Checks:

- Performed quarterly (due 1st month of qtr) or after repair as required: Yes — If no, explain below.
- Checks were within established limits: Yes — If no, explain below.

10. Monthly Xenon Machine Quality Control Checks:

- Performed monthly/quarterly or after repair as required: Yes — If no, explain below.
- Quality control checks were within established limits: Yes — If no, explain below.

11. Semi-Annual Air Flow Measurements (AFM)/Fume Hood Certification and Xenon Spill Clearance Time Calculations:

- Semi-annual AFM performed as required (due in Jun. & Dec.): Yes — If no, explain below.
- Imaging room & hot lab under negative pressure & confirmed by smoke test: Yes — If no, explain below.
- Xenon spill clearance times calculated and posted after AFM made: Yes — If no, explain below.
- Semi-annual fume hood certification performed (due in Feb. & Aug.): N/A — If no, explain below.
- Fume hood sash level noted after calibration made: N/A — If no, explain below.

12. Annual Survey Meter Calibrations:

- Performed annually as required (due in Mar. or after repair): N/A — If no, explain below.

13. Quarterly/Annual Radionuclide Sealed Source Inventory:

- Performed quarterly (due 1st month of qtr) as required: Yes — If no, explain below.
- All sources accounted for: Yes — If no, explain below.
  - 137 sealed sources.
- Performed monthly check of Cs-137 calibration source: Yes — If no, explain below.
- Annual NHPP sealed source verification performed as required (due in Mar.) N/A — If no, explain below.

14. Semi-Annual Radionuclide Sealed Source Leak Testing:

- Performed semi-annually as required (due in Jan. & Jul.): N/A — If no, explain below.
- Any leakage detected above required limits: N/A — If yes explain below.

15. Reportable or Recordable Events/Incidents:

- Any reported reportable or recordable events/incidents: No — If yes, explain below.

16. Reported Radioactive Spills:

- Any reported radioactive spills: No — If yes, explain below.

17. Quarterly Review of In-coming Radionuclide Receiving Records:

- Any receiving record missing pertinent info (e.g., survey/wipe results): No — If yes, explain below.
- Any problems noted (e.g., contamination, wrong material): No — If yes, explain below.
- 237 in-coming shipments with 204 being from local radiopharmacy.

Radionuclide	# of Shipments	# from local radiopharmacy	# w/ another primary local shipment (e.g., Tc-99m)	mCi
I-131 (Capsule)	5	5	3 (w/Tc-99m)	175.6
In-111	5	1	-	11.8
Tc-99m	192	192	-	27,402.7
Tl-201	15	5	1 (w/Tc-99m)	228.2
Xe-133	20	1	-	763.3
Total	237	204	4 (w/Tc-99m)	N/A

Radiation Safety Committee
Detailed Quarterly Audit for Apr - Jun 2009
Nuclear Medicine Service

18. Quarterly Review of Out-going Radionuclide/Return Package Records:

- Any out-going record missing pertinent info (e.g., survey/wipe results): No — If yes, explain below.
- Any problems noted (e.g., contamination): No — If yes, explain below.
- 203 out-going packages:
  - 203 return packages to local radiopharmacy.
- Did return packages to local pharmacy equal the amount received: No x1 If no, explain below.
  - 05/12 - Return documentation not initially recorded for the late afternoon shipment (i.e., 4:45P). This shipment was for patient study that went over the normal working hours (past 4:30P). Based on the patient dose record (assayed @ 4:50P) and wipe test print out (wipe @ 5:11P); the return package was wipe tested but not recorded. The other return documentation was also not recorded. The returned package was picked up the next morning; therefore, it must have been set up for return (i.e., proper return labels) and most likely also surveyed. Based on the initial shipment and empty package surveys (all at background levels) done within the half-hour of the wipe test and the wipe test results (at background level), the technologist delayed documented the return and attached the supporting documentation. The RSO stressed to the technologist involved to make sure that return documentation is done especially at times when you might be rushed (e.g., after hours studies).

19. Written Directive (WD) Audits for Nuclear Medicine: x5

Compared WD on file in Radiation Safety Office to radionuclide receipt and use records, and if applicable, Radiation Safety therapy patient file, and immediate/delayed patient release file.

Pt. ID	Isotope & Procedure	Date	WD mCi	Given mCi	Comments	* Problems
JB	I-131 Whole Body	04/13/09	5.0	5.35	N/A	None
JB	I-131 Thy CA Rx	04/15/09	150.0	154.0	Pt. released immediately based on pt. a specific calculation which is on file. Pt. given required written radiation safety instructions.	None
RW	I-131 Whole Body	04/27/09	5.0	5.3	N/A	None
SL	I-131 Whole Body	05/13/09	5.0	5.36	N/A	None
AM	I-131 Whole Body	06/03/09	5.0	5.3	N/A	None

*e.g., WD incomplete, patient identity not verified by two methods, dose not within ±10% of prescribed dose, etc.

- I-131 Thy Uptake - 0, I-131 Whole Body - 4, I-131 Hyper Thy Rx - 0, I-131 Thy CA Rx - 1, Sm-153 Bone Pain Rx - 0.
- Any problems noted. No If yes, explain below.

20. Training (Include all staff if dealing with clinical use of radionuclides.): Yes x6.25 If yes, attach list.

- DOT HAZMAT refresher training (i.e., every 3 yrs) for Nuclear Medicine staff is due by September 21, 2010 (i.e., last done on 09/21/07) or initial training for new staff within 90 days.

21. Radiation Safety Improvements and/or Additional Comments/Problems: Yes x2 If yes, explain below.

- May - Raised & modified the position of the Tc-99m shielded sharps container in the hot lab to allow for easier access when changing out a full sharps container. This should minimize the time involved during this process thus reducing the staff's radiation exposure. This issue was discussed during the June staff meeting.
- Jun - Painted & mounted one of the locked shielded sharps containers in the imaging room to better secure the low level radioactive/biohazard waste. This was the first of three to be done. This issue was discussed during the June staff meeting.

Audit performed by: Michael T. Hackett, MS, Radiation Safety Officer

Radiation Safety Committee
Detailed Quarterly Audit for Apr - Jun 2009
Nuclear Medicine Service

Radiation Safety Training:

#	Date	Time	# Staff	# hrs/ Staff	Total # hrs	Type	Section/Service	Training Title (click on the below links to view training)
N/A	Apr	N/A	5	0.25	1.25	PP/H	Nuclear Medicine	Monthly Reminders for Nuclear Medicine - 2009: Feb - Radiation Spill Prevention
N/A	Apr	N/A	1	0.25	0.25	PP/H	Radiation Safety	Monthly Reminders for Nuclear Medicine - 2009: Feb - Radiation Spill Prevention
N/A	May	N/A	1	0.25	0.25	PP/H	Nuclear Medicine	Monthly Reminders for Nuclear Medicine - 2009: Feb - Radiation Spill Prevention
N/A	May	N/A	1	0.50	0.50	PP/H	Safety Office	Monthly Reminders for Nuclear Medicine - 2009: Jan - Pulmonex Xenon System
N/A	May	N/A	3	0.25	0.75	PP/H	Safety Office	Monthly Reminders for Nuclear Medicine - 2009: Feb - Radiation Spill Prevention
N/A	May	N/A	3	0.25	0.75	PP/H	Nuclear Medicine	Monthly Reminders for Nuclear Medicine - 2009: Mar - Patient Instructions for I-131 Therapy
N/A	May	N/A	3	0.25	0.75	PP/H	RadiationSafety/ Safey Office	Monthly Reminders for Nuclear Medicine - 2009: Mar - Patient Instructions for I-131 Therapy
N/A	May	N/A	2	0.25	0.50	PP/H	Nuclear Medicine	Monthly Reminders for Nuclear Medicine - 2009: Apr - Pulmonex Xenon System Update
N/A	May	N/A	2	0.25	0.50	PP/H	RadiationSafety/ Safey Office	Monthly Reminders for Nuclear Medicine - 2009: Apr - Pulmonex Xenon System Update
N/A	Jun	N/A	3	0.25	0.75	PP/H	Nuclear Medicine	Monthly Reminders for Nuclear Medicine - 2009: Mar - Patient Instructions for I-131 Therapy
					6.25	Grand Total of # Training Hrs.		

N/A = if not a RSO Lecture/Training Session (e.g., viewed video, special lecture, review material, or read article and took test)

Key:	Type of training	Key:	Type of training	Key:	Type of training
A/T =	Article & Test - Self Review	OST/PP =	Off Site Training PowerPoint presentation	PP/T =	PowerPoint presentation/Handout - Self Review with Test
H/T =	Handout & Test - Self Review	P/E =	Procedure and/or Equipment Review	R =	Review of Records and Procedures - Self Review
L =	Lecture with PowerPoint presentation/Handout	PP/H =	PowerPoint presentation/Handout - Self Review	V =	Video - Self Review

Radiation Safety Committee
Detailed Quarterly Audit for Apr - Jun 2009
Research Service

1. **Monthly Radiation Surveys/Wipes of Core Labs, Waste, Common Areas done by Radiation Safety Office:**
   - Performed monthly: Yes — If no, explain below.
   - Any areas greater than trigger level (TL): No — If yes, explain below.
   - If areas were greater than TL, was appropriate action taken to decrease radiation levels below TL: N/A — If no, explain below.

2. **Annual Radiation Surveys/Wipes of each Authorized User Lab/Room done by Radiation Safety Office:**
   - Performed in December: N/A — If no, explain below.
   - Any areas greater than trigger level (TL): N/A — If yes, explain below.
   - If areas were greater than TL, was appropriate action taken to decrease radiation levels below TL: N/A — If no, explain below.
   - Number of Rooms: N/A Number of Authorized Users: N/A

3. **Quarterly Record Audit of Weekly Radiation Wipes Performed by each Authorized User Labs:**
   - Performed weekly if radioactivity is used: No — If no, explain below.
   - Any areas greater than trigger level (TL): No — If yes, explain below.
   - If areas were greater than TL, was appropriate action taken to decrease radiation levels below TL: N/A — If no, explain below.
   - Number of Rooms: 12 Number of Authorized Users: 9

4. **Quarterly/Annual Radionuclide Sealed Source Inventory of Labs and Core Labs done by Radiation Safety Office:**
   - Performed quarterly as required: Yes — If no, explain below.
   - All sources accounted for: Yes — If no, explain below.
     - 17 sealed sources.

5. **Semi-Annual Radionuclide Sealed Source Leak Testing done by Radiation Safety Office:**
   - Performed semi-annually as required (due in Jan. & Jul.): N/A — If no, explain below.
   - Any leakage detected above required limits: N/A — If yes explain below.

6. **Quarterly Radionuclide (Unsealed) Inventory of each Authorized User Lab done by Radiation Safety Office:**
   - All sources accounted for: Yes — If no, explain below.
   - All Authorized Users within possession limits: Yes — If no, explain below.
   - Number of Authorized Users: 9 As of: April1, 2009

7. **Reported Radioactive Spills:**
   - Any reported radioactive spills: No — If yes, explain below.

8. **Authorized User Lab Closings:**
   - None to report.

9. **Annual Survey Meter Calibrations:**
   - Performed annually as required (due in Mar. or after repair): N/A — If no, explain below.

10. **Annual Beta Counter (2) Quench Curve and Gamma Counter (2) Calibration:**
    - Performed annually (due in Jan. or after repair): N/A — If no, explain below.

11. **Monthly Beta Counter (2) Normalization, Chi-Square, and Constancy Checks and Gamma Counter (2) Peak, % Resolution, Chi-Square, Constancy, and Efficiency Checks:**
    - Performed monthly Yes — If no, explain below.
    - All checks were within established limits: Yes — If no, explain below.

Radiation Safety Committee
Detailed Quarterly Audit for Apr - Jun 2009
Research Service

12. Authorized User Approvals by Radiation Safety Committee:

- None to report.

13. Quarterly Review of In-coming Radionuclide Receiving Reports:

- Any shipments received that were not pre-approved by RSO: No — If yes, explain below.
- Any receiving report missing pertinent info (i.e., survey/wipe results): No — If yes, explain below.
- Any problems noted (i.e., contamination, wrong material): No — If yes, explain below.
- 1 shipment with 1 order

Isotope	# Shipments	mCi
H-3	1	5.00

14. Quarterly Review of Out-going Radionuclide Package Records:

- Any out-going record missing pertinent info (e.g., survey/wipe results): N/A — If yes, explain below.
- Any problems noted (e.g., contamination): N/A — If yes, explain below.
- None to report.

15. Training (Include all staff if dealing with research use of radionuclides.): Yes x1.25 If yes, list below.
See Nuclear Medicine audits for support staff (e.g., EMS, Police, etc.)

16. Radiation Safety Improvements and/or Additional Comments/Problems: Yes — If yes, explain below.

- Apr - Worked with Research Safety Manager to update safety training & lab entrance poster. Both included various aspects of radiation safety and this training will be made available to all research staff during 2009. Note that this training does not replace annual radiation safety training for radioactive users in research.

Research Safety Training Lab Entrance Poster

Audit performed by: Michael T. Hackett, MS, Radiation Safety Officer

Radiation Safety Committee
Detailed Quarterly Audit for Apr - Jun 2009
Research Service

Radiation Safety Training:

#	Date	Time	# Staff	# hrs/ Staff	Total # hrs	Type	Section/Service	Training Title (click on the below links to view training)
N/A	May	N/A	3	0.25	0.75	PP/H	Research	* Research Emergency & Safety Procedures
N/A	May	N/A	2	0.25	0.50	PP/H	Radiation Safety/ Safety Office	* Research Emergency & Safety Procedures
					1.25	Grand Total of # Training Hrs.		

* Note of the 60 minutes of this research safety training, about 15 minutes would be applicable to radiation safety.

Key:	Type of training
A/T =	Article & Test - Self Review
H/T =	Handout & Test - Self Review
L =	Lecture with PowerPoint presentation/Handout

Key:	Type of training
OST/PP =	Off Site Training PowerPoint presentation
P/E =	Procedure and/or Equipment Review
PP/H =	PowerPoint presentation/Handout - Self Review

Key:	Type of training
PP/T =	PowerPoint presentation/Handout - Self Review with Test
R =	Review of Records and Procedures - Self Review
V =	Video - Self Review

Research Emergency and Safety Procedures Training

Presented by: VAMC Lexington, KY

Michael T. Hackett, MS,
Radiation Safety Officer

Steve Brown, PhD,
Research Safety Manager

April 2009

Why Have Safety Training?

HERALD-LEADER

Published on 2007-02-27, Page C2
Lexington Herald-Leader (KY)

- Accidents can occur when chemicals are improperly transported
- Please read & learn why we have safety training

Click on Icon to View/Print Article

Auto with hazardous chemicals in accident

FORCES BRIEF CLOSURE OF RICHMOND GAS STATION, 2 ROADS

By Cassondra Kirby
[illegible]

RICHMOND — An Eastern Kentucky University chemistry professor who was transporting hazardous chemicals in his car was involved in an accident yesterday morning that resulted in the closing of a Richmond gas station and two roads.

Jonathan Barnes, 34, turned left about 8:15 a.m. from Red House Road onto the Robert R. Martin Bypass and into the path of a Dodge truck, Richmond Police Sgt. Willard Bearden said. Barnes was taken to Pattie A. Clay Hospital. His condition was not known.

Barnes' two daughters, ages 7 and 8, were not injured. The driver of the truck, Elvie Phillips, also was not hurt, Bearden said.

Shortly after the accident, emergency workers, who had towed Barnes' car to Hamm's BP on Eastern Bypass, discovered that sodium hydroxide and hydrochloric acid were in containers in the car.

The chemicals "had been released in the vehicle during the accident," said Corey Lewis, a spokesman for the Richmond Fire Department. "They can be dangerous, and we weren't sure what we had at the time, especially with the combination and mixing of the chemicals."

A hazardous materials unit was called in. It shut down the gas station, as well as two side roads. Officials diverted traffic around the contaminated area, Lewis said.

"Any time it's known that there's chemicals involved, we immediately take all the major precautions until we can slowly make the determination that it's not a problem," he said.

Lewis said crews in protective suits and gear cleaned up the scene. The area remained closed until about 11:30 a.m.

The emergency workers who had been exposed to the chemicals did not appear to have any ill health effects, Lewis said.

Officials said no charges were expected in connection with the accident.

Reach Cassondra Kirby in the Richmond bureau at (859) 623-1838 or ckirby@herald-leader.com.

Why Have Safety Training?

HERALD-LEADER

Published on 2006-11-04, Page B1
Lexington Herald-Leader (KY)

- Accidents can occur when chemicals are improperly combined
- Please read & learn why we have safety training

Click on Icon to View/Print Article

Lab explosion injures student

LAB | Six taken to hospital as precaution

Why Have Safety Training?

Los Angeles Times

Published on 2009-03-01, Page A1
Los Angeles Times (CA)

- Accidents can be **deadly** & occur when chemicals are improperly handled
- Please read & learn why we have safety training

Click on Icon to View/Print Article

Los Angeles Times
March 1, 2009

Deadly UCLA lab fire leaves haunting questions

Federal and state safety agencies investigate after university officials failed to address lapses before a Dec. 29 chemical accident left a research assistant with fatal burns

By Kim Christensen

March 1, 2009

UCLA's Molecular Sciences Building was mostly closed for the holidays on Dec. 29 as research assistant Sheri Sangji worked on an organic chemistry experiment.

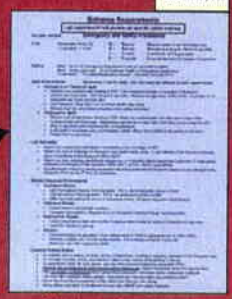
Lab Specific Safety Training

- Lab supervisor/PI is required to provide lab specific safety training to staff working in their VA lab(s)
- The following training is to supplement the above mentioned training & give you an overview of emergency and safety procedures

Emergency and Safety Procedures Poster

- Found on each research lab door
- Quick reference in case of an emergency or an issue concerning safety

Click on Icon for MAC Friendly File



Click on Document to Open/Print

Fire: Remember R.A.C.E.

R = Rescue	Rescue people in the immediate area
A = Activate	Activate by pulling fire Alarm & call 4500
C = Confine	Confine fire by Closing doors
E = Evacuate	Evacuate the floor, Extinguish if a small fire

Fire: Remember R.A.C.E.

- **Fire alarm pull** stations are located by each **stair well**
- Every VA phone has # listed to report a **fire (4500)** & other emergency #s (e.g., VA Police, Code Blue)
- **Evacuation routes** are posted in the hallways

Fire: Remember R.A.C.E.

- An announcement will be made over the PA system notifying all personnel of the location of the fire: "Code Red & location of the fire"
- Area fire alarms with flashing lights & audible alarms will be activated

- Listen for both in case there is a fire in the research area (in 3C###, 3D###, 4C###, 4D###)

Fire Extinguishers

- Fire Extinguishers:
  - Located in some labs
  - Do not obstruct or conceal fire extinguishers
  - Located in hallways throughout Research
  - **Know where your nearest fire extinguisher is**

Fire Extinguishers

- When using remember **P.A.S.S.**
  - **P** = **P**ull the pin
  - **A** = **A**im at base of fire about 8-10ft away
  - **S** = **S**queeze the trigger
  - **S** = **S**weep side to side
- "How to Use" instructions can be found on the fire extinguisher label
- Use only if fire is small & you have had training on its use

Fire Safety and Prevention

- During a fire
  - Turn off oxygen, gas, and electrical equipment in the affected area
  - Use the stairs – Never use the elevators

- Sprinkler heads should be free from obstructions
  - Maintain a minimum of 18" between sprinkler deflectors along a horizontal plane throughout the lab/room

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Injury

- Major – Go to VA Emergency Dept (ED) if able, or call 4368 or 4966
- Minor – Notify supervisor and go to VA ED, VA Employee Health (5270, A529), or if applicable, UK Employee Health (323-5823, ext. 256, Kentucky Clinic)
- Code Blue (cardiac/respiratory arrest) – Call 4500 and start CPR

14

Hazardous Spill Response

Please remember:

- **Do not attempt to clean up any hazardous spill yourself!**
- Notify staff in the immediate area and the appropriate safety staff
- Contain spill if possible
- Biological or Chemical: Evacuate lab
  Radioactive: Stay at lab doorway
- Wait for instructions

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Biological or Chemical Spill

- Remove any contaminated clothing or personal protective equipment (PPE)
- Use emergency shower or eyewash
- Contain spill if possible
- **Evacuate lab**, close and lock door
- Call Research Office (4927) or VA Police (4445) after hours
- Remain near lab for instructions

Biological or Chemical Spill

- Emergency showers located in hallways throughout Research
- Eyewash stations located in every lab
  - Remember to test them weekly
  - Document each test
  - Report problems to Research Office (4927)

Biological or Chemical Spill

- Contain spill if it can be done safely
  - Spill kits located in core labs (C309, C326, D307 & D317), chemical storage room (C321), D406 (VMU) & outside C410

  - Various spill kits for biologicals, acids, caustic (bases), formaldehyde & solvents (flammables) plus general sorbents (pads, socks)

Radioactive Spill

- Remove any contaminated clothing & PPE. Wash any contaminated skin with warm soapy water.

- Contain and/or shield spill if possible. **Stay at lab door until monitored for contamination**.
- Notify staff in the area and the Radiation Safety Officer (RSO) @ 5929, pager 850 or #s posted on door below radioactive sign

Radioactive Spill

- Follow RSO's instructions
- Radioactive spill kits located in core labs C326 & D307 along with sorbents
- Spare survey meter located in core lab C326

Hazardous Spill Response

Please remember (one more time):

- **Do not attempt to clean up any hazardous spill yourself!**
- Notify staff in the immediate area and the appropriate safety staff
- Contain spill if possible
- Biological or Chemical: Evacuate lab
  Radioactive: Stay at lab doorway
- Wait for instructions

Lab Security

- Report any **suspicious individuals** immediately to the VA Police (4445)
- Report any **lost, stolen, or found** VA Research keys/swipe cards or **any failures** of the Research security doors immediately to the Research Office (4927)

Lab Security

- Report any **lost, missing, potentially dangerous, or concerns about hazardous materials or radioactive materials** immediately to the Research Office (4927) or the RSO (5929), respectively

Lab Security

- **No tailgating**
  (one swipe = one person)
- **Unauthorized visitors** or service personnel requesting entrance to Research areas must be sent to the Research Office (C403) on the 4th floor for assistance

Waste Disposal Procedures

Biological Waste:

- Pathological (tissue):
  - [illegible] waste
  - Put in [illegible] in D306
- Non-Tissue:
  - [illegible] waste
  - Put in [illegible] in D306
- VMU:
  - Use [illegible] in procedure rooms
  - All tissue disposal in D439 freezer

Waste Disposal Procedures

Chemical Waste:

- Collect waste in appropriate labeled container
- Complete and submit "Request for a VA Research Chemical Pickup" electronic form
  - On UK web site:

http://www.mc.uky.edu/ukcro/vasubmission_page.htm
- Questions can be directed to Safety Office (3354)

Waste Disposal Procedures

Radioactive Waste:

- Collect in appropriate labeled & shielded (i.e., if needed) container
- Separate containers for:
  - Type (e.g., dry, liquid, scintillation fluid)
  - Nuclide (e.g., H-3, I-125, P-32)
- Call RSO (5929) for pick up

Waste Disposal Procedures

Sharps:

- Uncontaminated lab glassware
  - Put in yellow barrel in D306 or glassware box in D439 (VMU)

- Needles, scalpels, etc.
  - Do not cap needles
  - Put in sharps container in lab
    - When full, call VMU supervisor (5946)

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GEMS (Green Environmental Management System)

What is GEMS?

- The VHA GEMS (Green Environmental Management Systems) is a formal system for integrating the environmental footprint into the overall management of the organization. Required by presidential Executive Order 13148, the goal of GEMS is to achieve continual improvement in environmental protection.

Lexington VAMC GEMS Coordinator:
Richard Archer: 859-233-4511 ext 3354

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GEMS (Green Environmental Management System)

In Research:

- Properly collect and dispose of biological waste, chemicals, radioactive materials, etc.
- Recycle (e.g., paper, batteries, cardboard)
- Replace mercury containing items if possible (e.g., thermometers) with non-mercury based items

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General Safety Rules

- **No** children in the Research labs
- **No** eating, drinking, or storing of food/drinks in labs
- **No** smoking in labs or the hospital
- **No** applying cosmetics in labs

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General Safety Rules

While working in the lab:

- **Do not** wear sandals
- **Do not** wear shorts
- **Do not** wear short skirts
- **Do not** wear other similar clothes

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General Safety Rules

As appropriate, wear:

- Lab Coat
- Gloves
- Any other personal protective equipment (PPE):
  - Safety glasses/goggles
  - Face shield

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General Safety Rules

Remove gloves:

- Before using phone or computer

Remove lab coat & gloves and wash hands:

- Before leaving the lab, unless transporting items that require them
- As posted on the inside of lab door

General Safety Rules

Transporting:

- Use secondary containment when transporting biologicals, chemicals and/or radioactive materials

Eye Wash Station:

- As noted earlier, test weekly
- Document testing & report any problems (4927)

General Safety Rules

Good review of lab safety issues can be found on the posters in hallway outside rooms D308 (cold room) & D317 (core lab)

Walk over and take a look at it sometime!

Chemical Safety

Chemical Inventory:

- Each lab(s) must update their chemical inventory at least semi-annually and submit it to the Research Office
- **All chemicals** ordered or coming over from UK must be **delivered to/checked** in by the **Research Office**

Chemical Safety

Material Data Safety Sheets (MSDS):

- Each lab(s) must have a MSDS binder

- For **every chemical** in the lab(s), there **must be a MSDS** in this binder

Chemical Safety

Material Data Safety Sheets (MSDS):

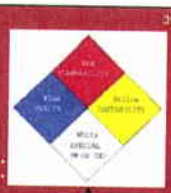
Click on Icon for MAC Friendly File

- Contains important info about the chemical
  - Product/company information
  - Hazard identification
  - First aid measures
  - Handling and storage
  - Etc. (see attached)

Click on Document to Open/Print

- Please review article on ANSI standardized (& optional) MSDS format

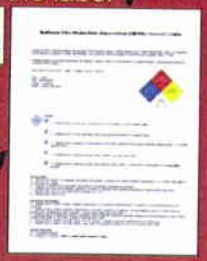
Chemical Safety



Chemical Hazard Identification:

Most chemicals have some safety/hazard info on the label

Click on Icon for MAC Friendly File



PPE & Use/Storage

NFPA Code

Click on Document to Open/Print

Chemical Safety

Click on Icon for HAC Friendly File

Chemical Hazard Identification:

Globally Harmonized System (GHS) of Classification and Labeling of Chemicals

Click on Document to Open/Print

Chemical Safety

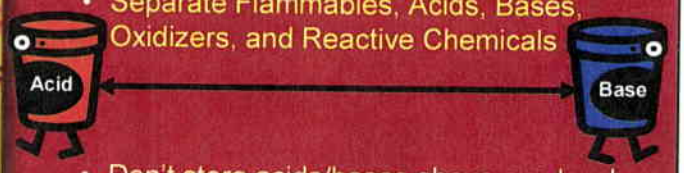
Chemical Labeling:

- Every container with any chemical must be properly labeled plus have
  - Lab name
  - Date received
  - Date opened if applicable
- If a chemical is transferred into another container, this container must include the chemical name along with the lab name and date

Chemical Safety

Proper Chemical Storage:

- Separate Flammables, Acids, Bases, Oxidizers, and Reactive Chemicals



- Don't store acids/bases above eye level
- Some acids must be stored separately from other acids:
  - Acetic Acid – cabinet in core lab C326
  - Perchloric Acid – cabinet in core lab D317

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Chemical Safety

Proper Chemical Storage:

- **Acetic acid**

Acetic acid (ethanoic acid) when concentrated is flammable; therefore, bulk concentrated acetic acid MUST be stored in the flammable cabinet in C326 (core lab) that is labeled "ACETIC ACID ONLY".

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Chemical Safety

Proper Chemical Storage:

- **Perchloric acid**

Perchloric acid (hydroxidotrioxidochlorine) is a strong oxidizer and when in the anhydrous and monohydrated form, it can be explosive. Its use is restricted here at this VA; therefore, contact the VA Research Safety Manager at ext. 4274 and the VA Safety Office at ext. 4176 before any perchloric acid use. Note that perchloric acid should not be purchased and when it is allowed to be used, "core" bottle(s) will be available in D317 (core lab).

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Chemical Safety

Proper Chemical Storage:

- **Picric acid**

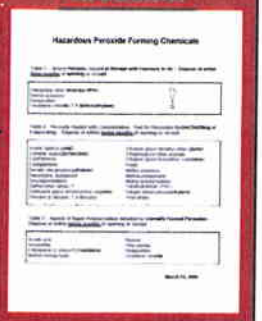
Picric acid (trinitrophenol) can be explosive if dry but can be stored safely when wet (e.g., water content is above 10%). DO NOT OPEN if the contents appears to be dry or deposits of crystalline solid can be seen inside the container (e.g., around the container lid) and immediately notify the VA Research Safety Manager at ext. 4274 and the VA Safety Office at ext. 4176.

Chemical Safety

Click on Icon for HAC Friendly File

Proper Chemical Storage:

- **Hazardous peroxide forming chemicals**
  - Limited shelf life – 3-12 months



Click on Document to Open/Print

Chemical Safety

Chemical Usage:

- **Know the hazardous properties of the chemicals you are using!**
- **Know the hazardous properties of the chemicals you are using!**
- **Know the hazardous properties of the chemicals you are using!**
- **Know the hazardous properties of the chemicals you are using!**

Gas Cylinder Safety

- Only transport using special transport carts
- Secure cylinder to prevent it falling over
- Regulator
  - Use proper regulator
  - Do not pick up cylinder by the regulator
  - Do not lean over regulator when adjusting
- Install safety cap when not in use
- **Know the gas's hazardous properties**

Liquid Nitrogen (LN2) Use

- Before your first use, contact the Research Safety Manager (4274) for liquid nitrogen training
- Store & use in a well ventilated area
  - Never use in small closed area/cold room
- Use only LN2 designed containers
  - Caution: glass lined containers may shatter
  - Recommend shatterproof HDPE containers
- Never place in a sealed container

Dewar Flask

Liquid Nitrogen (LN2) Use

- Wear appropriate PPE
  - Face shield
  - Loose-fitting Cryogenic gloves
  - Cryogenic apron
- Wear appropriate clothing
  - Lab coat, cuff-less pants & shoes made of non-absorbent material

Fume Hoods

- Do not store chemicals or equipment in fume hoods
- Use appropriate PPE
- Use with sash in proper position

- Check for proper airflow before using (e.g., "tissue on sash alarm")

- Report any diminished airflow to the Research Office (4927)

Biological Safety Cabinets

- Follow procedures in 5th Edition of the BMBL (on CDC website) for the proper use of a BSC
- Use proper PPE
- Disinfect all biohazardous material after use

- Make sure the pipetters are clean and in proper working order
- No open flames (e.g., Bunsen burner)

Environment of Care (EOC)

- EOC monitors the physical facilities in Research Service
- Report to Research Office (4927) any:
  - Lighting malfunction
  - Stained ceiling tiles
  - Water/air leaks
  - Plumbing issues
  - Cleaning issues
  - Etc.

Emergency and Safety Procedures

- The Emergency and Safety Procedures Poster and this training give you some general guidance but it does not cover every issue
- Also available:
  - Safety Manuals
  - Additional Training
  - Contacts

Safety Manuals

Each lab(s) should have:

- Research Safety Manual
- Medical Center Environment of Care Management Plans
- Laboratory Biosafety Manual (orange cover)
- Radiation Safety Records binder (if authorized for radioactive materials)

Posted in hallways

- Emergency Operation Procedures

by rooms C303, C323b, D313 and C401

Safety Manuals

- These manuals contain detailed emergency and safety procedures that were covered in this training plus other issues like:
  - Severe weather
  - Bomb threats
  - Utility failures
  - Etc.

Please review what is contained in each of these safety manuals.

Safety Training

- Supervisor (PI) will provide lab specific safety training
- Annual training required:
  - Lab safety
  - Radiation safety (if authorized to use radioactive materials)
- Additional training as needed

Questions

If you have any questions about this training, or questions or concerns about any safety issue in your lab, please contact your supervisor or any of the following safety contacts.

Safety Contacts

Lab supervisor/PI
Office:
Phone:
E-mail:

Know how to contact your supervisor!

Safety Contacts

Steve Brown, PhD
Research Safety Manager
Office: C301
Phone: 4274
E-mail: UK: sabrow1@email.uky.edu
VA: shephen.brown5@va.gov

Click to e-mail Steve a Question (via UK e-mail)

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Safety Contacts

Michael Hackett, MS
Radiation Safety Officer
Office: B101K (Nuclear Medicine)
Phone: 5929
VA Pager: 850
E-mail: michael.hackett@va.gov

Click to e-mail Mike a Question

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Safety Contacts

Sally Higgins, CSP, CFPS
Safety Manager
Office: 218-2 Leestown (Engineering)
Phone: 3365
VA Cell phone: (859) 825-8836
E-mail: sally.higgins@va.gov

Click to e-mail Sally a Question

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Safety Contacts

Lisa Westendorf, BS
Industrial Hygienist
Office: D238 (Engineering)
Phone: 4176
VA Cell phone: (859) 559-6180
E-mail: lisa.westendorf@va.gov

Click to e-mail Lisa a Question

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Safety Contacts

Richard Archer, MPH, CIH
GEMS Coordinator
Office: 218-2 Leestown (Engineering)
Phone: 3364
VA Cell phone: (859) 559-1375
E-mail: richard.archer2@va.gov

Click to e-mail Richard a Question

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This required training should have given you:

- Basic information concerning emergency and safety procedures in Research
- References where to get more detailed information concerning emergency and safety procedures in Research

Please use this to make a safer work environment in your lab. Thank you.

66

Required Training Credit

- Complete the training credit form and return it to the Research Office (C403) for 1 hour of training credit

Click on Icon to Open/Complete/Print

- You can also get a copy of this training credit form and/or the presentation with attachments through the Research Office

LEXINGTON HERALD-LEADER WWW.KENTUCKY.COM

Published on 2007-02-27, Page C2
Lexington Herald-Leader (KY)

Auto with hazardous chemicals in accident

FORCES BRIEF CLOSURE OF RICHMOND GAS STATION, 2 ROADS

By Cassondra Kirby
CENTRAL KENTUCKY BUREAU

RICHMOND — An Eastern Kentucky University chemistry professor who was transporting lab chemicals in his car was involved in an accident yesterday morning that resulted in the closing of a Richmond gas station and two roads.

Jonathan Barnes, 34, turned left about 8:15 a.m. from Red House Road onto the Robert R. Martin Bypass and into the path of a Dodge truck, Richmond Police Sgt. Willard Reardon said. Barnes was taken to Pattie A. Clay Hospital. His condition was not known.

Barnes' two daughters, ages 7 and 8, were not injured. The driver of the truck, Elvin Phillips, also was not hurt, Reardon said.

Shortly after the accident, emergency workers, who had towed Barnes' car to Hamm's BP on Eastern Bypass, discovered that sodium hydroxide and hydrochloric acid were in containers in the car.

The chemicals "had been released in the vehicle during the accident," said Corey Lewis, a spokesman for the Richmond Fire Department. "They can be dangerous, and we weren't sure what we had at the time, especially with the combination and mixing of the chemicals."

A hazardous-materials unit was called in. It shut down the gas station, as well as two side roads. Officials diverted traffic around the contaminated area, Lewis said.

"Any time it's known that there's chemicals involved, we immediately take all the major precautions until we can slowly make the determination that it's not a problem," he said.

Lewis said crews in protective suits and gear cleaned up the scene. The area remained closed until about 11:30 a.m.

The emergency workers who had been exposed to the chemicals did not appear to have any ill health effects, Lewis said.

Officials said no charges were expected in connection with the accident.

Reach Cassondra Kirby in the Richmond bureau at (859) 626-5878 or ckirby@herald-leader.com

LEXINGTON HERALD-LEADER WWW.KENTUCKY.COM

Published on 2006-11-04, Page B1
Lexington Herald-Leader (KY)

Lab explosion injures student

Chemical reaction apparently the cause

HERALD-LEADER STAFF REPORT

A University of Kentucky student suffered cuts and burns to her face and throat yesterday after a concoction exploded in an engineering lab in UK's Anderson Hall.

The woman was pouring nitric acid into a waste container for disposal about 9:30 a.m. when the chemical apparently reacted with another substance, causing the container to shatter, said Maj. Joe Monroe of the UK police department. The explosion occurred on the seventh floor of Anderson Hall.

Diane Mier, who works in the computer science department's office down the hall, said she heard the explosion and saw the woman running from the lab, bleeding from the neck.

She said a bystander tried to help stop the bleeding. Others applied sodium bicarbonate to minimize the burning, Monroe said.

Officials and students decontaminated the woman at the scene. She was taken to UK Hospital, where she was listed in good condition, according to UK.

Officials were not releasing the name of the woman, who is an exchange student from Germany. They were waiting to contact her family.

Six other people in the vicinity of the lab — including

See LAB, B3

LAB | Six taken to hospital as precaution

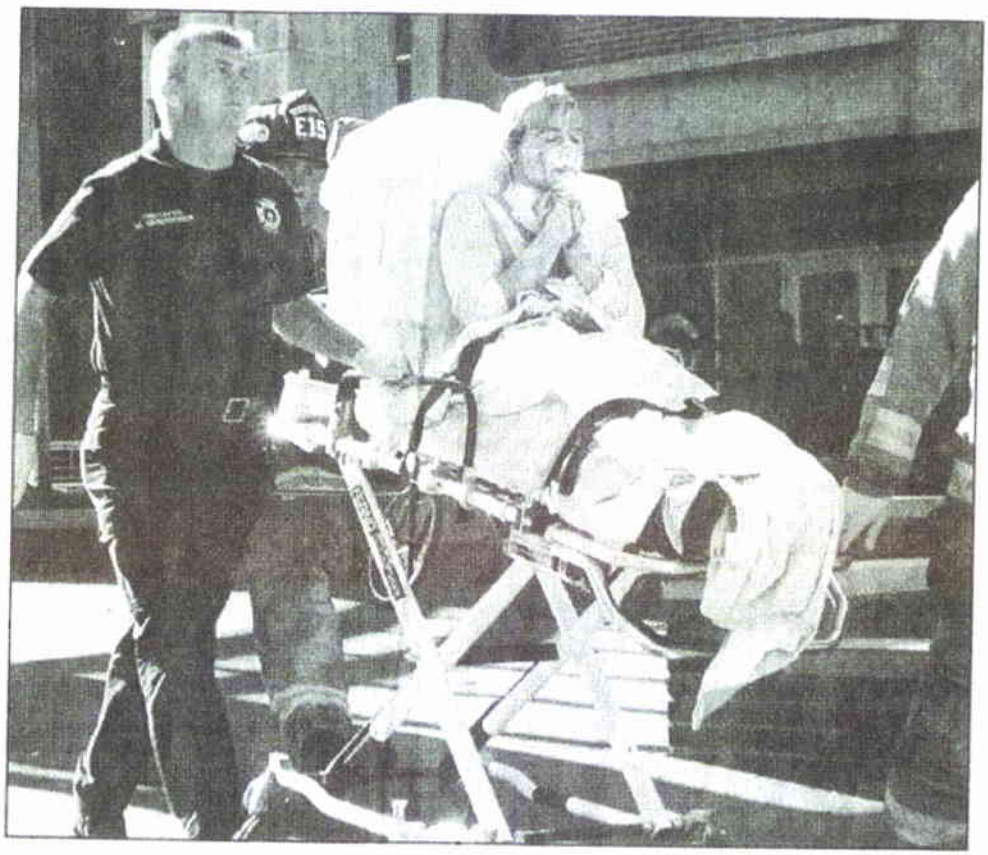
From Page B1

students and staff — were also decontaminated and taken to the hospital as a precautionary measure. All six were evaluated and released.

Anderson Hall was evacuated temporarily as a precaution. The first six floors were opened at noon for classes. The lab was closed.

UK police, Lexington fire department, UK Environmental Health and Safety and other emergency personnel responded to the scene.

"Our primary concern at this time is the health and safety of the students and staff," College of Engineering Dean Thomas Lester said in a prepared statement. "The laboratory where the accident occurred is closed and will not reopen until the incident investigation is completed. The college is taking all measures possible to ensure this type of accident does not happen again."

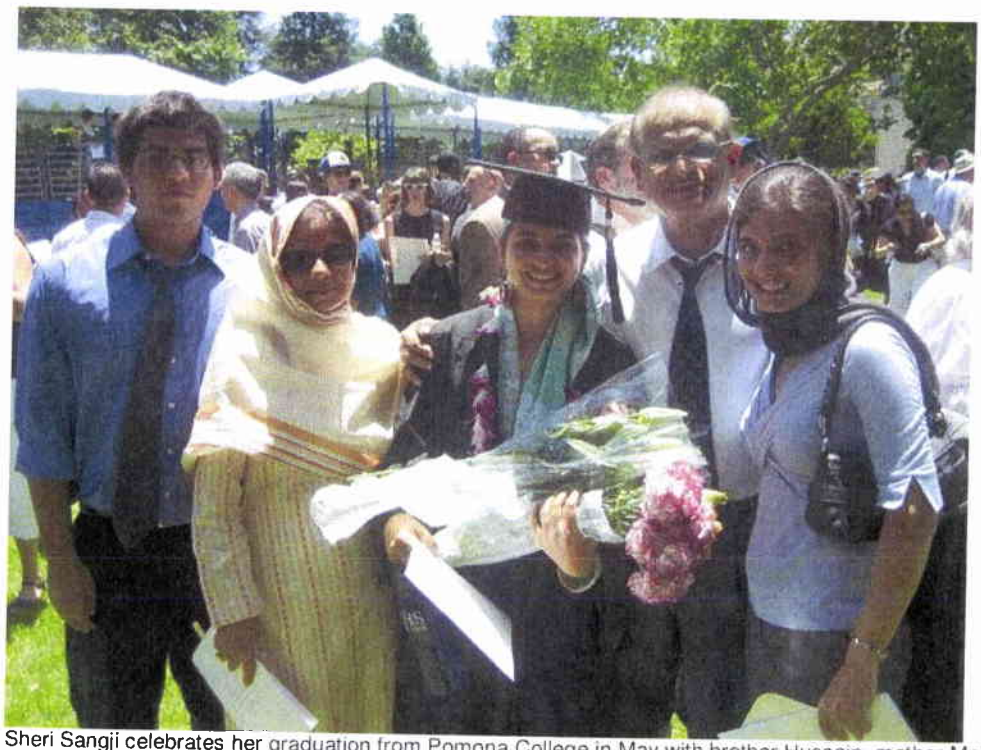


DAVID STEPHENSON | STAFF

Firefighters took the injured woman to be transported to UK Hospital. Officials did not release the name of the woman, a German exchange student, because her family had not been notified.

Los Angeles Times
March 1, 2009

Deadly UCLA lab fire leaves haunting questions



Sheri Sangji celebrates her graduation from Pomona College in May with brother Hussain, mother Maimoona, father Shaukat and sister Naveen. Two months before Sangji was burned in a chemical fire, UCLA safety inspectors found more than a dozen deficiencies where she was working.

Federal and state safety agencies investigate after university officials failed to address lapses before a Dec. 29 chemical accident left a research assistant with fatal burns.

By Kim Christensen

March 1, 2009

UCLA's Molecular Sciences Building was mostly closed for the holidays on Dec. 29 as research assistant Sheri Sangji worked on an organic chemistry experiment.

Only three months into her job in the lab, the 23-year-old Pomona College graduate was using a plastic syringe to extract from a sealed container a small quantity of t-butyl lithium -- a chemical compound that ignites instantly when exposed to air.

As she withdrew the liquid, the syringe came apart in her hands, spewing flaming chemicals, according to a UCLA accident report. A flash fire set her clothing ablaze and spread second- and third-degree burns over 43% of her body.

Eighteen excruciating days later, Sangji died in a hospital burn unit.

"It is horrifying," said her sister Naveen, 26, a Harvard medical student. "Sheri wasn't out doing something stupid. She was working in a lab at one of the largest universities in the world. She gets these horrific injuries and loses her life to these injuries and we still don't know how it happened or why it wasn't prevented."

Sangji's death was more than a tragic workplace accident. It also raised serious questions about the university's attention to laboratory safety.

"It was totally preventable," said Neal Langerman, a San Diego consultant and former head of the American Chemical Society's Division of Chemical Health and Safety, whose members were given a detailed account of the incident by a University of California safety official.

"Poor training, poor technique, lack of supervision and improper method. This was just not the right way to transfer these things," Langerman said. "She died, didn't she? It speaks for itself."

Two months earlier, UCLA safety inspectors found more than a dozen deficiencies in the same lab, Molecular Sciences Room 4221, according to internal investigative and inspection reports reviewed by The Times. Among the findings: Employees were not wearing requisite protective lab coats, and flammable liquids and volatile chemicals were stored improperly.

Chemical Safety Officer Michael Wheatley sent the inspection report to the researcher who oversees the lab, Professor Patrick Harran, as well as to the head of the Chemistry and Biochemistry Department and a top UCLA safety official. The report directed that problems be fixed by Dec. 5.

But the required corrective action was not taken, records show, and on Dec. 29 all that stood between Sangji's torso and the fire that engulfed her was a highly flammable, synthetic sweater that fueled the flames.

Under scrutiny

The California Division of Occupational Safety and Health is investigating, as are the Office of the State Fire Marshal, the National Institute for Occupational Safety and Health and the U.S. Chemical Safety and Hazard Investigation Board. A spokeswoman for Cal/OSHA, the lead agency, said she could not comment on the investigation.

UCLA officials say they are cooperating with all of the agencies.

"We consider this a profoundly tragic accident, and the campus community is still reeling from the loss of Sheri as a member of the Bruin family," said Kevin Reed, vice chancellor for legal affairs.

Harran, the organic chemistry professor for whom Sangji worked, said he could not comment on the accident because of the pending investigations. But he said he's heartbroken.

"Words cannot convey my grief or that of those who work in my lab, and our pain cannot possibly compare with the immeasurable anguish felt by Sheri's family," he wrote in an e-mail. "Sheri's death is a tragedy that has left her friends, colleagues and co-workers here in our department devastated."

UCLA has launched a comprehensive review of lab safety protocols and has stepped up inspections and shortened the time allowed to correct serious violations. Chancellor Gene Block also established a campuswide lab safety committee and ordered enhanced accountability measures.

Such efforts are of little comfort to Sangji's family. Her parents, Shaukat Sangji, a small-business owner who lives in Toronto, Canada, with his wife, Maimoona, a Montessori schoolteacher, were too distraught to be interviewed, said Naveen, who relayed an e-mail message to The Times from her father.

"They say time will heal, but I know for sure nothing can heal this," he said. "This has completely destroyed our lives forever."

Born and raised in Pakistan, Sheharbano "Sheri" Sangji followed her older sister to Pomona College, a small, top-tier liberal arts school in Claremont, in 2003. Their parents and younger brother moved to Canada.

"Sheri always loved science and fell in love with chemistry," Naveen said, but she also was interested in the rights of women and immigrants, environmental policy and law. She decided to become an attorney, with an eye toward a career that would blend her interests.

"She was brilliant, just so impressive," her sister said.

Daniel O'Leary, Sheri's chemistry professor for nearly three years at Pomona, recalled her as being upbeat, with a good sense of humor, and an independent problem-solver who published two papers as an undergraduate in professionally vetted chemistry journals.

"She was a talented researcher and a very involved student in the chemistry department," said O'Leary, who earned his doctorate at UCLA and now teaches at Bowdoin College in Maine.

Sangji graduated in May and had applied to some of the nation's top law schools.

In October, she took a job in a lab run by Harran, a rising star who joined the UCLA faculty in July as the first Donald J. Cram Chair in Organic Chemistry. In 2007, Harran and colleagues at the University of Texas Southwestern Medical Center gained notice for their work on a synthetic toxin that shrinks cancerous tumors in mice.

"Sheri was excited about this job . . . and was so happy when she got it," said her friend Jahan Bruce, 24, a special-education teacher. "She wanted to be in the research area and wanted to be in a university setting. All of her friends thought this was perfect for her."

On Dec. 29, Sangji was performing an experiment related to Harran's work on a potential anti-obesity drug, UCLA's Reed said.

She was trying to transfer up to 2 ounces of t-butyl lithium, which was dissolved in pentane, another highly flammable chemical, from one sealed container to another. It was the second time she had performed that procedure in Harran's lab, UCLA officials said.

"The barrel of the syringe was either ejected or pulled out of the syringe, causing liquid to be released," the UCLA accident report stated.

Sangji's rubber gloves caught fire, searing her hands. Her sweater, made of a synthetic material, was so flammable that Langerman, the chemical safety expert, compared it to "solid gasoline." It, too, was quickly engulfed.

The panicked young woman ran away from a nearby emergency shower instead of toward it, records state, costing her precious time.

"She might have been fine" had she quickly made it to the shower, said Russ Phifer, head of the American Chemical Society's safety division, who also reviewed the UC official's account of the accident.

A postdoctoral researcher, who UCLA officials say was just a few feet away, rushed to Sangji's aid and tried to smother the flames with a lab coat. Another ran in from an adjoining room, helped douse the fire, then called 911 and summoned Harran, Reed said.

"He said when he got there Sheri was sitting with her arms outstretched in front of her and someone was throwing water at her from a sink," said Naveen, who spoke with Harran later at the hospital. That account squares with the UCLA accident report.

From the Ronald Reagan UCLA Medical Center, Sangji was transferred to the Grossman Burn Center in Sherman Oaks.

It is unknown whether a typical cotton lab coat would have saved her. But even if it caught fire, it could have been removed much more easily than a burning synthetic sweater, safety expert Phifer said.

"I can't imagine why she didn't have protective clothing if she knew she was working with chemicals that dangerous," Sheri's friend Bruce said.

Training questioned

But just how much Sangji knew about the procedure that took her life is an open question.

"The employee may not have been using best work practices while handling the syringe to transfer a pyrophoric liquid," a UCLA accident report concluded. "The employees should be instructed in safer handling techniques."

Harran told a UCLA investigator the day after the fire that a syringe "was the appropriate method" for transferring t-butyl lithium -- and that Sangji had been trained how to do it. But according to the investigator's report, Harran did not know when that training occurred and had no record of it, as required by Cal/OSHA and UCLA lab safety standards.

UCLA's Reed said Sangji "was trained by senior chemists within Dr. Harran's lab to conduct this specific experiment and handle these specific chemicals." But he couldn't say why there was no record of it.

"We're still trying to figure that one out," he said, adding that Cal/OSHA is also looking into it.

At the hospital, Naveen said, her sister told her that she was not given safety training: "She was very clear about the lack of safety training, because I asked her directly."

It was not unheard of for people in Harran's labs to work without protective gear, UCLA records show.

On Oct. 30, two months before the fire, an annual safety inspection uncovered more than two dozen deficiencies in his four labs, including the one where Sangji worked. Among other things, inspectors found excessive amounts of flammable liquids and missing chemical spill cleanup kits.

"Eye protection, nitrile [rubber] gloves and lab coats were not worn by laboratory personnel," the inspection report said.

The Nov. 5 report said lab coats "must be worn while conducting research and handling hazardous materials in the lab" and assigned the Dec. 5 deadline to correct the deficiencies.

After the accident, however, Bill Peck, UCLA manager of occupational safety and employee health, wrote in his report that "most of the corrections in the laboratory were not accomplished by 12/30/08."

A first-aid kit and spill cleanup materials were still lacking; flammable materials and water- and air-reactive chemicals were still being stored improperly; and employees still weren't using protective equipment, the report said.

Cal/OSHA is investigating why the deficiencies were not corrected sooner, UCLA officials said. One potential factor, they said, is that Harran had planned to move the lab.

Phifer and Langerman saw other potential problems: At the time of the fire, Sangji worked at a cupboard-like "fume hood," which pulls potentially harmful vapors out through an exhaust system. It has a tempered-glass vertical sash that probably was not lowered enough, they said, because if it had been, only her hands and forearms would have been burned.

In addition to the fume hood, Sangji would have been better protected if she had used a "blast shield," a free-standing portable device made of brass that chemists put between themselves and potentially dangerous experiments, the experts said. A blast shield was not required for that experiment, Reed said, and it is unknown if one was available.

Langerman also questioned the safety of transferring t-butyl lithium with a syringe.

"The preferred method is to use pressure to push the liquid out of the source bottle into your receiver through a stainless-steel tube," he said.

Both experts also wondered if Sangji and the postdoctoral researchers who risked their lives to help her had received adequate fire safety training. UCLA officials say they had.

"The response afterward is probably most responsible for her death," Phifer said. "The fact that she immediately turned away from the shower and went in the opposite direction is a problem. It means that she wasn't properly trained in what to do in the event she caught fire."

Final days

At the burn center, Sangji's family found her wrapped in bandages, her arms suspended from the ceiling. Deep burns covered her back, legs, torso and ears.

"It was really hard to see her like that," Naveen said. "They gave her a lot of sedation and oxygen therapy, but she was in a lot of pain. Her big concern was her hands. She really worried that she wouldn't get function back. She kept asking about her hands: 'Will they get better? How long will it take?' "

Naveen said her sister could not bring herself to discuss the accident: "She was having flashbacks and nightmares, and she didn't want to talk about it."

Only family members were permitted visits, so friends dropped off cards and posters with photos and messages of encouragement for Sheri, an avid soccer player. She seemed to make progress for about a week, her sister said, but began to decline at about the time of a second surgery to remove burned tissue.

On Jan. 16, she succumbed to respiratory failure, infection and other complications, according to a coroner's report.

"Sheri was such a fighter that it just never entered our minds that she wouldn't make it through," her sister said.

A day before her funeral in Toronto, her family learned that she had been accepted to UC Berkeley's Boalt Hall School of Law.

"It was her dream school," Naveen said.

kim.christensen @latimes.com

Times staff writer William Heisel contributed to this report.

Entrance Requirements

Lab supervisor/PI will provide lab specific safety training.

Rev. 04/09 - MTH/SAB

Emergency and Safety Procedures

Fire: Remember **R.A.C.E.**
"Code Red" = "Fire"

R =	**R**escue	**R**escue people in the immediate area.
A =	**A**ctivate	**A**ctivate by pulling fire **A**larm & call **4500**.
C =	**C**onfine	**C**onfine fire by **C**losing doors.
E =	**E**vacuate	**E**vacuate the floor; **E**xtinguish if a small fire.

Injury:
Major - Go to VA Emergency Department if able or call (4368 or 4966).
Minor - Notify supervisor. Go to Employee Health or Emergency Department.
"Code Blue" = "Cardiac/Respiratory Arrest" - Call 4500 and start CPR.

Spill Procedures: Remember: **Call for help – Do not clean up without proper supervision.**

- **Biological or Chemical Spill:**
  - Remove any contaminated clothing & PPE. Use emergency shower or eyewash if necessary.
  - Contain spill if possible. Spill kits are in core labs, chemical storage room, D406 (VMU), & outside C410.
  - **Evacuate lab**, close and lock door.
  - Call Research Office (4927) or VA Police (4445) after hours.
  - Remain near lab, and follow instructions from safety personnel.
- **Radioactive Spill:**
  - Remove any contaminated clothing & PPE. Wash any contaminated skin with warm soapy water.
  - Contain/shield spill if possible. Radioactive spill kits are in core labs C326 (plus survey meter) & D307.
  - **Stay at lab door until monitored for contamination**.
  - Notify staff in immediate area and Radiation Safety Officer (RSO) (5929 or #s posted on lab door).
  - Follow RSO's instructions.

Lab Security:

- Report any **suspicious individuals** immediately to the VA Police (4445).
- Report any **lost or missing** VA Research keys and/or swipe cards, or **any failures** of the Research security doors immediately to the Research Office (4927).
- Report any **lost, missing, potentially dangerous, or concerns about hazardous materials or radioactive materials** immediately to the Research Office (4927) or RSO (5929), respectively.
- **Unauthorized visitors** or service personnel requesting entrance into Research areas must be directed to the Research Office on the 4th floor for assistance.

Waste Disposal Procedures:

- **Biological Waste:**
  - **Lab** Pathological (tissue): Red bag waste. Put in **red incineration** barrel in D306.
  - **Lab** Non-tissue: Red bag waste. Put in **red autoclave** barrels in D306.
  - **VMU**: Use **red autoclave** barrels in procedure rooms. All tissue disposal in D439 freezer.
- **Chemical Waste:**
  - Collect waste in appropriate container.
  - Complete and submit a "Request for a VA Research Chemical Pickup" electronic form.
- **Radioactive Waste:**
  - Collect (separate by type and nuclide) in appropriately labeled & shielded containers/storage area.
  - Call RSO (5929) for pick-up.
- **Sharps:**
  - Uncontaminated lab glassware: Put in yellow barrel in D306 or glassware box in D439 (VMU).
  - Needles, scalpels, etc.: Do not recap needles. Put in sharps container in your lab. When full, call VMU supervisor (5946).

General Safety Rules:

- No children and no eating, drinking, storing of food/drinks, smoking or applying cosmetics in the Research labs.
- Do not wear sandals, shorts, short skirts or other similar clothes while working in the lab.
- As appropriate, wear lab coat, gloves, and any other personal protective equipment (PPE).
- **Remove lab coat/gloves & wash hands before leaving lab** unless transporting items that require them.
- Use **secondary containment** when transporting biologicals, chemicals and/or radioactive materials.
- Test your lab's eyewash station weekly. Document your test and report any problems (4927).
- **Know the hazardous properties of the chemicals that you are using.**
- **Know where and what is contained in your lab's MSDS and safety manuals.**

ANSI revises standardized MSDS format

New chemicals are being developed every day and are used in an ever-widening variety of applications. The need to provide accurate, clear and concise information to people who use, handle or store hazardous industrial chemicals is paramount.

Per the Occupational Safety and Health Administration (OSHA) Hazard Communication Standard (29 Code of Federal Regulations [CFR] 1910.1200), a Material Safety Data Sheet—or MSDS—is one means of providing this information.

Details on material identity, manufacturer information, hazard identity, emergency information and other technical information are contained in an MSDS. The Hazard Communication Standard provides little information regarding the formatting of an MSDS.

In 1993, the American National Standard for Hazardous Industrial Chemicals—Material Safety Data Sheets—Preparation, ANSI Z400.1, was developed to address the need for an MSDS format that was comprehensive, understandable and consistent. ANSI Z400.1-1993 introduced the standardized 16-section MSDS.

Revisions were made to the ANSI standard in 1998 and 2004. The 2004 revisions improve readability, minimize redundancies and reorder the MSDS sections as outlined below:

Section 1: Product and company identification

This section names the material and links the MSDS to the label and shipping documents. It also identifies the name of the manufacturer, importer or other responsible party along with a mailing address and phone number for obtaining additional information.

Section 2: Hazard identification

This section describes the material's appearance and most significant immediate concerns. It is divided into four subsections: emergency overview, OSHA regulatory status, potential health effects and potential environmental effects.

The physical state of the material and the health, physical and environmental hazards that require immediate attention in emergencies are listed in the emergency overview.

The OSHA regulatory status subsection indicates if the material is hazardous or not with respect to the Hazard Communication Standard.

Potential adverse health effects and symptoms associated with exposure to the material are given in the potential health effects subsection.

The potential environmental effects subsection offers information on the potential effects tied to the release of the material into the environment.

Section 3: Composition/information on ingredients

This section identifies the components, byproducts and impurities that contribute to the material's hazards. The chemical name, common name or synonym, along with the corresponding Chemical Abstracts Service (CAS) Registry Number and percentages or ranges of percentages are included.

Section 4: First aid measures

This section is divided into two subsections: first aid procedures and notes to physicians.

First aid procedures should be brief, easily understood emergency and first aid instructions for each potential route of exposure. They are intended for use by any untrained individual.

Notes to physicians convey additional information on antidotes, specific treatments and diagnostic procedures and are intended for use by healthcare professionals.

Section 5: Firefighting measures

This section describes specific hazards arising from the fire and explosive properties of the material, the appropriate extinguishing media for the fire and special protective equipment and precautions for firefighting.

Section 6: Accidental release measures

This section contains information for responding to spills, leaks or releases in order to prevent or minimize adverse health effects on people, property and the environment. Information on personal protective equipment, containment equipment, cleanup equipment and techniques, environmental precautions and specific reporting requirements may be included.

Section 7: Handling and storage

This section provides guidance on safe handling and storage practices. Precautions proper for the unique properties of the material should be emphasized.

Section 8: Exposure control/personal protection

This section is divided into three subsections:

1. Established exposure guidelines for the material and/or its components. The established exposure guidelines include, but are not limited to, OSHA's Permissible Exposure Limits (PELs) and American Conference of Governmental Industrial Hygienist's (ACGIH's) Threshold Limit Values (TLVs) and Biological Exposure Indices (BEIs).

2. Engineering controls that may be appropriate to help minimize the hazards.

3. Personal protective equipment guidelines—eye/face protection, skin protection, respiratory protection and general hygiene considerations.

Section 9: Physical and chemical properties

This section identifies the physical and chemical properties of the material.

If applicable and relevant, these characteristics must be detailed: appearance, odor, odor threshold, physical state, pH, melting/freezing point, initial boiling point and boiling range, flash point, evaporation rate, flammability (solid, gas), upper/lower flammability or explosive limits, vapor pressure, vapor density, specific gravity or relative density, solubility, partial

Continued on page 5

coefficient: n-octanol/water, auto-ignition temperature and decomposition temperature.

If a characteristic is included, but not applicable or relevant, it should be indicated.

Section 10: Stability and reactivity

This section describes the potential hazards associated with the stability and reactivity of the material under specified conditions. Chemical stability, conditions to avoid, incompatible materials, hazardous decomposition products and the possibility of hazardous reactions should be addressed.

Section 11: Toxicological information

This section provides toxicological information that can be used to assess human health hazards or potential health effects of the material and/or its components.

Acute dose effects, repeated dose effects, irritation, corrosivity, skin and respiratory sensitization, carcinogenicity, neurological effects, genetic effects, reproductive effects, developmental effects and target organ effects data may be listed.

Section 12: Ecological information

Information to assist in the evaluation of the environmental impact of the material and/or its components if released to the environment is provided in this section. Ecotoxicity, persistence/degradability, bioaccumulation/accumulation, mobility in environmental media and other adverse effects may be addressed.

Section 13: Disposal considerations

This section provides information that may be useful in the proper disposal, recycling or reclamation of the material and/or its container.

Section 14: Transport information

Basic classification information and special precautionary information to help a knowledgeable user prepare a material for shipment is given in this section. This section is not intended to contain every regulatory detail involving the transportation of a material.

Section 15: Regulatory information

This section provides information on the regulatory status useful for compliance with health, safety and environmental regulations. Content and organization of this section depends on where the material is manufactured or used. It is not intended to be a comprehensive list of all regulations that may apply.

Section 16: Other information

This section includes any additional information that may be useful. It may include label text, hazard ratings, preparation and revision information or key/legend that explains the abbreviations used in the MSDS.

This is a general overview of the ANSI Z400.1-2004 standard. Copies of the standard may be obtained by contacting:

American National Standards Institute, Inc.
25 West 43rd Street
New York, NY 10036
Telephone: 212-642-4900
Web site: www.ansi.org ■

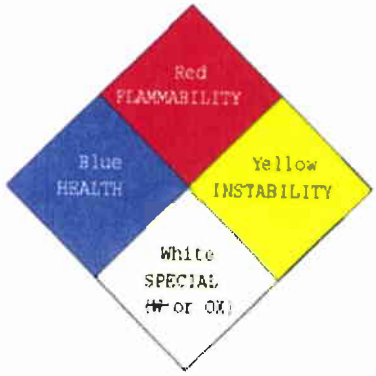
National Fire Protection Association (NFPA) Hazard Codes

Labels on many chemicals feature the National Fire Protection Agency (NFPA) Hazard Code. These ratings alert users of a material's acute hazards in regard to health, flammability, and reactivity during emergency conditions such as spills, leaks, or fires.

Potential hazards are rated numerically per degree of danger—from 4 (most severe) to 0 (least severe)—and are found inside the universal NFPA symbol.

Each section may be color coded to indicate specific hazards:

blue = health
red = flammability
yellow = reactivity
white = special warnings



Health

4 = Material that on very short exposure could cause death or major residual injury

3 = Material that on short exposure could cause serious temporary or residual injury

2 = Material that on intense or continued but not chronic exposure could cause temporary incapacitation or possible residual injury

1 = Material that on exposure would cause irritation but only minor injury

0 = Material that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible material

Flammability
4 = Material will rapidly or completely vaporize at atmospheric pressure and normal ambient temperature, or is readily dispersed in air and will burn readily
3 = A liquid or solid that can be ignited under almost all ambient temperature conditions
2 = Material that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur
1 = Material that must be preheated before ignition can occur
0 = Material that will not burn

Reactivity (Instability)
4 = Material that in itself is readily capable of detonation or of explosive decomposition or reaction at normal temperatures and pressures
3 = Material that in itself is capable of detonation or explosive reaction but requires a strong initiation source; or while must be heated under confinement before initiation; or may react explosively with water
2 = Material that is unstable and readily undergoes violent chemical change at elevated temperatures and pressures or which reacts violently with water or may form explosive mixtures with water
1 = Material that in itself is normally stable, but can become unstable at elevated temperatures and pressures
0 = Material that in itself is normally stable, even under fire exposure conditions and is not reactive with water

Special Warnings
OX = Oxidizing material
W = Material is hazardous when in contact with moisture or water

Globally Harmonized System (GHS)
of Classification and Labeling of Chemicals
Produced by SCHC-OSHA Alliance
GHS Information Sheet Workgroup

Info Sheet #1 Pictograms

May, 2008

How does the GHS define pictograms?

A pictogram is a symbol or picture which represents a word or idea. We see pictograms everyday in signs and labels. We are all familiar with the "No Smoking" pictogram posted in public buildings. The Department of Transportation (DOT) routinely requires labels with pictograms for vehicles carrying hazardous materials.

Under the GHS, a **pictogram** is a graphical representation that includes a symbol plus other graphic elements, such as a border, background pattern or color intended to convey specific information. In the most basic terms, a pictogram is a picture plus a border used to convey information. **See the GHS pictograms on the next page.**

Under the GHS, a **symbol** is a graphical element intended to succinctly convey information – it is the picture or graphic without the border or background color. **See 'When are pictograms and symbols required under the GHS?' below.**

The distinction between pictogram and symbol is important: Certain circumstances require a pictogram, while others require only the symbol or pictogram name.

When are pictograms and symbols required under the GHS?

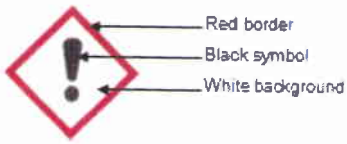
Labels

- When chemicals meet classification criteria under any of the hazard classes identified by the GHS, the corresponding pictogram must be printed on the chemical label.
- The pictograms must have a black symbol on a white background with a red border frame. A black frame may be used for shipments within one country if authorized by the competent authority. Where transport pictograms are required (e.g. under the DOT Hazardous Materials Regulations), the GHS pictogram for the same hazard should not appear.

MSDSs

- As part of the required label elements, the pictograms or symbols or the pictogram name(s) based on the product hazards must be listed.

Pictogram Example



Pictogram Name: Exclamation Mark

To learn more ...

- Electronic images of GHS pictograms may be downloaded from the United Nation's GHS website at http://www.unece.org/trans/danger/publi/ghs/pictograms.html
- The GHS, in its entirety (including classification criteria and label and MSDS requirements), can be downloaded at http://www.unece.org/trans/danger/publi/ghs/ghs_rev01/01files_e.html
- Find OSHA's Advanced Notice of Proposed Rulemaking at http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=FEDERAL_REGISTER&p_id=18890
- A 12-hour training course on the GHS is offered by the Society for Chemical Hazard Communication (SCHC). http://www.schc.org/schcnewsite/committee.php?page=profdev/courses/course_list.html
- The OSHA Guide to the Globally Harmonized System for Classification and Labels is available at http://www.osha.gov/dsg/hazcom/ghs.html

GHS Pictograms and Corresponding Chemical Hazards

Name	Hazard
Exploding Bomb	Explosive (Unstable, Divisions 1.1, 1.2, 1.3 and 1.4), Self Reactive (Type A and B), Organic Peroxide (Type A and B)
Flame	Flammable (Solids Categories 1 and 2, Liquids Categories 1, 2 and 3, Gases Category 1, Flammable Aerosols Categories 1 and 2), Self Reactive (Type B, C, D, E and F), Pyrophoric, Self-heating, Emits Flammable Gas, Organic Peroxide (Type B, C, D, and F)
Flame over Circle	Oxidizer
Gas Cylinder	Gas under pressure

Name	Hazard
Corrosive	Corrosive (Skin Corrosion Categories 1A, 1B and 1C, Eye Corrosion Category 1), Corrosive to metals.
Skull	Acute toxicity (Categories 1, 2, and 3)
Exclamation Mark	Irritant (Skin Irritation Category 2 and Eye Irritation Category 2A), Dermal Sensitizer (Category 1), Acute Toxicity (Category 4, harmful), Target Organ Toxicity/ STOT Category 3 = narcotic effects, respiratory irritation
Chronic Health Hazard	Carcinogen (Categories 1A, 1B, and 2), Respiratory Sensitizer (Category 1), Reproductive Toxicity (Categories 1A, 1B, and 2), Target Organ Toxicity/STOT (Categories 1 and 2), Mutagenicity (Categories 1A, 1B and 2), Aspiration Toxicity (Categories 1 and 2)

Additional Pictograms

OSHA does not have jurisdiction over environmental hazards, and the following GHS pictogram will not be covered by OSHA. It may be covered by other agencies once those decisions have been made, and is provided for informational purposes.

Environmental Hazard	Acute Aquatic Toxicity (Category 1), Chronic Aquatic Toxicity (Categories 1and 2)

The information contained in this sheet is believed to accurately represent provisions of U.S. regulations, consensus standards, and current GHS requirements. However, SCHC cannot guarantee the accuracy or completeness of this information. Users are responsible for determining the suitability and appropriateness of these materials for any particular application.

This sheet was developed through OSHA's Alliance Program for informational purposes only. It does not necessarily reflect the official views of OSHA or the U.S. Department of Labor.

Hazardous Peroxide Forming Chemicals

Table 1 – Severe Peroxide Hazard in Storage with Exposure to Air – Dispose of within <u>three months</u> of opening or receipt

Diisopropyl ether (isopropyl ether) Divinyl acetylene Divinyl ether Vinylidene chloride (1,1-dichloroethylene)	!

Table 2 – Peroxide Hazard with Concentration - Test for Peroxides Before Distilling or Evaporating – Dispose of within <u>twelve months</u> of opening or receipt

Acetal (diethyl acetal)	Ethylene glycol dimethyl ether (glyme)
Cumene (isopropyl benzene)	Ethyleneglycol ether actetate
Cyclohexene	Ethylene glycol monoether (cellosolve)
Cyclopentene	Furan
Decalin (decahydronapthalene)	Methyl acetylene
Diacetylene (butadiene)	Methylcyclopentane
Dicyclopentadiene	Methyl isobutyl ketone
Diethyl ether (ether) *	Tetrahydrofuran (THF)
Diethylene glycol dimethylether (diglyme)	Tetralin (tetrahydronaphthalene)
Dioxane (p-dioxane, 1,4-dioxane)	Vinyl ethers

Table 3 – Hazard of Rapid Polymerization Initiated by Internally Formed Peroxides – Dispose of within <u>twelve months</u> of opening or receipt

Acrylic acid	Styrene
Acrylonitile	Vinyl acetate
Chlorprene (2-chloro-1,3-butadiene)	Vinylpyridine
Methyl methacrylate	Vinylidene chloride

March 15, 2006

Training Credit Form

Self Review of PowerPoint Presentation:

Research Emergency and Safety Procedures Training

(Dated April 2009)

VAMC Lexington, KY

Complete:

Print Name	**Signature ***	Lab (PI's Name) or Service	Date Viewed
Comments or Suggestions: (optional)			
*** I certify that I viewed the above-named PowerPoint presentation and its attachments or reviewed the printout of the presentation and its attachments.**			

Please return the completed and signed form to the VA Research Safety Office, room C403.

To be completed by Research Service or Designee:

****

See attached PowerPoint presentation printout with attachments for items covered.
The presentation and/or copy of the printout with attachments was available to each person.

Put into Education Tracking Package (TEMPO) on _____ by _____ for 60 minutes of training.

Entrance Requirements

Lab supervisor/PI will provide lab specific safety training.

Rev. 04/09 - MTH/SAB

Emergency and Safety Procedures

Fire: Remember **R.A.C.E.**
"Code Red" = "Fire"

R =	**R**escue	**R**escue people in the immediate area.
A =	**A**ctivate	**A**ctivate by pulling fire **A**larm & call **4500**.
C =	**C**onfine	**C**onfine fire by **C**losing doors.
E =	**E**vacuate	**E**vacuate the floor; **E**xtinguish if a small fire.

Injury: Major - Go to VA Emergency Department if able or call (4368 or 4966).
Minor - Notify supervisor. Go to Employee Health or Emergency Department.
"Code Blue" = "Cardiac/Respiratory Arrest" - Call 4500 and start CPR.

Spill Procedures: Remember: **Call for help – Do not clean up without proper supervision.**

- **Biological or Chemical Spill:**
  - Remove any contaminated clothing & PPE. Use emergency shower or eyewash if necessary.
  - Contain spill if possible. Spill kits are in core labs, chemical storage room, D406 (VMU), & outside C410.
  - **Evacuate lab**, close and lock door.
  - Call Research Office (4927) or VA Police (4445) after hours.
  - Remain near lab, and follow instructions from safety personnel.
- **Radioactive Spill:**
  - Remove any contaminated clothing & PPE. Wash any contaminated skin with warm soapy water.
  - Contain/shield spill if possible. Radioactive spill kits are in core labs C326 (plus survey meter) & D307.
  - **Stay at lab door until monitored for contamination**.
  - Notify staff in immediate area and Radiation Safety Officer (RSO) (5929 or #s posted on lab door).
  - Follow RSO's instructions.

Lab Security:

- Report any **suspicious individuals** immediately to the VA Police (4445).
- Report any **lost or missing** VA Research keys and/or swipe cards, or **any failures** of the Research security doors immediately to the Research Office (4927).
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  - **Lab** Pathological (tissue): Red bag waste. Put in **red incineration** barrel in D306.
  - **Lab** Non-tissue: Red bag waste. Put in **red autoclave** barrels in D306.
  - **VMU**: Use **red autoclave** barrels in procedure rooms. All tissue disposal in D439 freezer.
- **Chemical Waste:**
  - Collect waste in appropriate container.
  - Complete and submit a "Request for a VA Research Chemical Pickup" electronic form.
- **Radioactive Waste:**
  - Collect (separate by type and nuclide) in appropriately labeled & shielded containers/storage area.
  - Call RSO (5929) for pick-up.
- **Sharps:**
  - Uncontaminated lab glassware: Put in yellow barrel in D306 or glassware box in D439 (VMU).
  - Needles, scalpels, etc.: Do not recap needles. Put in sharps container in your lab. When full, call VMU supervisor (5946).

General Safety Rules:

- No children and no eating, drinking, storing of food/drinks, smoking or applying cosmetics in the Research labs.
- Do not wear sandals, shorts, short skirts or other similar clothes while working in the lab.
- As appropriate, wear lab coat, gloves, and any other personal protective equipment (PPE).
- **Remove lab coat/gloves & wash hands before leaving lab** unless transporting items that require them.
- Use **secondary containment** when transporting biologicals, chemicals and/or radioactive materials.
- Test your lab's eyewash station weekly. Document your test and report any problems (4927).
- **Know the hazardous properties of the chemicals that you are using.**
- **Know where and what is contained in your lab's MSDS and safety manuals.**

Radiation Safety Committee
Detailed Quarterly Audit for Apr - Jun 2009
Radiographic-Fluoroscopic Use

D. Low Volume Exams (Sampling different procedures reviewed each qtr):

(1) Broken down by Procedure Type: CT THORACIC SPINE W/O CONTRAST

Effective Dose	mSv
Average	27.5
Minimum	9.2
Maximum	71.0
Total # of CT Exams (B152) Reviewed	13
# of exams over ≥10 mSv but ≤100 mSv	12
# of exams over >100 mSv	0

(2) Broken down by Procedure Type: CT TRAUMA FACE

Effective Dose	mSv
Average	1.9
Minimum	1.7
Maximum	2.3
Total # of CT Exams (B152) Reviewed	11
# of exams over ≥10 mSv but ≤100 mSv	0
# of exams over >100 mSv	0

2. Patient radiation dose from Interventional Fluoroscopy (Specials B180):

See reference table/link at end of this audit related to patient skin doses.

Air Kerma (estimated entrance skin dose)		mGy	Fluoro Time (min)
1 Gy = 1,000 mGy	Average	306.7	6.8
	Minimum	1.3	0.0
	Maximum	2,394.1	58.0
Total # of Exams in Specials (B180) Reviewed		86	
# of exams over ≥3 Gy but <10 Gy		0	
# of exams over ≥10 Gy but <15 Gy		0	
# of exams over ≥15 Gy		0	

3. Patient radiation dose from Cardiac Cath (A233 & A235):

See reference table/link at end of this audit related to patient skin doses.

Air Kerma (estimated entrance skin dose)		mGy	Fluoro Time (min)
1 Gy = 1,000 mGy	Average	2,568	15.0
	Minimum	1	0.0
	Maximum	11,942	86.6
Total # of Exams in A233 (EPL) & A235 (CCL) Reviewed		226	
# of exams over ≥3 Gy but <10 Gy		72	←
# of exams over ≥10 Gy but <15 Gy		2	←
# of exams over ≥15 Gy		0	

A. Broken down by: A233 (EP Lab - EPL)

Air Kerma (estimated entrance skin dose)		mGy	Fluoro Time (min)
1 Gy = 1,000 mGy	Average	1,852	16.6
	Minimum	1	0.1
	Maximum	8,437	86.6
Total # of Exams in A233 (EPL) Reviewed		71	
# of exams over ≥3 Gy but <10 Gy		17	←
# of exams over ≥10 Gy but <15 Gy		0	
# of exams over ≥15 Gy		0	

B. Broken down by: A235 (Cardiac Cath Lab - CCL)

Air Kerma (estimated entrance skin dose)		mGy	Fluoro Time (min)
1 Gy = 1,000 mGy	Average	2,897	14.3
	Minimum	1	0.0
	Maximum	11,942	63.8
Total # of Exams in A235 (CCL) Reviewed		155	
# exams over ≥3 Gy but <10 Gy		55	←
# exams over ≥10 Gy but <15 Gy		2	←
# exams over ≥15 Gy		0	

Radiation Safety Committee
Detailed Quarterly Audit for Apr - Jun 2009
Radiographic-Fluoroscopic Use

Use the links below for detailed case-by-case breakdown.

1. **Patient radiation dose from CT (B152 only):**
See reference tables/links at end of this audit related to patient effective doses.
CT Exams by Procedures:

Total	3182	Exams for 60 Procedures
Average	53.0	Exams/Procedure (note: patient may have multiple procedures; dose may reflect all exams done)

A. Interventional CT Exams:

Effective Dose	mSv
Average	8.4
Minimum	2.3
Maximum	27.8
Total # of Interventional CT Exams (B152) Reviewed	32
# exams over ≥10 mSv but ≤100 mSv	6
# of exams over >100 mSv	0

(1) Further broken down by CCTA W/WO, QUAN CALCIUM Exams:

Effective Dose	mSv
Average	8.4
Minimum	2.3
Maximum	27.8
Total # of CCTA Exams (B152) Reviewed	32
# of exams over ≥10 mSv but ≤100 mSv	6
# of exams over >100 mSv	0

B. High Volume Exams (Sampling of different procedures reviewed each qtr):
(1) Broken down by Procedure Type: CT ABDOMEN W/O CONTRAST

Effective Dose	mSv
Average	18.6
Minimum	3.8
Maximum	36.6
Total # of CT Exams (B152) Reviewed	32
# of exams over ≥10 mSv but ≤100 mSv	24
# of exams over >100 mSv	0

(2) Broken down by Procedure Type: CT PELVIS W/O CONTRAST

Effective Dose	mSv
Average	16.8
Minimum	3.8
Maximum	36.6
Total # of CT Exams (B152) Reviewed	32
# of exams over ≥10 mSv but ≤100 mSv	22
# of exams over >100 mSv	0

C. Average Volume Exams (Sampling different procedures reviewed each qtr):
(1) Broken down by Procedure Type: CT LUMBAR SPINE W/O CONTRAST

Effective Dose	mSv
Average	26.3
Minimum	4.1
Maximum	71.0
Total # of CT Exams (B152) Reviewed	30
# of exams over ≥10 mSv but ≤100 mSv	24
# of exams over >100 mSv	0

(2) Broken down by Procedure Type: CT NECK SOFT TISSUE W/ CONTRAST

Effective Dose	mSv
Average	2.8
Minimum	1.1
Maximum	6.3
Total # of CT Exams (B152) Reviewed	30
# of exams over ≥10 mSv but ≤100 mSv	0
# of exams over >100 mSv	0

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4. Radiation Safety Improvements and/or Additional Comments/Problems: Yes If yes, explain below.

- Jun - Special dose (i.e., air kerma) evaluation done on Specials & Cardiac Cath equipment:

Cath Lab Dose Meter Comparison

Audit performed by: Michael T. Hackett, MS, Radiation Safety Officer

References for Section 1 above

Table 1. Relative radiation level designations along with common example examinations for each classification

Relative Radiation Level*	Effective Dose Estimate Range	Example Examinations
None	0	Ultrasound, MRI
Minimal	<0.1 mSv	Chest radiographs, hand radiographs
Low	0.1-1 mSv	Pelvis radiographs, mammography
Medium	1-10 mSv	Abdomen CT, barium enema, nuclear medicine bone scan
High	10-100 mSv	Abdomen CT without and with contrast, whole body PET

*RRL assignments are not included for some examinations. These are designated as IP (in progress) or NS (not specified). The RRL assignments for the IP examinations will be available in future releases. The RRL assignments for the NS examinations cannot be made because the RRL depends on the region of the body exposed to ionizing radiation, and the body part will vary as a function of the clinical situation.

Taken from ACR Appropriateness Criteria® Radiation Dose Assessment Introduction (Relative Radiation Level Information)

Table 2

Adult Effective Doses for Various CT Procedures

Examination	Average Effective Dose (mSv)	Values Reported in Literature (mSv)
Head	2	0.9–4.0
Neck	3	
Chest	7	4.0–18.0
Chest for pulmonary embolism	15	13–40
Abdomen	8	3.5–25
Pelvis	6	3.3–10
Three-phase liver study	15	
Spine	6	1.5–10
Coronary angiography	16	5.0–32
Calcium scoring	3	1.0–12
Virtual colonoscopy	10	4.0–13.2

Taken from Mettler FA, Jr., Huda W, Yoshizumi TT, Mahesh M. Effective doses in radiology and diagnostic nuclear medicine: a catalog. Radiology 2008; 248(1):254-263.

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Reference for Sections 2 & 3 above

Table II. Radiation-Induced Skin Injuries

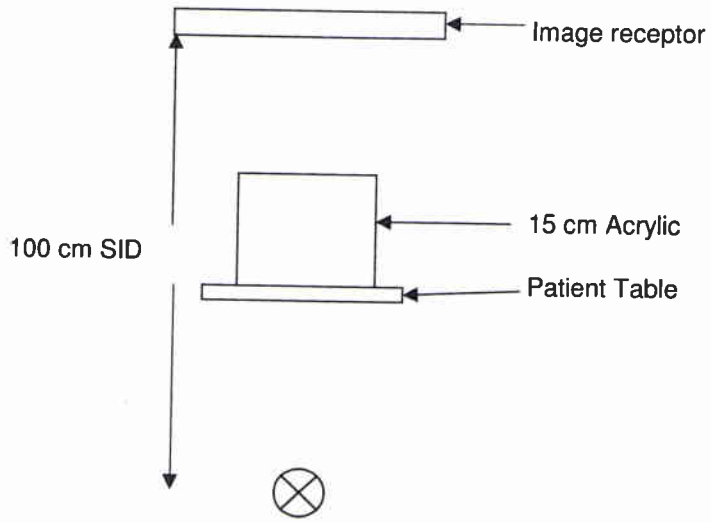
Effect	Typical Threshold Absorbed Dose (Gy)*	Hours of Fluoroscopic "On Time" to Reach Threshold* at: Usual Fluoro. Dose Rate of 0.02 Gy/min (2 rad/min)	High-Level Dose Rate of 0.2 Gy/min (20 rad/min)	Time to Onset of Effect**
Early transient erythema	2	1.7	0.17	hours
Temporary epilation	3	2.5	0.25	3 wk
Main erythema	6	5.0	0.50	10 d
Permanent epilation	7	5.8	0.58	3 wk
Dry desquamation	10	8.3	0.83	4 wk
Invasive fibrosis	10	8.3	0 83	
Dermal atrophy	11	9.2	0.92	>14 wk
Telangiectasis	12	10.0	1.00	>52 wk
Moist desquamation	15	12.5	1.25	4 wk
Late erythema	15	12.5	1.25	6-10 wk
Dermal necrosis	18	15.0	1.50	>10 wk
Secondary ulceration	20	16.7	1.67	>6 wk

* The unit for absorbed dose is the gray (Gy) in the International System of units. One Gy is equivalent to 100 rad in the traditional system of radiation units.
* Time required to deliver the typical threshold dose at the specified dose rate
** Time after single irradiation to observation of effect.

(Table adapted from Ref. 4.)

Taken from FDA's Avoidance of Serious X-ray-Induced Skin Injuries to Patients During Fluoroscopically-Guided Procedures

VA Medical Center
Comparison of machine stated skin dose with measured dose.



GE Cardiac Cath Lab

Chamber was placed at 55.5 centimeters as stated by GE as the measurment point of the internal dose meter. Fifteen cm of acrylic was used as phantom and the AEC system chose the techniques. After several minutes of fluoro the results below were obtained:

GE Cath Lab 1

Measurements in mGy

Stated	Measured	% Diff
31	25	19%

GE Cath Lab 2

Measurements in mGy

Stated	Measured	% Diff
46	37	20%

Philips Angio Lab

Chamber was placed at 66 centimeters as stated by Philips as the measurment point of the internal dose meter. Fifteen cm of acrylic was used as phantom and the AEC system chose the techniques. After several minutes of fluoro the results below were obtained:

Measurements in mGy

Stated	Measured	% Diff
50.3	51.4	2%

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ALARA-Radiation Exposure

1. **Personnel Exposure Records/ALARA Investigational Levels:**

Quarterly ALARA Levels & Annual Limits are expressed in mrem	ALARA Quarterly Investigational Levels		
	Level I (10% of ¼ annual limits)	Level II (30% of ¼ annual limits)	Annual Limits*
Whole Body (WB) Deep Exposure (DDE = Deep Dose Equivalent) (if lead/lead equivalent apron **not** used)	125	375	5,000
Whole Body Effective Dose Equivalent (WB EDE) = 0.3 x DDE (due to use of lead/lead equivalent apron)	125	375	5,000
Lens of Eye Exposure (LDE = Lens Dose Equivalent)	375	1,125	15,000
WB Shallow (Skin) Exposure (SDE = Shallow Dose Equivalent)	1,250	3,750	50,000
Extremity Shallow Exposure (SDE = Shallow Dose Equivalent)	1,250	3,750	50,000

* Annual Occupational Dose Limits for Adults based on NRC Regulations

A. Radioactive Materials Use:

a) Follow-up on previous quarter's review: x0
- None to report.

b) Exceeded the ALARA Quarterly Investigational Level I (10% of ¼ annual limit): x0
- None to report.

c) Exceeding ALARA Quarterly Investigational Level II (30% of ¼ annual limit): x0
- None to report.

B. Radiographic-Fluoroscopic Use:

a) Follow-up on previous quarter's review:

Exceeded the whole body effective dose equivalent of 125 mrem: x1

1) Badge # 1048, anesthesiologist in the pain clinic exceeded the whole body effective dose equivalent ALARA investigational level I of 125 mrem with a quarterly reading of 130 mrem in the 1st calendar quarter of 2009. This employee was within this ALARA level for the 2nd calendar quarter of 2009 with a quarterly reading of 61 mrem.

Exceeded the lens dose equivalent of 375 mrem: x1

1) Badge # 1048, anesthesiologist in the pain clinic exceeded the lens dose equivalent ALARA investigational level I of 375 mrem with a quarterly reading of 434 mrem in the 1st calendar quarter of 2009. This employee was within this ALARA level for the 2nd calendar quarter of 2009 with a quarterly reading of 218 mrem.

b) Exceeded the ALARA Quarterly Investigational Level I (10% of ¼ annual limit): x0
- None to report.

c) Exceeding ALARA Quarterly Investigational Level II (30% of ¼ annual limit): x0
- None to report.

2. **I-125/I-131 Bioassay Results:**

Were performed 6-72 hours post handling and each measured uptake was less than or equal to the minimal detectable activity (MDA) of the counting system on the day of counting. Radiopharmaceutical and research use records were reviewed to assure that each use requiring a bioassay had a documented bioassay.

a) Nuclear Medicine: Administration of $\geq$ 1 mCi in solution or $\geq$ 10 mCi in capsule form of I-131 as NaI or any problem/issue (e.g., spill, damaged capsule) with I-131 as NaI that may lead to intake even though based on past bioassays and our I-131 as NaI usage, it is unlikely that any staff member exceed 10% of the annual limit on intake (i.e., 5 μCi/year via inhalation with ALI of 50 μCi/year):
- One employee (1 bioassay) after 1 NaI administration (i.e., 1: 154 mCi in capsule form) with MDA of $\leq$ 0.005 μCi.

b) Research: Use of $\geq$ 1 mCi in solution of I-125 as NaI or any problem/issue (e.g., spill) with I-125 as NaI that may lead to intake:
- None to report.

Follow-up: None required.

3. **Pregnant Radiation Workers:**
- None to report.

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ALARA-Radiation Exposure

4. Quarterly Area Monitors Involving Radioactive Materials:

Three areas are monitored with quarterly radiation badges (deep dose equivalent):

			QTR mrem	2009 mrem
a)	NM2	Wall in main hallway outside Nuclear Medicine, i.e., outer wall of hot lab	6	14
b)	NM3	Wall in main hallway outside Nuclear Medicine, i.e., outer wall of hot lab	M	M
c)	RES1	Doorway of research radioactive waste storage room	M	M

The minimal detectable (M) quantity is <1 mrem for x-ray and gamma rays, and <10 mrem for energetic beta particles). The projected 2009 annual readings for all the above areas are expected to be less than 100 mrem/area.
Follow-up: None required.

5. Sanitary Sewer Disposal of Radioactive Material:

- None to report.

Audit performed by: Michael T. Hackett, MS, Radiation Safety Officer

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

FACT SHEET

Office of Public Affairs
Phone: 301-415-8200
Email: opa.resource@nrc.gov

NRC'S Response to Medical Events at the Veterans Affairs Medical Center in Philadelphia, Pa.

The U.S. Nuclear Regulatory Commission (NRC) responded aggressively and decisively to the medical errors at Department of Veterans Affairs (VA) hospitals as soon as the VA – which has the primary responsibility for notifying the NRC of problems – reported a potential issue to the NRC. The health and safety of this nation's veterans is of paramount importance to the NRC, and the NRC has been conducting comprehensive inspections and continually monitoring the VA program to identify the causes of the problems at VA hospitals. The NRC will ensure that appropriate actions are taken to be certain veterans receive effective treatment.

In May of 2008, the NRC was notified of a prostate cancer procedure in which the patient received less than the prescribed dose. The NRC was kept apprised of an ongoing internal VA examination of the issue. The VA hospital in Philadelphia suspended its prostate treatment program in June 2008. Four additional VA medical centers in Cincinnati, Ohio; Jackson, Miss.; Los Angeles, Calif.; and Washington, D.C. suspended their programs as problems were identified.

Based on the increasing numbers of identified problems at the VA in Philadelphia, NRC management launched an in-depth inspection in July 2008 and expressed its concerns about the errors at the VA. This inspection was then expanded to a Special Inspection. The NRC reminded the VA that its hospitals have a responsibility to provide U.S. veterans with safe and effective care and before it can resume cancer treatment programs the VA must demonstrate to the NRC the ability to safely conduct cancer treatment programs at its hospitals.

On March 30, 2009, the NRC issued a report on its inspections that focused on the medical errors at the VA hospital in Philadelphia and identified six apparent violations. The NRC plans to hold an enforcement conference with VA Philadelphia after inspection activities are finalized. An enforcement conference is designed to offer the medical center an opportunity to provide the agency with additional information or offer a different point of view and is open to the public. The information presented at this meeting will enable the NRC to make a well-informed final decision regarding the apparent violations. If the NRC decides that violations did occur, the agency will take enforcement actions determined by the severity of the violations.

The NRC continues inspections in Philadelphia and at other VA hospitals and will issue a report when these inspections are complete. There are 13 VA hospitals with a prostate treatment program.

Background

Department of Veterans Affairs - Holds a master materials license, issued by the NRC March 2003. A master license is issued to a federal organization and authorizes the use of radioactive material at multiple sites. A master materials license authorizes the VA to issue permits for the possession and use of licensed material at its hospitals and medical centers, and ties the licensee to a framework of oversight consistent with NRC regulations, inspection, licensing, enforcement policies, procedures, and guidance.

VA National Radiation Safety Committee - Has responsibility for providing oversight of the VA's implementation of its license and associated activities. The Committee has delegated the authority to manage the VA radiation safety program to its National Health Physics Program.

National Health Physics Program - Is the VA regulatory organization responsible for issuing permits, conducting inspections and event follow-up, investigating incidents, allegations, and enforcement.

Nuclear Regulatory Commission - The agency's regional office based in Lisle, Ill., has regulatory oversight of the VA's master materials license, which includes the National Radiation Safety Committee and the National Health Physics Program. The NRC does not have the responsibility for day-to-day oversight of VA medical procedures with radioactive materials because that entails examining patient records without cause, raising privacy issues. That responsibility lies with the VA's National Radiation Safety Committee and the National Health Physics Program. Failing to report a medical mistake is a violation of NRC regulations.

Discussion

On May 18, 2008, the NRC received notification that a patient undergoing treatment for prostate cancer at the Veterans Affairs hospital in Philadelphia, Pa., received a dose more than 20 percent lower than what was prescribed. The treatment involved implanting iodine-125 seeds into the patient's prostate.

In response to the prostate underdose at the VA Philadelphia hospital, the National Health Physics Program conducted an inspection at the facility in May 2008. Based on the preliminary inspection findings, the National Health Physics Program expanded the scope of their inspection and reviewed 20 additional prostate cancer treatments. The expanded review identified three more patients who received doses that were less than the prescribed dose. The VA medical center went on to review all 116 prostate cancer treatments performed since the inception of the prostate cancer treatment program in February 2002.

In September 2008, the VA hospital completed their evaluation of all the prostate treatments performed since the inception of the program. A total of 92 medical events have been identified by the VA hospital - 35 medical events involved unintended doses to an organ or tissue, other than the prostate and 57 medical events where the dose delivered to the prostate was less than the prescribed dose.

The NRC first received a report of a medical problem in 2003. Inspectors from the nearest regional office, in King of Prussia, Pa., reviewed the record of the event as well as the procedures for prostate implants and interviewed the physician involved but did not identify a performance problem. Then in 2005, after the VA received the master materials license, a similar event was reported to the National Health Physics Program. The NRC was informed of the event and evaluated the performance of the National Health Physics Program inspectors during the inspection at VA Philadelphia. The NRC found the inspection

adequate. During its inspection, the National Health Physics Program did not identify a performance deficiency at VA Philadelphia. The NRC is enhancing inspection methods to make discovery of a similar problem by NRC inspectors more likely. Additionally, NRC is revising a regulation to prohibit physicians from changing written treatment orders in the midst of a medical procedure.

NRC's Response

Immediately after the NRC was notified in May 2008, the agency took action and maintained close oversight of the VA and National Health Physics Program inspection of the medical events. Shortly after, the NRC conducted its own thorough inspection at the facility. Based on the preliminary findings and the continued number of medical events reported, the NRC launched a Special Inspection at the hospital in September 2008. In October 2008, the NRC issued a Confirmatory Action Letter (CAL). The CAL documents the commitments made by the VA to identify and address the problems that have led to these medical errors at VA hospitals and to prevent their recurrence.

The Confirmatory Action Letter commitments of the National Health Physics Program include:

- conducting inspections at all 13 VA hospitals authorized to perform prostate cancer treatments
- developing and implementing standardized procedures for prostate cancer treatments at all VA hospitals
- identifying causes of the medical events and implementing corrective actions
- suspending any prostate cancer treatment program where 20% or more of the treatments have been identified as medical events
- conducting an inspection to confirm that all necessary corrective actions have been taken prior to restarting any suspended cancer treatment program
- notifying the NRC when program restart is planned
- conducting an inspection of new prostate cancer treatment programs before they start to confirm they meet the enhanced standards

The NRC Special Inspection focused on:

- conducting on-site inspections at the VA hospital in Philadelphia and all of the VA hospitals authorized to perform prostate cancer treatments
- reviewing the circumstances surrounding the multiple medical events at the VA hospital in Philadelphia
- assessing prostate programs at the other VA facilities
- assessing the response of the National Health Physics Program to these events
- determining whether the problems at the VA center in Philadelphia could be affecting other medical facilities
- using a medical consultant to conduct an independent assessment of possible health effects on patients

The NRC's Special Inspection report of March 30, 2009, on the medical events at the Philadelphia VA identified six apparent violations associated with failure to: (1) develop adequate written procedures to provide high confidence that each prostate seed implant administration is in accordance with the written directive; (2) develop procedures that address methods for verifying that administration is in accordance with the treatment plan and written directive; (3) train supervised individuals regarding identification and reporting requirements for medical events; (4) instruct a non-supervised individual regarding identification and reporting of medical events; (5) record total dose received by a patient on a written directive; and (6) provide required information in several 15-day reports to the NRC.

Future Actions

The NRC will issue a separate Special Inspection report that will address the findings of the inspections conducted at all of the other VA facilities authorized to perform prostate brachytherapy and the National Health Physics Program's response to the events at the conclusion of these inspection activities. Both reports will be available from the NRC RIII Office of Public Affairs and on its Web site at: http://www.nrc.gov/reading-rm/adams/web-based.html.

The NRC plans to issue a generic communication that will identify findings from the special inspections that may have common or broader implications with the medical community and interested stakeholders, once the inspection activities have been completed. This information will be publically available and posted to the NRC Web site.

The NRC will continue to revise a regulation to prohibit physicians from changing written treatment orders involving the use of radioactive material in the midst of a medical procedure.

Veterans Affairs Hospitals with a Prostate Treatment Program

Samuel S. Stratton VA Medical Center, Albany, N.Y.
VA Medical Center Philadelphia, Pa.*
VA Boston Healthcare System, Boston, Mass.
VA N.Y. Harbor Healthcare System, Brooklyn, N.Y.
VA Medical Center, Cincinnati, Ohio*
VA Medical Center, Durham, N.C.
G.V. (Sonny) Montgomery VA Medical Center, Jackson, Miss.*
VA Greater Los Angeles Healthcare System, Los Angeles, Calif.*
VA Medical Center, Minneapolis, Minn.
Hunter Holmes McGuire VA Medical Center, Richmond, Va.
VA Medical Center, San Francisco, Calif.
VA Puget Sound Health Care System, Seattle, Wash.
VA Medical Center, Washington, D.C.*

*Program Suspended

All Prostate Brachytherapy Patients from 10/01/07 to 06/30/09

#	Pt. Name (see RSO file)	SS# (see RSO file)	Date	Radiation Oncologist (see RSO file)	~ Prostate Volume (ml)	# Needles	# Seeds	mCi/Seed	Total mCi	Prescription Dose (Gy)	CPRS Note	CPRS F/U Note	Scanned Operative Report	Comments
1			02/12/08		28.6	27	63	0.41	25.8	144	Yes	N/A	Yes	Scanned Operative Report volume was 29.6 ml
2			02/19/08		41	25	74	N/A	N/A	N/A	Yes	Yes	N/A	
3			03/18/08		41	28	77	N/A	N/A	N/A	Yes	Yes	Yes	
4			04/11/08		34.4	31	76	N/A	N/A	N/A	Yes	Yes	Yes	It was noted: "... a series of 3 seeds appeared to be extraprostatic. Cystoscopy confirmed no intraurethral or intrabladder seeds." & "... one needle on the patient's right side appeared to be a bit more superior and lateral than the prostate." # seeds & needles only noted in scanned hand written post-operative/procedure note with volume noted as 33.6 Scanned progress notes had manufacturer seed label (unable to read details)
5			06/06/08		19.5	22	59	N/A	N/A	N/A	Yes	Yes	Yes	Scanned perioperative record & progress notes had manufacturer seed label (unable to read details)
6			11/14/08		33.9	30	81	0.366	29.6	144	Yes	Yes	N/A	
7			02/24/09		30	23	70	N/A	N/A	N/A	Yes	Yes	N/A	
8			04/21/09		30	25	69	N/A	N/A	N/A	Yes	Yes	N/A	
9			06/09/09		31.9	26	73	N/A	N/A	N/A	Yes	Pending	N/A	It was noted: "... One seed was into the area of the bladder. Therefore, a needle was used to place seeds to replace that seed." & "Cystoscopy was thenperformed .... No seed was identified within the bladder."
10			06/23/09		30.5	24	66	N/A	N/A	N/A	Yes	Pending	N/A	

Urology Review of Prostate Cancer cases treated with Brachytherapy October 1, 2007 to June 30, 2009:

Summary: 10 patients from the Lexington VA Medical Center were treated with brachytherapy seed implants for prostate cancer in the time period above. Prostate brachytherapy is currently contracted to the Lexington Clinic and these 10 cases were all performed by the Lexington Clinic physicians at St. Joseph Hospital. There were no major complications that were identified (i.e. death, myocardial infarction, rectourethral fistula, misplaced or migrated seeds). There were some minor, but expected routine complications such as urinary tract infection, mild radiation proctitis, urge urinary incontinence and urinary retention that are quite common with brachytherapy seed implants for prostate cancer.

Cancer control rates are acceptable and within national standards. Of note, this data set is not yet mature enough to accurately comment on true cancer control rates, but none of the patients have yet developed metastatic disease.

If further details are needed, I can provide a summary of each case by name and the minor complications (if they occurred).

David M. Preston, M.D.

Chief, Urology Service

VA Medical Center

Lexington, KY

Rev. 08/08 - MTH

Authorized User Application for Authorization to Possess and Use Radioactive Materials for Non-Human Research Use

Department of Veterans Affairs Medical Center, Lexington, Kentucky

Complete the application and electronically submit it to the Radiation Safety Office via the "SUBMIT" button at the end of this application.

You may save this application at anytime and complete it at a later date. If all required fields have not been completed when it is saved, a pop up will come noting that "This form contains validation errors. ... Do you still want to save it?". You should answer "Yes" and name your ".xml" file. You now can open up this saved file to complete and/or submit. If you need to open this saved ".xml" file on a different computer, you will first need to open the original ".xsn" file (i.e., "Authorized User Application for Authorization to Possess and Use Radioactive Materials for Non-Human Research Use.xsn") on the other computer to automatically download the original form template. After you open this ".xsn" file which will be a blank application, close it and then you can open your saved ".xml" file that contains your application.

Your application will be reviewed for approval by the Radiation Safety Committee (RSC). You will be notified of the Committee's action on this application (i.e., you cannot start using radioactive materials until the RSC approves your application unless this a renewal application and you are currently approved to use radioactive materials).

Use your mouse or tab/arrow keys to move around the application.

Required fields are noted with "*", a red asterisk in the right corner of the field or "", a red box around the field in this electronic form. This notation does not appear on the printed copy. All required fields must be completed prior to submission although not required to save the file as noted above.

Your written responses will be in blue Arial font sizes 8 to 10**.**

Note that changing your selection in some option buttons (e.g., ◉ Yes ○ No) may change/delete information that you have entered relating to this selection (e.g., changing from Yes to No concerning experience with one radionuclide and you had entered a list of procedures for that radionuclide). If it was done in error, you should be able to use the "Undo" button on your toolbar or under the "Edit" menu and your information should be able to be restored.

To delete a repeating item or line (e.g., in education section) that you have added and do not need, roll mouse pointer over the repeating line that you want to delete and a shortcut menu button will appear in its upper-left corner (button may first appear gray before you click on it). Click on this button to go to the delete option. Using this same menu, you can also insert a new item or line above or below.

Questions can be directed to the Radiation Safety Office via e-mail at vhalex.radiationSafetyOffice@va.gov or at ext. 5929.

A. Applicant Information

First Name	Last Name	E-mail Address
Richard	Greenberg	rngree01@uky.edu
Office Located @ ◉ VA ○ UK (if @ UK include Building)		
Room #	Building if @ UK:	Phone #
D316		4599

B. Education (start with most recent & include all college degrees)

Degree	Major Field of Study	Institution	City, State or City, Country	Year (yyyy)
MD	Medicine	Tufts Medical School	Boston, MA	1972

C. Radiation Safety Training (include VA & non-VA training)

◉ Yes ○ No	**Have you had any radiation safety training?** (Including but not limited to formal course work, on-the-job training & educational seminars.)
If no, continue to the next section (i.e., Section D. Experience with Radioactive Materials). **If yes, did this training include the following radiation safety topics?**	
◉ Yes ○ No	**Safe Handling of Radioactive Materials** (e.g., time, distance & shielding, PPE)
◉ Yes ○ No	**Characteristics of Ionizing Radiation** (e.g., alpha, beta & gamma radiation, half life)
◉ Yes ○ No	**Units of Radiation Dose and Quantities** (e.g., rad, rem, µCi, dpm)
◉ Yes ○ No	**Radiation Detection Instrumentation** (e.g., survey meter, scintillation counter)
◉ Yes ○ No	**Biological Hazards of Exposure to Radiation** (e.g., cell damage/death, ALARA)

If yes to any of the above training, indicate where this training was obtained & ~ # of hrs. (Start with the most recent and include this VA if applicable. If there were several training sessions over your tenure somewhere, just note start & end dates with ~ total # of radiation safety training hours during that time period.)

Institution/Training Site	City, State or City, Country	When (use date format: mm/yyyy; e.g., 01/2008)	~ # of hrs
VAMC	Lexington, Kentucky	08/2009 to 08/2009	5
University of Kentucky	Lexington, Kentucky	01/1991 to 01/1992	5
		~ Total # of Hours of Radiation Safety Training:	10

D. Experience with Radioactive Materials (include VA & non-VA experience)

◉ Yes ○ No **Do you have any experience with radioactive materials?**

If no, continue to the next section (i.e., Section E. Initial Check on Training and Experience).
If yes, indicate below your experience with the following radionuclides.

Radio-nuclide	Have you used this type of radioactive material?	If yes, highest activity you have handled (1 mCi = 1000 µCi)	If yes, list the procedures that you were involved with using this radionuclide (e.g., cell proliferation, iodination of proteins, DNA sequencing, animal work)	If yes, ~ # of hrs
C-14	◉ Yes ○ No	1 mCi	• label incorporation	2
Cr-51	◉ Yes ○ No	1 mCi	• lymphocyte stimulation assay	2
H-3	◉ Yes ○ No	1 mCi	• label incorporation	2
I-125	◉ Yes ○ No	1 mCi	• iodination and RIA	50
I-131	○ Yes ◉ No	0 mCi	• N/A	0
P-32	○ Yes ◉ No	0 mCi	• N/A	0
P-33	○ Yes ◉ No	0 mCi	• N/A	0
S-35	◉ Yes ○ No	1 mCi	• label incorporation	2
Other	○ Yes ◉ No	Have you had any other experience with other radionuclides that are not listed above?		

If no, continue on to the indicate where your experience was obtained.
If yes, indicate your experience with these other radionuclides (i.e., up to 7 other radionuclides).

# 1	○ Yes ◉ No	0 mCi	• N/A	0

Radio-nuclide	Have you used this type of radioactive material?	If yes, highest activity you have handled (1 mCi = 1000 µCi)	If yes, list the procedures that you were involved with using this radionuclide (e.g., DNA sequencing, cell proliferation, iodination, animal work)	If yes, ~ # of hrs

~ Total # of Hours of Experience with Radioactive Materials: 58

If yes to any experience with radioactive materials, continue on to the indicate where your experience with the above radionuclide(s) was obtained.
(Start with the most recent and include this VA if applicable. Note that changes with the above radionuclides after you have started to complete the below information may effect your indication of experience at each institution.)

Institution / City, State or City, Country / When (use date format: mm/yyyy; e.g., 01/2008)	C-14	Cr-51	H-3	I-125	I-131	P-32	P-33	S-35							
University of Kentucky Lexington, KY 08/1989 to 01/2004	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
St. Louis University St. Louis, MO 07/1981 to 01/1985	☑	☑	☑	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐

Key: ☑ = Experience with this radionuclide at this institution
☐ = Experience with this radionuclide but not at this institution

☐ = **No Experience with this radionuclide at all**

E. Initial Check on Training and Experience

Before you proceed any further with this application, please check to see if your information above concerning your past radiation safety training (Section C) and experience with radioactive materials (Section D) is complete and accurate.

☑ **Check here after your review is complete and wait for further instructions below.**
Please proceed on with your application.

F. Staff Listing (staff who will work with radioactive materials other than yourself)

List all staff who will work with the radioactive materials that are outlined in this application once it is approved by the Radiation Safety Committee (i.e., once approved, you will be the Authorized User and the below named staff will be working with the radioactive materials under your supervision and will be your responsibility). If there is no current staff, enter "N/A" for the first and last name. Each staff person listed below must complete an "Application for Approval to Use Radioactive Materials for Non-Human Research Use Under an Authorized User" which is available through the Radiation Safety Office via e-mail at vhalex.radiationSafetyOffice@va.gov or at ext. 5929. These staff applications also have to be approved by the Radiation Safety Committee (i.e., no staff person can start using radioactive materials until the RSC approves both the application for authorization to possess and use radioactive materials and the staff application for approval to use radioactive materials unless this is a renewal application for which all parties have current RSC approval).

#	First Name	Last Name	RSC review of staff application - to be attached by Radiation Safety Office
1	Victoria	Greenberg	RSC Approved Staff - Greenberg 09.16.2009.xml XML Document 619 KB

G. Radiation Protection Equipment and Supplies Available for Use

Check items that will be available to you and your staff that will be used to control radiation exposure and/or contamination. Space is available for additional items not listed.

☑ Mechanical Pipettes	☑ Remote Handling Tongs	☑ Radiation Labels
☐ Bench Top Shields	☑ Shielded Storage/ Waste Containers	☑ Transporting Containers
☑ Disposable Gloves	☑ Lab Coats	☑ Safety Glasses/ Face Shield
☑ Fume Hood	☐ Iodination Hood	☐
☑ Absorbent Padding	☑ Containment Trays/Containers	☐

Scintillation Counters (i.e., other than the ones available in the Research core labs)

☐ Liquid Scintillation Counter (beta)	Manufacturer	Model	Serial #
☐ Sodium Iodide (NaI) Counter (gamma)	Manufacturer	Model	Serial #
☑ Survey Meter	Meter Manufacturer Ludlum	Meter Model 3	Meter Serial # 123275
	Probe Manufacturer Ludlum	Probe Model 44-9	Probe Serial # PR279449

H. Location for Use and Storage of Radioactive Materials and Waste

Contact the Radiation Safety Office via e-mail at vhalex.radiationSafetyOffice@va.gov or at ext. 5929 to obtain a room diagram for any areas for which you are requesting approval for the use and storage of radioactive materials/waste. When obtained, indicate on the room diagram(s) what radionuclides will be in that room and where the use, storage, and waste areas are located along with the location of any phones and desks/computer work areas. Scan each room diagram into a separate pdf file noting the room # as the file name and then attach each file below. Indicate below the room # and if radioactive material will be used and/or stored in the room and if radioactive waste will be stored in this room until disposed of by the Radiation Safety Office. Include research core labs that will be used for storage (e.g., radioactive samples in -70° freezer) but it is not necessary to include core labs that will only be temporarily used for counting radioactive samples in core lab scintillation counters.

Room #	Radioactive material will be used in this room	Radioactive material will be stored in this room	Radioactive waste will be stored in this room	Room Diagram
D316	☑	☑	☑	D316 Greenberg.pdf PDF File 160 KB

I. Description of Use of Radioactive Materials

Provide the information below concerning the radioactive materials that you would like to be approved to possess and use for non-human research use. You must complete this section for each radionuclide. Additional radionuclides can be added at the end of this section.

I. 1. Description of Use of Radioactive Materials: I-125

I-125 **If Other, indicate below:**	**Select which radionuclide you would like to be authorized to possess and use for non-human research use, and complete the information below. Additional radionuclides can be added at the end of this section.**	**The below file contains information on the selected radionuclide.** I-125 Radionuclide Information Sheet.xls Microsoft Office Excel 97-2003 Worksheet 153 KB

Notice: I-125, especially in the form of sodium iodide is potentially volatile, and work may be required to be done in a fume hood and/or an iodination hood depending on the form and the amount being used. Thyroid bioassays may also be required. A solution of alkaline sodium thiosulphate and carrier iodine should be used for spills involving I-125. See the above file for more radionuclide information concerning I-125.

5 **mCi** — **What will be highest total activity (1 mCi = 1000 µCi) of I-125 possessed at any one time (i.e., total of all sources from all locations)?**

- (●) **In Vitro Only**
- ( ) **Animal Only**
- ( ) **Both**

What type of non-human use procedures will be done using I-125 (i.e., animal procedures involve actual administration of the radionuclide into the animal)?

Complete the below requested information concerning these procedures.

- **Description of In Vitro Procedures Using I-125 - Describe each procedure separately**

 # 1 **(e.g., cell proliferation, iodination of proteins, DNA sequencing)**

I-125 In Vitro Procedure Name: RIA (radioimmunoassay)

List Chemical Form(s) of I-125 (e.g., thymidine, sodium iodide, ATP) to be Used: Iodinated prouroguanylin

Highest total activity (1 mCi = 1000 µCi) used at one time per procedure: 0.01 **mCi**

Briefly describe this procedure to include how the radionuclide will be handled and used (e.g., ~0.5 µCi pipetted per well of tissue culture plates for 90-100 wells), what equipment will be used (e.g., centrifuge, incubator), and timeframe of use (e.g., 3 day procedure, 24 hr incubation):

Diluted sample or standard (prouroguanylin) will be incubated with antiserum for 24 hours. Iodinated prouroguanylin (i.e., done by manufacturer) will be added (~25,000 cpm or ~0.016 microCi) to each sample or standard and incubated for an additional 24 hours. The bound and free prouroguanylin will be separated by centrifugation after incubation for one hour with anti-mouse IgG and a polyethylene glycol solution. The amount of radioactivity in the precipitate will be determined using a gamma counter. Incubations will be performed at 4°C.

- **Description of Animal Procedures Using I-125 - Describe each procedure separately**

- **Description of Preventive Measures to Limit Exposure and Contamination from I-125**

Briefly describe what preventive measures you and your staff will be taking to limit exposure and contamination while this radionuclide is being stored and/or used to include but not limited to PPE (Personal Protective Equipment, e.g., lab coat, disposal gloves, etc.) and shielding devices if applicable:

lab coat, gloves, face shield, monitoring with survey meter and wipe testing; using time, distance and shielding for exposure

- **Radioactive Waste Generated from Using I-125**

Will you be generating any radioactive waste of this each type?			If this type of waste will be generated, will it contain any hazardous (i.e., other than being radioactive) and/or biohazardous material? If yes, indicate the hazardous/biohazardous material.		
◉ Yes	○ No	Dry/Solid	○ Yes	◉ No	N/A
◉ Yes	○ No	Liquid	○ Yes	◉ No	N/A
○ Yes	◉ No	Scintillation Fluid	○ Yes	◉ No	N/A
○ Yes	◉ No	Animal	○ Yes	◉ No	N/A

• Transporting of I-125

Transporting within this VA:

◉ Yes ○ No **Will there be a need to transport this radionuclide from one room to another within this VA?** (This includes radioactive samples being transported to and from the core labs for counting on the scintillation counters.)

If yes, explain below what will be transported (e.g., samples to be counted), ~ **activity** (e.g., ~ µCi), **to and from what rooms, and how it is transported** (e.g., capped tubes/vials, on a cart):

sealed as test tubes (total <10 microCi) on a cart to core lab (C326 or D307) for counting

Transporting between this VA and UK:

○ Yes ◉ No **Will there be an expected need to transport this radionuclide between this VA and UK?** (If radioactive material needs to be shipped off site, this must be done by the Radiation Safety Office.)

If yes, explain below what will be transported (e.g., samples to be counted), ~ **activity** (e.g., ~ µCi), **to and from what areas, and how it is transported** (e.g., capped tubes/vials, on a cart):

N/A

Please review this application for accuracy and completeness. To submit this application and you are using Microsoft Outlook, press the "Submit" button below. If you are not using Outlook, send this file as an attachment to vhalex.radiationSafetyOffice@va.gov.

J. Radiation Safety Committee Review (to be completed by Radiation Safety Office)

The Radiation Safety Committee (RSC) has reviewed the above Authorized User Application for Authorization to Possess and Use Radioactive Materials for Non-Human Research Use. The review was completed on 09/16/2009 and based on this review, the application was:

- (●) **Approved**
- ( ) **Approved - Pending Completion of Below Item(s)**
- ( ) **Disapproved Based on the Below Application Issue(s)**

This application and RSC approval expires on the 5-year anniversary of the RSC review date listed above (i.e., 09/16/2014). Changes to this application (e.g., staff, rooms, procedures, etc.) must be approved by the Radiation Safety Committee prior their activation (i.e., via an amendment request).

9/22/09

Richard Greenberg, Authorized User Signature — **Date**

I affirm that the above application and attached information is correct to the best of my knowledge. As a RSC approved Authorized User, I shall conduct and/or supervise the described work utilizing radioactive materials with full regard for the safety of those engaged in the work including myself, other staff, and the general public. I and the RSC approved staff who I supervise will abide by the policies and procedures set by the VA Radiation Safety Committee.

9/22/09

Michael T. Hackett, MS, Radiation Safety Officer Signature — **Date**

9/23/09

Cheryl Baker, M.D., Radiation Safety Committee Chair Signature — **Date**

File Attachment **Attached is the signed copy of this RSC review.**

Rev. 08/08 - MTH

Staff Application for Approval to Use Radioactive Materials for Non-Human Research Use Under an Authorized User

Department of Veterans Affairs Medical Center, Lexington, Kentucky

Complete the application and electronically submit it to the Radiation Safety Office via the "SUBMIT" button at the end of this application.

You may save this application at anytime and complete it at a later date. If all required fields have not been completed when it is saved, a pop up will come noting that "This form contains validation errors. ... Do you still want to save it?". You should answer "Yes" and name your ".xml" file. You now can open up this saved file to complete and/or submit. If you need to open this saved ".xml" file on a different computer, you will first need to open the original ".xsn" file (i.e., "Staff Application for Approval to Use Radioactive Materials for Non-Human Research Use Under an Authorized User.xsn") on the other computer to automatically download the original form template. After you open this ".xsn" file which will be a blank application, close it and then you can open your saved ".xml" file that contains your application.

Your application will be reviewed for approval by the Radiation Safety Committee (RSC). You will be notified of the Committee's action on this application (i.e., you cannot start using radioactive materials until the RSC approves your application unless this a renewal application and you are currently approved to use radioactive materials).

Use your mouse or tab/arrow keys to move around the application.

Required fields are noted with "*", a red asterisk in the right corner of the field or "", a red box around the field in this electronic form. This notation does not appear on the printed copy. All required fields must be completed prior to submission although not required to save the file as noted above.

Your written responses will be in blue Arial font sizes 8 to 10**.**

Note that changing your selection in some option buttons (e.g., ◉ Yes ○ No) may change/delete information that you have entered relating to this selection (e.g., changing from Yes to No concerning experience with one radionuclide and you had entered a list of procedures for that radionuclide). If it was done in error, you should be able to use the "Undo" button on your toolbar or under the "Edit" menu and your information should be able to be restored.

To delete a repeating item or line (e.g., in education section) that you have added and do not need, roll mouse pointer over the repeating line that you want to delete and a shortcut menu button will appear in its upper-left corner (button may first appear gray before you click on it). Click on this button to go to the delete option. Using this same menu, you can also insert a new item or line above or below.

Questions can be directed to the Radiation Safety Office via e-mail at vhalex.radiationSafetyOffice@va.gov or at ext. 5929.

A. Staff Applicant Information

First Name	Last Name	E-mail Address
Victoria	Greenberg	vlgreen@uky.edu

You can be reached @ ◉ VA ○ UK (if @ UK include Building)		
Room #	Building if @ UK:	Phone #
D316		ext 4599

The Authorized User* who you will be working for as it pertains to radioactive materials
Richard Greenberg

***Authorized User is the person who has the RSC's approval to possess and use radioactive materials for non-human research use, and who is ultimately responsible for its use.**

B. Education (start with most recent & include all college degrees)

Degree	Major Field of Study	Institution	City, State or City, Country	Year (yyyy)
Ph.D.	Microbiology	University of Kentucky	Lexington, KY	1998
B.S.	Biology	Southern Illinois University	Edwardsville, IL	1985

C. Radiation Safety Training (include VA & non-VA training)

◉ Yes ○ No	**Have you had any radiation safety training?** (Including but not limited to formal course work, on-the-job training & educational seminars.)
If no, continue to the next section (i.e., Section D. Experience with Radioactive Materials). **If yes, did this training include the following radiation safety topics?**	
◉ Yes ○ No	**Safe Handling of Radioactive Materials** (e.g., time, distance & shielding, PPE)
◉ Yes ○ No	**Characteristics of Ionizing Radiation** (e.g., alpha, beta & gamma radiation, half life)
◉ Yes ○ No	**Units of Radiation Dose and Quantities** (e.g., rad, rem, µCi, dpm)
◉ Yes ○ No	**Radiation Detection Instrumentation** (e.g., survey meter, scintillation counter)
◉ Yes ○ No	**Biological Hazards of Exposure to Radiation** (e.g., cell damage/death, ALARA)

If yes to any of the above training, indicate where this training was obtained & ~ # of hrs. (Start with the most recent and include this VA if applicable. If there were several training sessions over your tenure somewhere, just note start & end dates with ~ total # of radiation safety training hours during that time period.)

Institution/Training Site	City, State or City, Country	When (use date format: mm/yyyy; e.g., 01/2008)	~ # of hrs
VAMC	Lexington, KY	08/2009 to 08/2009	5
University of Kentucky	Lexington, KY	01/1993 to 01/1994	3
St. Louis University/VA Hospital	St. Louis, MO	04/1986 to 06/1988	3
		~ Total # of Hours of Radiation Safety Training:	11

D. Experience with Radioactive Materials (include VA & non-VA experience)

◉ Yes ○ No Do you have any experience with radioactive materials?

If no, continue to the next section (i.e., Section E. Initial Check on Training and Experience).
If yes, indicate below your experience with the following radionuclides.

Radio-nuclide	Have you used this type of radioactive material?	If yes, highest activity you have handled (1 mCi = 1000 µCi)	If yes, list the procedures that you were involved with using this radionuclide (e.g., cell proliferation, iodination of proteins, DNA sequencing, animal work)	If yes, ~ # of hrs
C-14	○ Yes ◉ No	0 mCi	• N/A	0
Cr-51	○ Yes ◉ No	0 mCi	• N/A	0
H-3	○ Yes ◉ No	0 mCi	• N/A	0
I-125	◉ Yes ○ No	0.01 mCi	• Membrane binding assays	100
I-131	○ Yes ◉ No	0 mCi	• N/A	0
P-32	◉ Yes ○ No	0.25 mCi	• RNA (Northern) analysis	10
P-33	○ Yes ◉ No	0 mCi	• N/A	0
S-35	○ Yes ◉ No	0 mCi	• N/A	0
Other	○ Yes ◉ No	Have you had any other experience with other radionuclides that are not listed above?		

If no, continue on to the indicate where your experience was obtained.
If yes, indicate your experience with these other radionuclides (i.e., up to 7 other radionuclides).

# 1	○ Yes ◉ No	0 mCi	• N/A	0

Radio-nuclide	Have you used this type of radioactive material?	If yes, highest activity you have handled (1 mCi = 1000 µCi)	If yes, list the procedures that you were involved with using this radionuclide (e.g., DNA sequencing, cell proliferation, iodination, animal work)	If yes, ~ # of hrs

~ Total # of Hours of Experience with Radioactive Materials: 110

If yes to any experience with radioactive materials, continue on to the indicate where your experience with the above radionuclide(s) was obtained.
(Start with the most recent and include this VA if applicable. Note that changes with the above radionuclides after you have started to complete the below information may effect your indication of experience at each institution.)

Institution / City, State or City, Country / When (use date format: mm/yyyy; e.g., 01/2008)	C-14	Cr-51	H-3	I-125	I-131	P-32	P-33	S-35							
University of Kentucky Lexington, KY 01/1993 to 01/1994	☐	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐
St. Louis University/VA Hospital St. Louis, MO 04/1986 to 06/1988	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Key: ☑ = Experience with this radionuclide at this institution
☐ = Experience with this radionuclide but not at this institution

☐ = No Experience with this radionuclide at all

Please review this application for accuracy and completeness. To submit this application and you are using Microsoft Outlook, press the "Submit" button below. If you are not using Outlook, send this file as an attachment to vhalex.radiationSafetyOffice@va.gov.

J. Radiation Safety Committee Review (to be completed by Radiation Safety Office)

The Radiation Safety Committee (RSC) has reviewed the above Staff Application for Approval to Use Radioactive Materials for Non-Human Research Use Under an Authorized User.

The review was completed on 09/16/2009 and based on this review, the application was:

- (●) Approved
- ( ) Approved - Pending Completion of Below Item(s)
- ( ) Disapproved Based on the Below Application Issue(s)

This application and RSC approval expires on the 5-year anniversary of the RSC review date of the Authorized User's RSC approval to possess and use radioactive materials for non-human research use (i.e., 09/16/2014).

Victoria Greenberg — 9/22/09

Victoria Greenberg, Staff Applicant Signature — **Date**

I affirm that the above application is correct to the best of my knowledge. I shall conduct work utilizing radioactive materials with full regard for the safety of those engaged in the work including myself, other staff, and the general public. I will abide by the policies and procedures set by the VA Radiation Safety Committee.

9-22-09

Richard Greenberg, Authorized User Signature — **Date**

9/22/09

Michael T. Hackett, MS, Radiation Safety Officer Signature — **Date**

9/23/09

Cheryl Baker, M.D., Radiation Safety Committee Chair Signature — **Date**

File Attachment **Attached is the signed copy of this RSC review.**

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D316 Room Diagram

Section H. Location for Use and Storage of Radioactive Materials and Waste

Authorized User Application for Authorization to Possess and Use Radioactive Materials for Non-Human Research Use

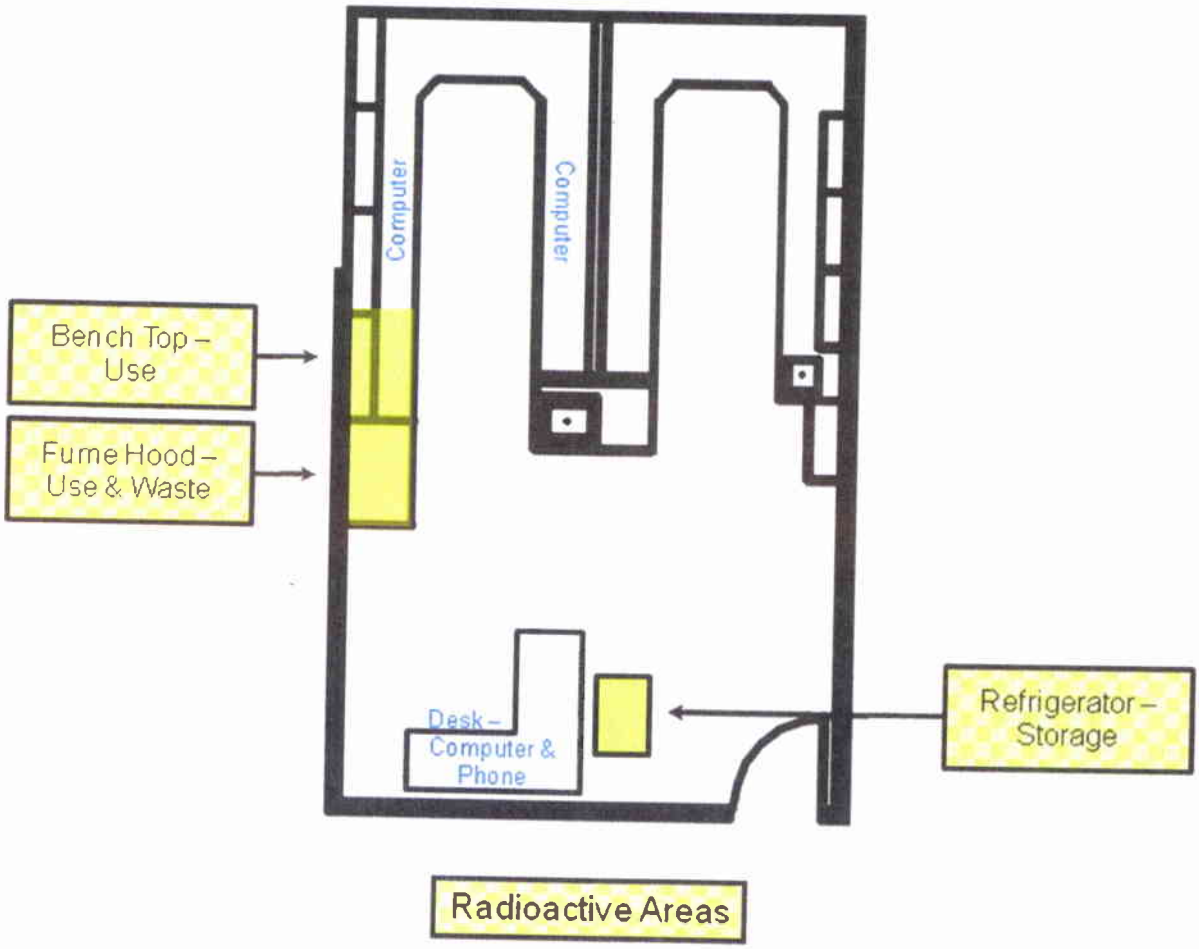
Electronically complete the table below.

Applicant's Name: Richard Greenberg

Check the appropriate boxes based on use & storage

	C-14	Cr-51	H-3	I-125	I-131	P-32	P-33	S-35	Other Radionuclides (add as needed)						
Radioactive Material Used in Room	☐	☐	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Radioactive Material Stored in Room	☐	☐	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Radioactive Waste Stored in Room	☐	☐	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Print and then indicate on the room diagram where the above noted radionuclides will be used and/or stored (e.g., bench tops, hoods, refrigerators/freezers, equipment, etc.), and the locations of any radioactive waste storage. Include locations of any phones and desks/computer work areas in the room.



Upon completion, scan as a pdf file and electronically attach it to "Section H. Location for Use and Storage of Radioactive Materials and Waste" within your "Authorized User Application for Authorization to Possess and Use Radioactive Materials for Non-Human Research Use".

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VAMC
Lexington, KY

Iodine-125 (I-125)
Radionuclide Information Sheet

Note: Specific data and information concerning the above radionuclide is in blue bold Arial font.
Data can be entered in cells that are shaded in green.
Cells with calculations based on this data input will be shaded in red.

1. Decay Characteristics

Mode of Decay: Electron Capture

Mass Number (A): 125

Atomic Number (Z): 53

Decays to: Tellurium-125m (Te-125m; metastable) & Tellurium-125 (Te-125; stable)

Half-Life ($T_{1/2}$)[1]: 60.14 days

Exponential Decay: $A_t = A_0 e^{-(\ln 2/T_{1/2})*t}$ or

Fraction of Activity Remaining $= e^{-(\ln 2/T_{1/2})*t}$

where A_t is the activity remaining after time t, A_0 is the initial known activity at time 0, ln2 is the natural log of 2 (i.e., 0.693147), $T_{1/2}$ is the half-life, and t is the time period in the same units as $T_{1/2}$

Activity Calculator:

Known Activity			Decayed Activity	
Enter Activity #	Select Unit	Enter Date of Activity	Enter Date to Decay to	Calculated Activity
A_0		$Date_0$	$Date_t$	A_t
$t = Date_t - Date_0 =$				

Decay Chart:

Time t in # of Weeks	Time t in # of Days: 0	1	2	3	4	5	6
0	1.0000000	0.9885406	0.9772125	0.9660143	0.9549443	0.9440012	0.9331836
1	0.9224898	0.9119187	0.9014686	0.8911383	0.8809264	0.8708315	0.8608523
2	0.8509875	0.8412357	0.8315956	0.8220661	0.8126457	0.8033333	0.7941275
3	0.7850273	0.7760314	0.7671385	0.7583476	0.7496574	0.7410668	0.7325746
4	0.7241797	0.7158811	0.7076775	0.6995679	0.6915513	0.6836266	0.6757926
5	0.6680484	0.6603930	0.6528253	0.6453443	0.6379491	0.6306386	0.6234118
6	0.6162679	0.6092058	0.6022247	0.5953236	0.5885015	0.5817577	0.5750911
7	0.5685009	0.5619862	0.5555462	0.5491799	0.5428867	0.5366655	0.5305157
8	0.5244363	0.5184265	0.5124857	0.5066129	0.5008074	0.4950685	0.4893953
9	0.4837871	0.4782432	0.4727628	0.4673453	0.4619898	0.4566957	0.4514622
10	0.4462887	0.4411745	0.4361189	0.4311213	0.4261809	0.4212971	0.4164693
11	0.4116968	0.4069790	0.4023153	0.3977050	0.3931475	0.3886423	0.3841887
12	0.3797861	0.3754340	0.3711317	0.3668788	0.3626746	0.3585186	0.3544102
13	0.3503488	0.3463340	0.3423653	0.3384420	0.3345636	0.3307297	0.3269398

Fraction of Activity Remaining after Time t (i.e., $e^{-(\ln 2/T_{1/2})*t}$)

Note: If time t is before the known activity date, use the reciprocal of the above fraction (e.g., 10 days prior, i.e., 1 week and 3 days = 1/0.8911383 = 1.1221603)**or use the following "Fraction of Activity Remaining Calculator" by entering the # of days as a negative number (e.g., -10).**

Fraction of Activity Remaining Calculator:

Enter Time t in days	Fraction of Activity Remaining after Time t

Activity Unit Conversion:

Ci	=	curie	Bq	=	becquerel
1 Ci	=	1000 mCi (millicurie)	1000 Bq	=	1 kBq (kilobecquerel)
1 mCi	=	1000 μCi (microcurie)	1000 kBq	=	1 MBq (megabecquerel)
1 μCi	=	1000 nCi (nanocurie)	1000 MBq	=	1 GBq (gigabecquerel)
dpm	=	disintegrations/minute	dps	=	disintegrations/second

1 Ci	=	37 GBq	=	2.22×10^{12} dpm	=	3.7×10^{10} dps (Bq)
1 mCi	=	37 MBq	=	2.22×10^{9} dpm	=	3.7×10^{7} dps (Bq)
1 μCi	=	37 kBq	=	2.22×10^{6} dpm	=	3.7×10^{4} dps (Bq)
1 nCi	=	37 Bq	=	2.22×10^{3} dpm	=	37 dps (Bq)

1 Bq	=	$0.\overline{027}$ nCi	=	60 dpm	=	1 dps
1 kBq	=	$0.\overline{027}$ μCi	=	6.0×10^{4} dpm	=	10^{3} dps (Bq)
1 MBq	=	$0.\overline{027}$ mCi	=	6.0×10^{7} dpm	=	10^{6} dps (Bq)
1 GBq	=	$0.\overline{027}$ Ci	=	6.0×10^{10} dpm	=	10^{9} dps (Bq)

Activity Unit Calculator:

	Enter Activity #	Select Unit	Calculated Activity	Calculated Activity	Calculated Activity
from "_Ci":					
from "_Bq":					
from "dp_":					

Primary Emissions[1]:

Beta Energy - Maximum (keV)	Beta Energy - Average (keV)	Beta Probability per Decay	Electron Energy (keV)	Electron Probability per Decay	Photon (Gamma & X-ray) Energy (keV)	Photon Probability per Decay
N/A	No Beta	Emissions	3.190	1.561000	3.770	0.154380
			3.678	0.778800	27.202	0.392330
			22.700	0.196910	27.472	0.731960
			30.553	0.122660	31.000	0.254090
					35.492	0.064900

Emissions with a probability of ≥5% (i.e., ≥0.05) are listed above. See link below for:

Complete I-125 emission data plus decay scheme from Brookhaven National Laboratory's *Chart of Nuclides*

2. Exposure Characteristics

Radiation Exposure & Dose Units:

Roentgen (R) is the unit of gamma or x-ray exposure in air that is expressed by the amount of ionizations that occur. One roentgen produces a charge equal to 2.58×10^{-4} coulombs/kg of air at STP (standard temperature and pressure) where 1 coulomb = 1 C = 6.28×10^{18} electronic charges.

Rad (radiation absorbed dose) is the unit of absorbed dose. One rad is equal to an absorbed dose of 100 ergs/g or 0.01 joule/kg (i.e., 0.01 gray). For photons (i.e., gamma and/or x-rays), 1 R ~ 1 rad.

Rem (roentgen equivalent in man) is the unit of any of the quantities expressed as dose equivalent (1 rem = 0.01 sievert = 0.01 Sv). The dose equivalent in rems is equal to the absorbed dose in rads multiplied by the quality factor. The quality factor for photon (i.e., gamma and/or x-rays) or beta radiation is equal to 1 (i.e., 1 rad = 1 rem).

Annual Occupational Dose Limits[2]:

Total Effective Dose Equivalent = Deep Dose Equivalent (DDE) from Whole Body External Exposure plus Committed Effective Dose Equivalent from Internal Exposure	**5,000 mrem (5 rem)**
Deep Dose Equivalent plus Committed Dose Equivalent to Any Individual Organ or Tissue other than the Lens of the Eye	**50,000 mrem (50 rem)**
Lens of the Eye Dose Equivalent (LDE)	**15,000 mrem (15 rem)**
Shallow Dose Equivalent to Skin of Whole Body (SDE-WB) or to any Extremity (SDE-E)	**50,000 mrem (50 rem)**

External Exposure:

Photon Component

Specific Gamma Ray Dose Constant[1]: 2.74984 x 10^{-4} (mrem/hr)/μCi @ 1 meter (m)

Inverse Square Law: $$\frac{I_1}{I_2} = \frac{(D_2)^2}{(D_1)^2}$$

where I_1 is the radiation intensity (e.g., mrem/hr) at distance D_1 from the radiation source and I_2 is the radiation intensity at distance D_2 from the radiation source assuming a point source and no attenuation

Photon Dose Rate[1]:

	Unshielded Point Source in Air Calculated Dose Rates (mrem/hr)				
	Activity (μCi)	**@ 1 cm (0.4 in)**	**@ 30 cm (11.8 in)**	**@ 1 m (3.3 ft)**	**:cm - Enter :inches**
Enter μCi:					
	10	27.5	0.03	0.003	
	100	275.0	0.31	0.027	
	250	687.5	0.76	0.069	
	500	1,374.9	1.53	0.137	
	750	2,062.4	2.29	0.206	
	1000	2,749.8	3.06	0.275	
	2500	6,874.6	7.64	0.687	
	5000	13,749.2	15.28	1.375	

Click to Convert inches to cm

Photon Attenuation: $I_x = I_0 e^{-\mu x}$ **or**

Fraction of Intensity Remaining $= e^{-\mu x}$

where I_x is the attenuated radiation intensity (e.g., mrem/hr), I_0 is the radiation intensity w/o attenuation (i.e., point source, narrow beam), μ is the mean attenuation coefficient (cm^{-1}), and x is the thickness of the absorber (cm)

Mean Attenuation Coefficient (μ)[1]: 373.1 cm^{-1} in lead

Half-Value Layer (HVL): 0.002 cm of lead (i.e., 50% Intensity Reduction)

Photon Attenuation:

Fraction of Intensity Remaining	0.50	0.10			
Percent Intensity Reduction	50%	90%			
Intensity Reduction by Factor of	2	10			**:Enter Reduction by the Factor of**
Thickness of Lead Required in cm (x)	0.002	0.006			
Thickness of Lead Required in in. (x)	0.001	0.002	**Enter :cm Thickness of Lead**		

Internal Exposure:

Annual Limit on Intake[2]:

Annual Limit on Intake (ALI) means the derived limit for the amount of radioactive material taken into the body of an adult worker by inhalation or ingestion in a year. ALI is the smaller value of intake of a given radionuclide in a year by the reference man that would result in a committed effective dose equivalent (CEDE) of 5 rems or a committed dose equivalent (CDE) of 50 rems to any individual organ or tissue. Class for inhalation may be separated by range of clearance half-times: Class D for <10 days, Class W for 10-100 days, and Class Y for >100 days.

Derived Air Concentration[2]:

Derived air concentration (DAC) means the concentration of a given radionuclide in air which, if breathed by the reference man for a working year of 2,000 hours under conditions of light work (i.e., inhalation rate 1.2 cubic meters of air per hour), results in an intake of one ALI.

Class	Oral Ingestion ALI (µCi)	Inhalation ALI (µCi)	Inhalation DAC (µCi/ml)
D, all compounds	40 for Thyroid CDE	60 for Thyroid CDE	3.0×10^{-8}
	(100 for CECE)	(200 for CECE)	-

Taken from 10 CFR 20[2] Appendix B, Table 1 Occupational Values, columns 1-3.

Recommended Activity Limits Based Radiotoxicity and Type of Workplace[1]:

Radio-nuclide	Group #	Radionuclide Radiotoxicity	Type of Workplace Required		
			Type I (C)	Type II (B)	Type III (A)
	1	Very High	≤ 13.5 µCi (≤ 500 kBq)	13.5 µCi - 13.5 mCi (500 kBq - 500 MBq)	≥ 13.5 mCi (≥ 500 MBq)
I-125	2	High	≤ 135 µCi (≤ 5 MBq)	135 µCi - 135 mCi (5 MBq - 5 GBq)	≥ 135 mCi (≥ 5 GBq)
	3	Moderate	≤ 1.35 mCi (≤ 50 MBq)	1.35 mCi - 1.35 Ci (50 MBq - 50 GBq)	≥ 1.35 Ci (≥ 50 GBq)
	4	Low	≤ 13.5 mCi (≤ 500 MBq)	13.5 mCi - 13.5 Ci (500 MBq - 500 GBq)	≥ 13.5 Ci (≥ 500 GBq)

Where Type I (C) is similar to a good quality modern chemical laboratory, Type II (B) is a specially designed laboratory for work with radionuclides, and Type III (A) specially designed laboratory for handling large activities of highly radioactive materials. The above limits are based on normal operations. In case of a conventional modern chemical laboratory with adequate ventilation and non-porous work surfaces, the upper limits of Type I (C) workplace may be increased toward the limits for Type II (B) workplaces for low (4) and moderate (3) radiotoxicity groups[3].

Monitoring to be Done:

Staff:
- Whole body radiation badge for the determination of DDE, LDE, and SDE-WB.
- Ring radiation badge for the determination of SDE-E, if applicable (i.e., dependant on amounts used & frequency of use).
- Bioassays for the determination of thyroid CDE and CEDE, if applicable (i.e., dependant on amounts and forms used & frequency of use, and/or situations with potential for internal intake, e.g., spill, staff contamination).
- See below work area monitoring equipment that can also be used to evaluate staff contamination.

Work Area:
- Survey meter with thin-window G-M probe (e.g., pancake, end window) for the evaluation of ambient exposure levels and gross surface contamination.
- Scintillation counter (i.e., solid iodide - gamma counter) for the evaluation of removable surface contamination.

3. Basic Radiation Safety Precautions

- Use the basic principles of radiation safety: TIME, DISTANCE, and SHIELDING.
  - Use lead and/or steel (i.e., dependant on amounts, e.g., lab cabinets) for shielding of I-125.
- Wear the proper PPE (Personal Protective Equipment, e.g., lab coat, disposable gloves, face shield or goggles if there is a potential of splashing of radioactive liquids) and radiation badges, if applicable when handling radioactivity.
- NO eating, drinking, storage of food, smoking, or applying make-up in rooms containing radioactive materials.
- Handle potentially volatile radioactive compounds or ones that may become airborne as an aerosol in a fume hood and/or use activated charcoal if applicable.
  - I-125, especially in the form of sodium iodide is potentially volatile, and work may be required to be done in a fume hood and/or an iodination hood depending on the form and the amount being used.
- NEVER pipet radioactive materials by mouth.
- Work over absorbent material and/or containment devices when radioactive materials are used.
- Follow the VA radiation safety procedures (e.g., ordering, use, disposal, monitoring) and perform the required documentation.
- Report and respond to radioactive spills as outlined in the VA radiation safety procedures.
  - For spills involving I-125, a solution of alkaline sodium thiosulphate and carrier iodine should be used.

4. References

1. *The Health Physics and Radiological Health Handbook* Revised Edition © 1992 Edited by Bernard Shleien, Scinta, Inc., Silver Spring, MD.
2. Title 10 of Code of Federal Regulations (CFR) Part 20 *STANDARDS FOR PROTECTION AGAINST RADIATION*
3. NUREG-1556, Vol. 11 *Program-Specific Guidance About Licenses of Broad Scope* (Appendix K Radionuclides Classified According to Relative Toxicity)

5. Links to Other Radionuclide Information Sources

1. *Safe Handling Guide* (Iodine-125 Handling Precautions) by Perkin Elmer
2. *10 Golden Rules* (for Working with Radioactivity) by Amersham/GE Healthcare
3. *Working with Radioactivity Safely* by Amersham/GE Healthcare
4. *Radiochemical Decomposition - A Guide to the Properties and Storage of Radiolabelled Compounds* by Amersham/GE Healthcare

6. Questions or Comments Concerning this Radionuclide

For any questions or comments concerning this radionuclide, please contact the VA Radiation Safety Office via e-mail (vhalex.radiationSafetyOffice@va.gov) or ext. 5929.

Hackett, Michael

From: Hackett, Michael
Sent: Thursday, September 10, 2009 11:29 AM
To: Baker, Cheryl D.; Hackett, Michael; Jacobs, Donna K.; Shih, Wei-Jen; Kiefer, Vickie; Hardin, Shannon B.; Brown, Stephen A.; Morgan, Bert D.; Jones, Jon
Subject: Authorized User Application - Greenberg

Importance: High

Radiation Safety Committee members,

As we discussed at the last RSC meeting on August 27, Dr. Greenberg had submitted an application to become a new Authorized User (AU) in research. We reviewed some of the application but do to time constraints and the need for air flow measurements on the room, the RSC postponed final approval until further reviewing the application and final supporting documentation.

I have created summary sheets for the AU and staff (1) applications with links their completed applications, supporting documentation (e.g., training, room air flow evaluation) and approval criteria.

Summary of AU Application - Greenberg

Summary of Staff Application - Greenberg

Please carefully review this information. Please use the Voting Buttons on this e-mail to either approve or disapprove these applications. Please do so by COB on Wednesday, September 16.

If you have any questions concerning the applications or have any problems with the links, please contact me. Thank you.

Michael T. Hackett, MS
Radiation Safety Officer
x5929

Tracking:

Recipient	Response
Baker, Cheryl D.	Approve: 9/16/2009 9:21 AM
Hackett, Michael	Approve: 9/10/2009 11:29 AM
Jacobs, Donna K.	Approve: 9/15/2009 8:12 AM
Shih, Wei-Jen	
Kiefer, Vickie	Approve: 9/14/2009 10:49 AM
Hardin, Shannon B.	Approve: 9/16/2009 7:42 AM
Brown, Stephen A.	Approve: 9/15/2009 10:51 AM
Morgan, Bert D.	
Jones, Jon	

Rev. 09/09 - MTH

Summary of
Authorized User Application for Authorization to Possess and Use Radioactive Materials for Non-Human Research Use

☑ New Submission ☐ Re-Authorization

A. Applicant Information

Richard Greenberg, M.D. (If link does not work, open/close above link and re-try)

B. Education

M.D. in Medicine from Tufts Medical School in 1972

C. Radiation Safety Training

- ☑ **Safe Handling of Radioactive Materials** (e.g., time, distance & shielding, PPE)
- ☑ **Characteristics of Ionizing Radiation** (e.g., alpha, beta & gamma radiation, half life)
- ☑ **Units of Radiation Dose and Quantities** (e.g., rad, rem, µCi, dpm)
- ☑ **Radiation Detection Instrumentation** (e.g., survey meter, scintillation counter)
- ☑ **Biological Hazards of Exposure to Radiation** (e.g., cell damage/death, ALARA)

10 **~ Total # of Hours of Radiation Safety Training**

Recent VA Radiation Safety Training

08/2009	"Practicing Safe Science" Howard Hughes Medical Institute video (~30 min w/ ~15 min pertaining to radiation safety)
08/2009	"Radionuclide Hazards" Title 8 from "Safety in the Research Laboratory" Howard Hughes Medical Institute video (~15 min)
08/2009	"Research Emergency and Safety Procedures" 2009 research safety training PowerPoint presentation (~60 min w/ ~15 min pertaining to radiation safety)
08/2009	"Radiation Safety Training – Research" 2007 annual radiation safety training PowerPoint presentation (~90 min)
08/2009	"Radiation Safety Training – Research" 2008 annual radiation safety training PowerPoint presentation with test (~45 min)
08/2009	"Initial Radiation Safety Training – Research" Lecture for new AU submission and/or new staff (~90-150 min)

4.5 **~ Total # of Hours of Recent VA Radiation Safety Training**

D. Experience with Radioactive Materials

~# of hrs		
2	☑	**C-14**
2	☑	**Cr-51**
2	☑	**H-3**
50	☑	**I-125**
0	☐	**I-131**
0	☐	**P-32**
0	☐	**P-33**
2	☑	**S-35**
0	☐	**Other:**

58 **~ Total # of Hours of Experience with Radioactive Materials**

E. Initial Check on Training and Experience

68 **~ Total # of Hours of Radiation Safety Training & Experience with Radioactive Materials**

F. Staff Listing Victoria Greenberg, Ph.D.

G. Radiation Protection Equipment and Supplies Available for Use

☑ **Mechanical Pipettes**	☑ **Remote Handling Tongs**	☑ **Radiation Labels**
☐ **Bench Top Shields**	☑ **Shielded Storage/ Waste Containers**	☑ **Transporting Containers**
☑ **Disposable Gloves**	☑ **Lab Coats**	☑ **Safety Glasses/ Face Shield**
☑ **Fume Hood**	☐ **Iodination Hood**	
☑ **Absorbent Padding**	☑ **Containment Trays/Containers**	

Scintillation Counters **(i.e., other than the ones available in the Research core labs)**

☐ **Liquid Scintillation Counter (beta)**
(2 liquid scintillation counters are currently available in the Research core labs for all approval labs)

☐ **Sodium Iodide (NaI) Counter (gamma)**
(2 sodium iodide counters are currently available in the Research core labs for all approval labs)

☑ **Survey Meter: Ludlum Model 3 with Pancake Probe**
(1 spare survey meter with pancake probe is currently available in a research core lab for all approval labs)

H. Location for Use and Storage of Radioactive Materials and Waste

Room	Radioactive Materials Used	Radioactive Materials Stored	Radioactive Waste Stored	Room Diagram of Use/Storage	Room Air Flow Evaluation
D316	☑	☑	☑	D316	D316

I. 1. Description of Use of Radioactive Materials: I-125 (Radionuclide Information Sheet)

5 mCi Requested highest total activity (1 mCi = 1000 μCi) possessed at any one time

	In Vitro Procedure(s)	Chemical Form(s)	~ highest activity per procedure
#1	RIA (radioimmunoassay)	Iodinated prouroguanylin	0.01 mCi (10 μCi)

Radioactive Waste Generated:	Dry/Solid	Liquid	Scintillation	Animal
	☑	☑	☐	☐

Excepted Transport:	Within the VA	Between VA and UK
	☑ to core labs for counting	☐

Approval Criteria:

AU Applicant:

☑ 10 Code of Federal Regulations 33.15(b)(1) and (2)

(b) The applicant submits a statement that byproduct material will be used only by, or under the direct supervision of, individuals who have received:

(1) A college degree at the bachelor level, or equivalent training and experience, in the physical or biological sciences or in engineering; and

(2) At least 40 hours of training and experience in the safe handling of radioactive materials, and in the characteristics of ionizing radiation, units of radiation dose and quantities, radiation detection instrumentation, and biological hazards of exposure to radiation appropriate to the type and forms of byproduct material to be used

☑ NUREG-1556, Volume 11, Appendix L, Radiation Safety Training Topics

Facilities and Equipment:

- ☑ NUREG-1556, Volume 11, Appendix L, *Facilities and Equipment Considerations*
- ☑ NUREG-1556, Volume 11, Appendix K, *Radionuclides Classified According to Relative Toxicity*
- ☑ *Handbook of Health Physics and Radiological Health*, 3rd Edition
  Edited by B. Shleien, L. Slaback, and B. Birky © 1998 Lippincott Williams & Wilkins
  - Table 11.1.1 *Classification of Workplaces*
  - Table 11.1.1.1 *Toxicity Classification of Radionuclides*
  - Table 11.1.1.2 *Activity Limits for Use of Radionuclides in Various Types of Workplace*

Room	Radio-nuclide	Group #	Radionuclide Radiotoxicity	Type of Workplace Required		
				Type I (C)	Type II (B)	Type III (A)
D316	I-125	2	High	≤ 135 µCi (≤ 5 MBq)	135 µCi - 135 mCi (5 MBq - 5 GBq)	≥ 135 mCi (≥ 5 GBq)

Where Type I (C) is similar to a good quality modern chemical laboratory, Type II (B) is a specially designed laboratory for work with radionuclides, and Type III (A) specially designed laboratory for handling large activities of highly radioactive materials. The above limits are based on normal operations (see below for other types of operations). In case of a conventional modern chemical laboratory with adequate ventilation and non-porous work surfaces, the upper limits of Type I (C) workplace may be increased toward the limits for Type II (B) workplaces for low (4) and moderate (3) radiotoxicity groups.

Operation	Modifying Factor
Storage (stock solutions)	x 100
Very simple wet operations	x 10
Normal operations	x 1
Complex wet operations with risk of spills and simple dry operations	x 0.1
Dry and dusty operations	x 0.01

Rev. 09/09 - MTH

Summary of
Staff Application for Approval to Use Radioactive Materials for Non-Human Research Use Under an Authorized User

☑ New Submission ☐ Re-Approval

A. Applicant Information
Victoria Greenberg, Ph.D. (If link does not work, open/close above link and re-try)

Working Under Authorized User/AU Applicant Richard Greenberg, M.D.

B. Education
Ph.D. in Microbiology from University of Kentucky in 1998

C. Radiation Safety Training

☑ **Safe Handling of Radioactive Materials**
(e.g., time, distance & shielding, PPE)

☑ **Characteristics of Ionizing Radiation**
(e.g., alpha, beta & gamma radiation, half life)

☑ **Units of Radiation Dose and Quantities**
(e.g., rad, rem, µCi, dpm)

☑ **Radiation Detection Instrumentation**
(e.g., survey meter, scintillation counter)

☑ **Biological Hazards of Exposure to Radiation**
(e.g., cell damage/death, ALARA)

11 **~ Total # of Hours of Radiation Safety Training**

Recent VA Radiation Safety Training

08/2009	"Practicing Safe Science" Howard Hughes Medical Institute video (~30 min w/ ~15 min pertaining to radiation safety)
08/2009	"Radionuclide Hazards" Title 8 from "Safety in the Research Laboratory" Howard Hughes Medical Institute video (~15 min)
08/2009	"Research Emergency and Safety Procedures" 2009 research safety training PowerPoint presentation (~60 min w/ ~15 min pertaining to radiation safety)
08/2009	"Radiation Safety Training – Research" 2007 annual radiation safety training PowerPoint presentation (~90 min)
08/2009	"Radiation Safety Training – Research" 2008 annual radiation safety training PowerPoint presentation with test (~45 min)
08/2009	"Initial Radiation Safety Training – Research" Lecture for new AU submission and/or new staff (~90-150 min)
4.5	**~ Total # of Hours of Recent VA Radiation Safety Training**

D. Experience with Radioactive Materials

~# of hrs		
0	☐	**C-14**
0	☐	**Cr-51**
0	☐	**H-3**
100	☑	**I-125**
0	☐	**I-131**
10	☑	**P-32**
0	☐	**P-33**
0	☐	**S-35**
0	☐	**Other:**

110 **~ Total # of Hours of Experience with Radioactive Materials**

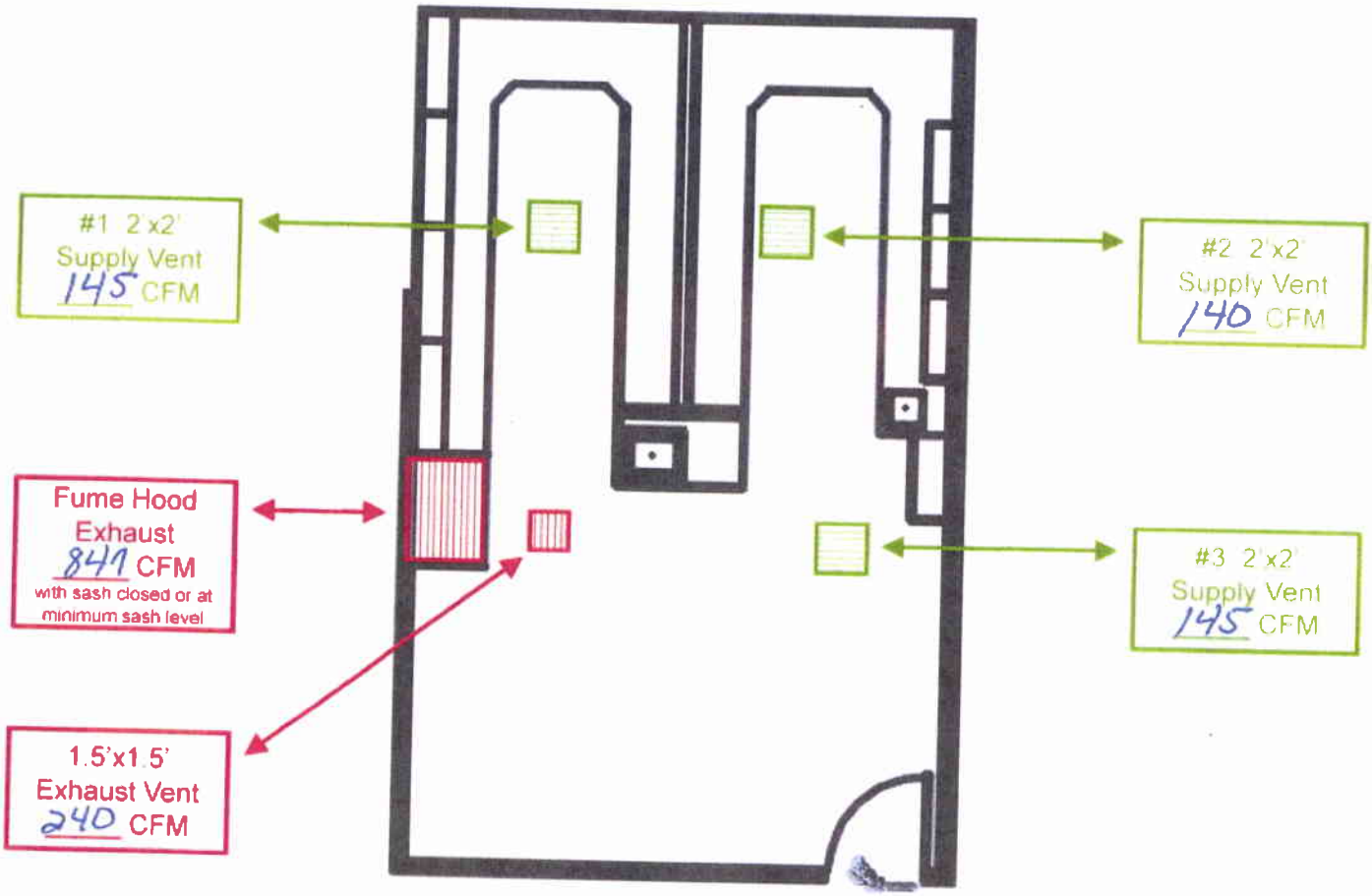
121 **~ Total # of Hours of Radiation Safety Training & Experience with Radioactive Materials**

Approval Criteria:

Staff Applicant:

☑ NUREG-1556, Volume 11, Appendix L, Radiation Safety Training Topics

D316
Air Flow Measurements with Door Closed



Date: 9/2/09

By: A. Rogers
HVAC Technician

Instrument(s) Used:
- Alnor Velometer (S/N 9793) Calibrated: 8/09
- TSI VelociCheck (S/N 94080385) Calibrated: 8/09
- _____ (S/N_____) Calibrated: _____

Vent locations are approximate & not to scale.

Total Supply (3)	= 430	CFM (A)
- Total Exhaust (2)	= 1087	CFM (B)
Room Pressure	= 657	CFM (A-B)
Room Volume	= 5126	CF (C)
# of Air Exchanges/hr	= 12.7	(Bx60/C)

= Smoke test performed at base of closed door Did it confirm that the room was under negative pressure? Yes ☑ No ☐

Rev. 08/08 - MTH

Authorized User Application for Authorization to Possess and Use Radioactive Materials for Non-Human Research Use

Department of Veterans Affairs Medical Center, Lexington, Kentucky

Complete the application and electronically submit it to the Radiation Safety Office via the "SUBMIT" button at the end of this application.

You may save this application at anytime and complete it at a later date. If all required fields have not been completed when it is saved, a pop up will come noting that "This form contains validation errors. ... Do you still want to save it?". You should answer "Yes" and name your ".xml" file. You now can open up this saved file to complete and/or submit. If you need to open this saved ".xml" file on a different computer, you will first need to open the original ".xsn" file (i.e., "Authorized User Application for Authorization to Possess and Use Radioactive Materials for Non-Human Research Use.xsn") on the other computer to automatically download the original form template. After you open this ".xsn" file which will be a blank application, close it and then you can open your saved ".xml" file that contains your application.

Your application will be reviewed for approval by the Radiation Safety Committee (RSC). You will be notified of the Committee's action on this application (i.e., you cannot start using radioactive materials until the RSC approves your application unless this a renewal application and you are currently approved to use radioactive materials).

Use your mouse or tab/arrow keys to move around the application.

Required fields are noted with "*", a red asterisk in the right corner of the field or "", a red box around the field in this electronic form. This notation does not appear on the printed copy. All required fields must be completed prior to submission although not required to save the file as noted above.

Your written responses will be in blue Arial font sizes 8 to 10**.**

Note that changing your selection in some option buttons (e.g., ◉ Yes ○ No) may change/delete information that you have entered relating to this selection (e.g., changing from Yes to No concerning experience with one radionuclide and you had entered a list of procedures for that radionuclide). If it was done in error, you should be able to use the "Undo" button on your toolbar or under the "Edit" menu and your information should be able to be restored.

To delete a repeating item or line (e.g., in education section) that you have added and do not need, roll mouse pointer over the repeating line that you want to delete and a shortcut menu button will appear in its upper-left corner (button may first appear gray before you click on it). Click on this button to go to the delete option. Using this same menu, you can also insert a new item or line above or below.

Questions can be directed to the Radiation Safety Office via e-mail at vhalex.radiationSafetyOffice@va.gov or at ext. 5929.

A. Applicant Information

First Name	Last Name	E-mail Address
Lisa	Tannock	Lisa.Tannock@uky.edu
Office Located @ ○ VA ◉ UK (if @ UK include Building)		
Room #	Building if @ UK:	Phone #
563	Charles T. Wethington	859-323-4933 x81415

B. Education (start with most recent & include all college degrees)

Degree	Major Field of Study	Institution	City, State or City, Country	Year (yyyy)
Fellow...	Endocrinology	University of Washington	Seattle, WA	2000
Reside...	Internal Medicine	University of Toronto	Toronto, Canada	1997
MD	Medicine	University of Toronto	Toronto, Canada	1994

C. Radiation Safety Training (include VA & non-VA training)

◉ Yes ○ No	**Have you had any radiation safety training?** (Including but not limited to formal course work, on-the-job training & educational seminars.)
If no, continue to the next section (i.e., Section D. Experience with Radioactive Materials). **If yes, did this training include the following radiation safety topics?**	
◉ Yes ○ No	**Safe Handling of Radioactive Materials** (e.g., time, distance & shielding, PPE)
◉ Yes ○ No	**Characteristics of Ionizing Radiation** (e.g., alpha, beta & gamma radiation, half life)
◉ Yes ○ No	**Units of Radiation Dose and Quantities** (e.g., rad, rem, μCi, dpm)
◉ Yes ○ No	**Radiation Detection Instrumentation** (e.g., survey meter, scintillation counter)
◉ Yes ○ No	**Biological Hazards of Exposure to Radiation** (e.g., cell damage/death, ALARA)

If yes to any of the above training, indicate where this training was obtained & ~ # of hrs.
(Start with the most recent and include this VA if applicable. If there were several training sessions over your tenure somewhere, just note start & end dates with ~ total # of radiation safety training hours during that time period.)

Institution/Training Site	City, State or City, Country	When (use date format: mm/yyyy; e.g., 01/2008)	~ # of hrs
VAMC	Lexington, KY	09/2009 to 09/2009	4
University of Kentucky	Lexington, KY	07/2004 to 09/2009	1
University of Washington	Seattle, WA	07/1997 to 12/2003	32
		~ Total # of Hours of Radiation Safety Training:	37

D. Experience with Radioactive Materials (include VA & non-VA experience)

◉ Yes ○ No **Do you have any experience with radioactive materials?**

If no, continue to the next section (i.e., Section E. Initial Check on Training and Experience).
If yes, indicate below your experience with the following radionuclides.

Radio-nuclide	Have you used this type of radioactive material?	If yes, highest activity you have handled (1 mCi = 1000 µCi)	If yes, list the procedures that you were involved with using this radionuclide (e.g., cell proliferation, iodination of proteins, DNA sequencing, animal work)	If yes, ~ # of hrs
C-14	◉ Yes ○ No	0.25 mCi	• molecular weight protein standards • Core protein labeling • Glucose Metabolism	100
Cr-51	○ Yes ◉ No	0 mCi	• N/A	0
H-3	◉ Yes ○ No	2 mCi	• Core Protein Labeling • Thymidine incorporation assay • Glycosaminoglycan side chain labeling	100
I-125	○ Yes ◉ No	0 mCi	• N/A	0
I-131	○ Yes ◉ No	0 mCi	• N/A	0
P-32	◉ Yes ○ No	0.025 mCi	• Northern Blot	100
P-33	○ Yes ◉ No	0 mCi	• N/A	0
S-35	◉ Yes ○ No	10 mCi	• SDS-PAGE • Core Protein labeling • Glycosaminoglycan side chain laebling	100
Other	○ Yes ◉ No	Have you had any other experience with other radionuclides that are not listed above?		

If no, continue on to the indicate where your experience was obtained.
If yes, indicate your experience with these other radionuclides (i.e., up to 7 other radionuclides).

# 1	○ Yes ◉ No	0 mCi	• N/A	0
Radio-nuclide	**Have you used this type of radioactive material?**	**If yes, highest activity you have handled (1 mCi = 1000 µCi)**	**If yes, list the procedures that you were involved with using this radionuclide (e.g., DNA sequencing, cell proliferation, iodination, animal work)**	**If yes, ~ # of hrs**

~ Total # of Hours of Experience with Radioactive Materials: 400

If yes to any experience with radioactive materials, continue on to the indicate where your experience with the above radionuclide(s) was obtained.
(Start with the most recent and include this VA if applicable. Note that changes with the above radionuclides after you have started to complete the below information may effect your indication of experience at each institution.)

Institution	C-14	Cr-51	H-3	I-125	I-131	P-32	P-33	S-35							
University of Kentucky	☑	☐	☑	☐	☐	☑	☐	☑	☐	☐	☐	☐	☐	☐	☐
City, State or City, Country Lexington, KY															
When (use date format: mm/yyyy; e.g., 01/2008) 07/2004 to 09/2009															

Institution	C-14	Cr-51	H-3	I-125	I-131	P-32	P-33	S-35							
University of Washington	☐	☐	☑	☐	☐	☑	☐	☑	☐	☐	☐	☐	☐	☐	☐
City, State or City, Country Seattle, WA															
When (use date format: mm/yyyy; e.g., 01/2008) 07/1997 to 12/2003															

Key: ☑ = **Experience with this radionuclide at this institution**
☐ = **Experience with this radionuclide but not at this institution**
☐ = **No Experience with this radionuclide at all**

E. Initial Check on Training and Experience

Before you proceed any further with this application, please check to see if your information above concerning your past radiation safety training (Section C) and experience with radioactive materials (Section D) is complete and accurate.

☑ **Check here after your review is complete and wait for further instructions below.**
Please proceed on with your application.

F. Staff Listing (staff who will work with radioactive materials other than yourself)

List all staff who will work with the radioactive materials that are outlined in this application once it is approved by the Radiation Safety Committee (i.e., once approved, you will be the Authorized User and the below named staff will be working with the radioactive materials under your supervision and will be your responsibility). **If there is no current staff, enter "N/A" for the first and last name. Each staff person listed below must complete an "Application for Approval to Use Radioactive Materials for Non-Human Research Use Under an Authorized User" which is available through the Radiation Safety Office via e-mail at vhalex.radiationSafetyOffice@va.gov or at ext. 5929. These staff applications also have to be approved by the Radiation Safety Committee** (i.e., no staff person can start using radioactive materials until the RSC approves both the application for authorization to possess and use radioactive materials and the staff application for approval to use radioactive materials unless this is a renewal application for which all parties have current RSC approval).

#	First Name	Last Name	RSC review of staff application - to be attached by Radiation Safety Office
1	Patricia	Wilson	RSC Approved Staff - Wilson 09.16.2009.xml XML Document 533 KB

G. Radiation Protection Equipment and Supplies Available for Use

Check items that will be available to you and your staff that will be used to control radiation exposure and/or contamination. Space is available for additional items not listed.

☑ Mechanical Pipettes	☐ Remote Handling Tongs	☑ Radiation Labels
☑ Bench Top Shields	☑ Shielded Storage/ Waste Containers	☑ Transporting Containers
☑ Disposable Gloves	☑ Lab Coats	☑ Safety Glasses/ Face Shield
☑ Fume Hood	☐ Iodination Hood	☐
☑ Absorbent Padding	☑ Containment Trays/Containers	☐

Scintillation Counters (i.e., other than the ones available in the Research core labs)

☐ Liquid Scintillation Counter (beta)	Manufacturer	Model	Serial #
☐ Sodium Iodide (NaI) Counter (gamma)	Manufacturer	Model	Serial #
☑ Survey Meter	Meter Manufacturer Ludlum	Meter Model 3	Meter Serial # TBA - Pending purchase when funding available
	Probe Manufacturer Ludlum	Probe Model 44-9	Probe Serial # TBA

H. Location for Use and Storage of Radioactive Materials and Waste

Contact the Radiation Safety Office via e-mail at vhalex.radiationSafetyOffice@va.gov or at ext. 5929 to obtain a room diagram for any areas for which you are requesting approval for the use and storage of radioactive materials/waste. When obtained, indicate on the room diagram(s) what radionuclides will be in that room and where the use, storage, and waste areas are located along with the location of any phones and desks/computer work areas. Scan each room diagram into a separate pdf file noting the room # as the file name and then attach each file below. Indicate below the room # and if radioactive material will be used and/or stored in the room and if radioactive waste will be stored in this room until disposed of by the Radiation Safety Office. Include research core labs that will be used for storage (e.g., radioactive samples in -70° freezer) but it is not necessary to include core labs that will only be temporarily used for counting radioactive samples in core lab scintillation counters.

Room #	Radioactive material will be used in this room	Radioactive material will be stored in this room	Radioactive waste will be stored in this room	Room Diagram
D322	☑	☑	☑	D322 Tannock.pdf PDF File 167 KB

I. Description of Use of Radioactive Materials

Provide the information below concerning the radioactive materials that you would like to be approved to possess and use for non-human research use. You must complete this section for each radionuclide. Additional radionuclides can be added at the end of this section.

I. 1. Description of Use of Radioactive Materials: C-14

C-14 **If Other, indicate below:**	**Select which radionuclide you would like to be authorized to possess and use for non-human research use, and complete the information below. Additional radionuclides can be added at the end of this section.**	**The below file contains information on the selected radionuclide.** C-14 Radionuclide Information Sheet.xls Microsoft Office Excel 97-2003 Worksheet 122 KB
0.1 **mCi**	**What will be highest total activity (1 mCi = 1000 µCi) of C-14 possessed at any one time (i.e., total of all sources from all locations)?**	
◉ **In Vitro Only** ○ **Animal Only** ○ **Both**	**What type of non-human use procedures will be done using C-14 (i.e., animal procedures involve actual administration of the radionuclide into the animal)?** **Complete the below requested information concerning these procedures.**	

- **Description of In Vitro Procedures Using C-14 - Describe each procedure separately**

 # 1 **(e.g., cell proliferation, iodination of proteins, DNA sequencing)**

C-14 In Vitro Procedure Name: Molecular weight standards

List Chemical Form(s) of C-14 (e.g., thymidine, sodium iodide, ATP) to be Used: methylated protein

Highest total activity (1 mCi = 1000 µCi) used at one time per procedure: 0.001 **mCi**

Briefly describe this procedure to include how the radionuclide will be handled and used (e.g., ~0.5 µCi pipetted per well of tissue culture plates for 90-100 wells), what equipment will be used (e.g., centrifuge, incubator), and timeframe of use (e.g., 3 day procedure, 24 hr incubation):

1 µCi of C-14 will be added to gels to estimate relative protein size following electrophoresis. Gels will be placed in an autoradiography cassette and exposed to film for 24-72hrs.

- **Description of Animal Procedures Using C-14 - Describe each procedure separately**

- **Description of Preventive Measures to Limit Exposure and Contamination from C-14**

Briefly describe what preventive measures you and your staff will be taking to limit exposure and contamination while this radionuclide is being stored and/or used to include but not limited to PPE (Personal Protective Equipment, e.g., lab coat, disposal gloves, etc.) and shielding devices if applicable:

To prevent against possible exposure and contamination, the radionuclide will be kept in sealed containers at all times. All personnel will wear protective lab coats, gloves and eye shielding. All work with radioactive material will require the use of mechanical pipettes equipped with filtered tips to prevent contamination of the pipette. Bench pads will be used to prevent contamination of work surfaces. All personnel will screen themselves and all used areas for possible contamination at the end of each experimental procedure using the wipe test method.

- **Radioactive Waste Generated from Using C-14**

Will you be generating any radioactive waste of this each type?	**If this type of waste will be generated, will it contain any hazardous (i.e., other than being radioactive) and/or biohazardous material? If yes, indicate the hazardous/biohazardous material.**

◉ Yes	○ No	Dry/Solid	○ Yes	◉ No	N/A
○ Yes	◉ No	Liquid	○ Yes	◉ No	N/A
◉ Yes	○ No	Scintillation Fluid	○ Yes	◉ No	N/A
○ Yes	◉ No	Animal	○ Yes	◉ No	N/A

Notice: Only biodegradable scintillation fluid should be used. If not, explain in the radioactive waste - hazardous section what type of hazardous scintillation fluid will be used and why this is necessary.

Notice: The amount of C-14 activity in scintillation fluid should be <0.05 microcuries (i.e., <111,000 dpm) per gram (i.e., ~1ml) of scintillation medium. If not, explain above in appropriate procedure description why this is necessary.

• Transporting of C-14

Transporting within this VA:

◉ Yes ○ No **Will there be a need to transport this radionuclide from one room to another within this VA?** (This includes radioactive samples being transported to and from the core labs for counting on the scintillation counters.)

If yes, explain below what will be transported (e.g., samples to be counted), **~ activity** (e.g., ~ µCi), **to and from what rooms, and how it is transported** (e.g., capped tubes/vials, on a cart):

Sealed cassettes containing the membranes and film will be transported to the darkroom (C324) for film development (i.e., radioactivity will remain in cassette while the film is removed). Personnel transporting the cassettes will wear PPE including lab coats, gloves and eye shields.

Transporting between this VA and UK:

○ Yes ◉ No **Will there be an expected need to transport this radionuclide between this VA and UK?** (If radioactive material needs to be shipped off site, this must be done by the Radiation Safety Office.)

If yes, explain below what will be transported (e.g., samples to be counted), **~ activity** (e.g., ~ µCi), **to and from what areas, and how it is transported** (e.g., capped tubes/vials, on a cart):

N/A

I. 2. Description of Use of Radioactive Materials: H-3

H-3 If Other, indicate below:	**Select which radionuclide you would like to be authorized to possess and use for non-human research use, and complete the information below. Additional radionuclides can be added at the end of this section.**	**The below file contains information on the selected radionuclide.** H-3 (Tritium) Radionuclide Information Sheet xls Microsoft Office Excel 97-2003 Worksheet 134 KB

10 mCi **What will be highest total activity** (1 mCi = 1000 µCi) **of H-3 possessed at any one time** (i.e., total of all sources from all locations)?

◉ In Vitro Only
○ Animal Only
○ Both

What type of non-human use procedures will be done using H-3 (i.e., animal procedures involve actual administration of the radionuclide into the animal)?

Complete the below requested information concerning these procedures.

• Description of In Vitro Procedures Using H-3 - Describe each procedure separately

 # 1

H-3 In Vitro Procedure Name: Collagenase-sensitive proline incorporation assay (e.g., cell proliferation, iodination of proteins, DNA sequencing)

List Chemical Form(s) of H-3 to be Used: proline (e.g., thymidine, sodium iodide, ATP)

Highest total activity (1 mCi = 1000 µCi) **used at one time per procedure:** 2 **mCi**

Briefly describe this procedure to include how the radionuclide will be handled and used (e.g., ~0.5 µCi pipetted per well of tissue culture plates for 90-100 wells), **what equipment will be used** (e.g., centrifuge, incubator), **and timeframe of use** (e.g., 3 day procedure, 24 hr incubation):

10-50µCi per well of H3-proline will be used to metabolically label cells for 6-72hrs at 37°C in a CO2 incubator. Briefly, cells are removed by trypsinization and protein is precipitated in 20% TCA. Pellets are washed three times with 1.0 ml of 5% TCA-0.01% proline and then dissolved with 0.2 M NaOH and titrated to neutral pH. Samples are incubated with collagenase (2 mg/ml; Worthington Biochemical) in Tris-CaCl2-N-ethylmaleimide buffer for 1hr at 37°C and then precipitated with 10% TCA for 1 h on ice. Samples are centrifuged at 14,000 rpm for 10min, and the collagenase-sensitive [3H]proline in the supernatant is determined by liquid scintillation counting.

• Description of Animal Procedures Using H-3 - Describe each procedure separately

• Description of Preventive Measures to Limit Exposure and Contamination from H-3

Briefly describe what preventive measures you and your staff will be taking to limit exposure and contamination while this radionuclide is being stored and/or used to include but not limited to PPE (Personal Protective Equipment, e.g., lab coat, disposal gloves, etc.) **and shielding devices if applicable:**

To prevent against possible exposure and contamination, the radionuclide will be kept in sealed containers at all times. All personnel will wear protective lab coats, gloves and eye shielding. All work with radioactive material will require the use of mechanical pipettes equipped with filtered tips to prevent contamination of the pipette. Bench pads will be used to prevent contamination of work surfaces. All personnel will screen themselves and all used areas for possible contamination at the end of each experimental procedure using the wipe test method.

• Radioactive Waste Generated from Using H-3

Will you be generating any radioactive waste of this each type?			If this type of waste will be generated, will it contain any hazardous (i.e., other than being radioactive) and/or biohazardous material? If yes, indicate the hazardous/biohazardous material.		
◉ Yes	○ No	Dry/Solid	○ Yes	◉ No	N/A
◉ Yes	○ No	Liquid	○ Yes	◉ No	N/A
◉ Yes	○ No	Scintillation Fluid	○ Yes	◉ No	N/A
○ Yes	◉ No	Animal	○ Yes	◉ No	N/A

Notice: Only biodegradable scintillation fluid should be used. If not, explain in the radioactive waste - hazardous section what type of hazardous scintillation fluid will be used and why this is necessary.

Notice: The amount of H-3 activity in scintillation fluid should be <0.05 microcuries (i.e., <111,000 dpm) per gram (i.e., ~1ml) of scintillation medium. If not, explain above in appropriate procedure description why this is necessary.

• Transporting of H-3

Transporting within this VA:

◉ Yes ○ No **Will there be a need to transport this radionuclide from one room to another within this VA?** (This includes radioactive samples being transported to and from the core labs for counting on the scintillation counters.)

If yes, explain below what will be transported (e.g., samples to be counted), **~ activity** (e.g., ~ µCi), **to and from what rooms, and how it is transported** (e.g., capped tubes/vials, on a cart):

Samples will be transported to the core lab (C326 or D307) for counting on the scintillation counters. Samples will be transported in sealed scintillation vials. Estimated activity of the scintillation vials is between 0.001 to 0.03 microcuries. Activity will never exceed 0.05 microcuries per ml of scintillation fluid.

Transporting between this VA and UK:

○ Yes ◉ No	**Will there be an expected need to transport this radionuclide between this VA and UK?** (If radioactive material needs to be shipped off site, this must be done by the Radiation Safety Office.)

If yes, explain below what will be transported (e.g., samples to be counted), **~ activity** (e.g., ~ µCi), **to and from what areas, and how it is transported** (e.g., capped tubes/vials, on a cart):

N/A

I. 3. Description of Use of Radioactive Materials: P-32

P-32 If Other, indicate below:	**Select which radionuclide you would like to be authorized to possess and use for non-human research use, and complete the information below. Additional radionuclides can be added at the end of this section.**	**The below file contains information on the selected radionuclide.** P-32 Radionuclide Information Sheet.xls Microsoft Office Excel 97-2003 Worksheet 132 KB

1 mCi	**What will be highest total activity** (1 mCi = 1000 µCi) **of P-32 possessed at any one time** (i.e., total of all sources from all locations)?
◉ In Vitro Only ○ Animal Only ○ Both	**What type of non-human use procedures will be done using P-32** (i.e., animal procedures involve actual administration of the radionuclide into the animal)? **Complete the below requested information concerning these procedures.**

• Description of In Vitro Procedures Using P-32 - Describe each procedure separately

 # 1

P-32 In Vitro Procedure Name: Northern blot (e.g., cell proliferation, iodination of proteins, DNA sequencing)

List Chemical Form(s) of P-32 to be Used: dATP (e.g., thymidine, sodium iodide, ATP)

Highest total activity (1 mCi = 1000 µCi) **used at one time per procedure:** 0.025 **mCi**

Briefly describe this procedure to include how the radionuclide will be handled and used (e.g., ~0.5 µCi pipetted per well of tissue culture plates for 90-100 wells), **what equipment will be used** (e.g., centrifuge, incubator), **and timeframe of use** (e.g., 3 day procedure, 24 hr incubation):

Total RNA is size-fractioned on a 1% denaturing formaldehyde agarose gel and transferred onto a nylon membrane. Blots are hybridized overnight at 42°C in with high sensitivity cDNA probes labeled with P-32-dATP (Random Priming DNA Labeling Kit, Ambion). After hybridization, membranes are washed, air-dried and exposed to Kodak BioMax MR-1 films or IP screen.

• Description of Animal Procedures Using P-32 - Describe each procedure separately

• Description of Preventive Measures to Limit Exposure and Contamination from P-32

Briefly describe what preventive measures you and your staff will be taking to limit exposure and contamination while this radionuclide is being stored and/or used to include but not limited to PPE (Personal Protective Equipment, e.g., lab coat, disposal gloves, etc.) **and shielding devices if applicable:**

To prevent against possible exposure and contamination, the radionuclide will be kept in sealed containers at all times. All personnel will wear protective lab coats, gloves and eye shielding. All work with radioactive material will require the use of mechanical pipettes equipped with filtered tips to prevent contamination of the pipette. Bench pads will be used to prevent contamination of work surfaces. The majority of P-32 work will be done behind shielding (i.e., plexiglass). All personnel will screen themselves and all used areas for possible contamination at the end of each experimental procedure using both a GM survey meter and the wipe test method. All waste and stored radioactive material will be shielded.

• Radioactive Waste Generated from Using P-32

Will you be generating any radioactive waste of this each type?			If this type of waste will be generated, will it contain any hazardous (i.e., other than being radioactive) and/or biohazardous material? If yes, indicate the hazardous/biohazardous material.		
◉ Yes	○ No	Dry/Solid	○ Yes	◉ No	N/A
◉ Yes	○ No	Liquid	○ Yes	◉ No	N/A
◉ Yes	○ No	Scintillation Fluid	○ Yes	◉ No	N/A
○ Yes	◉ No	Animal	○ Yes	◉ No	N/A

Notice: Only biodegradable scintillation fluid should be used. If not, explain in the radioactive waste - hazardous section what type of hazardous scintillation fluid will be used and why this is necessary.

• Transporting of P-32

Transporting within this VA:

◉ Yes ○ No **Will there be a need to transport this radionuclide from one room to another within this VA?** (This includes radioactive samples being transported to and from the core labs for counting on the scintillation counters.)

If yes, explain below what will be transported (e.g., samples to be counted), **~ activity** (e.g., ~ µCi), **to and from what rooms, and how it is transported** (e.g., capped tubes/vials, on a cart):

Sealed cassettes containing the membranes and film will be transported to the darkroom (C324) for film development (i.e., radioactivity will remain in cassette while the film is removed). Personnel transporting the cassettes will wear PPE including lab coats, gloves and eye shields.

Transporting between this VA and UK:

○ Yes ◉ No **Will there be an expected need to transport this radionuclide between this VA and UK?** (If radioactive material needs to be shipped off site, this must be done by the Radiation Safety Office.)

If yes, explain below what will be transported (e.g., samples to be counted), **~ activity** (e.g., ~ µCi), **to and from what areas, and how it is transported** (e.g., capped tubes/vials, on a cart):

N/A

I. 4. Description of Use of Radioactive Materials: S-35

S-35

If Other, indicate below:

Select which radionuclide you would like to be authorized to possess and use for non-human research use, and complete the information below. Additional radionuclides can be added at the end of this section.

The below file contains information on the selected radionuclide.

S-35 Radionuclide Information Sheet.xls
Microsoft Office Excel 97-2003 Worksheet
136 KB

Notice: Some S-35 labeled compounds are more volatile (e.g., methionine) than others. All S-35 labeled compounds should be opened in a fume hood and for the more volatile forms of S-35, work should be done in a fume hood and/or activated charcoal should be used to minimize airborne contamination. See the above file for more radionuclide information concerning S-35.

50 mCi **What will be highest total activity** (1 mCi = 1000 µCi) **of S-35 possessed at any one time** (i.e., total of all sources from all locations)?

◉ In Vitro Only
○ Animal Only
○ Both

What type of non-human use procedures will be done using S-35 (i.e., animal procedures involve actual administration of the radionuclide into the animal)?

Complete the below requested information concerning these procedures.

• Description of In Vitro Procedures Using S-35 - Describe each procedure separately

 # 1

S-35 In Vitro Procedure Name: (e.g., cell proliferation, iodination of proteins, DNA sequencing) Metabolic labeling of glycosaminoglycan chains or core protein

List Chemical Form(s) of S-35 to be Used: (e.g., thymidine, sodium iodide, ATP) sulfate (SO4), methionine

Highest total activity (1 mCi = 1000 μCi) **used at one time per procedure:** 10 **mCi**

Briefly describe this procedure to include how the radionuclide will be handled and used (e.g., ~0.5 μCi pipetted per well of tissue culture plates for 90-100 wells), **what equipment will be used** (e.g., centrifuge, incubator), **and timeframe of use** (e.g., 3 day procedure, 24 hr incubation):

Cells will be metabolically labeled with S-35 SO4 (50-100μCi/ml) to label glycosaminoglycan chains or S-35 methionine (50-100μCi/ml) to label core proteins for 6-72hrs. This metabolic labeling will require the use of a CO2 incubator. Proteoglycans will be purified and isolated by ion-exchange chromatography, then used in a modified gel mobility shift assay.

 # 2

S-35 In Vitro Procedure Name: (e.g., cell proliferation, iodination of proteins, DNA sequencing) LDL binding assay

List Chemical Form(s) of S-35 to be Used: (e.g., thymidine, sodium iodide, ATP) proteoglycans via above labeling with sulfate (SO4), methionine

Highest total activity (1 mCi = 1000 μCi) **used at one time per procedure:** 0.07 **mCi**

Briefly describe this procedure to include how the radionuclide will be handled and used (e.g., ~0.5 μCi pipetted per well of tissue culture plates for 90-100 wells), **what equipment will be used** (e.g., centrifuge, incubator), **and timeframe of use** (e.g., 3 day procedure, 24 hr incubation):

Proteoglycans isolated from the above procedure will be used in a modified gel mobility shift assay to determine their LDL binding affinity. Proteoglycan samples will be mixed with varying concentrations of mouse LDL and placed in a incubator for 1hr to allow binding. To determine the dpm of the samples prior to loading them onto the gels, a small amount of the media (50ul) from labeled cells is placed onto filter paper, allow it to dry, then rinsed it with CPC buffer 5x times and counted in scintillation fluid. Then the samples containing proteoglycans and LDL will be electrophoresed in an agarose gel for 2-3hrs. After this the gels will be dried for 24-72hrs in a fume hood before placement in a sealed autoradiography cassette containing film or an IP screen for 24-48hrs.

• Description of Animal Procedures Using S-35 - Describe each procedure separately

• Description of Preventive Measures to Limit Exposure and Contamination from S-35

Briefly describe what preventive measures you and your staff will be taking to limit exposure and contamination while this radionuclide is being stored and/or used to include but not limited to PPE (Personal Protective Equipment, e.g., lab coat, disposal gloves, etc.) **and shielding devices if applicable:**

To prevent against possible exposure and contamination, the radionuclide will be kept in sealed containers at all times. All personnel will wear protective lab coats, gloves and eye shielding. All work with radioactive material will require the use of mechanical pipettes equipped with filtered tips to prevent contamination of the pipette. Bench pads will be used to prevent contamination of work surfaces. All personnel will screen themselves and all used areas for possible contamination at the end of each experimental procedure using both a GM survey meter and the wipe test method. In addition activated charcoal discs will be placed in the lid of all methionine labeled culture dishes to prevent aerosols. All work with S-35 will be done in a fume hood.

• Radioactive Waste Generated from Using S-35

Will you be generating any radioactive waste of this each type?	If this type of waste will be generated, will it contain any hazardous (i.e., other than being radioactive) and/or biohazardous material? If yes, indicate the hazardous/biohazardous material.
◉ Yes ○ No Dry/Solid	○ Yes ◉ No N/A

◉ Yes	○ No	Liquid	○ Yes	◉ No	N/A
◉ Yes	○ No	Scintillation Fluid	○ Yes	◉ No	N/A
○ Yes	◉ No	Animal	○ Yes	◉ No	N/A

Notice: Only biodegradable scintillation fluid should be used. If not, explain in the radioactive waste - hazardous section what type of hazardous scintillation fluid will be used and why this is necessary.

• Transporting of S-35

Transporting within this VA:

◉ Yes ○ No **Will there be a need to transport this radionuclide from one room to another within this VA?** **(This includes radioactive samples being transported to and from the core labs for counting on the scintillation counters.)**

If yes, explain below what will be transported (e.g., samples to be counted), ~ activity (e.g., ~ µCi), to and from what rooms, and how it is transported (e.g., capped tubes/vials, on a cart):

Samples will be transported to the core lab (C326 or D307) for counting on the scintillation counters. Samples will be transported in sealed scintillation vials. Estimated activity of the scintillation vials is between 0.001 to 0.03 microcuries. Sealed cassettes containing the membranes and film will be transported to the darkroom (C324) for film development (i.e., radioactivity will remain in cassette while the film is removed). Personnel transporting the cassettes will wear PPE including lab coats, gloves and eye shields.

Transporting between this VA and UK:

○ Yes ◉ No **Will there be an expected need to transport this radionuclide between this VA and UK?** **(If radioactive material needs to be shipped off site, this must be done by the Radiation Safety Office.)**

If yes, explain below what will be transported (e.g., samples to be counted), ~ activity (e.g., ~ µCi), to and from what areas, and how it is transported (e.g., capped tubes/vials, on a cart):

N/A

Please review this application for accuracy and completeness. To submit this application and you are using Microsoft Outlook, press the "Submit" button below. If you are not using Outlook, send this file as an attachment to vhalex.radiationSafetyOffice@va.gov.

J. Radiation Safety Committee Review (to be completed by Radiation Safety Office)

The Radiation Safety Committee (RSC) has reviewed the above Authorized User Application for Authorization to Possess and Use Radioactive Materials for Non-Human Research Use. The review was completed on 09/16/2009 and based on this review, the application was:

- (●) Approved
- ( ) Approved - Pending Completion of Below Item(s)
- ( ) Disapproved Based on the Below Application Issue(s)

This application and RSC approval expires on the 5-year anniversary of the RSC review date listed above (i.e., 09/16/2014). Changes to this application (e.g., staff, rooms, procedures, etc.) must be approved by the Radiation Safety Committee prior their activation (i.e., via an amendment request).

Lisa Tannock, Authorized User Signature — Date: 9/22/09

I affirm that the above application and attached information is correct to the best of my knowledge. As a RSC approved Authorized User, I shall conduct and/or supervise the described work utilizing radioactive materials with full regard for the safety of those engaged in the work including myself, other staff, and the general public. I and the RSC approved staff who I supervise will abide by the policies and procedures set by the VA Radiation Safety Committee.

Michael T. Hackett, MS, Radiation Safety Officer Signature — Date: 9/22/09

Cheryl Baker, M.D., Radiation Safety Committee Chair Signature — Date: 9/23/09

File Attachment — Attached is the signed copy of this RSC review.

Rev. 08/08 - MTH

Staff Application for Approval to Use Radioactive Materials for Non-Human Research Use Under an Authorized User

Department of Veterans Affairs Medical Center, Lexington, Kentucky

Complete the application and electronically submit it to the Radiation Safety Office via the "SUBMIT" button at the end of this application.

You may save this application at anytime and complete it at a later date. If all required fields have not been completed when it is saved, a pop up will come noting that "This form contains validation errors. ... Do you still want to save it?". You should answer "Yes" and name your ".xml" file. You now can open up this saved file to complete and/or submit. If you need to open this saved ".xml" file on a different computer, you will first need to open the original ".xsn" file (i.e., "Staff Application for Approval to Use Radioactive Materials for Non-Human Research Use Under an Authorized User.xsn") on the other computer to automatically download the original form template. After you open this ".xsn" file which will be a blank application, close it and then you can open your saved ".xml" file that contains your application.

Your application will be reviewed for approval by the Radiation Safety Committee (RSC). You will be notified of the Committee's action on this application (i.e., you cannot start using radioactive materials until the RSC approves your application unless this a renewal application and you are currently approved to use radioactive materials).

Use your mouse or tab/arrow keys to move around the application.

Required fields are noted with "*", a red asterisk in the right corner of the field or "", a red box around the field in this electronic form. This notation does not appear on the printed copy. All required fields must be completed prior to submission although not required to save the file as noted above.

Your written responses will be in blue Arial font sizes 8 to 10**.**

Note that changing your selection in some option buttons (e.g., ◉ Yes ○ No) may change/delete information that you have entered relating to this selection (e.g., changing from Yes to No concerning experience with one radionuclide and you had entered a list of procedures for that radionuclide). If it was done in error, you should be able to use the "Undo" button on your toolbar or under the "Edit" menu and your information should be able to be restored.

To delete a repeating item or line (e.g., in education section) that you have added and do not need, roll mouse pointer over the repeating line that you want to delete and a shortcut menu button will appear in its upper-left corner (button may first appear gray before you click on it). Click on this button to go to the delete option. Using this same menu, you can also insert a new item or line above or below.

Questions can be directed to the Radiation Safety Office via e-mail at vhalex.radiationSafetyOffice@va.gov or at ext. 5929.

A. Staff Applicant Information

First Name	Last Name	E-mail Address
Patricia	Wilson	pgwils2@uky.edu

You can be reached @ ○ VA ◉ UK (if @ UK include Building)		
Room #	Building if @ UK:	Phone #
563	Charles T. Wethington	859-323-4933 x81342

The Authorized User* who you will be working for as it pertains to radioactive materials
Lisa Tannock

***Authorized User is the person who has the RSC's approval to possess and use radioactive materials for non-human research use, and who is ultimately responsible for its use.**

B. Education (start with most recent & include all college degrees)

Degree	Major Field of Study	Institution	City, State or City, Country	Year (yyyy)
MS	Biology	Eastern Kentucky University	Richmond, KY	2003
BA	Biology	Berea College	Berea, KY	2001

C. Radiation Safety Training (include VA & non-VA training)

◉ Yes ○ No	**Have you had any radiation safety training?** (Including but not limited to formal course work, on-the-job training & educational seminars.)
If no, continue to the next section (i.e., Section D. Experience with Radioactive Materials). **If yes, did this training include the following radiation safety topics?**	
◉ Yes ○ No	**Safe Handling of Radioactive Materials** (e.g., time, distance & shielding, PPE)
◉ Yes ○ No	**Characteristics of Ionizing Radiation** (e.g., alpha, beta & gamma radiation, half life)
◉ Yes ○ No	**Units of Radiation Dose and Quantities** (e.g., rad, rem, μCi, dpm)
◉ Yes ○ No	**Radiation Detection Instrumentation** (e.g., survey meter, scintillation counter)
◉ Yes ○ No	**Biological Hazards of Exposure to Radiation** (e.g., cell damage/death, ALARA)

If yes to any of the above training, indicate where this training was obtained & ~ # of hrs. (Start with the most recent and include this VA if applicable. If there were several training sessions over your tenure somewhere, just note start & end dates with ~ total # of radiation safety training hours during that time period.)

Institution/Training Site	City, State or City, Country	When (use date format: mm/yyyy; e.g., 01/2008)	~ # of hrs
VAMC	Lexington, KY	08/2009 to 09/2009	4
University of Kentucky	Lexington, KY	09/2005 to 09/2009	5
VAMC	Lexington, KY	07/2003 to 06/2004	5
		~ Total # of Hours of Radiation Safety Training:	14

D. Experience with Radioactive Materials (include VA & non-VA experience)

◉ Yes ○ No **Do you have any experience with radioactive materials?**

If no, continue to the next section (i.e., Section E. Initial Check on Training and Experience).
If yes, indicate below your experience with the following radionuclides.

Radio-nuclide	Have you used this type of radioactive material?	If yes, highest activity you have handled (1 mCi = 1000 µCi)	If yes, list the procedures that you were involved with using this radionuclide (e.g., cell proliferation, iodination of proteins, DNA sequencing, animal work)	If yes, ~ # of hrs
C-14	◉ Yes ○ No	0.25 mCi	• molecular weight protein standard • Core protein labeling • Glucose metabolism	40
Cr-51	○ Yes ◉ No	0 mCi	• N/A	0
H-3	◉ Yes ○ No	2 mCi	• Core Protein Labeling • Thymidine Incorporation • Glycosaminoglycab side chain labeling	40
I-125	○ Yes ◉ No	0 mCi	• N/A	0
I-131	○ Yes ◉ No	0 mCi	• N/A	0
P-32	◉ Yes ○ No	0.025 mCi	• Northern Blot	2
P-33	○ Yes ◉ No	0 mCi	• N/A	0
S-35	◉ Yes ○ No	10 mCi	• SDS-PAGE • Core Protein Labeling • Glycosaminoglycan side chain labeling	40
Other	○ Yes ◉ No	**Have you had any other experience with other radionuclides that are not listed above?**		

If no, continue on to the indicate where your experience was obtained.
If yes, indicate your experience with these other radionuclides (i.e., up to 7 other radionuclides).

# 1	○ Yes ◉ No	0 mCi	• N/A	0
Radio-nuclide	**Have you used this type of radioactive material?**	**If yes, highest activity you have handled (1 mCi = 1000 µCi)**	**If yes, list the procedures that you were involved with using this radionuclide (e.g., DNA sequencing, cell proliferation, iodination, animal work)**	**If yes, ~ # of hrs**

~ Total # of Hours of Experience with Radioactive Materials: 122

If yes to any experience with radioactive materials, continue on to the indicate where your experience with the above radionuclide(s) was obtained.
(Start with the most recent and include this VA if applicable. Note that changes with the above radionuclides after you have started to complete the below information may effect your indication of experience at each institution.)

Institution	C-14	Cr-51	H-3	I-125	I-131	P-32	P-33	S-35							
University of Kentucky	☑	☐	☑	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐
City, State or City, Country: Lexington, KY															
When (use date format: mm/yyyy; e.g., 01/2008): 09/2005 to 09/2009															
Institution	**C-14**	**Cr-51**	**H-3**	**I-125**	**I-131**	**P-32**	**P-33**	**S-35**							
VAMC	☐	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐
City, State or City, Country: Lexington, KY															
When (use date format: mm/yyyy; e.g., 01/2008): 07/2003 to 06/2004															

Key: ☑ = Experience with this radionuclide at this institution
☐ = Experience with this radionuclide but not at this institution
☐ = No Experience with this radionuclide at all

Please review this application for accuracy and completeness. To submit this application and you are using Microsoft Outlook, press the "Submit" button below. If you are not using Outlook, send this file as an attachment to vhalex.radiationSafetyOffice@va.gov.

J. Radiation Safety Committee Review (to be completed by Radiation Safety Office)

The Radiation Safety Committee (RSC) has reviewed the above Staff Application for Approval to Use Radioactive Materials for Non-Human Research Use Under an Authorized User.

The review was completed on 09/16/2009 and based on this review, the application was:

- (●) Approved
- ( ) Approved - Pending Completion of Below Item(s)
- ( ) Disapproved Based on the Below Application Issue(s)

This application and RSC approval expires on the 5-year anniversary of the RSC review date of the Authorized User's RSC approval to possess and use radioactive materials for non-human research use (i.e., 09/16/2014).

Patricia Wilson, Staff Applicant Signature — Date: 9/22/09

I affirm that the above application is correct to the best of my knowledge. I shall conduct work utilizing radioactive materials with full regard for the safety of those engaged in the work including myself, other staff, and the general public. I will abide by the policies and procedures set by the VA Radiation Safety Committee.

Lisa Tannock, Authorized User Signature — Date: 9/22/09

Michael T. Hackett, MS, Radiation Safety Officer Signature — Date: 9/22/09

Cheryl Baker, M.D., Radiation Safety Committee Chair Signature — Date: 9/23/09

File Attachment — **Attached is the signed copy of this RSC review.**

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D322 Room Diagram

Section H. Location for Use and Storage of Radioactive Materials and Waste

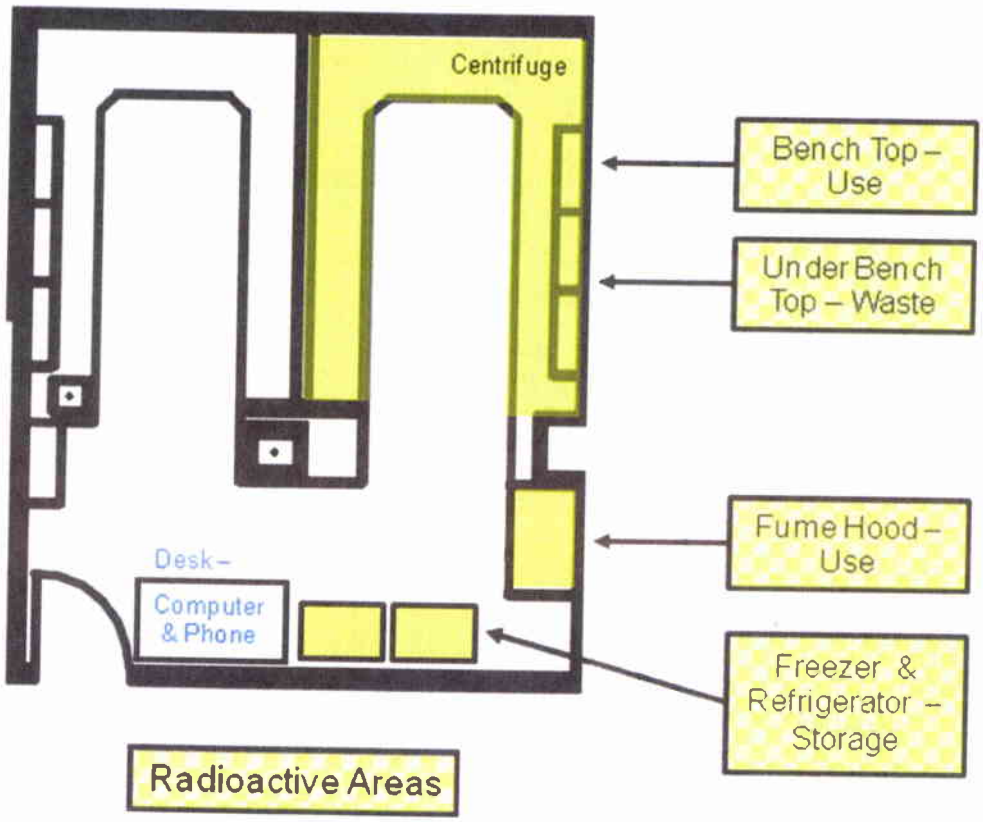
Authorized User Application for Authorization to Possess and Use Radioactive Materials for Non-Human Research Use

Electronically complete the table below.

Applicant's Name: Lisa Tannock

Check the appropriate boxes based on use & storage	C-14	Cr-51	H-3	I-125	I-131	P-32	P-33	S-35	Other Radionuclides (add as needed)						
Radioactive Material Used in Room	☒	☐	☒	☐	☐	☒	☐	☒	☐	☐	☐	☐	☐	☐	☐
Radioactive Material Stored in Room	☒	☐	☒	☐	☐	☒	☐	☒	☐	☐	☐	☐	☐	☐	☐
Radioactive Waste Stored in Room	☒	☐	☒	☐	☐	☒	☐	☒	☐	☐	☐	☐	☐	☐	☐

Print and then indicate on the room diagram where the above noted radionuclides will be used and/or stored (e.g., bench tops, hoods, refrigerators/freezers, equipment, etc.), and the locations of any radioactive waste storage. Include locations of any phones and desks/computer work areas in the room.



Upon completion, scan as a pdf file and electronically attach it to "Section H. Location for Use and Storage of Radioactive Materials and Waste" within your "Authorized User Application for Authorization to Possess and Use Radioactive Materials for Non-Human Research Use".

Carbon-14 (C-14)
Radionuclide Information Sheet

Note: Specific data and information concerning the above radionuclide is in blue bold Arial font.
Data can be entered in cells that are shaded in green.
Cells with calculations based on this data input will be shaded in red.

1. Decay Characteristics

Mode of Decay: Beta

Mass Number (A): 14

Atomic Number (Z): 6

Decays to: Nitrogen-14 (N-14; stable)

Half-Life ($T_{1/2}$)(1): 5730 years

Exponential Decay: $A_t = A_0 e^{-(\ln 2/T_{1/2})*t}$ or

Fraction of Activity Remaining $= e^{-(\ln 2/T_{1/2})*t}$

where A_t is the activity remaining after time t, A_0 is the initial known activity at time 0, ln2 is the natural log of 2 (i.e., 0.693147), $T_{1/2}$ is the half-life, and t is the time period in the same units as $T_{1/2}$

Due to C-14's extremely long half-life, decay correction will not be required (e.g., over 40 year period , <0.5% loss of activity due to radioactive decay).

Activity Unit Conversion:

Ci = curie	Bq = becquerel
1 Ci = 1000 mCi (millicurie)	1000 Bq = 1 kBq (kilobecquerel)
1 mCi = 1000 μCi (microcurie)	1000 kBq = 1 MBq (megabecquerel)
1 μCi = 1000 nCi (nanocurie)	1000 MBq = 1 GBq (gigabecquerel)

dpm = disintegrations/minute	dps = disintegrations/second

1 Ci	= 37 GBq	= 2.22×10^{12} dpm	= 3.7×10^{10} dps (Bq)
1 mCi	= 37 MBq	= 2.22×10^{9} dpm	= 3.7×10^{7} dps (Bq)
1 μCi	= 37 kBq	= 2.22×10^{6} dpm	= 3.7×10^{4} dps (Bq)
1 nCi	= 37 Bq	= 2.22×10^{3} dpm	= 37 dps (Bq)

1 Bq	= $0.\overline{027}$ nCi	= 60 dpm	= 1 dps
1 kBq	= $0.\overline{027}$ μCi	= 6.0×10^{4} dpm	= 10^{3} dps (Bq)
1 MBq	= $0.\overline{027}$ mCi	= 6.0×10^{7} dpm	= 10^{6} dps (Bq)
1 GBq	= $0.\overline{027}$ Ci	= 6.0×10^{10} dpm	= 10^{9} dps (Bq)

Activity Unit Calculator:

	Enter Activity #	Select Unit	Calculated Activity	Calculated Activity	Calculated Activity
from "_Ci":					
from "_Bq":					
from "dp_":					

Primary Emissions[1]:

Beta Energy - Maximum (keV)	Beta Energy - Average (keV)	Beta Probability per Decay	Electron Energy (keV)	Electron Probability per Decay	Photon (Gamma & X-ray) Energy (keV)	Photon Probability per Decay
156.480	49.470	1.000000	No Electron Emissions		No Photon Emissions	

C-14 emission data plus decay scheme from Brookhaven National Laboratory's *Chart of Nuclides*

2. Exposure Characteristics

Radiation Exposure & Dose Units:

Roentgen (R) is the unit of gamma or x-ray exposure in air that is expressed by the amount of ionizations that occur. One roentgen produces a charge equal to 2.58×10^{-4} coulombs/kg of air at STP (standard temperature and pressure) where 1 coulomb = 1 C = 6.28×10^{18} electronic charges.

Rad (radiation absorbed dose) is the unit of absorbed dose. One rad is equal to an absorbed dose of 100 ergs/g or 0.01 joule/kg (i.e., 0.01 gray). For photons (i.e., gamma and/or x-rays), 1 R ~ 1 rad.

Rem (roentgen equivalent in man) is the unit of any of the quantities expressed as dose equivalent (1 rem = 0.01 sievert = 0.01 Sv). The dose equivalent in rems is equal to the absorbed dose in rads multiplied by the quality factor. The quality factor for photon (i.e., gamma and/or x-rays) or beta radiation is equal to 1 (i.e., 1 rad = 1 rem).

Annual Occupational Dose Limits[2]:

Total Effective Dose Equivalent = Deep Dose Equivalent (DDE) from Whole Body External Exposure plus Committed Effective Dose Equivalent from Internal Exposure	**5,000** mrem (5 rem)
Deep Dose Equivalent plus Committed Dose Equivalent to Any Individual Organ or Tissue other than the Lens of the Eye	**50,000** mrem (50 rem)
Lens of the Eye Dose Equivalent (LDE)	**15,000** mrem (15 rem)
Shallow Dose Equivalent to Skin of Whole Body (SDE-WB) or to any Extremity (SDE-E)	**50,000** mrem (50 rem)

External Exposure:

Beta Dose Rate[1]:

	Activity (μCi)	Unshielded Point Source in Air Calculated Dose Rates (mrad/hr) @ 1 cm (0.4 in)	@ 6 cm (2.4 in)	@ 20 cm (7.9 in)	
Enter μCi:					Other dose rates at different distances are available. Contact the VA Radiation Safety Office via the link at end of this sheet.
	10	12,414	123	0.05	
	100	124,135	1,227	0.46	
	250	310,338	3,068	1.16	
	500	620,675	6,136	2.31	
	750	931,013	9,204	3.47	
	1000	1,241,350	12,272	4.63	
	2500	3,103,375	30,679	11.56	
	5000	6,206,750	61,358	23.13	

Beta Range[1]: $R = 0.412E^{1.265 - 0.0954 \ln E}$

where R is beta range in g/cm^2 (i.e., range in cm (r) times the density of the material in g/cm^3), E is the maximum beta energy in MeV (i.e., $0.01 \leq E \leq 2.5$ MeV), and lnE is the natural log of E

Material	in air	in water	in acrylic	Enter density of material :g/cm^3
density (g/cm^3)	0.001205	1.00	1.19	
beta range in cm (r)	23.6	0.03	0.02	
beta range in in. (r)	9.3	0.01	0.01	

Internal Exposure:

Annual Limit on Intake[2]:

Annual Limit on Intake (ALI) means the derived limit for the amount of radioactive material taken into the body of an adult worker by inhalation or ingestion in a year. ALI is the smaller value of intake of a given radionuclide in a year by the reference man that would result in a committed effective dose equivalent (CEDE) of 5 rems or a committed dose equivalent (CDE) of 50 rems to any individual organ or tissue. Class for inhalation may be separated by range of clearance half-times: Class D for <10 days, Class W for 10-100 days, and Class Y for >100 days.

Derived Air Concentration[2]:

Derived air concentration (DAC) means the concentration of a given radionuclide in air which, if breathed by the reference man for a working year of 2,000 hours under conditions of light work (i.e., inhalation rate 1.2 cubic meters of air per hour), results in an intake of one ALI.

Class	Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	Inhalation DAC (μCi/ml)
Monoxide	-	2,000,000 for CEDE	7.0×10^{-4}
Dioxide	-	200,000 for CEDE	9.0×10^{-5}
Compounds	2,000 for CEDE	2,000 for CEDE	1.0×10^{-6}

Taken from 10 CFR 20[2] Appendix B, Table 1 Occupational Values, columns 1-3.

Recommended Activity Limits Based Radiotoxicity and Type of Workplace[1]:

Radio-nuclide	Group #	Radionuclide Radiotoxicity	Type of Workplace Required		
			Type I (C)	Type II (B)	Type III (A)
	1	Very High	≤ 13.5 µCi (≤ 500 kBq)	13.5 µCi - 13.5 mCi (500 kBq - 500 MBq)	≥ 13.5 mCi (≥ 500 MBq)
	2	High	≤ 135 µCi (≤ 5 MBq)	135 µCi - 135 mCi (5 MBq - 5 GBq)	≥ 135 mCi (≥ 5 GBq)
C-14	3	Moderate	≤ 1.35 mCi (≤ 50 MBq)	1.35 mCi - 1.35 Ci (50 MBq - 50 GBq)	≥ 1.35 Ci (≥ 50 GBq)
	4	Low	≤ 13.5 mCi (≤ 500 MBq)	13.5 mCi - 13.5 Ci (500 MBq - 500 GBq)	≥ 13.5 Ci (≥ 500 GBq)

Where Type I (C) is similar to a good quality modern chemical laboratory, Type II (B) is a specially designed laboratory for work with radionuclides, and Type III (A) specially designed laboratory for handling large activities of highly radioactive materials. The above limits are based on normal operations. In case of a conventional modern chemical laboratory with adequate ventilation and non-porous work surfaces, the upper limits of Type I (C) workplace may be increased toward the limits for Type II (B) workplaces for low (4) and moderate (3) radiotoxicity groups[3].

Monitoring to be Done:

Staff:
- Radiation badges are not required for C-14 work because it does not present a significant external exposure hazard since its low energy beta emissions barely penetrate the outer dead layer of skin.
- Bioassays for the determination of CEDE, if applicable (i.e., situations with potential for internal intake, e.g., spill, staff contamination).
- See below work area monitoring equipment that can also be used to evaluate staff contamination.

Work Area:
- Survey meter with thin-window G-M probe (e.g., pancake, end window) for the evaluation of gross surface contamination.
- Scintillation counter (i.e., liquid scintillation - beta counter) for the evaluation of removable surface contamination.

3. Basic Radiation Safety Precautions

- Use the basic principles of radiation safety: TIME, DISTANCE, and SHIELDING.
  - Shielding is not as pertinent for C-14 (i.e., beta range in air is ~23.6 cm (~9.3 in) and <0.5 mm in acrylic).
- Wear the proper PPE (Personal Protective Equipment, e.g., lab coat, disposable gloves, face shield or goggles if there is a potential of splashing of radioactive liquids) and radiation badges, if applicable when handling radioactivity.
- NO eating, drinking, storage of food, smoking, or applying make-up in rooms containing radioactive materials.
- Handle potentially volatile radioactive compounds or ones that may become airborne as an aerosol in a fume hood and/or use activated charcoal if applicable.
- NEVER pipet radioactive materials by mouth.
- Work over absorbent material and/or containment devices when radioactive materials are used.
- Follow the VA radiation safety procedures (e.g., ordering, use, disposal, monitoring) and perform the required documentation.
- Report and respond to radioactive spills as outlined in the VA radiation safety procedures.

4. References

1. *The Health Physics and Radiological Health Handbook* Revised Edition © 1992 Edited by Bernard Shleien, Scinta, Inc., Silver Spring, MD.
2. Title 10 of Code of Federal Regulations (CFR) Part 20 *STANDARDS FOR PROTECTION AGAINST RADIATION*
3. NUREG-1556, Vol. 11 *Program-Specific Guidance About Licenses of Broad Scope* (Appendix K Radionuclides Classified According to Relative Toxicity)

5. Links to Other Radionuclide Information Sources

1. *Safe Handling Guide* (Carbon-14 Handling Precautions) by Perkin Elmer
2. *10 Golden Rules* (for Working with Radioactivity) by Amersham/GE Healthcare
3. *Working with Radioactivity Safely* by Amersham/GE Healthcare
4. *Radiochemical Decomposition - A Guide to the Properties and Storage of Radiolabelled Compounds* by Amersham/GE Healthcare

6. Questions or Comments Concerning this Radionuclide

For any questions or comments concerning this radionuclide, please contact the VA Radiation Safety Office via e-mail (vhalex.radiationSafetyOffice@va.gov) or ext. 5929.

Rev. 08/08 - MTH
VAMC
Lexington, KY

Hydrogen-3 (H-3) or Tritium
Radionuclide Information Sheet

Note: Specific data and information concerning the above radionuclide is in blue bold Arial font.
Data can be entered in cells that are shaded in green.
Cells with calculations based on this data input will be shaded in red.

1. Decay Characteristics

Mode of Decay: Beta

Mass Number (A): 3

Atomic Number (Z): 1

Decays to: Helium-3 (He-3; stable)

Half-Life ($T_{1/2}$)(1): 12.28 years

Exponential Decay: $A_t = A_0 e^{-(\ln 2/T_{1/2})*t}$ **or**

Fraction of Activity Remaining $= e^{-(\ln 2/T_{1/2})*t}$

where A_t is the activity remaining after time t, A_0 is the initial known activity at time 0, ln2 is the natural log of 2 (i.e., 0.693147), $T_{1/2}$ is the half-life, and t is the time period in the same units as $T_{1/2}$

Activity Calculator:

Known Activity			Decayed Activity	
Enter Activity #	Select Unit	Enter Date of Activity	Enter Date to Decay to	Calculated Activity
A_0		$Date_0$	$Date_t$	A_t
$t = Date_t - Date_0 =$				

Decay Chart:

Time t in # of Years	Time t in # of Months: 0	2	4	6	8	10
0	1.0000000	0.9906366	0.9813608	0.9721719	0.9630691	0.9540515
1	0.9451183	0.9362687	0.9275020	0.9188175	0.9102142	0.9016915
2	0.8932485	0.8848847	0.8765991	0.8683912	0.8602600	0.8522051
3	0.8442255	0.8363207	0.8284898	0.8207323	0.8130475	0.8054346
4	0.7978929	0.7904219	0.7830209	0.7756891	0.7684260	0.7612309
5	0.7541032	0.7470422	0.7400473	0.7331180	0.7262535	0.7194533
6	0.7127167	0.7060432	0.6994323	0.6928832	0.6863954	0.6799684
7	0.6736016	0.6672944	0.6610462	0.6548565	0.6487249	0.6426506
8	0.6366332	0.6306721	0.6247668	0.6189169	0.6131217	0.6073808
9	0.6016936	0.5960597	0.5904786	0.5849497	0.5794725	0.5740467
10	0.5686716	0.5633469	0.5580721	0.5528466	0.5476701	0.5425420
11	0.5374620	0.5324295	0.5274441	0.5225054	0.5176130	0.5127664
12	0.5079651	0.5032088	0.4984971	0.4938294	0.4892055	0.4846248
13	0.4800871	0.4755918	0.4711387	0.4667272	0.4623570	0.4580278

Fraction of Activity Remaining after Time t (i.e., $e^{-(\ln 2/T1/2)*t}$)

Note: If time t is before the known activity date, use the reciprocal of the above fraction (e.g., 18 months prior, i.e., 1 year and 6 months = 1/0.9188175 = 1.0883554) **or use the following "Fraction of Activity Remaining Calculator" by entering the # of months as a negative number (e.g., -18).**

Fraction of Activity Remaining Calculator:

Enter Time t in months	Fraction of Activity Remaining after Time t

Activity Unit Conversion:

Ci	=	curie	Bq	=	becquerel
1 Ci	=	1000 mCi (millicurie)	1000 Bq	=	1 kBq (kilobecquerel)
1 mCi	=	1000 μCi (microcurie)	1000 kBq	=	1 MBq (megabecquerel)
1 μCi	=	1000 nCi (nanocurie)	1000 MBq	=	1 GBq (gigabecquerel)
dpm	=	disintegrations/minute	dps	=	disintegrations/second

1 Ci	=	37 GBq	=	2.22×10^{12} dpm	=	3.7×10^{10} dps (Bq)
1 mCi	=	37 MBq	=	2.22×10^{9} dpm	=	3.7×10^{7} dps (Bq)
1 μCi	=	37 kBq	=	2.22×10^{6} dpm	=	3.7×10^{4} dps (Bq)
1 nCi	=	37 Bq	=	2.22×10^{3} dpm	=	37 dps (Bq)
1 Bq	=	$0.\overline{027}$ nCi	=	60 dpm	=	1 dps
1 kBq	=	$0.\overline{027}$ μCi	=	6.0×10^{4} dpm	=	10^{3} dps (Bq)
1 MBq	=	$0.\overline{027}$ mCi	=	6.0×10^{7} dpm	=	10^{6} dps (Bq)
1 GBq	=	$0.\overline{027}$ Ci	=	6.0×10^{10} dpm	=	10^{9} dps (Bq)

Activity Unit Calculator:

	Enter Activity #	Select Unit	Calculated Activity	Calculated Activity	Calculated Activity
from "_Ci":					
from "_Bq":					
from "dp_":					

Primary Emissions[1]:

Beta Energy - Maximum (keV)	Beta Energy - Average (keV)	Beta Probability per Decay	Electron Energy (keV)	Electron Probability per Decay	Photon (Gamma & X-ray) Energy (keV)	Photon Probability per Decay
18.601	5.685	1.000000	No Electron Emissions		No Photon Emissions	

H-3 emission data plus decay scheme from Brookhaven National Laboratory's *Chart of Nuclides*

2. Exposure Characteristics

Radiation Exposure & Dose Units:

Roentgen (R) is the unit of gamma or x-ray exposure in air that is expressed by the amount of ionizations that occur. One roentgen produces a charge equal to 2.58×10^{-4} coulombs/kg of air at STP (standard temperature and pressure) where 1 coulomb = 1 C = 6.28×10^{18} electronic charges.

Rad (radiation absorbed dose) is the unit of absorbed dose. One rad is equal to an absorbed dose of 100 ergs/g or 0.01 joule/kg (i.e., 0.01 gray). For photons (i.e., gamma and/or x-rays), 1 R ~ 1 rad.

Rem (roentgen equivalent in man) is the unit of any of the quantities expressed as dose equivalent (1 rem = 0.01 sievert = 0.01 Sv). The dose equivalent in rems is equal to the absorbed dose in rads multiplied by the quality factor. The quality factor for photon (i.e., gamma and/or x-rays) or beta radiation is equal to 1 (i.e., 1 rad = 1 rem).

Annual Occupational Dose Limits[2]:

Total Effective Dose Equivalent = Deep Dose Equivalent (DDE) from Whole Body External Exposure plus Committed Effective Dose Equivalent from Internal Exposure	**5,000 mrem (5 rem)**
Deep Dose Equivalent plus Committed Dose Equivalent to Any Individual Organ or Tissue other than the Lens of the Eye	**50,000 mrem (50 rem)**
Lens of the Eye Dose Equivalent (LDE)	**15,000 mrem (15 rem)**
Shallow Dose Equivalent to Skin of Whole Body (SDE-WB) or to any Extremity (SDE-E)	**50,000 mrem (50 rem)**

External Exposure:

Beta Dose Rate[1]:

	Activity (µCi)	Unshielded Point Source in Air Calculated Dose Rates (mrad/hr) @ 0.3 cm (0.12 in)	@ 0.4 cm (0.16 in)	@ 0.5 cm (0.20 in)	
Enter µCi:					Other dose rates at different distances are available. Contact the VA Radiation Safety Office via the link at end of this sheet.
	10	41,687	4,995	281	
	100	416,867	49,950	2,812	
	250	1,042,167	124,875	7,030	
	500	2,084,333	249,750	14,060	
	750	3,126,500	374,625	21,090	
	1000	4,168,667	499,500	28,120	
	2500	10,421,667	1,248,750	70,300	
	5000	20,843,333	2,497,500	140,600	

Beta Range[1]: $R = 0.412E^{1.265 - 0.0954 \ln E}$

where R is beta range in g/cm^2 (i.e., range in cm (r) times the density of the material in g/cm^3), E is the maximum beta energy in MeV (i.e., $0.01 \leq E \leq 2.5$ MeV), and lnE is the natural log of E

Material	in air	in water	in acrylic	Enter density of material :g/cm^3
density (g/cm^3)	0.001205	1.00	1.19	
beta range in cm (r)	0.5	0.0006	0.0005	
beta range in in. (r)	0.2	0.0002	0.0002	

Internal Exposure:

Annual Limit on Intake[2]:

Annual Limit on Intake (ALI) means the derived limit for the amount of radioactive material taken into the body of an adult worker by inhalation or ingestion in a year. ALI is the smaller value of intake of a given radionuclide in a year by the reference man that would result in a committed effective dose equivalent (CEDE) of 5 rems or a committed dose equivalent (CDE) of 50 rems to any individual organ or tissue. Class for inhalation may be separated by range of clearance half-times: Class D for <10 days, Class W for 10-100 days, and Class Y for >100 days.

Derived Air Concentration[2]:

Derived air concentration (DAC) means the concentration of a given radionuclide in air which, if breathed by the reference man for a working year of 2,000 hours under conditions of light work (i.e., inhalation rate 1.2 cubic meters of air per hour), results in an intake of one ALI.

Class	Oral Ingestion ALI (µCi)	Inhalation	
		ALI (µCi)	DAC (µCi/ml)
Water, DAC includes skin absorption	80,000 for CEDE	80,000 for CEDE	2.0×10^{-5}

Taken from 10 CFR 20[2] Appendix B, Table 1 Occupational Values, columns 1-3.

Recommended Activity Limits Based Radiotoxicity and Type of Workplace[1]:

Radio-nuclide	Group #	Radionuclide Radiotoxicity	Type of Workplace Required		
			Type I (C)	Type II (B)	Type III (A)
	1	Very High	≤ 13.5 µCi (≤ 500 kBq)	13.5 µCi - 13.5 mCi (500 kBq - 500 MBq)	≥ 13.5 mCi (≥ 500 MBq)
	2	High	≤ 135 µCi (≤ 5 MBq)	135 µCi - 135 mCi (5 MBq - 5 GBq)	≥ 135 mCi (≥ 5 GBq)
	3	Moderate	≤ 1.35 mCi (≤ 50 MBq)	1.35 mCi - 1.35 Ci (50 MBq - 50 GBq)	≥ 1.35 Ci (≥ 50 GBq)
H-3	4	Low	≤ 13.5 mCi (≤ 500 MBq)	13.5 mCi - 13.5 Ci (500 MBq - 500 GBq)	≥ 13.5 Ci (≥ 500 GBq)

Where Type I (C) is similar to a good quality modern chemical laboratory, Type II (B) is a specially designed laboratory for work with radionuclides, and Type III (A) specially designed laboratory for handling large activities of highly radioactive materials. The above limits are based on normal operations. In case of a conventional modern chemical laboratory with adequate ventilation and non-porous work surfaces, the upper limits of Type I (C) workplace may be increased toward the limits for Type II (B) workplaces for low (4) and moderate (3) radiotoxicity groups[3].

Monitoring to be Done:

Staff:
- Radiation badges are not required for H-3 work because it does not present an external exposure hazard since its low energy beta emissions do not penetrate the outer dead layer of skin.
- Bioassays for the determination of CEDE, if applicable (i.e., situations with potential for internal intake, e.g., spill, staff contamination).
- See below work area monitoring equipment that can also be used to evaluate staff contamination.

Work Area:
- Scintillation counter (i.e., liquid scintillation - beta counter) for the evaluation of removable surface contamination.

3. Basic Radiation Safety Precautions

- Use the basic principles of radiation safety: TIME, DISTANCE, and SHIELDING.
  - Shielding is not required for H-3 (i.e., beta range in air is <0.6 cm (<0.25 in) and <0.005 mm in acrylic).
- Wear the proper PPE (Personal Protective Equipment, e.g., lab coat, disposable gloves, face shield or goggles if there is a potential of splashing of radioactive liquids) and radiation badges, if applicable when handling radioactivity.
- NO eating, drinking, storage of food, smoking, or applying make-up in rooms containing radioactive materials.
- Handle potentially volatile radioactive compounds or ones that may become airborne as an aerosol in a fume hood and/or use activated charcoal if applicable.
- NEVER pipet radioactive materials by mouth.
- Work over absorbent material and/or containment devices when radioactive materials are used.
- Follow the VA radiation safety procedures (e.g., ordering, use, disposal, monitoring) and perform the required documentation.
- Report and respond to radioactive spills as outlined in the VA radiation safety procedures.

4. References

1. *The Health Physics and Radiological Health Handbook* Revised Edition © 1992 Edited by Bernard Shleien, Scinta, Inc., Silver Spring, MD.
2. Title 10 of Code of Federal Regulations (CFR) Part 20 *STANDARDS FOR PROTECTION AGAINST RADIATION*
3. NUREG-1556, Vol. 11 *Program-Specific Guidance About Licenses of Broad Scope* (Appendix K Radionuclides Classified According to Relative Toxicity)

5. Links to Other Radionuclide Information Sources

1. *Safe Handling Guide* (Tritium Handling Precautions) by Perkin Elmer
2. *10 Golden Rules* (for Working with Radioactivity) by Amersham/GE Healthcare
3. *Working with Radioactivity Safely* by Amersham/GE Healthcare
4. *Radiochemical Decomposition - A Guide to the Properties and Storage of Radiolabelled Compounds* by Amersham/GE Healthcare

6. Questions or Comments Concerning this Radionuclide

For any questions or comments concerning this radionuclide, please contact the VA Radiation Safety Office via e-mail (vhalex.radiationSafetyOffice@va.gov) or ext. 5929.

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VAMC
Lexington, KY

Phosphorus-32 (P-32)
Radionuclide Information Sheet

Note: Specific data and information concerning the above radionuclide is in blue bold Arial font.
Data can be entered in cells that are shaded in green.
Cells with calculations based on this data input will be shaded in red.

1. Decay Characteristics

Mode of Decay: Beta

Mass Number (A): 32

Atomic Number (Z): 15

Decays to: Sulfur-32 (S-32; stable)

Half-Life ($T_{1/2}$)[1]: 14.29 days

Exponential Decay: $A_t = A_0 e^{-(\ln 2/T_{1/2})*t}$ **or**

Fraction of Activity Remaining $= e^{-(\ln 2/T_{1/2})*t}$

where A_t is the activity remaining after time t, A_0 is the initial known activity at time 0, ln2 is the natural log of 2 (i.e., 0.693147), $T_{1/2}$ is the half-life, and t is the time period in the same units as $T_{1/2}$

Activity Calculator:

Known Activity			Decayed Activity	
Enter Activity #	Select Unit	Enter Date of Activity	Enter Date to Decay to	Calculated Activity
A_0		$Date_0$	$Date_t$	A_t
$t = Date_t - Date_0 =$				

Decay Chart:

Time t in # of Weeks	Time t in # of Days: 0	1	2	3	4	5	6
0	1.0000000	0.9526519	0.9075456	0.8645750	0.8236390	0.7846412	0.7474899
1	0.7120976	0.6783811	0.6462610	0.6156618	0.5865113	0.5587411	0.5322858
2	0.5070830	0.4830736	0.4602010	0.4384113	0.4176533	0.3978782	0.3790394
3	0.3610926	0.3439956	0.3277080	0.3121916	0.2974100	0.2833281	0.2699131
4	0.2571332	0.2449584	0.2333601	0.2223109	0.2117849	0.2017573	0.1922045
5	0.1831039	0.1744343	0.1661752	0.1583071	0.1508115	0.1436709	0.1368683
6	0.1303879	0.1242143	0.1183329	0.1127301	0.1073925	0.1023077	0.0974636
7	0.0928489	0.0884527	0.0842646	0.0802748	0.0764740	0.0728531	0.0694036
8	0.0661175	0.0629869	0.0600046	0.0571635	0.0544569	0.0518785	0.0494222
9	0.0470821	0.0448529	0.0427292	0.0407060	0.0387787	0.0369426	0.0351934
10	0.0335271	0.0319396	0.0304273	0.0289867	0.0276142	0.0263067	0.0250611
11	0.0238745	0.0227441	0.0216672	0.0206413	0.0196640	0.0187329	0.0178460
12	0.0170010	0.0161960	0.0154292	0.0146986	0.0140027	0.0133397	0.0127081
13	0.0121064	0.0115332	0.0109871	0.0104669	0.0099713	0.0094992	0.0090494

Fraction of Activity Remaining after Time t (i.e., $e^{-(\ln 2/T_{1/2})*t}$)

Note: If time t is before the known activity date, use the reciprocal of the above fraction (e.g., 10 days prior, i.e., 1 week and 3 days = 1/0.6156618 = 1.6242684) **or use the following "Fraction of Activity Remaining Calculator" by entering the # of days as a negative number (e.g., -10).**

Fraction of Activity Remaining Calculator:

Enter Time t in days	Fraction of Activity Remaining after Time t

Activity Unit Conversion:

Ci	=	curie	Bq	=	becquerel
1 Ci	=	1000 mCi (millicurie)	1000 Bq	=	1 kBq (kilobecquerel)
1 mCi	=	1000 μCi (microcurie)	1000 kBq	=	1 MBq (megabecquerel)
1 μCi	=	1000 nCi (nanocurie)	1000 MBq	=	1 GBq (gigabecquerel)
dpm	=	disintegrations/minute	dps	=	disintegrations/second

1 Ci	=	37 GBq	=	2.22×10^{12} dpm	=	3.7×10^{10} dps (Bq)
1 mCi	=	37 MBq	=	2.22×10^{9} dpm	=	3.7×10^{7} dps (Bq)
1 μCi	=	37 kBq	=	2.22×10^{6} dpm	=	3.7×10^{4} dps (Bq)
1 nCi	=	37 Bq	=	2.22×10^{3} dpm	=	37 dps (Bq)

1 Bq	=	$0.\overline{027}$ nCi	=	60 dpm	=	1 dps
1 kBq	=	$0.\overline{027}$ μCi	=	6.0×10^{4} dpm	=	10^{3} dps (Bq)
1 MBq	=	$0.\overline{027}$ mCi	=	6.0×10^{7} dpm	=	10^{6} dps (Bq)
1 GBq	=	$0.\overline{027}$ Ci	=	6.0×10^{10} dpm	=	10^{9} dps (Bq)

Activity Unit Calculator:

	Enter Activity #	Select Unit	Calculated Activity	Calculated Activity	Calculated Activity
from "_Ci":					
from "_Bq":					
from "dp_":					

Primary Emissions[1]:

Beta Energy - Maximum (keV)	Beta Energy - Average (keV)	Beta Probability per Decay	Electron Energy (keV)	Electron Probability per Decay	Photon (Gamma & X-ray) Energy (keV)	Photon Probability per Decay
1,710.400	694.900	1.000000	No Electron Emissions		No Photon Emissions	

P-32 emission data plus decay scheme from Brookhaven National Laboratory's *Chart of Nuclides*

2. Exposure Characteristics

Radiation Exposure & Dose Units:

Roentgen (R) is the unit of gamma or x-ray exposure in air that is expressed by the amount of ionizations that occur. One roentgen produces a charge equal to 2.58×10^{-4} coulombs/kg of air at STP (standard temperature and pressure) where 1 coulomb = 1 C = 6.28×10^{18} electronic charges.

Rad (radiation absorbed dose) is the unit of absorbed dose. One rad is equal to an absorbed dose of 100 ergs/g or 0.01 joule/kg (i.e., 0.01 gray). For photons (i.e., gamma and/or x-rays), 1 R ~ 1 rad.

Rem (roentgen equivalent in man) is the unit of any of the quantities expressed as dose equivalent (1 rem = 0.01 sievert = 0.01 Sv). The dose equivalent in rems is equal to the absorbed dose in rads multiplied by the quality factor. The quality factor for photon (i.e., gamma and/or x-rays) or beta radiation is equal to 1 (i.e., 1 rad = 1 rem).

Annual Occupational Dose Limits[2]:

Total Effective Dose Equivalent = Deep Dose Equivalent (DDE) from Whole Body External Exposure plus Committed Effective Dose Equivalent from Internal Exposure	**5,000 mrem (5 rem)**
Deep Dose Equivalent plus Committed Dose Equivalent to Any Individual Organ or Tissue other than the Lens of the Eye	**50,000 mrem (50 rem)**
Lens of the Eye Dose Equivalent (LDE)	**15,000 mrem (15 rem)**
Shallow Dose Equivalent to Skin of Whole Body (SDE-WB) or to any Extremity (SDE-E)	**50,000 mrem (50 rem)**

External Exposure:

Beta Dose Rate[1]:

	Activity (µCi)	Unshielded Point Source in Air Calculated Dose Rates (mrad/hr) @ 6 cm (2.4 in)	@ 30 cm (11.8 in)	@ 90 cm (3.0 ft)	
Enter µCi:					Other dose rates at different distances are available. Contact the VA Radiation Safety Office via the link at end of this sheet.
	10	95	3.9	0.4	
	100	954	39.0	4.3	
	250	2,384	97.5	10.7	
	500	4,769	195.1	21.3	
	750	7,153	292.6	32.0	
	1000	9,538	390.1	42.7	
	2500	23,844	975.4	106.7	
	5000	47,689	1,950.7	213.3	

Beta Range[1]: $R = 0.412E^{1.265 - 0.0954 \ln E}$

where R is beta range in g/cm^2 (i.e., range in cm (r) times the density of the material in g/cm^3), E is the maximum beta energy in MeV (i.e., $0.01 \leq E \leq 2.5$ MeV), and lnE is the natural log of E

Material	in air	in water	in acrylic	Enter density of material :g/cm^3
density (g/cm^3)	0.001205	1.00	1.19	
beta range in cm (r)	656	0.8	0.7	
beta range in in. (r)	258	0.3	0.3	

Internal Exposure:

Annual Limit on Intake[2]:

Annual Limit on Intake (ALI) means the derived limit for the amount of radioactive material taken into the body of an adult worker by inhalation or ingestion in a year. ALI is the smaller value of intake of a given radionuclide in a year by the reference man that would result in a committed effective dose equivalent (CEDE) of 5 rems or a committed dose equivalent (CDE) of 50 rems to any individual organ or tissue. Class for inhalation may be separated by range of clearance half-times: Class D for <10 days, Class W for 10-100 days, and Class Y for >100 days.

Derived Air Concentration[2]:

Derived air concentration (DAC) means the concentration of a given radionuclide in air which, if breathed by the reference man for a working year of 2,000 hours under conditions of light work (i.e., inhalation rate 1.2 cubic meters of air per hour), results in an intake of one ALI.

Class	Oral Ingestion ALI (µCi)	Inhalation	
		ALI (µCi)	DAC (µCi/ml)
D, all compounds except phosphates given for W	600 for CEDE	900 for CEDE	4.0×10^{-7}
W, phosphates of Zn^{2+}, S^{3+}, Mg^{2+}, Fe^{3+}, Bi^{3+}, and lanthanides*	-	400 for CEDE	2.0×10^{-7}

Taken from 10 CFR 20[2] Appendix B, Table 1 Occupational Values, columns 1-3.

*Complete listing of lanthanides from National Institute of Standards and Technology's *Periodic Table*

Recommended Activity Limits Based Radiotoxicity and Type of Workplace[1]:

Radio-nuclide	Group #	Radionuclide Radiotoxicity	Type of Workplace Required		
			Type I (C)	Type II (B)	Type III (A)
	1	Very High	≤ 13.5 µCi (≤ 500 kBq)	13.5 µCi - 13.5 mCi (500 kBq - 500 MBq)	≥ 13.5 mCi (≥ 500 MBq)
	2	High	≤ 135 µCi (≤ 5 MBq)	135 µCi - 135 mCi (5 MBq - 5 GBq)	≥ 135 mCi (≥ 5 GBq)
P-32	3	Moderate	≤ 1.35 mCi (≤ 50 MBq)	1.35 mCi - 1.35 Ci (50 MBq - 50 GBq)	≥ 1.35 Ci (≥ 50 GBq)
	4	Low	≤ 13.5 mCi (≤ 500 MBq)	13.5 mCi - 13.5 Ci (500 MBq - 500 GBq)	≥ 13.5 Ci (≥ 500 GBq)

Where Type I (C) is similar to a good quality modern chemical laboratory, Type II (B) is a specially designed laboratory for work with radionuclides, and Type III (A) specially designed laboratory for handling large activities of highly radioactive materials. The above limits are based on normal operations. In case of a conventional modern chemical laboratory with adequate ventilation and non-porous work surfaces, the upper limits of Type I (C) workplace may be increased toward the limits for Type II (B) workplaces for low (4) and moderate (3) radiotoxicity groups[3].

Monitoring to be Done:

Staff:
- Whole body radiation badge for the determination of DDE, LDE, and SDE-WB.
- Ring radiation badge for the determination of SDE-E, if applicable (i.e., dependant on amounts used & frequency of use).
- Bioassays for the determination of CEDE, if applicable (i.e., situations with potential for internal intake, e.g., spill, staff contamination).
- See below work area monitoring equipment that can also be used to evaluate staff contamination.

Work Area:
- Survey meter with thin-window G-M probe (e.g., pancake, end window) for the evaluation of ambient exposure levels and gross surface contamination.
- Scintillation counter (i.e., liquid scintillation - beta counter) for the evaluation of removable surface contamination.

3. Basic Radiation Safety Precautions

- Use the basic principles of radiation safety: TIME, DISTANCE, and SHIELDING.
  - Use acrylic (e.g., 3/8 inch thick of Lucite or Plexiglas) for shielding of P-32. For higher activity amounts (e.g., >1mCi), lead shielding should be added to the exterior of the acrylic to attenuate secordary photons (i.e., bremsstrahlung photons).
- Wear the proper PPE (Personal Protective Equipment, e.g., lab coat, disposable gloves, face shield or goggles if there is a potential of splashing of radioactive liquids) and radiation badges, if applicable when handling radioactivity.
- NO eating, drinking, storage of food, smoking, or applying make-up in rooms containing radioactive materials.
- Handle potentially volatile radioactive compounds or ones that may become airborne as an aerosol in a fume hood and/or use activated charcoal if applicable.
- NEVER pipet radioactive materials by mouth.
- Work over absorbent material and/or containment devices when radioactive materials are used.
- Follow the VA radiation safety procedures (e.g., ordering, use, disposal, monitoring) and perform the required documentation.
- Report and respond to radioactive spills as outlined in the VA radiation safety procedures.

4. References

1. *The Health Physics and Radiological Health Handbook* Revised Edition © 1992 Edited by Bernard Shleien, Scinta, Inc., Silver Spring, MD.
2. Title 10 of Code of Federal Regulations (CFR) Part 20 *STANDARDS FOR PROTECTION AGAINST RADIATION*
3. NUREG-1556, Vol. 11 *Program-Specific Guidance About Licenses of Broad Scope* (Appendix K Radionuclides Classified According to Relative Toxicity)

5. Links to Other Radionuclide Information Sources

1. *Safe Handling Guide* (Phosphorus-32 Handling Precautions) by Perkin Elmer
2. *10 Golden Rules* (for Working with Radioactivity) by Amersham/GE Healthcare
3. *Working with Radioactivity Safely* by Amersham/GE Healthcare
4. *Radiochemical Decomposition - A Guide to the Properties and Storage of Radiolabelled Compounds* by Amersham/GE Healthcare

6. Questions or Comments Concerning this Radionuclide

For any questions or comments concerning this radionuclide, please contact the VA Radiation Safety Office via e-mail (vhalex.radiationSafetyOffice@va.gov) or ext. 5929.

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Sulfur-35 (S-35)
Radionuclide Information Sheet

Note: Specific data and information concerning the above radionuclide is in blue bold Arial font.
Data can be entered in cells that are shaded in green.
Cells with calculations based on this data input will be shaded in red.

1. Decay Characteristics

Mode of Decay: Beta

Mass Number (A): 35

Atomic Number (Z): 16

Decays to: Chlorine-35 (Cl-35; stable)

Half-Life ($T_{1/2}$)[1]: 87.44 days

Exponential Decay: $A_t = A_0 e^{-(\ln 2/T_{1/2})*t}$ or

Fraction of Activity Remaining $= e^{-(\ln 2/T_{1/2})*t}$

where A_t is the activity remaining after time t, A_0 is the initial known activity at time 0, ln2 is the natural log of 2 (i.e., 0.693147), $T_{1/2}$ is the half-life, and t is the time period in the same units as $T_{1/2}$

Activity Calculator:

Known Activity			Decayed Activity	
Enter Activity #	Select Unit	Enter Date of Activity	Enter Date to Decay to	Calculated Activity
A_0		$Date_0$	$Date_t$	A_t
$t = Date_t - Date_0 =$				

Decay Chart:

Time t in # of Weeks	Time t in # of Days: 0	1	2	3	4	5	6
0	1.0000000	0.9921042	0.9842708	0.9764992	0.9687890	0.9611396	0.9535507
1	0.9460216	0.9385521	0.9311415	0.9237894	0.9164953	0.9092589	0.9020796
2	0.8949570	0.8878906	0.8808800	0.8739248	0.8670244	0.8601786	0.8533868
3	0.8466487	0.8399637	0.8333315	0.8267517	0.8202239	0.8137476	0.8073224
4	0.8009480	0.7946239	0.7883497	0.7821250	0.7759496	0.7698228	0.7637445
5	0.7577141	0.7517314	0.7457959	0.7399072	0.7340651	0.7282691	0.7225188
6	0.7168140	0.7111541	0.7055390	0.6999683	0.6944415	0.6889583	0.6835184
7	0.6781215	0.6727672	0.6674552	0.6621851	0.6569567	0.6517695	0.6466232
8	0.6415176	0.6364524	0.6314271	0.6264415	0.6214952	0.6165880	0.6117196
9	0.6068896	0.6020977	0.5973437	0.5926272	0.5879479	0.5833056	0.5787000
10	0.5741307	0.5695975	0.5651001	0.5606381	0.5562115	0.5518197	0.5474627
11	0.5431401	0.5388515	0.5345969	0.5303758	0.5261881	0.5220334	0.5179116
12	0.5138222	0.5097652	0.5057402	0.5017470	0.4977853	0.4938549	0.4899556
13	0.4860870	0.4822489	0.4784412	0.4746635	0.4709157	0.4671974	0.4635086

Fraction of Activity Remaining after Time t (i.e., $e^{-(\ln 2/T_{1/2})*t}$)

Note: If time t is before the known activity date, use the reciprocal of the above fraction (e.g., 10 days prior, i.e., 1 week and 3 days = 1/0.9237894 = 1.0824978)**or use the following "Fraction of Activity Remaining Calculator" by entering the # of days as a negative number (e.g., -10).**

Fraction of Activity Remaining Calculator:

Enter Time t in days	Fraction of Activity Remaining after Time t

Activity Unit Conversion:

Ci	=	curie	Bq	=	becquerel
1 Ci	=	1000 mCi (millicurie)	1000 Bq	=	1 kBq (kilobecquerel)
1 mCi	=	1000 μCi (microcurie)	1000 kBq	=	1 MBq (megabecquerel)
1 μCi	=	1000 nCi (nanocurie)	1000 MBq	=	1 GBq (gigabecquerel)
dpm	=	disintegrations/minute	dps	=	disintegrations/second

1 Ci	=	37 GBq	=	2.22×10^{12} dpm	=	3.7×10^{10} dps (Bq)
1 mCi	=	37 MBq	=	2.22×10^{9} dpm	=	3.7×10^{7} dps (Bq)
1 μCi	=	37 kBq	=	2.22×10^{6} dpm	=	3.7×10^{4} dps (Bq)
1 nCi	=	37 Bq	=	2.22×10^{3} dpm	=	37 dps (Bq)
1 Bq	=	$0.\overline{027}$ nCi	=	60 dpm	=	1 dps
1 kBq	=	$0.\overline{027}$ μCi	=	6.0×10^{4} dpm	=	10^{3} dps (Bq)
1 MBq	=	$0.\overline{027}$ mCi	=	6.0×10^{7} dpm	=	10^{6} dps (Bq)
1 GBq	=	$0.\overline{027}$ Ci	=	6.0×10^{10} dpm	=	10^{9} dps (Bq)

Activity Unit Calculator:

	Enter Activity #	Select Unit	Calculated Activity	Calculated Activity	Calculated Activity
from "_Ci":					
from "_Bq":					
from "dp_":					

Primary Emissions[1]:

Beta Energy - Maximum (keV)	Beta Energy - Average (keV)	Beta Probability per Decay	Electron Energy (keV)	Electron Probability per Decay	Photon (Gamma & X-ray) Energy (keV)	Photon Probability per Decay
167.470	48.830	1.000000	No Electron	Emissions	No Photon	Emissions

S-35 emission data plus decay scheme from Brookhaven National Laboratory's *Chart of Nuclides*

2. Exposure Characteristics

Radiation Exposure & Dose Units:

Roentgen (R) is the unit of gamma or x-ray exposure in air that is expressed by the amount of ionizations that occur. One roentgen produces a charge equal to 2.58×10^{-4} coulombs/kg of air at STP (standard temperature and pressure) where 1 coulomb = 1 C = 6.28×10^{18} electronic charges.

Rad (radiation absorbed dose) is the unit of absorbed dose. One rad is equal to an absorbed dose of 100 ergs/g or 0.01 joule/kg (i.e., 0.01 gray). For photons (i.e., gamma and/or x-rays), 1 R ~ 1 rad.

Rem (roentgen equivalent in man) is the unit of any of the quantities expressed as dose equivalent (1 rem = 0.01 sievert = 0.01 Sv). The dose equivalent in rems is equal to the absorbed dose in rads multiplied by the quality factor. The quality factor for photon (i.e., gamma and/or x-rays) or beta radiation is equal to 1 (i.e., 1 rad = 1 rem).

Annual Occupational Dose Limits[2]:

Total Effective Dose Equivalent = Deep Dose Equivalent (DDE) from Whole Body External Exposure plus Committed Effective Dose Equivalent from Internal Exposure	**5,000 mrem (5 rem)**
Deep Dose Equivalent plus Committed Dose Equivalent to Any Individual Organ or Tissue other than the Lens of the Eye	**50,000 mrem (50 rem)**
Lens of the Eye Dose Equivalent (LDE)	**15,000 mrem (15 rem)**
Shallow Dose Equivalent to Skin of Whole Body (SDE-WB) or to any Extremity (SDE-E)	**50,000 mrem (50 rem)**

External Exposure:

Beta Dose Rate[1]:

	Activity (µCi)	Unshielded Point Source in Air Calculated Dose Rates (mrad/hr) @ 1 cm (0.4 in)	@ 6 cm (2.4 in)	@ 20 cm (7.9 in)	
Enter µCi:					Other dose rates at different distances are available. Contact the VA Radiation Safety Office via the link at end of this sheet.
	10	11,736	119	0.2	
	100	117,364	1,192	1.6	
	250	293,410	2,981	3.9	
	500	586,820	5,961	7.9	
	750	880,230	8,942	11.8	
	1000	1,173,640	11,922	15.7	
	2500	2,934,100	29,806	39.3	
	5000	5,868,200	59,611	78.6	

Beta Range[1]: $R = 0.412E^{1.265 - 0.0954 \ln E}$

where R is beta range in g/cm^2 (i.e., range in cm (r) times the density of the material in g/cm^3), E is the maximum beta energy in MeV (i.e., $0.01 \leq E \leq 2.5$ MeV), and lnE is the natural log of E

Material	in air	in water	in acrylic	Enter density of material :g/cm^3
density (g/cm^3)	0.001205	1.00	1.19	
beta range in cm (r)	26.3	0.03	0.03	
beta range in in. (r)	10.4	0.01	0.01	

Internal Exposure:

Annual Limit on Intake[2]:

Annual Limit on Intake (ALI) means the derived limit for the amount of radioactive material taken into the body of an adult worker by inhalation or ingestion in a year. ALI is the smaller value of intake of a given radionuclide in a year by the reference man that would result in a committed effective dose equivalent (CEDE) of 5 rems or a committed dose equivalent (CDE) of 50 rems to any individual organ or tissue. Class for inhalation may be separated by range of clearance half-times: Class D for <10 days, Class W for 10-100 days, and Class Y for >100 days.

Derived Air Concentration[2]:

Derived air concentration (DAC) means the concentration of a given radionuclide in air which, if breathed by the reference man for a working year of 2,000 hours under conditions of light work (i.e., inhalation rate 1.2 cubic meters of air per hour), results in an intake of one ALI.

Class	Oral Ingestion ALI (µCi)	Inhalation	
		ALI (µCi)	DAC (µCi/ml)
Vapor	-	10,000 for CEDE	6.0×10^{-6}
D, sulfides and sulfates except those given for W	10,000 for Lower Large Intestine Wall CDE	20,000 for CEDE	7.0×10^{-6}
	(8,000 for CEDE)	-	-
W, elemental sulfur, sulfides of Sr, Ba, Ge, Sn, Pb, As, Sb, Bi, Cu, Ag, Au, Zn, Cd, Hg, W, and Mo, sulfates of Ca, Sr, Ba, Ra, As, Sb, and Bi	6,000 for CEDE	2,000 for CEDE	9.0×10^{-7}

Taken from 10 CFR 20[2] Appendix B, Table 1 Occupational Values, columns 1-3.

Recommended Activity Limits Based Radiotoxicity and Type of Workplace[1]:

Radio-nuclide	Group #	Radionuclide Radiotoxicity	Type of Workplace Required		
			Type I (C)	Type II (B)	Type III (A)
	1	Very High	≤ 13.5 µCi (≤ 500 kBq)	13.5 µCi - 13.5 mCi (500 kBq - 500 MBq)	≥ 13.5 mCi (≥ 500 MBq)
	2	High	≤ 135 µCi (≤ 5 MBq)	135 µCi - 135 mCi (5 MBq - 5 GBq)	≥ 135 mCi (≥ 5 GBq)
S-35	3	Moderate	≤ 1.35 mCi (≤ 50 MBq)	1.35 mCi - 1.35 Ci (50 MBq - 50 GBq)	≥ 1.35 Ci (≥ 50 GBq)
	4	Low	≤ 13.5 mCi (≤ 500 MBq)	13.5 mCi - 13.5 Ci (500 MBq - 500 GBq)	≥ 13.5 Ci (≥ 500 GBq)

Where Type I (C) is similar to a good quality modern chemical laboratory, Type II (B) is a specially designed laboratory for work with radionuclides, and Type III (A) specially designed laboratory for handling large activities of highly radioactive materials. The above limits are based on normal operations. In case of a conventional modern chemical laboratory with adequate ventilation and non-porous work surfaces, the upper limits of Type I (C) workplace may be increased toward the limits for Type II (B) workplaces for low (4) and moderate (3) radiotoxicity groups[3].

Monitoring to be Done:

Staff:
- Radiation badges are not required for S-35 work because it does not present a significant external exposure hazard since its low energy beta emissions barely penetrate the outer dead layer of skin.
- Bioassays for the determination of LLI Wall CDE and CEDE, if applicable (i.e., situations with potential for internal intake, e.g., spill, staff contamination).
- See below work area monitoring equipment that can also be used to evaluate staff contamination.

Work Area:
- Survey meter with thin-window G-M probe (e.g., pancake, end window) for the evaluation of gross surface contamination.
- Scintillation counter (i.e., liquid scintillation - beta counter) for the evaluation of removable surface contamination.

3. Basic Radiation Safety Precautions

- Use the basic principles of radiation safety: TIME, DISTANCE, and SHIELDING.
  - Shielding is not as pertinent for S-35 (i.e., beta range in air is ~26.3 cm (~10.4 in) and <0.5 mm in acrylic).
- Wear the proper PPE (Personal Protective Equipment, e.g., lab coat, disposable gloves, face shield or goggles if there is a potential of splashing of radioactive liquids) and radiation badges, if applicable when handling radioactivity.
- NO eating, drinking, storage of food, smoking, or applying make-up in rooms containing radioactive materials.
- Handle potentially volatile radioactive compounds or ones that may become airborne as an aerosol in a fume hood and/or use activated charcoal if applicable.
  - Some S-35 labeled compounds are more volatile (e.g., methionine) than others. All S-35 labeled compounds should be opened in a fume hood and for the more volatile forms of S-35, work should be done in a fume hood and/or charcoal should be used to minimize airborne contamination.
- NEVER pipet radioactive materials by mouth.
- Work over absorbent material and/or containment devices when radioactive materials are used.
- Follow the VA radiation safety procedures (e.g., ordering, use, disposal, monitoring) and perform the required documentation.
- Report and respond to radioactive spills as outlined in the VA radiation safety procedures.

4. References

1. *The Health Physics and Radiological Health Handbook* Revised Edition © 1992 Edited by Bernard Shleien, Scinta, Inc., Silver Spring, MD.
2. Title 10 of Code of Federal Regulations (CFR) Part 20 *STANDARDS FOR PROTECTION AGAINST RADIATION*
3. NUREG-1556, Vol. 11 *Program-Specific Guidance About Licenses of Broad Scope* (Appendix K Radionuclides Classified According to Relative Toxicity)

5. Links to Other Radionuclide Information Sources

1. *Safe Handling Guide* (Sulfur-35 Handling Precautions) by Perkin Elmer
2. *10 Golden Rules* (for Working with Radioactivity) by Amersham/GE Healthcare
3. *Working with Radioactivity Safely* by Amersham/GE Healthcare
4. *Radiochemical Decomposition - A Guide to the Properties and Storage of Radiolabelled Compounds* by Amersham/GE Healthcare

6. Questions or Comments Concerning this Radionuclide

For any questions or comments concerning this radionuclide, please contact the VA Radiation Safety Office via e-mail (vhalex.radiationSafetyOffice@va.gov) or ext. 5929.

Hackett, Michael

From: Hackett, Michael
Sent: Monday, September 14, 2009 12:25 PM
To: Baker, Cheryl D.; Hackett, Michael; Jacobs, Donna K.; Shih, Wei-Jen; Kiefer, Vickie; Hardin, Shannon B.; Brown, Stephen A.; Morgan, Bert D.; Jones, Jon
Subject: Authorized User Application - Tannock

Importance: High

Radiation Safety Committee members,

As we discussed at the last RSC meeting on August 27, Dr. Tannock had submitted an application to become a new Authorized User (AU) in research. We briefly discussed the application but due to time constraints and the need for air flow measurements on the room and completion of their initial radiation safety training, the RSC postponed final approval until further review of the application and final supporting documentation.

I have created summary sheets for the AU and staff (1) applications with links their completed applications, supporting documentation (e.g., training, room air flow evaluation) and approval criteria.

Summary of AU Application - Tannock

Summary of Staff Application - Wilson

Please carefully review this information. Please use the Voting Buttons on this e-mail to either approve or disapprove these applications. Please do so by COB on Wednesday, September 16.

If you have any questions concerning the applications or have any problems with the links, please contact me. Thank you.

Michael T. Hackett, MS
Radiation Safety Officer
x5929

Tracking:

Recipient	Response
Baker, Cheryl D.	Approve: 9/17/2009 3:40 PM
Hackett, Michael	Approve: 9/14/2009 12:25 PM
Jacobs, Donna K.	Approve: 9/14/2009 3:18 PM
Shih, Wei-Jen	
Kiefer, Vickie	Approve: 9/16/2009 7:54 AM
Hardin, Shannon B.	Approve: 9/16/2009 9:27 AM
Brown, Stephen A.	Approve: 9/15/2009 10:55 AM
Morgan, Bert D.	
Jones, Jon	

Rev. 09/09 - MTH

Summary of
Authorized User Application for Authorization to Possess and Use Radioactive Materials for Non-Human Research Use

☑ New Submission ☐ Re-Authorization

A. Applicant Information

Lisa Tannock, M.D. (If link does not work, open/close above link and re-try)

B. Education

M.D. in Medicine from University of Toronto in 1994

C. Radiation Safety Training

- ☑ **Safe Handling of Radioactive Materials** (e.g., time, distance & shielding, PPE)
- ☑ **Characteristics of Ionizing Radiation** (e.g., alpha, beta & gamma radiation, half life)
- ☑ **Units of Radiation Dose and Quantities** (e.g., rad, rem, µCi, dpm)
- ☑ **Radiation Detection Instrumentation** (e.g., survey meter, scintillation counter)
- ☑ **Biological Hazards of Exposure to Radiation** (e.g., cell damage/death, ALARA)

37 **~ Total # of Hours of Radiation Safety Training**

Recent VA Radiation Safety Training

09/2009	"Practicing Safe Science" Howard Hughes Medical Institute video (~30 min w/ ~15 min pertaining to radiation safety)
09/2009	"Radionuclide Hazards" Title 8 from "Safety in the Research Laboratory" Howard Hughes Medical Institute video (~15 min)
09/2009	"Research Emergency and Safety Procedures" 2009 research safety training PowerPoint presentation (~60 min w/ ~15 min pertaining to radiation safety)
09/2009	"Radiation Safety Training – Research" 2007 annual radiation safety training PowerPoint presentation (~90 min)
09/2009	"Radiation Safety Training – Research" 2008 annual radiation safety training PowerPoint presentation with test (~45 min)
09/2009	"Initial Radiation Safety Training – Research" Lecture for new AU submission and/or new staff (~90-150 min)

4.3 **~ Total # of Hours of Recent VA Radiation Safety Training**

D. Experience with Radioactive Materials

~# of hrs		
100	☑	**C-14**
0	☐	**Cr-51**
100	☑	**H-3**
0	☐	**I-125**
0	☐	**I-131**
100	☑	**P-32**
0	☐	**P-33**
100	☑	**S-35**
0	☐	**Other:**

400 **~ Total # of Hours of Experience with Radioactive Materials**

E. Initial Check on Training and Experience

437 **~ Total # of Hours of Radiation Safety Training & Experience with Radioactive Materials**

F. Staff Listing Patricia Wilson

G. Radiation Protection Equipment and Supplies Available for Use

☑ **Mechanical Pipettes**	☐ **Remote Handling Tongs**	☑ **Radiation Labels**
☑ **Bench Top Shields**	☑ **Shielded Storage/ Waste Containers**	☑ **Transporting Containers**
☑ **Disposable Gloves**	☑ **Lab Coats**	☑ **Safety Glasses/ Face Shield**
☑ **Fume Hood**	☐ **Iodination Hood**	
☑ **Absorbent Padding**	☑ **Containment Trays/Containers**	

Scintillation Counters **(i.e., other than the ones available in the Research core labs)**

☐ **Liquid Scintillation Counter (beta)**
(2 liquid scintillation counters are currently available in the Research core labs for all approval labs)

☐ **Sodium Iodide (NaI) Counter (gamma)**
(2 sodium iodide counters are currently available in the Research core labs for all approval labs)

☑ **Survey Meter: Ludlum Model 3 with Pancake Probe (Note: pending purchase when funding available)**
(1 spare survey meter with pancake probe is currently available in a research core lab for all approval labs)

H. Location for Use and Storage of Radioactive Materials and Waste

Room	Radioactive Materials Used	Radioactive Materials Stored	Radioactive Waste Stored	Room Diagram of Use/Storage	Room Air Flow Evaluation
D322	☑	☑	☑	D322	D322

I. 1. Description of Use of Radioactive Materials: C-14 (Radionuclide Information Sheet)

0.1 mCi Requested highest total activity (1 mCi = 1000 μCi) possessed at any one time

	In Vitro Procedure(s)	Chemical Form(s)	~ highest activity per procedure
#1	Molecular weight standards	methylated protein	0.001 mCi (1 μCi)

Radioactive Waste Generated:	Dry/Solid	Liquid	Scintillation	Animal
	☑	☐	☑	☐

Excepted Transport:	Within the VA	Between VA and UK
	☑ to dark room for film developing	☐

I. 2. Description of Use of Radioactive Materials: H-3 (Radionuclide Information Sheet)

10 mCi Requested highest total activity (1 mCi = 1000 μCi) possessed at any one time

	In Vitro Procedure(s)	Chemical Form(s)	~ highest activity per procedure
#1	Collagenase-sensitive proline incorporation assay	proline	2 mCi

Radioactive Waste Generated:	Dry/Solid	Liquid	Scintillation	Animal
	☑	☑	☑	☐

Excepted Transport:	Within the VA	Between VA and UK
	☑ to core labs for counting	☐

I. 3. Description of Use of Radioactive Materials: P-32 (Radionuclide Information Sheet)

1 mCi Requested highest total activity (1 mCi = 1000 µCi) possessed at any one time

	In Vitro Procedure(s)	Chemical Form(s)	~ highest activity per procedure
#1	Northern blot	dATP	0.025 mCi (25 µCi)

Radioactive Waste Generated:	Dry/Solid	Liquid	Scintillation	Animal
	☑	☑	☑	☐

Excepted Transport:	Within the VA	Between VA and UK
	☑ to dark room for film developing	☐

I. 4. Description of Use of Radioactive Materials: S-35 (Radionuclide Information Sheet)

50 mCi Requested highest total activity (1 mCi = 1000 µCi) possessed at any one time

	In Vitro Procedure(s)	Chemical Form(s)	~ highest activity per procedure
#1	Metabolic labeling of glycosaminoglycan chains or core protein	sulfate (SO4), methionine	10 mCi
#2	LDL binding assay	proteoglycans via above labeling with sulfate (SO4), methionine	0.07 mCi (70 µCi)

Radioactive Waste Generated:	Dry/Solid	Liquid	Scintillation	Animal
	☑	☑	☑	☐

Excepted Transport:	Within the VA	Between VA and UK
	☑ to core labs for counting & to dark room for film developing	☐

Approval Criteria:

AU Applicant:

☑ 10 Code of Federal Regulations 33.15(b)(1) and (2)

(b) The applicant submits a statement that byproduct material will be used only by, or under the direct supervision of, individuals who have received:

(1) A college degree at the bachelor level, or equivalent training and experience, in the physical or biological sciences or in engineering; and

(2) At least 40 hours of training and experience in the safe handling of radioactive materials, and in the characteristics of ionizing radiation, units of radiation dose and quantities, radiation detection instrumentation, and biological hazards of exposure to radiation appropriate to the type and forms of byproduct material to be used

☑ NUREG-1556, Volume 11, Appendix L, Radiation Safety Training Topics

Facilities and Equipment:

- ☑ NUREG-1556, Volume 11, Appendix L, *Facilities and Equipment Considerations*
- ☑ NUREG-1556, Volume 11, Appendix K, *Radionuclides Classified According to Relative Toxicity*
- ☑ *Handbook of Health Physics and Radiological Health*, 3rd Edition
  Edited by B. Shleien, L. Slaback, and B. Birky © 1998 Lippincott Williams & Wilkins
  - Table 11.1.1 *Classification of Workplaces*
  - Table 11.1.1.1 *Toxicity Classification of Radionuclides*
  - Table 11.1.1.2 *Activity Limits for Use of Radionuclides in Various Types of Workplace*

Room	Radio-nuclide	Group #	Radionuclide Radiotoxicity	Type of Workplace Required		
				Type I (C)	Type II (B)	Type III (A)
D322	C-14	3	Moderate	≤ 1.35 mCi (≤ 50 MBq)	1.35 mCi - 1.35 Ci (50 MBq - 50 GBq)	≥ 1.35 Ci (≥ 50 GBq)
D322	H-3	4	Low	≤ 13.5 mCi (≤ 500 MBq)	13.5 mCi - 13.5 Ci (500 MBq - 500 GBq)	≥ 13.5 Ci (≥ 500 GBq)
D322	P-32	3	Moderate	≤ 1.35 mCi (≤ 50 MBq)	1.35 mCi - 1.35 Ci (50 MBq - 50 GBq)	≥ 1.35 Ci (≥ 50 GBq)
D322	S-35	3	Moderate	≤ 1.35 mCi (≤ 50 MBq)	1.35 mCi - 1.35 Ci (50 MBq - 50 GBq)	≥ 1.35 Ci (≥ 50 GBq)
				≤ 13.5 mCi (≤ 500 MBq)	Increased by factor of x10 based on criteria below.	

Where Type I (C) is similar to a good quality modern chemical laboratory, Type II (B) is a specially designed laboratory for work with radionuclides, and Type III (A) specially designed laboratory for handling large activities of highly radioactive materials. The above limits are based on normal operations (see below for other types of operations). In case of a conventional modern chemical laboratory with adequate ventilation and non-porous work surfaces, the upper limits of Type I (C) workplace may be increased toward the limits for Type II (B) workplaces for low (4) and moderate (3) radiotoxicity groups.

Operation	Modifying Factor
Storage (stock solutions)	x 100
Very simple wet operations	x 10
Normal operations	x 1
Complex wet operations with risk of spills and simple dry operations	x 0.1
Dry and dusty operations	x 0.01

Rev. 09/09 - MTH

Summary of
Staff Application for Approval to Use Radioactive Materials for Non-Human Research Use Under an Authorized User

☑ New Submission ☐ Re-Approval

A. Applicant Information
Patricia Wilson (If link does not work, open/close above link and re-try)

Working Under Authorized User/AU Applicant Lisa Tannock, M.D.

B. Education
M.S. in Biology from Eastern Kentucky University in 2003

C. Radiation Safety Training

- ☑ **Safe Handling of Radioactive Materials** (e.g., time, distance & shielding, PPE)
- ☑ **Characteristics of Ionizing Radiation** (e.g., alpha, beta & gamma radiation, half life)
- ☑ **Units of Radiation Dose and Quantities** (e.g., rad, rem, µCi, dpm)
- ☑ **Radiation Detection Instrumentation** (e.g., survey meter, scintillation counter)
- ☑ **Biological Hazards of Exposure to Radiation** (e.g., cell damage/death, ALARA)

14 **~ Total # of Hours of Radiation Safety Training**

Recent VA Radiation Safety Training

09/2009	"Practicing Safe Science" Howard Hughes Medical Institute video (~30 min w/ ~15 min pertaining to radiation safety)
09/2009	"Radionuclide Hazards" Title 8 from "Safety in the Research Laboratory" Howard Hughes Medical Institute video (~15 min)
08/2009	"Research Emergency and Safety Procedures" 2009 research safety training PowerPoint presentation (~60 min w/ ~15 min pertaining to radiation safety)
09/2009	"Radiation Safety Training – Research" 2007 annual radiation safety training PowerPoint presentation (~90 min)
09/2009	"Radiation Safety Training – Research" 2008 annual radiation safety training PowerPoint presentation with test (~45 min)
09/2009	"Initial Radiation Safety Training – Research" Lecture for new AU submission and/or new staff (~90-150 min)

4.3 **~ Total # of Hours of Recent VA Radiation Safety Training**

D. Experience with Radioactive Materials

~# of hrs		
40	☑	**C-14**
0	☐	**Cr-51**
40	☑	**H-3**
0	☐	**I-125**
0	☐	**I-131**
2	☑	**P-32**
0	☐	**P-33**
40	☑	**S-35**
0	☐	**Other:**

122 **~ Total # of Hours of Experience with Radioactive Materials**

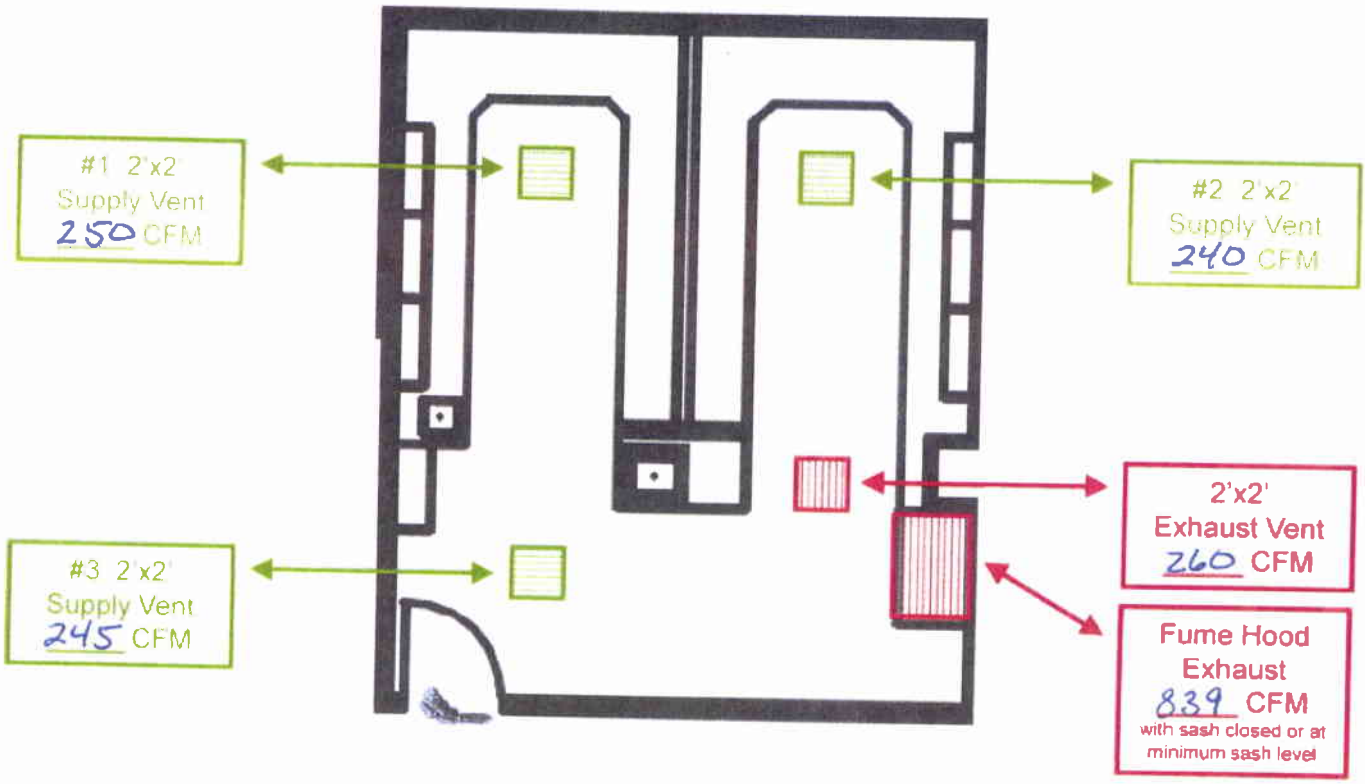
136 **~ Total # of Hours of Radiation Safety Training & Experience with Radioactive Materials**

Approval Criteria:

Staff Applicant:

☑ NUREG-1556, Volume 11, Appendix L, Radiation Safety Training Topics

D322
Air Flow Measurements with Door Closed



Date: 9/2/09

By: A. Rogers
HVAC Technician

Instrument(s) Used:
- Alnor Velometer (S/N 9793) Calibrated: 8/09
- TSI VelociCheck (S/N 94080385) Calibrated: 8/09
- _____ (S/N_____) Calibrated: _____

Vent locations are approximate & not to scale.

Total Supply (3)	= ~~730~~ 735 c.e.	CFM (A)
Total Exhaust (2)	= 1099	CFM (B)
Room Pressure	= 364	CFM (A-B)
Room Volume	= 4036	CF (C)
# of Air Exchanges/hr	= 16.3	(Bx60/C)

= Smoke test performed at base of closed door. Did it confirm that the room was under negative pressure? Yes ☑ No ☐

Radiation Safety Committee Sign-in Sheet

August 27, 2009 @ 11:30 AM

Representing Service	Member Name/Title	Signature
Chair Member from Radiology Service (physician)	**Cheryl Baker, M.D.** Service Chief	
Radiation Safety Officer	**Michael T. Hackett, MS,** Radiation Safety Officer	
Member from Management	**Donna Jacobs,** Associate Director	
Member from Nuclear Medicine Service (physician)	**Wei-Jen Shih, M.D.,** Service Chief, Clinical Authorized User	
Member from Nuclear Medicine Service (technical staff)	**Vickie Kiefer, CNMT,** Chief Technologist	Vickie Kiefer
Member from Patient Care Services (Nursing)	**Shannon Hardin, R.N.,** Nurse Manager for 2-South/ Cardiac Cath	Shannon Hardin
Member from Research Service	**Steve Brown, Ph.D.,** Research Chemist, Research Safety Manager, Research Authorized User	Steve Brown
Member from Radiology Service (technical staff)	**Bert D. Morgan, R.T.,** Administrative Officer	Excused - SL 11/24
Member from NAGE	**Jon Jones,** NAGE Safety Officer	
RECORDER:		
GUESTS:		

Radiation Safety Committee Dates and Attendance Record for 2009 Reviews

Time period being reviewed at the Radiation Safety Committee (RSC) meeting (i.e., during 2009)	2009 Jan-Mar	2009 Apr-Jun	2009 Jul-Sep	2009 Oct-Dec	2009 Review
Scheduled Date of Radiation Safety Committee meeting (i.e., set up for the 4th Thursday of 2nd month of the quarter following the review period & as needed)	Scheduled for 05/28/09; Rescheduled for 06/04/09	Scheduled for 08/27/09	11/26/09 = Holiday; Rescheduled for 12/03/09	Scheduled for 02/25/10	
Actual Date of Radiation Safety Committee meeting	**06/04/09**	**08/27/09**			
Scheduled Date above RSC minutes presented to Environment of Care Council (i.e., set up for the 2nd Thursday of 1st month of the quarter following the above mentioned RSC meeting & as needed - e.g., annual review presented at the following Environment of Care Council meeting)	Scheduled for 07/09/09	Scheduled for 10/08/09	Scheduled for 01/14/10	Scheduled for 04/08/10	Scheduled for 03/11/10
Actual Date above RSC minutes presented to Environment of Care Council	**07/09/09**	**TBA**			

Radiation Safety Committee (RSC) Membership

Representing Service	Member Name/Title	RSC Attendance				Total # of RSC Meetings	P = Present	R^{AMR} = Represented By Alternate Management Representative (voting member)	R = Represented By	E = Excused	A = Absent
Chair, Member from Radiology Service (physician)	**Cheryl D. Baker, M.D.,** Chief of Radiology Service	P	P			2	2	N/A	0	0	0
Radiation Safety Officer	**Michael T. Hackett, MS,** Radiation Safety Officer	P	P			2	2	N/A	0	0	0
Member from Management	**Donna Jacobs,** Associate Director (AD)	R^{AMR} by W. Divers, MD, Chief of Staff **	P			2	1	1	0	0	0
Member from Nuclear Medicine Service (physician)	**Wei-Jen Shih, M.D.,** Service Chief, Clinical Authorized User	P	P			2	2	N/A	0	0	0
Member from Nuclear Medicine Service (technical staff)	**Vickie Kiefer, CNMT,** Chief Technologist	P	P			2	2	N/A	0	0	0
Member from Patient Care Services (Nursing)	**Shannon Hardin, R.N.,** Nurse Manager for 2 South/ Cardiac Cath	P	P			2	2	N/A	0	0	0
Member from Research Service	**Steve Brown, Ph.D.,** Research: Chemist, Safety Manager, Authorized User	P	P			2	2	N/A	0	0	0
Member from Radiology Service (technical staff)	**Bert D. Morgan, R.T.,** Administrative Officer	P	E			2	1	N/A	0	1	0
Member from NAGE	**Jon Jones,** NAGE Safety Officer	A	A			2	0	N/A	0	0	2
# of RSC members present (P & R^{AMR})		8	7								
# of RSC members represented by (R)		0	0								
# of RSC members excused (E)		0	1								
# of RSC members absent (A)		1	1								
Total # of RSC members		9	9								
Was a quorum* present?		Yes	Yes								

** Alternate Management Representative (AMR)

* Quorum: at least one-half of the committee membership is in attendance and must include the Chair (or designee), Radiation Safety Officer and a management representative (or designee).