Jefferson Lab
Thomas Jefferson National Accelerator Facility

Notable Event Worksheet

(See ES&H Manual Chapter 5200 Appendix T1 Event Investigation and Causal Analysis for Instructions)

Click For Word Doc

Title of Event			
Event Title:	Unposted Radiological Area Near-Miss		
Date and Time of Occurrence:	Saturday 3/24/2012; 0630 to 0800	**Notable Event Number:**	ACC-12-0324
Event Location:	South Linac Spreader/Recombiner Area	**Date Notable Event Report is Due*:**	April 27, 2012

*The Notable Event Report is due to the ESH&Q Reporting Officer with 30 days of the Initial Fact Finding Meeting unless an extension is requested.

Categorization and Reporting
(To be completed by ESH&Q Reporting Officer within two hours – unless essential information is still pending)

ORPS Determination:	**Date:**	3/27/12	**Time:**	1000 hrs

Not ORPS reportable- See attached email for details

10 CFR 835/851 Screen:	**Date:**	3/27/2012	**Time:**	1000

This incident does not meet the voluntary reporting criteria either as a discreet event or as a programmatic weakness.

Unless otherwise specified the following is to be completed by the Lead Investigator.

Step 1 Initial Fact-Finding Meeting

Date:	3/27/2012	**Time:**	0830	**Location:**	MCC Conference Room

Required Attendees:	**Optional Attendees:**	✓ if Present
Lead Investigator:	**Associate Director:**	
(Print Name): Harry Fanning (DSO)	(Print Name):	
ESH&Q Representative:	**TJSO Observer:**	✓
(Print Name): Tina Johnson	(Print Name): Dave Luke, Patty Hunt	
Supervisor of involved persons(s):	**Subject Matter Expert(s), Facility/Equipment Owner as applicable:**	
(Print Name): Noel Okay	(Print Name): Vashek Vylet	✓
Involved or impacted person(s): ARMS worker	(Print Name): Terry Carlino	✓
(Print Name): David Hamlette	(Print Name):	
(Print Name): Greg Marble	(Print Name):	
Witness(es):	(Print Name):	
(Print Name):	(Print Name):	

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Notable Event & Lessons Learned Worksheet

Agenda *(Ensure the pace of the meeting allows time for accurate note taking.)*	√ if Complete
1. Introduction – Provide Event Title, Date and Time of Occurrence, and Location:	✓
2. Attendance - Are Required Attendees present.	✓
3. Purpose of Initial Fact-Finding meeting.	✓
4. Event Reconstruction – Use information to complete Section 3. Summary of Event and/or Injuries below.	✓
a. Personnel and organizations involved in the event.	✓
b. Conditions and actions preceding the event.	✓
c. Chronology (timeline) of the event; and	✓
d. Immediate actions taken in response to the event.	✓
5. Clarify information – Subject-Matter Expert (SME) confirms work conditions.	✓
6. Stop Work or the Tag Out Required? If "Yes" – establish the restart criteria and inform the affected Management chain.	no
7. Compensatory Actions Required? If "Yes" determine responsibility and include confirmation documentation.	no
8. Records or documentation required to confirm, clarify, or complete information (i.e., work plans, work control documents, photos, etc).	✓
9. Other Questions or Concerns: Ask attendees if there are any other questions, concerns, or information that they wish to provide.	✓
10. Obtain TJSO Observer feedback on conduct of fact finding meeting and potential improvements.	✓

Step 2 Investigation Team:	**Date Convened:** (Within 24 hours of Fact Finding Meeting.)	4/4/12 (earliest available time)	
Role	**Name**	**Department/Group**	**Phone**
Lead Investigator	Gina Dixon Roemer	ESH&Q/Radcon	7417
Safety	John Kelly	ESH&Q/Safety	7531
SME	Terry Carlino	Accelerator Ops	5827
TJSO Observer	n/a	TJSO	

Step 3 Summary of Event and / or Injuries, including Initial Fact Finding Meeting information: determine the chain of events and timeline. Use attachment as necessary.

0604 Vacuum Event recorded in the MCC.
NOTE: this is 6 hours into the ARM's first Owl Shift of this cycle. He later reported that he had not slept in approximately 32 hours. He worked days the previous Wednesday, had Thursday off, and came in at 2330 on Friday 3/25/12.

Step 3 Summary of Event and / or Injuries, including Initial Fact Finding Meeting information: determine the chain of events and timeline. Use attachment as necessary.

0623 ARM calls Radcon to report Vacuum Event and indicates he will soon make an access to perform a survey in the Spreader/Recombiner area. ARM says he will call Radcon with results.

0722 The ARM picks up one of two available meters, enters the South Linac (SL), and starts the survey. The two available meters are (1) the yellow Teletector-6112B, with an analog readout and lacking an audible signal, (typically used in high magnetic fields (i.e., Halls A and C)); and (2) the FH-40G, equipped with a digital readout and audible signal (please see photo, attached). The ARM selects the Teletector, since he most often surveys the Halls and is thus more familiar with this instrument. He later states that, once in the SL, he realized he should have brought the FAG, but decided to proceed with the instrument he had.

0727 Owls shift Crew Chief calls Radcon with same information as in previous call by ARM.

0801 The ARM leaves the SL; survey is completed. Two elevated contact readings (25 and 35 mrem/hr) on contact) were recorded. Highest recorded whole body dose rate is 3 mrem/hr. As defined by regulations, a Hot Spot is >100 mrem/hr on contact, and at least 5 times the whole body dose rate; a Radiation Area is defined as a reading of >5 mrem/hour at a distance of 30 cm from the source

0811 The ARM completes filling in the survey sheet and has the Owls Crew Chief review it. He then leaves the site, his shift over.

0824 The ARM's completed survey is posted in the Elog/Radlog.

0832 Radcon has not received the follow-up call from Owl Shift ARM or Crew Chief, so he called the MCC. The Day Shift Crew Chief relayed the results of the ARM's survey to Radcon. Radcon questioned the maximum readings, believing that a vacuum event would be associated with much higher levels, based on his knowledge and experience. A Vacuum Tech waiting to enter the SL to assess and repair speaks with Radcon and agreed to wait until Radcon arrives and repeats the survey.

0911 Radcon enters the SL with the Vacuum Tech. Radcon, using a Radcon instrument, surveys the SL, including the Recombiner and Spreader region, but not the Arcs. He finds two hot spots (9R02; 267 mrem/hr contact, and 2S03; 160 mrem/hr contact.) Each hot spot has an unposted Radiation Area associated with it (10 mrem/hr and 6.6 mrem/hour whole body, respectively). Radiation areas are posted.

0959 Radcon and the Vacuum Tech left the SL. The discrepancy with the survey was discussed with the Crew Chief and a determination **was** made to check the instrument that the ARM used. Radcon source checks the instrument using the calibration source in the MCC Control Room.

1040 Radcon reentered the SL to check the readings on the same instrument used by the ARM. Radcon found readings consistent with the survey he just performed: 200/10 at 9R02, 150/30 at 2S03.

1112 Radcon leaves the SL. Radcon accompanies the Vacuum Tech during his initial entries in a Radiation Area, then authorizes him to complete the job with brief entries for leak checks, etc.

Step 3 Summary of Event and / or Injuries, including Initial Fact Finding Meeting information: determine the chain of events and timeline. Use attachment as necessary.

1125 Radcon's completed survey is posted in the Radlog. Radcon verifies that no one entered the SL on the basis of the ARM's survey, so there was no 835 violation.

1140 Oncoming ARM enters the SL to the survey the Arcs. These are the only areas which have not been re-surveyed.

1231 Oncoming ARM leaves the SL.

1232 Post to Radlog by Radcon: *Unposted radiological area near-miss.*

This is a combination of specific times from the Elog, Radlog and PSSlog, with added information from the posts for actions for which exact times are not recorded.

Additional items:

1. Actual hot spot found by Radcon in the spreader/recombiner area was difficult to access (on the outside/wall side of the beam line).
2. Labeling for location purposes was found to be inconsistent with standard methods used throughout linacs.

Neither item, though, raised in the fact-finding meeting, appears to have relevance to this event.

Notable Event Report

Emergency Notifications Made (Subsequent to the Event):		Date	Time
Fire, Rescue & Emergency Medical: (9-911)	NA		
Guard Post: x4444; 269-5822	NA		
Occupational Medicine 269-7539	NA		
ESH&Q Reporting Officer: 876-1750		March 24, 2012	1140
Crew Chief 630-7050		March 24, 2012	1135
Industrial Hygiene: 269-7863:	NA		
Other: Mary Logue, Associate Director of ESH&Q		March 24, 2012	1200

Witness Accounts: (Use attachments as necessary. Box will expand as necessary)

Radcon management provided additional information, partially based upon historical events.

An almost identical scenario happened a number of years ago, and the common elements were;

- night shift operator
- survey occurring right at shift change
- surveying in Linac (Operators infrequently survey the linacs, and therefore aren't as familiar with them radiologically)
- Survey meter did not have an audible signal. (This necessitates constant visual monitoring of the device's analog display.)

Witness Accounts: (Use attachments as necessary. Box will expand as necessary)

Part of the correction for that event was that Accelerator Ops committed to avoiding putting ARMs in this situation, if at all possible, recognizing that coming off a night shift was not the best time to be doing safety-intensive tasks. Had this survey been performed by the oncoming shift, it is more likely that the radiation areas would have been found.

The dual purposes of this survey were to (1) investigate the area where a vacuum event had occurred, and (2) perform a radiological survey prior to entry.

Because it was a vacuum event, and based upon operational experience, the ARM ought to be expecting high dose rates. When beam loss is severe enough for vacuum to go bad, one should immediately assume you will find hot spots. Ops staff in the MCC probably should have questioned the relatively low rad levels on the survey.

More importantly, the dual purpose survey after a vacuum event presents an inherent "conflict of interest." The ARM's job is to perform a radiation survey for radiation protection purposes. When investigating a vacuum event, the focus moves somewhat into the "diagnostic, search and locate" mode. This is especially true if the ARM is conducting this activity by him/herself. It is very difficult for the ARM not to slip into this mode – even if they are consciously trying to avoid it – because it is so closely connected to their primary job, and because the radiation levels are such a good diagnostic tool for this task.

In almost all other cases, ARMs are surveying on behalf of others. In this particular case, the nature of what needs fixing is directly tied to the job of running beam, and there is operational value in finding the beam loss.

Environmental Aspects	**N/A**
Type of Material Released:	**Quantity:**
Source:	**Time Flow was Halted or Controlled:**

For Investigation Team (✓ All That Apply):

☐ **Reportable Quantity** ☐ **Impact Ground/Soil** ☐ **Storm Water Channel/Drain** ☐ **Sanitary Sewer**

Records, Documents, Pictures, and Other References: (Copy and paste, use attachments or document links as necessary)

Attachment 1: Survey conducted by ARM in SL on 3/24/12

Attachment 2: Survey conducted by Radcon in SL on 3/24/12

Attachment 3: Drawing of relevant area of South Linac

Attachment 4: Photo of two survey instruments

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Notable Event & Lessons Learned Worksheet

Causal Analysis: (Use attachment as necessary)	
Root Cause:	Human Performance: Worker excessively fatigued
Contributing Causes: (List as many as apply.)	1. Tools/instruments Needs Improvement NI (instrument provision/selection) 2. Complex System: Knowledge-based decision required (vacuum event = significant radiation loss) 3. Selection of Worker: fatigued (oncoming ARM more appropriate to do survey) 4. Management Standards, Policies, or Administrative Controls (SPAC) NI: Communication of SPAC NI (failure to formalize procedure change after previous, similar event)

Extent of Condition Check	Responsible Person(s)	JLab CATS Number	Target Date
N/A			

Corrective Action(s)	JLab CATS Number	Target Completion Date
Accelerator Ops to develop policy, in consultation with Dr. Chandler, on management of fatigue. Policy should address personal responsibility as well as scheduling and work management.	NE-2012-09-01	August 31, 2012
Acquire new instrument for MCC for Linac surveys.	NE-2012-09-02	July 31, 2012
Establish protocol for surveys needed due to beam loss incidents.	NE-2012-09-03	July 31, 2012
Consider need for periodic recertification of ARMS to include practical-factor component.	NE-2012-09-04	July 31, 2012

Lessons Learned (Confer with Division/Department Lessons-Learned Coordinator) (Use attachment as necessary)	JLab COE Number
Communication of valuable knowledge obtained from a past similar event was not shared with the new ARMS.	N/A

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Investigation Team Confirmation:
The below signees, confirm to the best of their knowledge, that the information presented in this document is accurate and complete.

Role	Print Name	Signature	Date
Lead Investigator	Gina Dixon Roemer	Gina Dixon Roemer	4/30/12
ESH&Q SME	John Kelly, CSP, CIH		4/30/12
Accelerator Ops SME	Isadoro Carlino		04/30/2012

Upon confirmation submit document to the ES&H Reporting Officer for completion and distribution.

Documentation of Findings: (To be Completed by ESH&Q Reporting Officer)

	Notable Event Number:	ACC-12-0324
	CATS Number:	NE-2012-09
	JLab COE Number:	NA
	ORPS Number:	NA
	NTS Number:	NA
	CAIRS Entry:	NA
	DOE Cause Code:	NA
	ISM Code:	Perform Work within Controls, Provide Feeback and Continuous Improvement.

Acceptance/Acknowledgement of Facts

	Print Name	Signature	Date:
Associate Director/ Department Manger	ANDREW HUTTON	Andrew Hutton	5/1/12

Distribution:
ES&H Reporting Officer (Original)
Associate Director/Department Manager
Division Safety Officer
Investigation Team Members

Form Revision Summary

Revision 1.3 – 01/31/12 – Updated ESH&Q Reporting Officer assignment from S. Smith to C. Johnson per M. Logue
Edited to clarify process steps.
Revision 1.2 – 10/20/11 – Updated ESH&Q Reporting Officer assignment from J. Kelly to S. Smith per M. Logue.
Revision 1.1 – 05/24/11 - Edited to clarify process steps.

Subject: ORPS/NTS determination for the Unposted Radiological Posting Near Miss
From: Tina Johnson <cjohnson@jlab.org>
Date: 3/27/2012 5:11 PM
To: Patty Hunt <phunt@jlab.org>, David Luke <luke@jlab.org>
CC: Harry Fanning <fanning@jlab.org>, Tina Johnson <cjohnson@jlab.org>, Mary Logue <logue@jlab.org>, Ned Walker <nwalker@jlab.org>, Jennifer Williams <jennifer@jlab.org>, John Kelly <jkelly@jlab.org>, kujawa <kujawa@jlab.org>, Bert Manzlak <manzlak@jlab.org>, Dick Owen <rowen@jlab.org>, Tina Menefee <menefee@jlab.org>, Paul Collins <paulc@jlab.org>, Bill Rainey <wrainey@jlab.org>, David Hamlette <hamlette@jlab.org>, Gina Dixon <gldixon@jlab.org>

Patty and Dave,

Good Afternoon! As you are aware, on March 23, 2012, there was a need to access the tunnel to check out a failed vaccum. The ARM surveyed and found the area to be reading ~3 mrem/hr, which would have allowed folks to go in and check out the vacuum. Dave Hamlette, RadCon, questioned the survey, as it appeared to be low to him and he came in and resurveyed the area, and found it to be ~5-10 mrem/hr. At those levels that area should have been posted as a Radiation Area.

As a follow-up to this morning's fact finding meeting (Unposted Radiological Posting Near Miss),this event is being classified as a Notable Event.

This event is not an ORPS/NTS reportable per DOE O 232.2.

If you have any questions or concerns about this event, feel free to contact me.

Thank you,
Tina

--
Tina Johnson
Reporting Officer/
Administrative Assistant
JSA/Jefferson Lab
12050 Jefferson Ave
Suite 602
Newport News, VA 23606
757-269-7611

HPF-SUR-001 Rev: 3 12/15/09	RADIATION CONTROL DEPARTMENT RADIOLOGICAL SURVEY FORM	Page ___ of ___
AREA (map reference if applicable): SOUTH LINAC	Accelerator Operating Conditions: 180uA 1st pass	Instrument: 6112B Serial #: 10189 Cal.Due: 6/9/12
Reason for survey: Vacuum Event Arc		

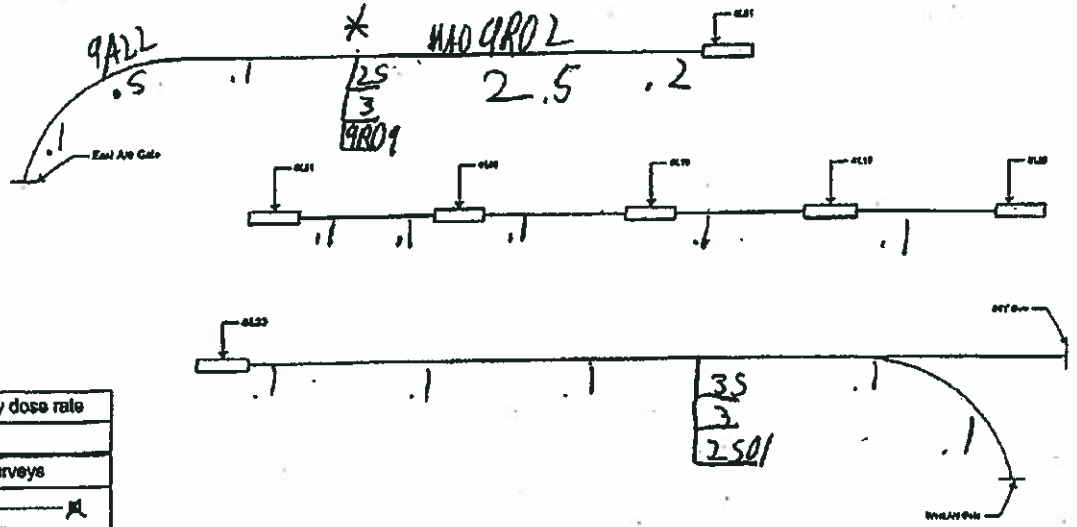
LEGEND

All Readings in mr/hr whole body (unless annotated otherwise)
------ Denotes posted area
(#) Denotes smear location (refer to pg 2 for smear results)

Contact dose rate
WB dose rate
Item Description

Approved Abbreviation:

RA-Radiation Area
HRA- High Radiation Area
CA- Contamination Area



Highest area posting and whole body dose rate
3 RCA
For Beam Enclosure Entry Surveys
Full survey, all areas posted ---------- ☒
Partial survey with continuous surveillance -- ☐
Partial survey with exclusion zones posted -- ☐
Comments:

Performed by: Brandi Griffin	Date/Time: 3/24/12 0811	Crew Chief Review:	RCD Review:

xv 3.10a: /tmp/tmp.B8NPMMmvf2.1 <unregistered>

HPF-SUR-001 Rev: 3 12/15/00	RADIATION CONTROL DEPARTMENT RADIOLOGICAL SURVEY FORM	Page 1 of 1
AREA (map reference if applicable): SOUTH LINAC	Accelerator Operating Conditions:	Instrument: FH40G Serial #: 10629 Cal.Due: 9/9/12
Reason for survey: RE-SURVEY		

LEGEND

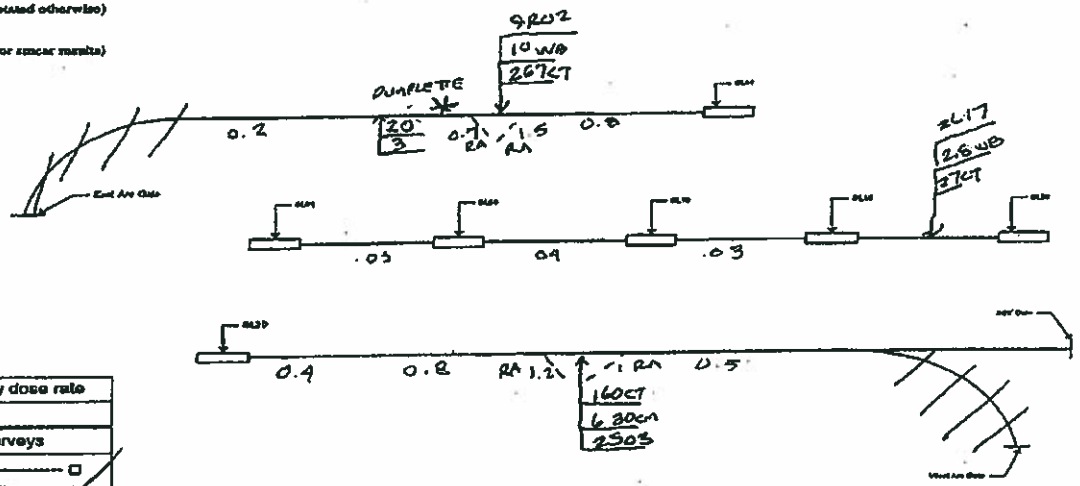
All Readings in mr/hr whole body (unless annotated otherwise)
-------- Denotes posted area
(#) Denotes smear location (refer to pg 2 for smear results)

Contact dose rate
WB dose rate
Item Description

Approved Abbreviation:

RA-Radiation Area
HRA-High Radiation Area
CA- Contamination Area

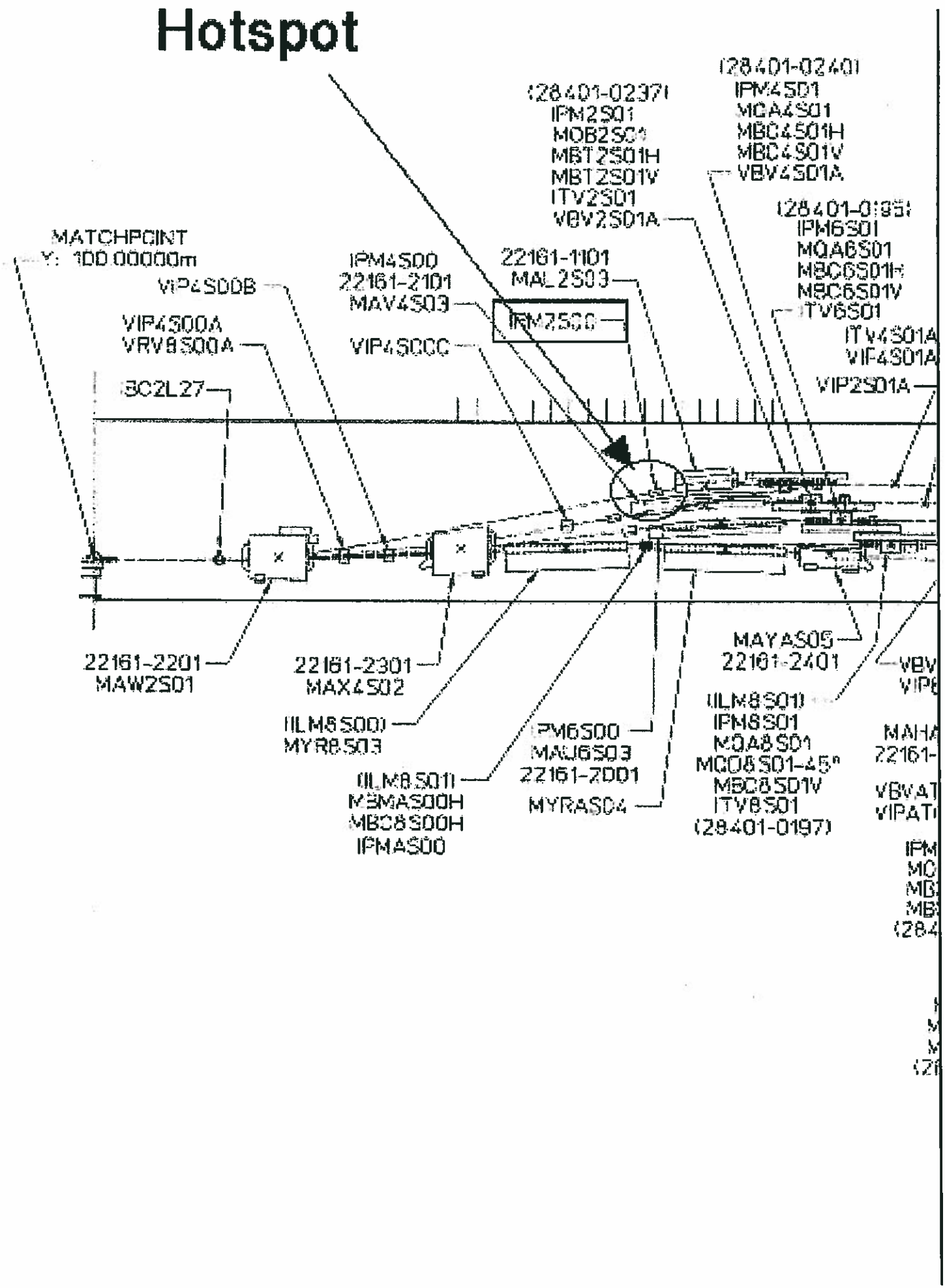
////-AREA NOT SURVEYED



Highest area posting and whole body dose rate
RA - 10
For Beam Enclosure Entry Surveys
Full survey, all areas posted ☐
Partial survey with continuous surveillance ☑
Partial survey with exclusion zones posted ☐
Comments: #1803 WATER SPRAY FROM PIPE

Performed by:	Date/Time: 3/26/12	Crew Chief Review:	RCD Review:

Hotspot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MBC8S00H
IPMAS00
IPM6S00
MAU6S03
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