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ENGINEERING DATA TRANSMITTAL

Page 1 of 3  
1. EDT 601992

2. To: (Receiving Organization) PFP Radiological Control	3. From: (Originating Organization) Same	4. Related EDT No.: 601992
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11. Receiver Remarks: N/A		10. System/Bldg./Facility: 234-5Z
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		13. Permit/Permit Application No.: N/A
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		Design Authority				1		T. D. Merkling	<i>T. D. Merkling</i>	4/17/00	TS-57
		Design Agent									
1		Cog. Eng. J. R. Cooper	<i>J. R. Cooper</i>	4/17/00							
1		Cog. Mgr. R. D. Cantwell	<i>R. D. Cantwell</i>	4/17/00							
		QA									
		Safety									
		Env.									

18. Signature of EDT Originator <i>J. R. Cooper</i> Date: 4/17/00	19. Authorized Representative for Receiving Organization <i>T. D. Merkling</i> Date: 4/17/00	20. Design Authority/Cognizant Manager <i>R. D. Cantwell</i> Date: 4/17/00	21. DOE APPROVAL (if required) Ctrl No. _____ <input type="checkbox"/> Approved <input type="checkbox"/> Approved w/comments <input type="checkbox"/> Disapproved w/comments
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## UNREVIEWED SAFETY QUESTION (USQ)

Identification Number:  
EDT-601992

## USQ SCREENING

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Title: New Technical Basis Document for Area Monitoring Dosimetry

**INSTRUCTIONS:** Respond to each question and provide justification for each response. A restatement of the question does not constitute a satisfactory justification or basis. An adequate justification provides sufficient explanation such that an independent reviewer could reach the same conclusion based on the information provided [DOE 5480.21, 10.e.1].

**DESCRIPTION**

This document identifies the means that the Plutonium Finishing Plant (PFP) will use to meet the Hanford Site requirements of HNF-PRO-382, *Area Dosimetry Program*, the Hanford Site Radiological Control Manual (HSRCM-1), Part 514, and ultimately Title 10, Code of Federal Regulations (CFR), Part 835, "Occupational Radiation Protection," Part 835.403. The requirements of this document are already being carried out, this document provides a source for consistent performance and provides the rationale for the way the higher tier requirements are met.

**INTRODUCTION**

No information in this document affects the configuration of components in the facility or descriptions in the Authorization Basis documents.

**AFFECTED SSC**

This document does not directly affect any safety SSC's nor does it in any way degrade the performance of their safety functions.

**AUTHORIZATION BASIS**

Of the documents identified as a part of the Authorization Basis in FSP-PFP-5-8, Section 2.23, Appendix A, Revision 22, the following documents apply:

- HNF-SD-CP-SAR-021, *Plutonium Finishing Plant Final Safety Analysis Report*, Revision 1
- WHC-SD-CP-OSR-010, *PFP Operational Safety Requirements (OSR)*, Revision 0-L

**CONCLUSION**

The change identified is within the bounds of the Authorization Basis. All screening questions have been answered "No" or "N/A" so a USQ Evaluation is not required. No changes to the Authorization Basis are required.

**REFERENCES**

No additional references were used for this screening.

**Questions**

1. Does the proposed activity or occurrence represent a change to the facility or procedures as described in the AUTHORIZATION BASIS?

N/A  No  Yes/Maybe

**Basis:** HNF-SD-CP-SAR-021, *Plutonium Finishing Plant Final Safety Analysis Report*, (SAR) does not discuss the area dosimetry program. Section 8.0, *Radiation Protection*, talks about personnel dose monitoring, neutron accident dosimeters, continuous air monitors, and criticality alarm monitors, but there is no discussion about an area dosimetry program. The references section of chapter 8.0 does not refer to the HNF-PRO-382.

The major purpose of this new document is to define the program, consolidate the references, and identify locations for the placement of and equipment to be used for sample monitoring. Nothing in this program affects the existing monitoring programs.

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Identification Number:  
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USQ SCREENING

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2. Does the proposed activity or occurrence represent conditions that have not been analyzed in the AUTHORIZATION BASIS?  
 N/A  No  Yes/Maybe

Basis: Accidents analyzed in the SAR Chapter 9 do not mention this program. The purpose of the this program is to verify that the doses next to radiological buffer areas are negligible. This is not an accident monitoring nor recovery system. Its data may be useful in understanding the results to the facility, but that is not the intent nor one of its stated functions.

3. Does the proposed activity represent a test or experiment NOT described in the Authorization Basis that may affect the safe operation of the facility?  
 N/A  No  Yes/Maybe

Basis: This USQ is not evaluating a test or experiment and so this question is not applicable.

4. Does the proposed activity or occurrence represent a change to the Technical Safety Requirements or a reduction in the margin of safety defined in the Technical Safety Requirements?  
 N/A  No  Yes

Basis: There are no TSR's associated with the area monitoring dosimetry system. The system falls under OSR Section 5.0, *Administrative Controls*, specifically, section 5.16.2g, *Measurement and Control of Radiation*. This document does not require a new or changed TSR.

USQE #1 W. F. White  
(Print Name)

USQE #2 J. P. King  
(Print Name)

[Signature] Date: 4/11/00  
Signature

[Signature] Date: 4/11/00  
Signature

If there is a YES/MAYBE response to questions 1, 2, 3, or 4, then a USQ Evaluation must be completed.

The following guidance should be considered when completing this screening. This guidance should not be considered all-inclusive; additional factors may need to be considered depending on the nature of the proposed change.

Does the proposed change:

- 1) Modify, add, or delete a safety class function of a structure, system or component stated in the authorization basis?
- 2) Alter the design of a structure, system or component as described in the authorization basis?
- 3) Modify, add, or delete the description of operation, operating environment, or analyses of any system or component described in the authorization basis?
- 4) Modify, add, delete or conflict with any of the design bases stated in the authorization basis?
- 5) Conflict with the principle or general design criteria stated in the authorization basis?
- 6) Modify, add, or delete any plant design features described in the authorization basis?
- 7) Modify, add, or delete a flow diagram or facility drawing provided in the authorization basis?
- 8) Create the potential for new system or component interactions (e.g., seismic, electrical breaker coordination)?

HNF-6087  
Revision 0

# **TECHNICAL BASIS DOCUMENT FOR PFP AREA MONITORING DOSIMETRY PROGRAM**

Prepared for the U.S. Department of Energy  
Assistant Secretary for Environmental Management

Project Hanford Management Contractor for the  
U.S. Department of Energy under Contract DE-AC06-96RL13200

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# TECHNICAL BASIS DOCUMENT FOR PFP AREA MONITORING DOSIMETRY PROGRAM

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Date Published  
April 2000


Prepared for the U.S. Department of Energy  
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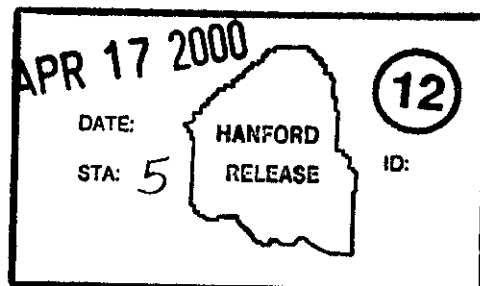
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## 1. Purpose

This document describes the phantom dosimetry used for the PFP Area Monitoring program and establishes the basis for the Plutonium Finishing Plant's (PFP) area monitoring dosimetry program in accordance with the following requirements:

Title 10, Code of Federal Regulations (CFR), part 835, "Occupational Radiation Protection" Part 835.403

Hanford Site Radiological Control Manual (HSRCM-1), Part 514

HNF-PRO-382, Area Dosimetry Program

PNL-MA-842, Hanford External Dosimetry Technical Basis Manual

## 2. Scope

The criteria, standards, and requirements contained in the technical basis apply to area dosimetry monitoring conducted at PFP. The area dosimetry program applies to the main PFP facility, 234-5Z and 2763-ZB. It does not apply to any posted radiological area where personnel dosimetry is required or in non-routinely occupied spaces. PFP additionally monitors five areas within known radiological areas utilizing area dosimetry to conduct its quarterly tracking and trending program.

## 3. Technical Basis for Area Dosimetry Monitoring

HNF-PRO-382, *Area Dosimetry Program* provides direction for when area dosimetry is required. In general, area monitoring is used to identify and control potential sources of personnel exposure to radiation and radioactive material. Its purpose is to minimize the number of areas requiring the issuance of personnel dosimeters and verifying that the doses next to radiological buffer areas are negligible.

This Technical Basis Document (TBD) includes the basis requirements for an Area Monitoring Program. It also contains the basis for the selection and placement of monitoring sample locations and the equipment used at those locations. This includes the rationale for the positioning the dosimeters and a facility grid map identifying all possible locations.

### 3.1 Area Dosimetry Monitoring

Any area or facility that is within 50 feet of the following posted radiological areas and where employees work at least eight hours a month shall have area dosimeters installed:

- Radiological Buffer Area (radiation)
- Radioactive Material Area
- Radiation Area
- High radiation Area
- Very High Radiation Area

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Areas that are not required to be included in the program are:

- Areas greater than 50 feet from nearest posted radiological area
- Any posted radiological area where personnel dosimetry is required
- Area not routinely occupied
- Area that has had a program in place for at least one year and dosimeters indicate a dose of less than 100 mrem/yr. and source terms have not changed.

Presently, all PFP personnel entering radiological areas are required to wear a Hanford Combination Neutron Dosimeters (HCND's) and Personal Neutron Accident Dosimeters (PNAD's).

### 3.2 General program criterion

- 3.2.1 The facility radiological control (FRC) organization determines the number and location of area dosimeters in each facility under their control.

PFP has identified over 665 grid areas within the facility that could contain area monitor dosimetry for any given quarter of exposure. Other facilities use fixed locations for their Area Dosimetry program. PFP decided to use random stations as a method to characterize the total facility. Based on random statistics, twenty-two stations were selected to provide a 95% confidence level of monitoring all the facility over a five year period. These grid areas are identified in Appendix A.

- 3.2.2 The FRC is to ensure each location that requires area dosimeters has a least one area dosimeter.

PFP uses four dosimeters per location. This usage is believed to more accurately represent a model-man's exposure.

- 3.2.3 The FRC is to install dosimeters at selected locations and maintain a map of each dosimeter location.

PFP installs dosimeters at selected locations and maintains maps of the desired locations which are included with the quarterly report.

- 3.2.4 The FRC is to ensure area dosimeters are placed 40" to 60" above the floor level and are protected from heat, moisture, and direct sunlight. Area dosimeters located in facilities where there is a potential for neutron exposure consist of the HCNDs, mounted on a suitable phantom prescribed by the Hanford External Dosimetry Program.

PFP uses a wooden stanchion that is approximately 40 inches in height and 12 inches square. This height is used to simulate the height of a model-man. A full five gallon carboy of water sits on top of this stanchion. It has HCNDs located on all four sides. See section 4.0 for a discussion on the suitability of the PFP phantoms.



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- 3.2.5 The FRC is to provide the Site Technical Authority (STA) for Dosimetry maps of the Area Dosimeter locations. The FRCs are to maintain records for each area dosimeter that is installed, changed out or discontinued.

PFP is included in the PNNL Quarterly Area Monitor program. TLDs are issued and exchanged on a monthly basis and a report is generated and maintained on all dosimeters. Any tampering or damage is reported to the FRC who assures the replacement or exchange of the existing TLD. Maps are maintained of all grid locations and are provided as part of the quarterly report.

- 3.2.6 The FRC is to post an identification card in each location that provides area monitoring with the dosimeter number and instructions not to tamper with the dosimeter.

Each phantom is numbered and has the approved warning instructions.

- 3.2.7 The FRC is to determine the exposure for each dosimeter and investigate any area dosimeter result exceeding 75 mrem/quarter.

Each quarter, dosimetry results are extrapolated and two trigger levels are investigated. PFP utilizes FSP-PFP-5-8 "Administrative Control Manual," Section 14.10, to conduct and control their Area Monitoring program.

- 3.2.8 The FRC is to prepare an annual report to the Facility Radiological Control Manager with a copy to the STA.

PFP submits to the Radiological Control Manager and PFP Director a quarterly report, within sixty (60) days of receipt of the Area Dosimetry Monitoring results. An annual report is also submitted as required.

### 3.3 Program Description

For this program, only non-radiological spaces are used because PFP already has an extensive dosimetry program in place with the Nuclear Accident Dosimeter (NAD) Program. These NAD dosimeters can be used to provide dosimetry results in case of an accident scenario.

Quarterly, a PFP phantom is placed at each selected location. The phantom consists of a wooden stand and a five (5) gallon plastic water filled jug with four (4) mounted Combination Hanford Neutron Dosimeter holders. PNNL supplies the required dosimeters for placement in the holders. The holders are positioned so that dosimeters face all four directions from the phantom, providing for North, South, East and West exposure data.

The gathered data is evaluated against two trigger levels. These are a whole body dose equivalent greater than or equal to 75 mrem and greater to or equal to 100 mrem. Both levels are for 2000 hours of exposure. This is more conservative than the required trigger of 75 mrem per quarter.

Dependent on the criterion, different recovery actions have been identified. For any occupied area exceeding 100 mrem for 2000 hours of exposure, the area is posted as a Radiological Buffer Area (RBA). An occupied space is one where an individual could be located for 40 hours a week for 50 weeks a year, thus receiving 2000 hours of exposure.

A radiological survey is taken for both neutron and gamma exposure. For areas where the 75 mrem for 2000 hours of exposure is exceeded, the area is surveyed and additional monitoring evaluations are conducted to determine what; if any, further actions are appropriate. The radiological surveys have normally not indicated any exposure levels. At PFP, the Area Monitoring Program exposure has been predominately due to neutron exposure.

On July 16, 1998, PFP determined that there was a need for additional posting to ensure personnel exposure was kept within ALARA. This posting "Caution – Do Not Loiter" was for areas that exceed the 100 mrem for 2000 hours of exposure but are normally unoccupied. In these areas, personnel will not be exposed for long enough periods to require posting the area as a RBA. In those cases where one of the phantom dosimeters exceeds the trigger level, an average of the four dosimeters is made and the criterion is based on that average. Quarterly reports are submitted to the PFP Director, Operations Manager(s), and the Radiological Control manager.

#### **4.0 Phantom Determination**

*Determination of Photon Backscatter From Several Calibration Phantoms*, by R.J. Traub, J.C. McDonald, and M. K. Murphy, accepted November 7, 1997, and *Effect of Phantom Size and Composition on Neutron Dosimeter Reading* by J.C. McDonald, J.E. Tanner, R.D. Stewart, R. Michael, M.K. Murphy, and R.J. Traub, Accepted January 27, 1995 were reviewed. These documents describe that water filled phantoms has been tested by the International Organization of Standardization (ISO). ISO has recommended the adoption of a water-filled phantom for calibration of neutron dosimeters. Various sizes have been tested including those of 30 X 30 X 15 cm<sup>3</sup> and 40 X 40 x 15 cm<sup>3</sup>.

Those various sizes were modeled. A very small percentage difference in exposure data was identified, based on phantom sizes. PFP believes its 5 gallon water-filled carboy which measures approximately 30 X 27 X 15 cm<sup>3</sup> is representative of the 30 X 30 x 15 cm<sup>3</sup> phantom tested. Therefore, this is the neutron phantom in use at PFP.

#### **5.0 Phantom Placement**

- 5.1 PFP's initial Area Monitoring Program included an effort to characterize all of PFP's non-radiological areas. In an effort to determine the appropriate permanent monitoring stations, PFP selected twenty-two randomly locations from over six hundred and fifty identified "non-radiological" areas each quarter. These areas included hallways, operating areas, occupied and non-occupied office spaces and non-occupied ventilation spaces.
- 5.2 Appendix A provides a listing of the PFP grid locations along with the past usage history for each location from 1996 through March 2000. The grid areas used for the second quarter of 2000 were selected, not based on a random selection, but rather on an evaluation of areas still needing to be monitored. As noted in the Appendix A, some grids have been removed from consideration in the program.

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These grids were removed when exposure levels for Radiological Buffer Areas (RBA's) exist and personnel dosimeter is required. As can be determined from Appendix A, after three years not all grid locations have been monitored. A review of the unmonitored grids will continue during the year 2000 to assure all major areas of the plant have been monitored by the end of the fifth program year. Permanent fixed locations shall be identified based on an evaluation of that data.

APPENDIX A

TECHNICAL BASIS DOCUMENT FOR PFP AREA MONITORING DOSIMETRY PROGRAM  
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Area	Associated Grid Numbers	Grids previously monitored * = used more than once	Grids removed for consideration in the program
Corridor 1	13, 20, 25, and 33	20*, 25*	
Room 100	36 – 39	37	
Room 101	34		
Room 102	26	26*	
Room 103	21	21	
Room 104	14 – 15	14*	
Room 105	36	36	
Room 106	31-32	31, 32	
Room 107	24 and 29	24, 29*	
Room 108	19	19	
Room 109	12		
Room 110	9, 10, 16, 17, 22 and 27	27	
Room 120	8		
Room 121	6	6*	
Room 123	5 and 7	5*	
Room 124	1 – 4	4	
Corridor 2	11, 18, 23, 28, 30, 35, 40, 44, 49, 54, 59, 64, 69, 75, 81, 85, 91, 96, 101, 106, 111, 116, 121, and 126	23, 64, 69, 75, 96, 106, 111, 116	
Room 194	185 and 189		
Room 194A	186 and 190 – 192	191, 192	
Room 194B	187 and 188		
Room 196A	173, 174, 175, 177, 178, and 179	173	
Room 199	155, 159, 169, 163, and 164		
Room 200	153	153	
Room 200A	158		
Room 201	154	154*	
Room 202	137, 140 – 142, 144 – 146, 148 – 150	137, 140, 141, 142, 144, 148, 149, 150	
Room 205	132	132	
Room 208A	117		
Room 208	112		
Room 209	103, 104, 108, 109, 113, 114, 118, 119	103, 104, 109, 118	
Room 210	102 and 107	102	
Room 211	86, 92, 93, 94, 97, 98, and 99	86	86, 92, 97 (7/97)
Room 212	89	89	
Room 212A	83	83	
Room 214	82, 88	82, 88	
Room 215	70, 71, 76, and 77	76*, 77	
Room 216	60 - 62, 64 – 67, 72, 73, 78, and 79	60, 67, 78	
Room 217A	56		
Room 217	57	57*	
Room 218A	42	42	

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Area	Associated Grid Numbers	Grids previously monitored * = used more than once	Grids removed for consideration in the program
Room 218B	41	41	
Room 218C	45 and 46	46	
Room 218E	52		
Room 218D	47	47	
Room 218F	50 and 51	51	
Corridor 13	131, 134, 135, 138, 139, 145, 147, 151, 156, 161, 165, 167, 169, 171, and 176	131*, 151, 167	134, 135, 138, 147, 151, 156, 161, 165, 167, 169, 171, and 176 (7/97)
Corridor 13A	180 – 184	180*, 182, 183	
Corridor 14	120		
Corridor 14A	122 – 125 127 – 130	122, 123, 124	
Corridor 14B	53, 58, 63, 68, 74, 80, 84, 90, 95, 100, 105, 110, and 115	90, 100, 110	
Corridor 14C	43 and 48	43	
Room 250	133 and 136	133	
Room 251A	143	143	
Room 251B	152 and 157	152	
Room 252	162 and 166	162	
Room 253	168 and 170	170	
Room 254	172	172	
Room 260	496 – 516 554 – 591 610 - 648	497*, 501, 502*, 503, 505, 507, 527, 562 *, 563, 565, 566, 568, 570, 571*, 573, 582, 583, 584*, 587, 611*, 612, 616*, 618, 619, 621, 624, 625, 636, 637, 638, 640, 646, 648	
Room 264	517 – 553 592 – 609	518, 521, 522*, 526, 529, 533*, 535*, 539, 545, 546, 547, 551, 594, 597, 598*, 601, 602, 603*, 605, 606	
Room 272	649 – 665	649, 650, 651, 653, 663, 664	
Room 300	374 – 378 385 – 392	374, 375*, 376*, 378, 385, 387, 390	378 and 385 (11/97)
Room 301	370 and 371	371*	
Room 301A	369 and 372	369	
Room 301B	367	367	
Room 301C	368	368	
Room 303	347, 348, 349, 350, 355, 356, 357, 358, 365, and 366	348, 349, 350, 357, 358	
Room 303A	329		
Room 303B	330	330	
Room 303C	331 and 332		
Room 303D	333	333	
Room 303E	334		

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Area	Associated Grid Numbers	Grids previously monitored * = used more than once	Grids removed for consideration in the program
Room 303F	335		
Room 303G	336 and 337	336	
Room 303H	345 and 352	345	
Room 303J	346 and 351		
Room 303K	361 and 362		
Room 303L	360 and 363	360	
Room 303M	359 and 354	354, 359	354 (11/97)
Corridor 303-2	344	344*	
Room 304	278 – 281, 291 – 298, 301 – 310, 315 – 324	279, 281*, 283*, 294, 297, 303, 308*, 315, 316, 317*, 323	
Room 304A	285	285	
Room 304B	284	284*	
Room 305	224 – 235, 244 – 255, 260 – 265, 267 – 270	223, 226, 227*, 231, 232*, 248, 254, 255*, 262, 254, 261, 265, 268	
Room 305A	266		
Room 306	242, 243, 258, and 259	243, 259	
Room 306A	222, 223, 236, and 237	223	
Room 319	485	485	
Room 321	400 – 409, 418 – 449, 451 – 456, 459, 460, 463 – 484, 486 – 495	400, 402*, 403*, 405, 406, 420, 421*, 424, 426, 428*, 431, 433, 435, 438, 446, 452, 453, 459, 473	464 – 495 (7/97)
Room 321A	457, 458, 461, and 462	457	
Room 321C	450	450	
Room 322	397, 398, 410 – 417	398, 411*, 414, 416, 417	
Room 323	399	399	
Room 324	393	393	393 (11/97)
Room 325	382 – 384, 394 – 396	282	382 – 384 (7/97) 394 – 396 (7/97)
Room 326	379 – 381	380*	
Room 336	313, 326, 327, 339, 340, 342, and 353	342*, 353	326, 327, 339, 340, 342, and 353 (5/98)
Room 337	276, 287, 288, 289, 299, & 312	287*	
Room 340	220, 221, 238 – 241, 256, and 257	240, 241, 257	
Corridor 31	271, 277, 286, 290, 300, 311, 314, 325, 328, 338, 341, 343, and 354	300, 328, 338, 341, 343	341 (11/97) 343 (7/97)
Corridor 32	272 – 275	272	
Room 603	194	194	

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Area	Associated Grid Numbers	Grids previously monitored * = used more than once	Grids removed for consideration in the program
Room 604	193		
Room 605	198	198	
Room 606	200	200*	
Room 607	205	205	
Room 609	199	199	
Room 610	204		
Room 611	209 and 211	211	
Room 612	210		
Room 614	212		
Room 616	218		
Corridor 617	206		
Room 218	213	213	
Room 619	208 and 214		
Room 620	195, 196, 197, 201, 202, and 203	195, 197	
Room 622	215	215	
Room 623	216	216	
Room 624	219	219*	
Room 646	217	217	