

Riverside Regional Medical Center

Fax

MS16

K-8

To: NRC attention Sandra Gabriel**From:** Harold Prussia **Fax:** 610 337 5269**Pages:** 32**Phone:** 757-594-2757**Date:** 5/26/2006**Re:** Licensee: Riverside Regional Medical
Center, License No.: 45-09001-01
Docket No.: 03003330,
Control No.: 138887☐ **Urgent** ☒ **For Review** ☐ **Please Comment** ☐ **Please Reply** ☐ **Please Recycle**

To: Sandra Gabriel, Senior Health Physicist
Medical Branch
NRC Region I

Additional information for NRC amendment request, mail control 138887 and follow-up from email dated, 5/24/2006.

We have reviewed your email dated, 5/24/2006 and would like to provide follow-up to the items below:

- 1) Our emergency procedure policy, RSO policy 36-03 has been updated to meet the requirements of 10 CFR 35.610 and includes the items listed in (1) (a) and (1) (b) and is being resubmitted for your review.
- 2)
 - (a) RSO policy 36-04 was updated to include items requested in (1), (2), and (3) and is being resubmitted for your review.
 - (b) RSO policy 36-05 was updated to include items requested in (1), (2), (3), (4), and (5) and is being updated for your review.
 - (c) The Daily Startup Procedure form was updated to include the listed items and is included for your review.
 - (d) The Monthly Check Form was updated to include the listed items and included for your review.
 - (e) No response to this item is required.
- 3) RSO policy 36-01, page 3, was revised as requested. Resubmission is not necessary.
- 4) RSO policy 36-01, page 4, was revised as requested. Resubmission is not necessary.

As requested, RSO policies 36-03, 36-04, 36-05, as well as the forms for Daily startup Checks and Monthly Checks have been revised and are being resubmitted.

138887

**RIVERSIDE****H E A L T H S Y S T E M**

701 Town Center Drive, Suite 1000, Newport News, Virginia 23606

Policy / Procedure

RIVERSIDE FACILITY: RPMC**Category: Radiation Safety****Page 1 of 23****Subject:** Gamma Knife® Stereotactic Radiosurgery Device Emergency Procedures**Policy #:** RSO - 36-03**Distribution Group:** Radiosurgery and Radiation Therapy**Related Policies:** RSO-36:01 and RSO-36:02.**References:** Leksell Gamma Knife® 4C Users Manual**POLICY:** Gamma Knife® Emergency Procedures

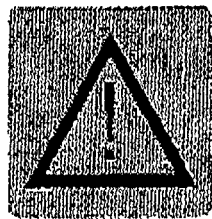
PURPOSE: The Leksell Gamma Knife® is a radiosurgery system for the treatment of various conditions diagnosed within the brain. The precautions below should be observed at all times.

PROCEDURE:

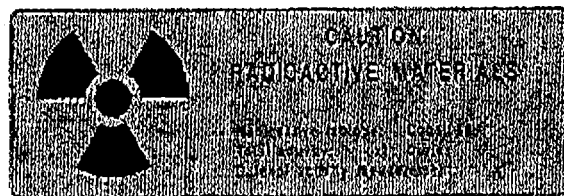
I. Labels: The following are examples of some of the warning labels that are found on the LGK.

A. General warning

1. Instructs users to refer to the manual Leksell Gamma Knife® *Instructions for Use*. This warning label is present a several places.



B. Radiation warning labels on the radiation unit

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EMERGENCY
CLOSING OF SHIELDING DOORS
OPEN COVER HERE

FOR EMERGENCY USE ONLY
 Pull the brake (1) and at the same time attach the ratchet handle at (2) and by turning the ratchet handle the doors will be closed manually

D. Labels on the ratchet handle**OPEN****CLOSE****Individual Authorized By:****Committees Authorized By: Radiation Safety Committee****Authoring Department: Riverside and University of Virginia Radiosurgery Center****Date Approved: 3/2006 Effective Date: 6/2006****Last Date Reviewed: 5/2006****Last Revision Date: 05/2006 Replace Policy Date:****Retired:**

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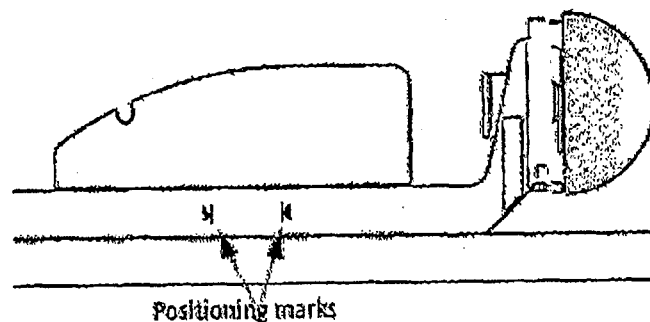
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E. Positioning marks on the treatment couch



F. Label on the treatment couch

COUCH RELEASE

G. Label on models with handwheel

FOR EMERGENCY USE ONLY
Handwheel for manually
closing the shielding doors

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II. Radiation

- A. Only qualified and authorized personnel are permitted to operate this system. A list of names and telephone numbers of the authorized users, the authorized medical physicist and the Radiation Safety Officer are included in this policy and are posted at the Treatment Console for quick reference during an emergency. Full use must be made of all radiation protection features, devices, systems, procedures and accessories.

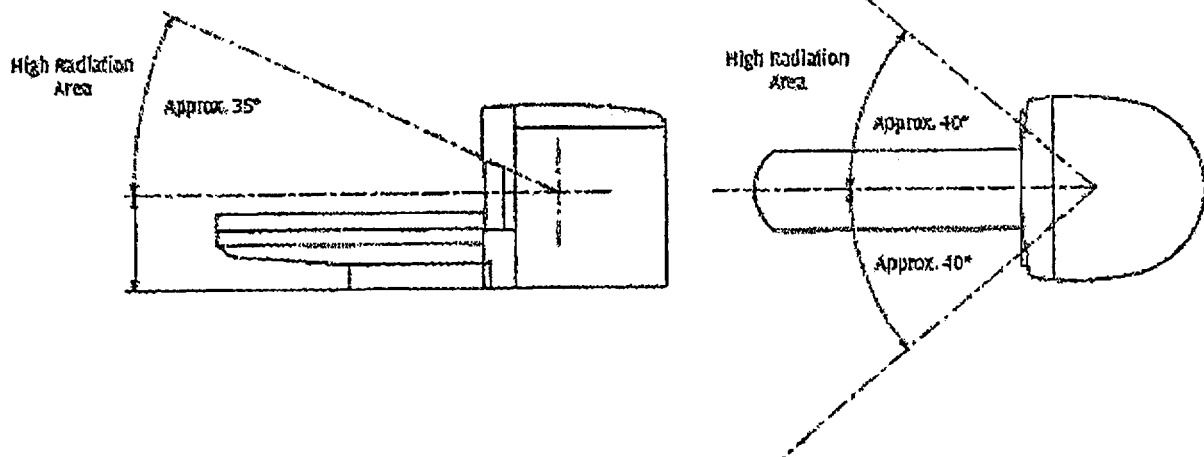


Figure 1.1 High Radiation Area

III. Special Tools

A. APS Release Tools

1. The APS release tool and the spade tool allows you to release the patient from the helmet if the couch is stuck in the treatment position when the APS is used. The emergency equipment is located upon entrance of the treatment room immediately on the left wall.

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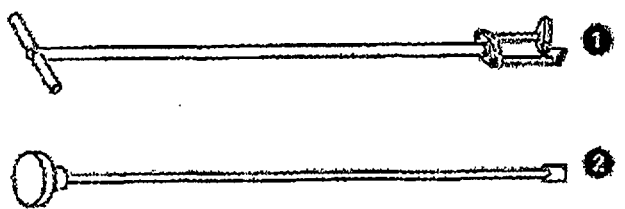
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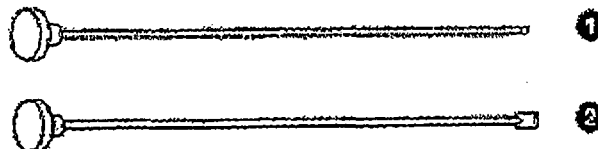
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2. Normally, the couch is moved out of the treatment position when the emergency **Couch Out** button is pressed, or can be pulled out manually. If both of these methods fail, the patient can be released by use of the APS Special Release Tool (1) and the Spade Tool (2).

**B. Trunnion Release Tools**

1. The long allen key and spade tool allow you to release the patient from the helmet if the couch is stuck in the treatment position when trunnions are used. The emergency equipment is located upon entrance of the treatment room immediately on the left wall
2. Normally, the couch is moved out of the treatment position when the emergency **Couch Out** button is pressed, or can be pulled out manually. If both of these methods fail, the patient can be released by use of the Long Allen Key (1) and the Spade Tool (2).

**C. Collimator Pliers**

1. The collimator pliers are used to insert or remove collimators/plugs from the helmet. Depending on the collimator/plug socket, two types are available:
 - a) Pliers for spring socket (1).

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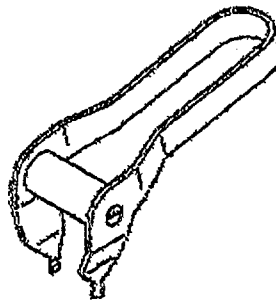
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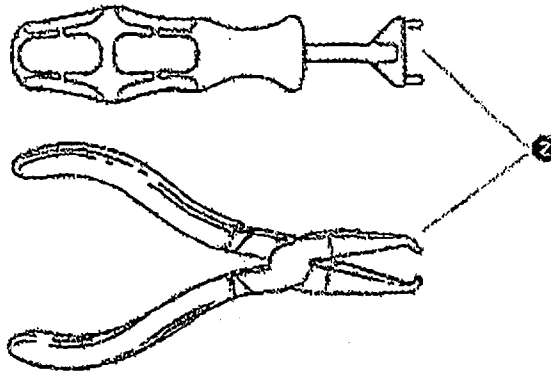
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b) Pliers and screwdriver for bayonet socket (2).

**D. APS Test Tool**

1. The APS test tool should be used to perform a test of the APS weekly and after installation of the APS units.
2. The APS test tool comprises a frame (1) which docks into the APS units. Unlike the coordinate frame, the test tool docks with all four gamma angle setting pins. A handle (2) is provided to carry the tool.
3. Two bars (3) and (4) with spring loaded tips project from the frame towards the collimator helmet. The springs are compressed as the bars press against the face of the

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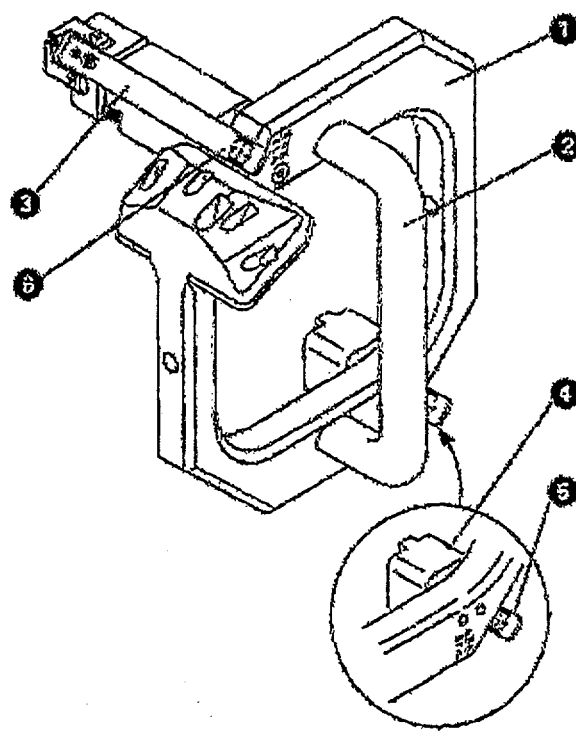
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collimator helmet, causing the attached indicator scale (5) and (6) to move. If the APS is functioning correctly the scale should read 0 + or - 0.5 mm when the APS is at the test position.



E. Patient Docking Indicator

1. The patient docking indicator (PDI) is used to verify a correct docking position of the coordinate frame to the APS. It comprises of a slightly curved magnetic base plate (1) with a handle (2).
2. The lower face of the plate houses a microswitch and five optical sensors (3).
3. The microswitch closes when the PDI is placed correctly on top of the left APS y-slide above the coordinate frame, causing the status lamp (4) on the top of the plate to illuminate.

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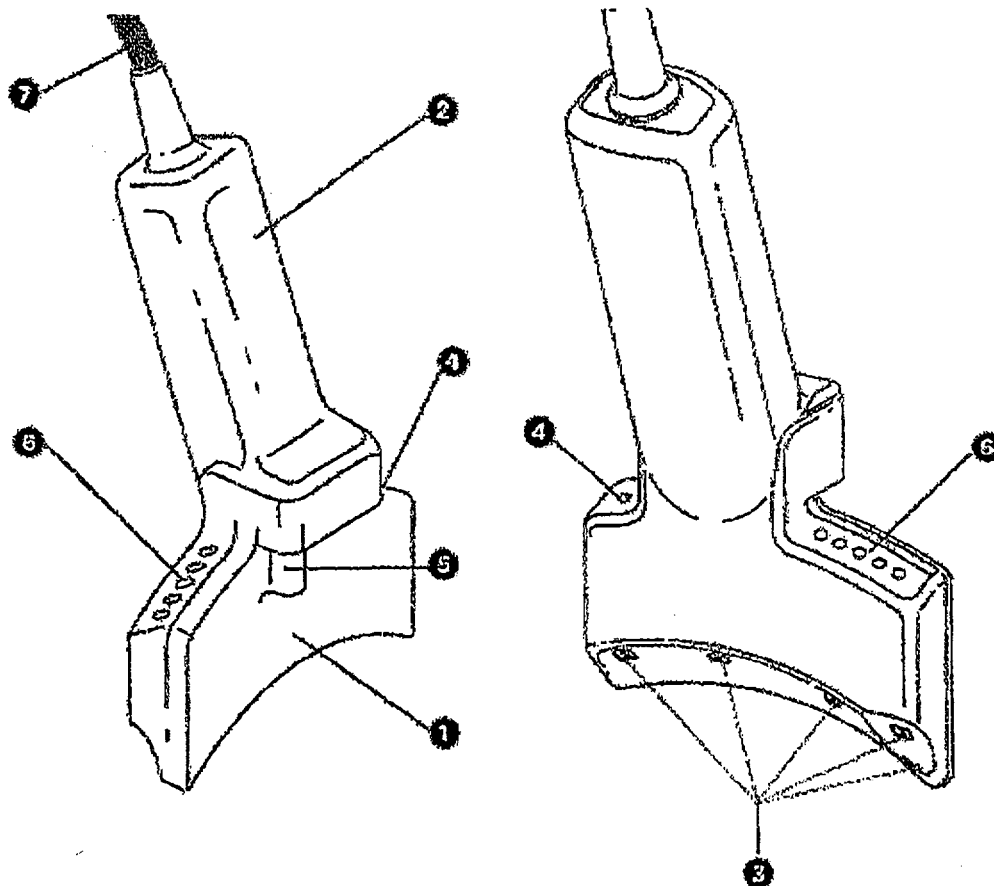
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4. The guiding pin (5) fits into the notch on top of the y-slide.
5. The five optical sensors are positioned so that each one corresponds to one of the five possible docking positions: 72°; 90°; 110°; 125° or **HIGH**. When checking the docking position the corresponding lamp (6) illuminates to indicate the reading angle.
6. The PDI is stored in the cabinet at the front of the radiation unit and is permanently connected by an electrical cable (7).

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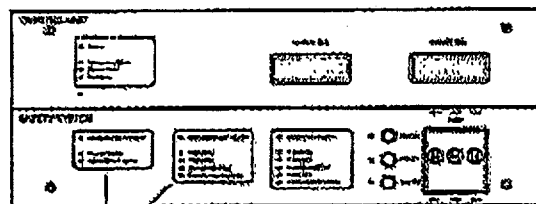
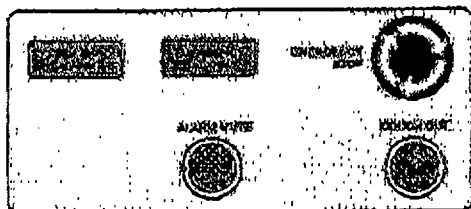
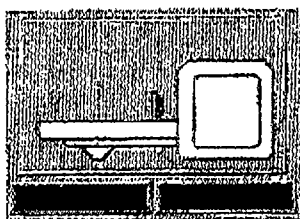
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IV. Emergency Alarm

A. An **emergency alarm** indicates a situation which has the potential to expose the patient or personnel to excessive radiation or some other hazard and requires immediate operator action.



Emergency Stop and Alarm Indicators

1. The **Emergency Alarm** indicators on the control panel and computer monitor lights up and the alarm buzzer is activated.
2. Information about the cause or nature of the alarm is shown in the System Information field at the bottom of the Treatment View dialog.
3. The Safety System also indicates the source of the emergency stop as either;

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- (1) Emergency caused by the operator by pressing the **Emergency Stop** button on the Control Panel.

b) External Pushbutton

- (1) Emergency caused by pressing an external emergency button (other emergency button than on the Control Panel).

B. Resetting an Emergency Alarm

1. Once the cause of the alarm has been cleared the interlocking can be reset by clicking the appropriate button in the **Configuration dialog**.

V. Emergency Procedures**A. What to do in an Emergency:**

1. In an emergency situation the authorized user (and/or neurosurgeon or radiation oncologist, and/or nurse), physicist, radiation therapist and RSO are responsible to implement corrective actions to the emergency situation.
2. In an emergency situation the authorized user, to include the neurosurgeon and/or radiation oncologist, and/or nurse, and/or radiation therapist is responsible for safe guarding the patient and safely removing the patient from the treatment room.
3. The physicist is responsible to assure the sources are shielded and to monitor access into the treatment room.
4. The radiation therapist and/or nurse will monitor the emergent event documenting the time of the emergency, the duration the patient is on the table if the shielding door remains open, duration the staff members are in the room if the shielding door remains open and time the emergent event has been corrected.
5. The RSO will be notified of all emergency situations.

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6. If any patient emergency occurs during the automatic treatment sequences you must assess the situation and decide on the most appropriate course of action:

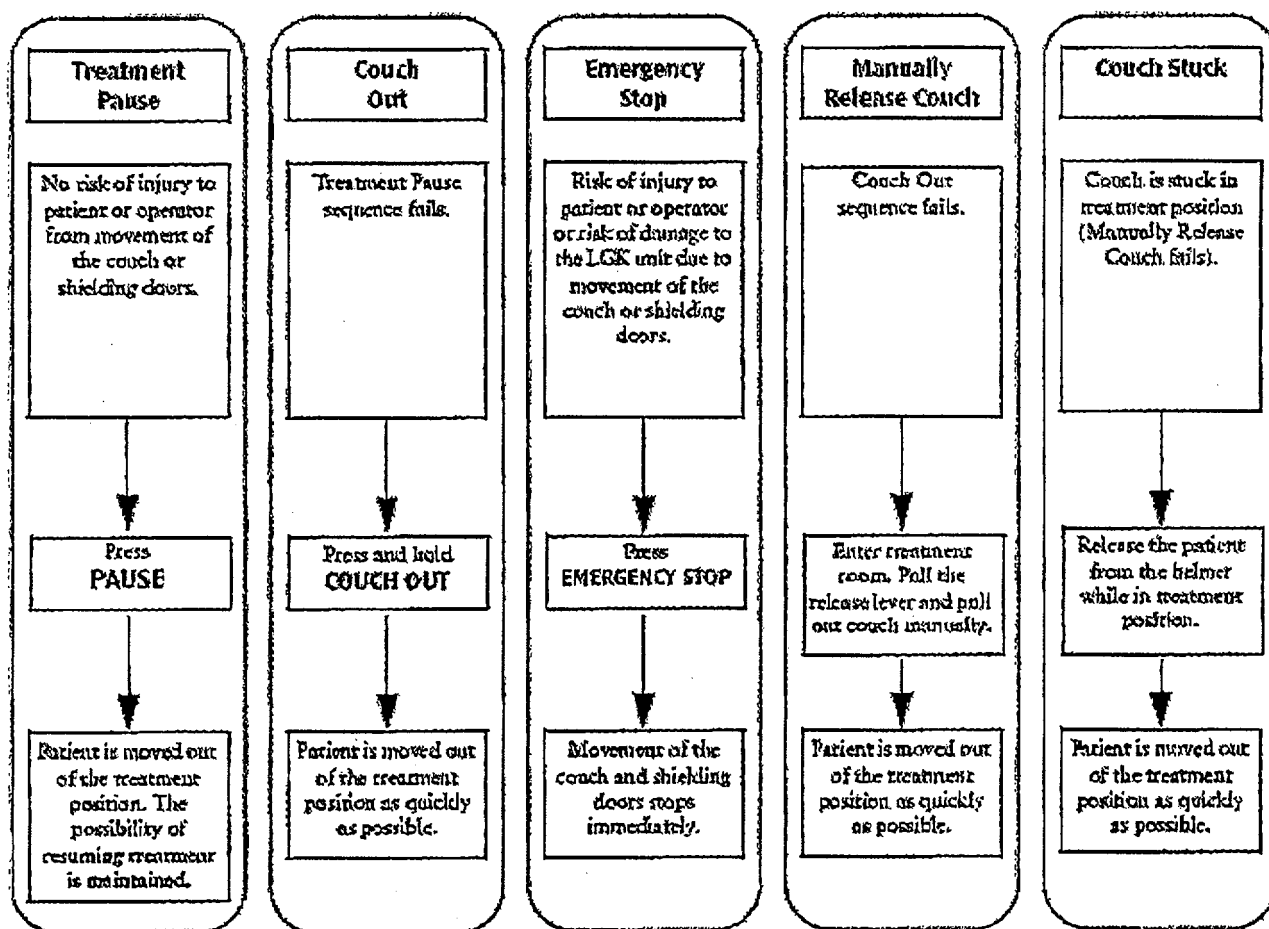


Figure 9.1 What to do in an Emergency: Options

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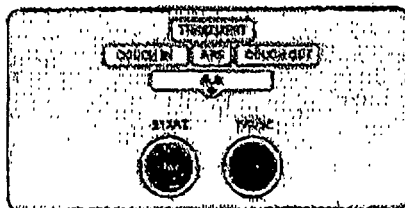
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B. Treatment Pause

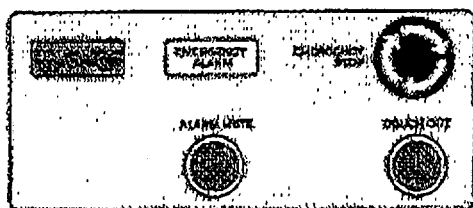
1. A treatment pause can be initiated if there is no risk of injury to the patient or operator from movement of the couch or shielding doors.
2. Activate a treatment pause by pressing the **Pause** key on the keyboard.



3. If the treatment pause sequence fails, press the **Couch Out** button at the operator panel.

C. Couch Out

1. If a treatment pause is activated but fails, the Couch Out button is used to move the patient out of the treatment position as quickly as possible. *Note: the Couch Out can be used even if the control unit is non-operational but it will not operate if the emergency stop is activated.*
2. Press and hold the **Couch Out** button until the shielding doors are closed.



The couch moves at high speed all the way to its outer position.

3. Release the patient from the collimator helmet.
4. Escort the patient from the treatment room.
5. If the shielding doors do not close automatically you must close them manually.
6. The physicist and/or RSO may attempt to close the shielding doors. In either case the treatment room will be locked and the service representative notified.
7. A sign will be posted on the treatment door restricting access until service arrives.

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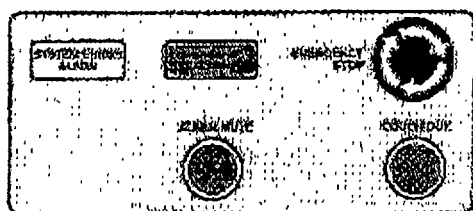
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8. There will be no admittance in the treatment room until the service representative has arrived.

D. Emergency Stop

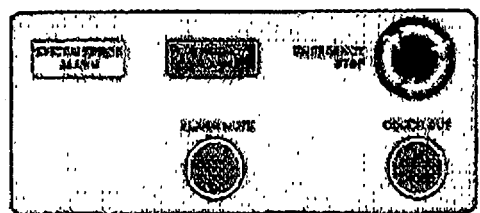
1. Use the emergency stop button when there is a risk of injury to patient or operator or risk of damage to the LGK unit due to movement of the couch or shielding doors. Movement of the couch and shielding doors stops immediately when the button is pressed.
2. Press the Emergency Stop button.



- a) The emergency alarm buzzer sounds, the emergency alarm indicators on the control panel and the treatment view monitor flash and the message Emergency Stop activated is displayed in the system information field.
 - b) The couch and radiation shielding doors hold their positions until the emergency stop is released.
3. If necessary, pull out the sliding couch manually. *Note: The Couch Out button will not operate while the emergency stop is activated.*

E. Restarting After an Emergency Stop

1. Turn the Emergency Stop button clockwise to release it as indicated by the arrows on the button. The couch moves out and the shielding doors close automatically.

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2. If the shielding doors do not close automatically, try to close them by use of the **Couch Out** button.

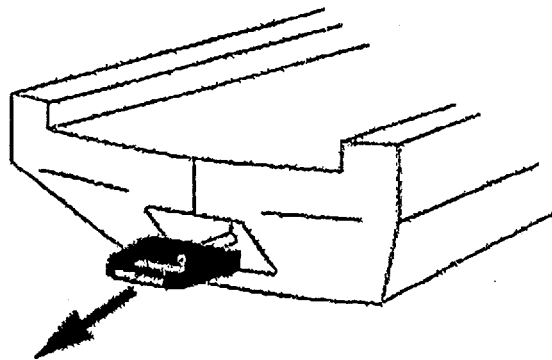
F. Manually Release Couch

1. If the couch out sequence fails and the couch is stuck in the treatment position you have to manually release the couch as follows:
 - a) The physicist, radiation therapist and/or nurse will enter the treatment room.

**WARNING**

Personnel entering the treatment room while the shielding doors are open must keep their exposure time to a minimum. Overexposure to gamma radiation can endanger health.

- b) Pull the couch release handle.

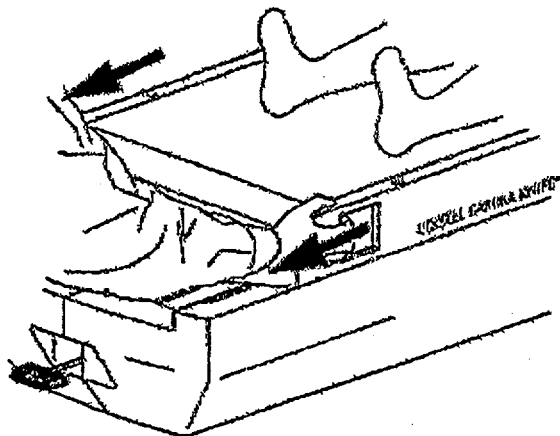


- c) Pull out the couch to fully withdrawn position by hand.

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- d) Release the patient and leave the treatment room together with the patient.
- e) If the shielding doors **did not** close, lock the door to the treatment room and inform the Physicist and Radiation Safety Officer.
- f) The physicist and/or RSO may attempt to close the shielding doors. In either case the treatment room will be locked and the service representative notified.
- g) There will be no admittance in the treatment room until the service representative has arrived.
- h) If the shielding doors did close, push back the release handle into locking position and verify that the couch is locked.

G. Couch Stuck in Treatment Position

- 1. If the couch becomes stuck in the treatment position and cannot be withdrawn manually, the patient must be released from the helmet using the special release tool(s).

**WARNING 64**

Personnel entering the treatment room while the shielding doors are open must keep their exposure time to a minimum. Overexposure to gamma radiation can endanger health.

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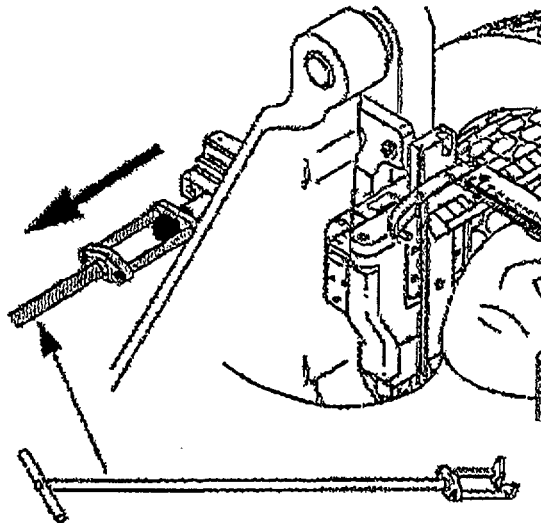
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The patient's head must be supported at all times when the coordinate frame is being docked to or removed from the APS or trunnions to avoid injury to the patient.

H. Manually Releasing the Patient from the APS

1. Ask the patient to keep his/her head up and be ready to take the weight of the coordinate frame.
2. Loosen one or both of the X axes slides of the APS units using the APS Special Release Tool.



3. If necessary, insert the Spade Tool between the APS Y slide and the coordinate frame and gently lever out the frame.
4. Release the patient and leave the treatment room together with the patient.
5. Lock the door(s) to the treatment room and inform the Radiation Safety Officer.

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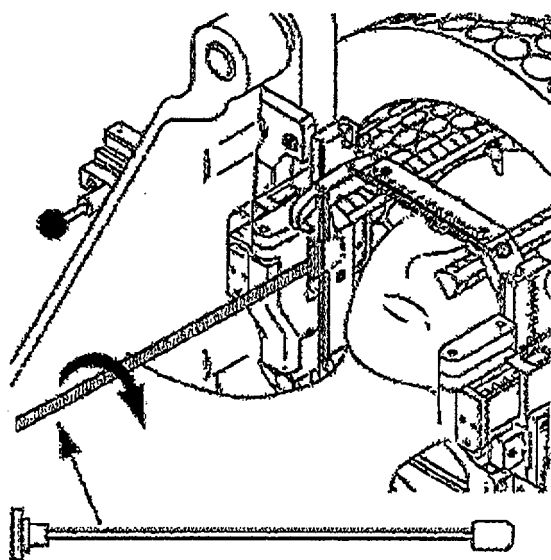
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I. Manually Releasing the Patient from Trunnions

**WARNING 66**

Personnel entering the treatment room while the shielding doors are open must keep their exposure time to a minimum. Overexposure to gamma radiation can endanger health.

**WARNING 67**

The patient's head must be supported at all times when the coordinate frame is being docked to or removed from the APS or trunnions to avoid injury to the patient.

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Authoring Department: Riverside and University of Virginia Radiosurgery Center

Date Approved: 3/2006

Effective Date: 6/2006

Last Date Reviewed: 5/2006

Last Revision Date: 05/2006

Replace Policy Date:

Retired:

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701 Town Center Drive, Suite 1000, Newport News, Virginia 23606

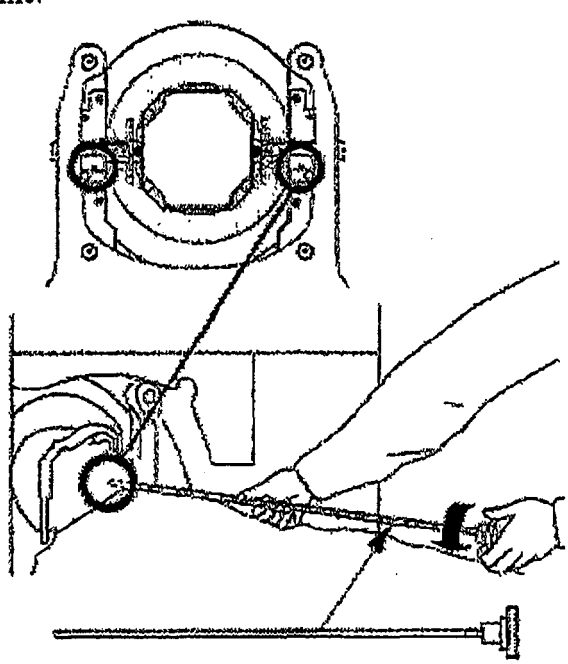
Policy / Procedure

RIVERSIDE FACILITY: RPMC**Category: Radiation Safety**

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Subject: Gamma Knife® Stereotactic Radiosurgery Device Emergency Procedures**Policy #: RSO - 36-03****Distribution Group: Radiosurgery and Radiation Therapy**

1. Ask the patient to keep his/her head up and be ready to take the weight of the coordinate frame.



2. Loosen one or both of the helmet trunnions using the long Allen key.
3. If necessary, insert the Spade Tool between the coordinate frame and the trunnion and gently lever out the frame.
4. Release the patient and leave the treatment room together with the patient.
5. Lock the door(s) to the treatment room and inform the Radiation Safety Officer.

Individual Authorized By:

Committees Authorized By: Radiation Safety Committee

Authoring Department: Riverside and University of Virginia Radiosurgery Center

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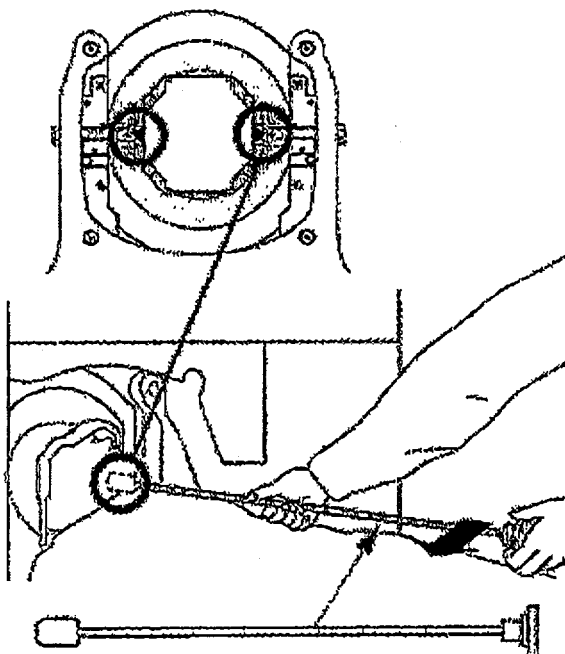
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RIVERSIDE FACILITY: RRMC**Category: Radiation Safety**

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Subject: Gamma Knife® Stereotactic Radiosurgery Device Emergency Procedures**Policy #: RSO - 36-03****Distribution Group: Radiosurgery and Radiation Therapy**

J. Closing the Shielding Doors

**WARNING 68**

Personnel entering the treatment room while the shielding doors are open must keep their exposure time to a minimum. Overexposure to gamma radiation can endanger health.

Individual Authorized By:

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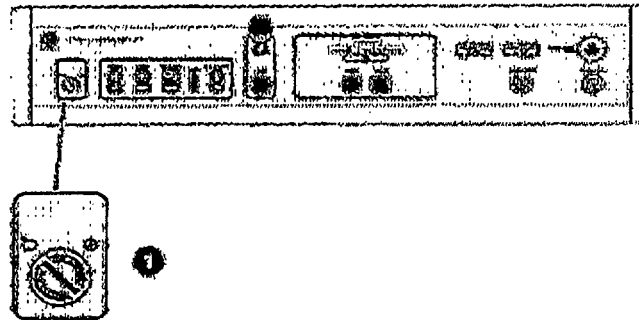
Policy / Procedure

RIVERSIDE FACILITY: RRMC**Category: Radiation Safety**

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Subject: Gamma Knife® Stereotactic Radiosurgery Device Emergency Procedures**Policy #: RSO - 36-03****Distribution Group: Radiosurgery and Radiation Therapy**

1. When the shielding doors are stuck in open position they will need to be closed manually.
2. Escort the patient from the treatment room.
3. Notify the RSO.
4. The physicist and/or RSO may attempt to close the shielding doors with the procedure outlined below. In either case the treatment room will be locked and the service representative notified.
5. Procedure:
 - a) Exit the system until the log-in dialog opens. Turn the Power keyswitch (1) to the off position. Bring the key with you.



6. Open the cover on the left side of the radiation unit.

Individual Authorized By:**Committees Authorized By: Radiation Safety Committee****Authoring Department: Riverside and University of Virginia Radiosurgery Center****Date Approved: 3/2006****Effective Date: 6/2006****Last Date Reviewed: 5/2006****Last Revision Date: 05/2006****Replace Policy Date:****Retired:**

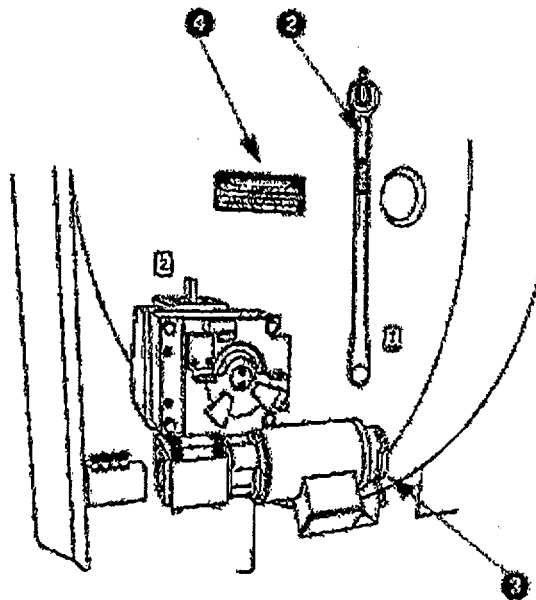
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RIVERSIDE FACILITY: RRMC**Category: Radiation Safety**

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Subject: Gamma Knife® Stereotactic Radiosurgery Device Emergency Procedures**Policy #: RSO - 36-03****Distribution Group: Radiosurgery and Radiation Therapy**

- ② Ratchet handle
- ③ Brake release handle
- ④ Instruction label:

FOR EMERGENCY USE ONLY

Pull the brake (1) and at the same time attach the ratchet handle at (2) and by turning the ratchet handle the doors will be closed manually

Individual Authorized By:

Committees Authorized By: Radiation Safety Committee

Authoring Department: Riverside and University of Virginia Radiosurgery Center

Date Approved: 3/2006

Effective Date: 6/2006

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Last Revision Date: 05/2006

Replace Policy Date:

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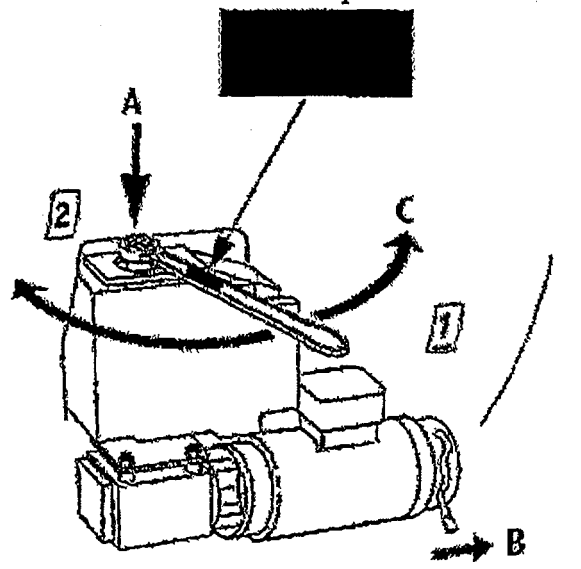
Policy / Procedure

RIVERSIDE FACILITY: RRMC**Category: Radiation Safety**

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Subject: Gamma Knife® Stereotactic Radiosurgery Device Emergency Procedures**Policy #: RSO - 36-03****Distribution Group: Radiosurgery and Radiation Therapy**

7. Lift the ratchet handle from the hook and attach it to the shaft pivot of the electrical motor unit with the label **CLOSE** upwards. A



8. Pull and hold the brake release handle of the motor. B
9. While holding the brake release handle, turn the ratchet handle from side to side to close the shielding doors. C
10. If the shielding doors cannot be closed manually, the treatment room door will be locked and the service representative notified and no admittance into the treatment room until service representative has arrived.

Individual Authorized By:**Committees Authorized By: Radiation Safety Committee****Authoring Department: Riverside and University of Virginia Radiosurgery Center****Date Approved: 3/2006****Effective Date: 6/2006****Last Date Reviewed: 5/2006****Last Revision Date: 05/2006****Replace Policy Date:****Retired:**

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Policy / Procedure**RIVERSIDE FACILITY: RRMC****Category: Radiation Safety**

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Subject: Gamma Knife® Stereotactic Radiosurgery Device Emergency Procedures**Policy #: RSO - 36-03****Distribution Group: Radiosurgery and Radiation Therapy****Emergency Contact Listing:****Authorized Users:**

Dr. C. Ronald Kersh: Office: (757) 220-4900
Home: (757) 220-8492
Pager: (757) 881-2705
Cell Phone: 291-3556

Dr. Joseph Layser Office: (757) 594-2644
Pager: (757) 885-0085
Cell Phone: (757) 880-3029

Authorized Medical Physicist:

John Freshcorn: Pager: (757) 885-3883
Offsite Pager: (513) 819-3730- Does not work in Virginia
Cell Phone: (513) 484-5708
Office- Ohio: (513) 965-9700 ext. 24

Radiation Safety Officer:

Harold Prussia: Office: (757) 594-2757
Home: (757) 826-4580
Pager: (757) 885-3878*
*can access www.archwireless.com to enter text message

Gamma Knife Administrator:

Sandra M. Snapp Office: (757) 594-2301
Home: (757) 868-4832
Cell: (757) 870-7841
Pager: (757) 885-0083

Individual Authorized By:**Committees Authorized By: Radiation Safety Committee****Authoring Department: Riverside and University of Virginia Radiosurgery Center****Date Approved: 3/2006 Effective Date: 6/2006 Last Date Reviewed: 5/2006****Last Revision Date: 05/2006 Replace Policy Date: Retired:**

**RIVERSIDE****H E A L T H S Y S T E M**

701 Town Center Drive, Suite 1000, Newport News, Virginia 23606

Policy / Procedure

RIVERSIDE FACILITY: RRM**Category: Radiation Safety**

Page 1 of 3

Subject: Gamma Knife® Stereotactic Radiosurgery Quality Assurance Plan**Policy #: RSO - 36-04****Distribution Group: Radiosurgery Department**

- 1) Periodic spot-checks shall be performed for the gamma knife stereotactic radiosurgery unit.
- 2) Periodic spot-check measurements shall be performed:
 - a. Monthly;
 - b. Before the first use of the unit on a given day; and
 - c. After each source installation.
- 3) Measurements shall be performed in accordance with this written policy which has been established by the authorized medical physicist (Policy RSO 36-05). The authorized medical physicist need not actually perform the spot check measurements.
- 4) The authorized medical physicist will review the spot-check measurements within 15 days and will notify the stereotactic radiosurgery facility as soon as possible in writing the results of each spot-check.
- 5) The monthly spot-checks shall assure proper operation of:
 - a. Audio/Visual System
 - b. Survey Meter/Check Source
 - c. Door Lock Operation
 - d. Room Radiation Monitors used to indicate source exposure (room & remote)
 - e. Emergency Tools (Allen Key, Trunnion Release)
 - f. Trunnion Centricity (using Trunnion test tool)
 - g. Microswitch test (using Helmet test box)
 - h. Stereotactic Frames and accessories
 - i. Door interlock Systems
 - j. Radiation (beam) Status Indicators
 - k. Treatment Stop Buttons in room
 - l. Emergency Interrupt Button (console)
 - m. Emergency Strobe Light Activation

Date of Origin: 05/06

Last Revision Date: 05/2006

Authorized By: Radiation Safety Committee

Source: U.S. Nuclear Regulatory Commission, VA Radiological Health

**RIVERSIDE****H E A L T H S Y S T E M**

701 Town Center Drive, Suite 1000, Newport News, Virginia 23606

Policy / Procedure

RIVERSIDE FACILITY: RRMC**Category: Radiation Safety****Page 2 of 3****Subject: Gamma Knife® Stereotactic Radiosurgery Quality Assurance Plan****Policy #: RSO - 36-04****Distribution Group: Radiosurgery Department**

- n. Timer accuracy over typical clinical range
 - o. Timer linearity over typical clinical range
 - p. Timer Reproducibility
 - q. On-Off error
 - r. Machine output in phantom with 18mm Helmet
 - s. Difference between the measured output and the expected (decayed output expressed as a percentage of the expected output)
 - t. Treatment table retraction mechanism
 - u. Emergency off buttons
 - v. Emergency timing circuits
 - w. Comparison of measured source output vs. calculated source output and comparison to output in computer system
- 6) The monthly spot-check measurements of the Leksell Gamma Knife Unit will contain all of the items listed on the Monthly Quality Checklist. A record of each spot-check measurement will be maintained for a period of at least 3 years. If the difference between the measured and the decayed output is 5% or more, the authorized medical physicist will immediately notify the RSO and the facility administrator.
- 7) Before the first use of the unit on a given day, spot-checks must assure proper operation of:
- a. Electrical interlocks at each gamma stereotactic radiosurgery room entrance;
 - b. Source exposure indicator lights on the gamma stereotactic radiosurgery unit, on the control console, and in the facility;
 - c. Viewing and intercom systems;
 - d. Emergency response tools;
 - e. Timer termination;
 - f. Radiation monitors used to indicate room exposures; and
 - g. Emergency off buttons; and
 - h. APS/Trunnion exchange check.

Date of Origin: 05/06**Last Revision Date: 05/2006****Authorized By: Radiation Safety Committee****Source: U.S. Nuclear Regulatory Commission, VA Radiological Health**

**RIVERSIDE****H E A L T H S Y S T E M**

701 Town Center Drive, Suite 1000, Newport News, Virginia 23606

Policy / Procedure**RIVERSIDE FACILITY: RPMC****Category: Radiation Safety****Page 3 of 3****Subject: Gamma Knife® Stereotactic Radiosurgery Quality Assurance Plan****Policy #: RSO - 36-04****Distribution Group: Radiosurgery Department**

- 8) On each day of use a daily check of the Leksell Gamma Knife Unit shall be made before the first treatment of a patient. The daily check will contain all of the items listed on the Daily Quality Assurance Checklist. The record of each daily check will be maintained for a period of at least 3 years.
- 9) The gamma knife stereotactic radiosurgery facility shall arrange for the repair of any system not operating properly.
- 10) If the results of the spot-checks indicate the malfunction of any system the facility shall lock the control console in the off position and will not use the gamma knife unit except to repair, replace, or check the malfunctioning system.
- 11) The gamma knife stereotactic radiosurgery department shall retain a record of the periodic spot-checks. All records required for compliance with the NRC's regulations, the conditions of our license and commitments made in our license application and correspondence with NRC shall be maintained.

Date of Origin: 05/06**Last Revision Date: 05/2006****Authorized By: Radiation Safety Committee****Source: U.S. Nuclear Regulatory Commission, VA Radiological Health**

**RIVERSIDE****HEALTH SYSTEM**

701 Town Center Drive, Suite 1000, Newport News, Virginia 23606

Policy / Procedure

RIVERSIDE FACILITY: RPMC**Category: Radiation Safety****Page 1 of 3****Subject: Gamma Knife® Stereotactic Radiosurgery Spot-Check Procedure****Policy #: RSO - 36-05****Distribution Group: Radiosurgery Department**

- 1) Periodic spot-check measurements shall be performed:
 - a. Monthly;
 - b. Before the first use of the unit on a given day; and
 - c. After each source installation.
- 2) Measurements shall be performed in accordance with this procedure which has been established by the authorized medical physicist. The authorized medical physicist need not actually perform the spot check measurements.
- 3) The authorized medical physicist will review the spot-check measurements within 15 days and will notify the stereotactic radiosurgery facility as soon as possible in writing the results of each spot-check.
- 4) The monthly spot-check procedure is as follows:
 - a. **Absorbed Dose Rate:**
 - i. Measured leakage during 5 minutes: $L = \text{nC}$
 - ii. Temperature = $^{\circ}\text{C}$, Pressure = mbar
 - iii. Took 10 different readings for 1 min each:
 - iv. Average $M = (\text{nC}/\text{min})$
 - v. $C_{lp} =$
 - vi. $M_u = M - L/5 [\text{nC}/\text{min}]$
 - vii. Dose Rate in water $D_w(t) = C_{lp} \cdot N_{D,w} \cdot M_u \cdot k_c [\text{Gy}/\text{min}]$
 - viii. $N_{D,w} = [\text{Gy}/\text{nC}]$
 - ix. So the Dose Rate = Gy/min at Date
 - x. Comparison of measured source output vs. calculated source output and comparison to output in computer system

Date of Origin: 05/06

Last Revision Date: 05/2006

Authorized By: Radiation Safety Committee

Source: U.S. Nuclear Regulatory Commission, VA Radiological Health

**RIVERSIDE****H E A L T H S Y S T E M**

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Policy / Procedure**RIVERSIDE FACILITY: RRMC****Category: Radiation Safety****Page 2 of 3****Subject: Gamma Knife® Stereotactic Radiosurgery Spot-Check Procedure****Policy #: RSO - 36-05****Distribution Group: Radiosurgery Department****b. Microswitch Test (using Helmet Test box):**

- i. Micro switches test performed for all four helmets by putting 0.1 mm shim under each helmet and tested and set the switches.
- ii. Adjust ring attached, "green signal"
- iii. Adjust ring & shims 0.1 mm attached, "red signal"
- iv. Check the Helmet ID = 1 and that helmet cap sensor is ok"

c. Trunnion Centricity (using Trunnion test tool):

- i. Mount and check Trunnions pair with helmet test tool, center coordinate left and right and 100 ok
- ii. Select timer run first select wrong collimator helmet then correct result ok
- iii. Start treatment, the door opening time is 7 ± 2 seconds
- iv. Treatment with shims 0.1 mm attached, couch return after 6 seconds during incorrect position.

d. Safety Switches Test:

- i. Check that it is not possible to start the treatment when
 1. The cap is removed ok
 2. Left patient protection panel is removed ok
 3. Right patient protection panel is removed ok
 4. The helmet changer is elsewhere than in stored position ok
 5. The treatment room door is open ok
 6. If emergency release handle on couch door is pulled
- ii. Checked the helmet screw sensor at helmet consol work properly ok
- iii. Check the helmet changer "in" sensor works properly i.e. press "couch in". Pull helmet changer Couch stop ok
- iv. Checked that the helmet trolley sensor works properly i.e. helmet can only be lowered to the helmet trolley if this sensor is activated ok

Date of Origin: 05/06**Last Revision Date: 05/2006****Authorized By: Radiation Safety Committee****Source: U.S. Nuclear Regulatory Commission, VA Radiological Health**

**RIVERSIDE****HEALTH SYSTEM**

701 Town Center Drive, Suite 1000, Newport News, Virginia 23606

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RIVERSIDE FACILITY: RRMC**Category: Radiation Safety****Page 3 of 3****Subject: Gamma Knife® Stereotactic Radiosurgery Spot-Check Procedure****Policy #: RSO - 36-05****Distribution Group: Radiosurgery Department**

- v. Checked that the helmet changer "down" sensor works properly i.e. helmet cannot be released from changer if this is not in down position even when helmet table is in position.ok
- vi. Checked the mattress slide lock/unlock works and that the squeeze protection works at front, middle and back on both right and left side. Ok

e. Emergency Safety Test:

- i. Switch on mains start treatment shut off mains. Treatment interrupted after 1 minute. Ok

f. Treatment Stop Test:

- i. Pushed "Treatment Pause" when couch is in treatment position:
- ii. checked that couch return ok
- iii. checked that elapsed time have stopped ok
- iv. pushed "Treatment Start" and checked that the treatment is continuing from existing elapsed time when the couch is in position ok
- v. pushed emergency stop. All movements stopped in the treatment room while shielding doors are opening .ok

g. Timer Safety Test:

- i. Checked synchronization during 30 minutes treatment
- ii. Verified timer correctness by: 1, 2, 4, 10, 20 min +/- 2%
- iii. On the treatment planning side we tested the treatment plan exported correctly to the treatment computer
- iv. Timer accuracy (Including on-off error)

h. Other Tests:

- i. General facility radiation safety items as listed on Monthly Check form
- ii. Proper operation of stereotactic frames and accessories

Date of Origin: 05/06**Last Revision Date: 05/2006****Authorized By: Radiation Safety Committee****Source: U.S. Nuclear Regulatory Commission, VA Radiological Health**

Gamma Knife Center
Riverside and University of Virginia Radiosurgery Center
Neuroscience Department

Daily Startup Procedure:

Week of / /	Mon	Tues	Wed	Thurs	Fri
Initials Physicist					
Emergency Release Tools Available					
Emergency Procedures Posted					
2 Video Monitors Operational					
Audio Communication Operational					
Source Exposure Indicator Light in Gamma Room					
Source Exposure Indicator Light at Console					
Which Helmet? (4, 8, 14 or 18 mm):					
Perform Alarm Test					
Test Run: Interlocks:					
1) Electrical Door Interlock					
2) Helmet Cover Interlock					
3) Lt. Patient Protection Interlock					
4) Rt. Patient Protection Interlock					
5) Timer Termination Check					
Test Run: Emergency Stops: Verify that the couch returns and treatment is paused under the following conditions:					
1) Open Door During Test Run					
2) Press "Couch Out" during Rx					
a) Press "Stop" while couch is moving out – verify that couch motion stops					
b) Pull out "Stop" and push "Reset" – verify that couch returns and doors close					
3) Press "Pause" during Rx					
4) Test of "Emergency Off" console button					
Test Run: Verify proper completion					
Both radiation monitors flashing during "Beam On" conditions:					
Both radiation monitors cease flashing when shield doors close:					
Radiation Survey: Meter reading less than 2.0 mR/hr?					
If indicated, run APS QA Test.					
Record Helmet Size (4, 8, 14, or 18 mm)					

Comments: _____

Riverside and University of Virginia
Gamma Knife Center
Gamma Knife Monthly Checks

Date: _____

Performed by: _____

Mechanical Checks	tolerance	P	F	Comments
Posted Safety Instructions	—			
Posted Emergency Instructions	—			
Audio/ Visual system	—			
Survey Meter/ Check Source	$\pm 20\%$			
Door Lock Operation	—			
Room Radiation Monitor	—			
Remote Indication for Room Radiation Monitor	—			
Emergency Tools (Allen Key, Trunnion Release)	—			
Trunnion Tests (2sets) 18mm	0.3mm			
Trunnion Tests (2sets) 14mm	0.3mm			
Trunnion Tests (2sets) 8mm	0.3mm			
Trunnion Tests (2sets) 4mm	0.3mm			
Microswitch Test 18mm	0.1mm			
Microswitch Test 14mm	0.1mm			
Microswitch Test 8mm	0.1mm			
Microswitch Test 4mm	0.1mm			
Stereotactic Frames and accessories				
Door Interlock Operation	—			
Radiation (beam) Status Indicators	—			
Treatment Stop Buttons (in room)	—			
Emergency Interrupt Button (console)	---			
Emergency Strobe Light Activation	<80s			
Emergency Timing Circuits	—			
Timer Accuracy/Linearity on/off error	$\pm 2\%$			
Timer Reproducibility	$\pm 2\%$			
Timer Linearity	$\pm 2\%$			
End Effect Value (from linearity curves)	—			
Timer Termination of Exposure	—			
Treatment Table Retraction or Backup				
Record result source output measurement				
Comparison source output measurement w/ anticipated output				
Comparison source output measurement w/ gamma knife computer calculations				
Comparison source output measurements w/ anticipated and computer values				

Comments: _____

Reviewed by Physicist: _____