

Notable Event Report

Title of Event			
Event Title:	Employee Failed to Properly Post a High Radiation Area and a Radiation Area		
Date and Time of Occurrence:	October 3, 2016 ~12:00	Notable Event Number:	ACC-16-1003
Event Location:	South Linac	Date Notable Event Report is Due*:	11/03/2016

*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.

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

During a Controlled Access, an employee in the South Linac came upon a radiological area and questioned the posting. The worker informed the Operability Manager who then contacted RadCon. RadCon investigated the South Linac, and determined that a high radiation area and radiation area were not appropriately posted as required under 10 CFR 835. The condition was immediately corrected.

The initial entry survey was completed by the ARM on shift. The ARM was asked to complete a full survey by their Crew Chief during normal business hours. Standard practice is to have RadCon perform the survey when possible. The ARM indicated that they tried to contact RadCon Field Ops Supervisor and got their voice message. At that particular time, the message did not leave the other technicians' telephone numbers. His crew chief asked the ARM to proceed (note, the standard web call-in list was not consulted).

As the ARM prepared for the survey he was asked to provide an escorted survey to the 2L12 area. The employee completed his task, and the ARM escorted him back out. The ARM then restarted his survey. The completed survey and related radiological postings contained several errors, described below.

(1) The survey form indicates a Radiation Area near the 2S04 viewer (7 mrem/hr @ 30 cm). However, the ARM failed to post this location as a radiation area. The ARM erroneously interpreted the posting criterion to be based on general work area dose rates and judged the vicinity of the viewer to be inaccessible. The requirement is based on dose rate at 30 cm from the item. The viewer was accessible by use of a ladder or platform.

(2) The survey map correctly shows a radiation area near the C100's but the ARM did not change the postings in this area to indicate the radiation area condition. The C100s area was posted "Danger- Area Not Surveyed- DO NOT ENTER" (a pre-posted boundary intended to prevent access prior to surveys). The signs should have been replaced with signage that stated Radiation Area.

(3) The region around the Southeast tuneup dumps (dumplettes) was documented on the survey map and posted as a Radiation Area, but the ARM failed to survey behind the dumplette area where there is no shielding, and therefore did not identify the High Radiation Area (HRA) that was present there. Had the ARM discovered this area, the appropriate action would have been to contact RadCon for assistance in posting it (ARMs are not permitted to enter or post HRAs during their surveys). The ARM stated he was unaware that the dumplette was not shielded on the back side so therefore did not focus his attention there. The HRA was discovered when the RCT resurveyed the area (see the documents section of this report for copies of surveys).

Causal Analysis: (Use attachment as necessary)

Summary

The root cause of this event takes into account several other similar recent events. This event is the third in two years involving inadequate surveys/postings by an ARM (two of these events resulted in infractions of 10 CFR 835). In this particular event, three different types of survey/posting errors were made. In all of these cases, the surveys were conducted in areas where radiation levels were dynamic and judgments about posting and erecting boundaries were required. While training is an obvious potential root cause, when we take into account the details of these events, it is believed that the expanding and dynamic radiological footprint around CEBAF may have outgrown the current ARM program. While providing additional or more frequent training may help, evidence suggests that given the present radiological conditions, the level of radiological expertise needed to conduct the scope of duties required for ARMs may be higher than can be adequately supported as a "supplemental" duty for Operations staff (this is also evident in the account given by the ARM below, and has been a potential contributor in previous errors).

Based on this analysis, we have recommended that a review be conducted by RadCon to evaluate the scope of the program for goodness-of-fit within the Operations program and to make recommendations for any changes determined to be needed. The final decision on these changes should be made jointly by ESH&Q and Operations management. It is noted that this root cause determination requires additional review to confirm, and it is possible that the review may conclude that this potential root cause was not in fact the primary cause of the event. In any case, the final conclusions will be fully documented.

In addition, training deficiencies were noted as well as some inconsistencies with how "keep out" zone postings have been implemented in various areas of the site. These topics need to be addressed as well, with the changes to the training program tailored to support whatever adjustments are made in the scope of the ARM program. To accommodate this, due dates for the training actions should be commensurate with completion of any other program revisions determined necessary.

See attached Causal Analysis for additional details.

Root Cause:	Complex system; knowledge-based decision required. Given the current scope and complexity of radiological conditions, performance expectations for ARMs may exceed the level of resources available to maintain an error-free program of the present depth and breadth.
Contributing Causes: (List as many as apply.)	Understanding Needs Improvement (NI): Instruction needs improvement/continuing training needs improvement. Details of beamline/shielding configuration not covered specifically in training. Requirements for posting not understood. Standards, Policies or Admin Controls NI: Confusing or Incomplete. The use of "keep out" zone posting is not consistent in all areas and was incorrectly applied following a complete survey.

Extent of Condition Check	JLab CATS Number	Target Date	Action Owner
Check the probe to ensure that it is accurate. Evidence of completion: Calibration Report	NE-2016-19	01/31/2017	David Hamlette

Extent of Condition Check		JLab CATS Number	Target Date	Action Owner
Does this event involve failed equipment?	Y <input type="checkbox"/> N <input checked="" type="checkbox"/>	Is there similar equipment in other areas?	Y <input type="checkbox"/> N <input checked="" type="checkbox"/>	** If yes, assign extent of condition check to the appropriate DSO(s).

Corrective Action(s)	JLab CATS Number	Target Date	Action Owner
Conduct a thorough review of the scope of the ARM program. The review should include (1) benchmarking the scope of the program against similar DOE facilities, (2) interviews or surveys of ARMs to identify vulnerabilities, (3) practices such as pre-posted areas, "walk-through" postings, use of escorted accesses, etc. and (4) discussions with Operations management to evaluate feasibility of potential changes.	NE-2016-19	3/31/17	Keith Welch
Evidence of completion: Formal proposal from RadCon detailing findings and recommendations for program modifications, if any.			
Revise/update ARM training. The scope of the revision should cover the classroom training, the job performance measures, and OJT signoff process. In particular, improve the details of expected process knowledge of the radiological conditions on the area familiarization documents. Evaluate the need for retraining on practical elements. Evaluate annual refresher training. Changes need to be harmonized with whatever program scope changes are made based on the ARM program review.	NE-2016-19	4/30/17	David Hamlette
Evidence of completion: Results of the evaluation and revised training program elements.			
Evaluate the posting of "keep out" areas. If this practice is retained, ensure that the postings and protocols for establishing them are consistent and their basis is documented.	NE-2016-19	2/28/17	David Hamlette
Evidence of completion: Document describing rationale and scope of practice.			
RadCon should establish a schedule for management self-assessments to specifically evaluate the ARMs program on a periodic basis.	NE-2019-19	05/30/17	Keith Welch
Evidence of completion: Email to QA Lead Assessor requesting the topic get added to the database			

Lessons Learned (Confer with Lessons Learned Coordinator) (Use attachment as necessary)	Lessons Learned Number
Unique programs involving delegation of key functions outside primary program ownership should undergo periodic formal reviews to ensure scope of the delegated functions and skill set inventory remain well matched.	982

Lessons Learned (Confer with Lessons Learned Coordinator) (Use attachment as necessary)	<u>Lessons Learned Number</u>
Subject matter experts (SMEs) should either conduct or provide close oversight of on-the-job training on safety-significant tasks.	982

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

Questions and responses of the ARM in a follow-up query conducted to obtain more details. Answers received on 10/17/16 (answers are in bold red type).

1. Was your recollection of the requirement to post an area based on dose rate at 30 cm from at item unclear? Said differently, did you interpret the posting requirement to apply to "general area" conditions rather than specific dose rate at 30 cm?

I interpreted it as the conditions based on the general walkway area and didn't remember that a posting acts as a vertical barrier. My thinking was I know no one was working in this area and it was too high to affect anyone in passing. In retrospect, I'm aware of my error.

2. Given what you remember from training, would you consider the beamline in the first pass to be inaccessible?

Nope after it was made aware to me by the Rad Tech w/ his "ladder" example

Another possibility is that the decision was influenced by human engineering aspects (ergonomics, system complexity, etc.). For instance the ergonomics of posting the area. Specifically:

1. Could the difficulty or time involved in retrieving posting materials have influenced your decision in not posting it? Said differently; if there had been signs and ropes available in the immediate area, do you think you would have been more likely to post it?

It's a possibility that this played a factor in retrospect, but I'm sure it wasn't my first thought when I decided not to. As for posting if materials were closer, I really can't answer that based on it not being my first thought.

2. Are you familiar with the locations of where the RCD stores ropes, signs, etc.?

Yes

3. Do you consider the supply cabinets to be reasonably accessible and well-stocked?

They seem to be

Lastly, the issue of the scheduling or lack thereof of the maintenance work is another area we're looking at. **This actually applies to all the survey/posting issues from the event.** When looking at time pressure, events that come up in an unscheduled manner etc., we want to try to understand how these issues are managed.

1. Were there any *specific* tasks you were interrupted from, that you had in the back of your mind as an item you were "getting behind on" while doing the survey?

As I recall, no there wasn't

2. Was someone waiting on your return in order to continue or complete another task?

There's always someone waiting for an ARMs return (mostly the people who requested the access)

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

3. Do you think the machine state (controlled rather than restricted), or your assumptions about the duration of the access played into the details of your surveys or posting practices at all?

I think my erroneous decisions were based on my limited understanding of what work was being done. In other words I didn't think anyone had to work on that particular girder [Note: this should not have affected the need to post]

A couple final general questions. I realize this is very subjective, but we're looking for your thoughts (and considering sending some similar queries out to all ARMs, or possibly a subset). In general, do you feel the responsibilities of conducting ARM duties are commensurate with your training, and are they well-managed within the other duties you have on your plate (i.e. are you spread too thin, asked to do too much, or are there conflicts of interest that interfere with doing the best job you can)? Are you spinning too many plates, and are the requirements too nuanced to keep up with? If so, has that condition worsened in recent years or months (is the complexity increasing)?

So, I think this was touched on in the meeting we had. To answer the first part, I would say that the duties are commensurate with the training I received, but are not well managed with in the other duties. Understand...as an Operator, I have to wear many hats. I'm sure our list of training is longer than any tech on this campus (I can't prove this, but it feels like it at least). The training that you have given us is a lot to take in. On top of that, I'm not assisting RadCon on a consistent basis. So, that training does start to slip a little. Now, this wasn't much of a concern with the old machine. There were places that you knew were a concern (although, not many). The new machine has worsen this condition. Not only do we have to worry about the tunnel (where there seems to be a new concern constantly), but now we have to worry about the service buildings. As a dept., we are spread thin just like you guys. But, while you have to worry about radiation control, we have to worry about rad control, personnel safety, the other various hazards when working in the field, etc. It's a lot. I really believe the duty of an ARM should be escorting and 3am surveys (if you absolutely can't support). I think is says a lot when an ARM does a full survey by themselves verses it taking two Rad Techs to do the same survey (in the big areas, of course). I hope this helps.

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

SF1 Survey.PNG (PNG Image, 960 x 739 pixels)

https://zimbra.jlab.org/service/home/~/?auth=co&loc=en_US&id=2438...

WPI-SUR-001	Rev. 4	07/16/2012	RADIATION CONTROL DEPARTMENT RADIOLOGICAL SURVEY FORM		Page 1 of 1
LOCATION SOUTH LINAC	Accelerator Operating Conditions SWA tune Beam to 2R	Instrument: TLE 400 for 4 R2 B Serial #: 112991 Calibration Due: 10/27/16	Survey Number N/A	RWP 2016-5001	
Reason for Survey: <i>Diagnostic Work</i>					
<p>LEGEND</p> <p>All readings in mR, for whole body unless indicated otherwise</p> <p>--- Delineates posted area</p> <p>○ Delineates unmonitored location (refer to page 2 for results)</p> <p>☐ Contact dose rate ☐ Whole Body dose rate ☐ Room decontamination</p> <p>▨ Delineates area not surveyed</p> <p>Abbreviations RA - Radiation Area HRA - High Radiation Area CA - Contamination Area</p>					
<p>For Beam Enclosure Entry Survey:</p> <p><input checked="" type="checkbox"/> Full survey, all areas posted</p> <p><input type="checkbox"/> Partial survey with continuous surveillance</p> <p><input type="checkbox"/> Partial survey with exclusion zone(s) posted</p> <p>Comments: <i>Found Hot Spot @ 12 duquette flange</i></p>					
<p>Performed By: <i>[Redacted]</i></p> <p>Date: <i>10/28/16</i></p> <p>Time: <i>1200</i></p>		<p>Area Used During Survey: <i>[Redacted]</i></p> <p>Date: <i>2016-10-03</i></p> <p>Time: <i>1159</i></p>		<p>RD (to include process)</p> <p>Doc:</p>	

Initial entry survey conducted by ARM.
Follow-up survey by RCT.

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

AH1 Survey.PNG (PNG Image, 989 x 753 pixels)

https://zimbra.jlab.org/service/home/~/?auth=co&loc=en_US&id=2438...

HPF-SUR-001	Rev 4	07/16/2012	RADIATION CONTROL DEPARTMENT RADIOLOGICAL SURVEY FORM		Page 1 of 1
Location SOUTH LINAC	Accelerator Operating Conditions RESTORE (EAMF)	Instrument Model 76	Survey Number N/A	RWP 2012 - 5002	
Reason for Survey: CHANGE STATUS MISSING CA'S RA		Serial # 322329	Calibration Due 1/22/17		

LEGEND
 All read pts in mR/hr whole body (unless annotated otherwise)
 --- Denotes posted area
 (O) Denotes time at location (refer to page 2 for results)
 --- Contact dose rate
 --- Whole Body dose rate
 --- Rem description
 [Hatched] Denotes area not surveyed

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

For Beam Enclosure Entry Surveys
 Full survey, all areas posted
 Partial survey with continuous surveillance zone
 Partial survey with exclusion zone(s) posted
 Comments: **N/A**

Performed By (Print): [Redacted]	Date: 10/1/16	Crew Chief Review (Print): N/A	Date: N/A	BCD Review (Print): [Redacted]	Date:
Sign: [Redacted]	Time: 1300	Sign: N/A	Time: N/A	[Redacted]	11/23/16

ARM Training
** Double Click on
Image to review

**Assigned Radiation Monitor
Training**

**Job Performance Measures
Sign-Off**
(February 2011)

ARM Name: _____ Issue Date: _____
ARM Signature of Completion: _____ Date: _____
Final Reviewer Signature: _____ Date: _____
RCD Mgr

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

Causal analysis for ACC-16-1004

Using Taproot 15 questions and considering the three errors to be different failures.

1. Failure to post radiation area at viewer 2SD4

Error: The ARM made a decision not to post the radiation area because it did not extend into the region of the general walkway.

**** Double Click to access entire analysis**

Human perf element:	Individual performance	Team performance	Management system
Questions with "yes" answers:	Did the person need more skill/knowledge...?	None	Was a task performed in a hurry or a shortcut used?
Basic Causes:	1) Training 2) Work Direction		1) Management system 2) Work direction
	Training	Work Direction	Management System
Possible Root Causes:	Instruction NI	None	None
	Testing NI		
	Cont. training NI		

NI = Needs improvement

Analysis

Preliminary conclusion is that the ARM decided not to post the area because he did not properly interpret the requirements to post radiation areas. This information is covered in training, so, since the decision was in direct opposition to the training, the rigor, frequency or thoroughness of the training may need improvement. The near root cause is "Understanding NI", which points to instruction, testing and continuing training.

Note that the "shortcut" used suggests that a management system or work direction issues may have caused this problem. However, after interviewing the individual twice, it appears that the shortcut (not posting) was due to the incorrect judgment about the need to post, and time pressure was not a major factor.

2. Failure to post high radiation area at duplettes in SE recombiner

Error: The ARM did not survey the area behind the duplettes and therefore did not locate the HRA.

Human perf element:	Individual performance	Team performance	Management system
Questions with "yes" answers:	Did the person need more skill/knowledge...?	None	Was a task performed in a hurry or a shortcut used?
Basic Causes:	1) Training 2) Work Direction		1) Management system 2) Work direction
	Training	Work Direction	Management System
Possible Root Causes:	Instruction NI	None	None
	Testing NI		
	Cont. training NI		

NI = Needs improvement

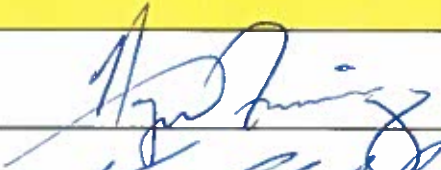

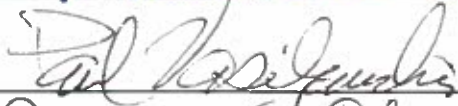

Emergency Notifications Made (Subsequent to the Event):	Date	Time
Fire, Rescue & Emergency Medical: (9-911)		
Guard Post: x5822; 269-5822		
Occupational Medicine 269-7539		
ESH&Q Reporting Officer: 876-1750	10/03/2016	1430
Crew Chief 630-7050		
Industrial Hygiene: 269-7863:		
Other: TJSO	10/03/2016	1500

Confirmation Review Distribution:
Investigation Team Members
Affected Division Managers
ESH&Q Reporting Officer

It is asked that you review and provide comments to this document to the Lead Investigator (denoted on Page 1) within ___ days. Your comments will be reviewed and incorporated as appropriate. Thank you for your consideration in this matter.

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	Signature	Date
Lead Investigator	Harry Fanning		20 DEC 2016
Co- Lead	Keith Welch		12/20/16
SME	Paul Vasilauskis		12/20/2016
ESH&Q Reporting Officer	Tina Johnson		12/19/16

Acceptance/Acknowledgement of Facts

	Print	Signature	Date:
Associate Director/ Department Manger	Andrew Hutton		12/20/16

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-16-1003
CATS Number:	NE-2016-19
Lessons Learned Number:	982
ORPS Number:	N/A
NTS Number:	N/A
CAIRS Entry:	N/A
DOE Cause Code:	A3B2C05- Situation incorrectly identified or represented resulting in the wrong rule used, A3B1C03- Incorrect performance due to mental lapse, A6B2C01- Practice or hands on experience LTA
ISM Code:	Provide Feedback and Continuous Improvement

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

Step 1 Initial Fact-Finding Meeting (To be held as soon as reasonably possible following event (within 24 hours))			
Date:	10/04/2016	Time:	0830
		Location:	MCC Conference Room
Required Attendees: (Print Name)		Optional Attendees: (Print Name) Present	
Lead Investigator:	Harry Fanning	Associate Director:	Andrew Hutton Notified
ESH&Q Representative:	Tina Johnson	TJSO Observer:	Patty Hunt Present
Supervisor of involved persons(s):	Paul Vasilauskis	<u>Subject Matter Expert(s)</u> , Facility/Equipment Owner as applicable:	
Involved or impacted person(s):	Shawn Frierson	Keith Welch	
Witness(es):	Adam Hartberger		

Agenda (Ensure the pace of the meeting allows time for accurate note taking.)	√ if Complete
Introduction – Provide Event Title, Date and Time of Occurrence, and Location:	√
Attendance - Are Required Attendees present.	√
Purpose of Initial Fact-Finding meeting.	√
Event Reconstruction – Use information to complete Section 3. <u>Summary of Event and/or Injuries</u> 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.	√
Clarify information – <u>Subject-Matter Expert</u> (SME) confirms work conditions.	√
<u>Stop Work</u> or the <u>Tag Out</u> Required? If “Yes” – establish the restart criteria and inform the affected Management chain.	N/A
Compensatory Actions Required? If “Yes” determine responsibility and include confirmation documentation.	N/A
Records or documentation required to confirm, clarify, or complete information (i.e., work plans, work control documents, photos, etc).	√
Other Questions or Concerns: Ask attendees if there are any other questions, concerns, or information that they wish to provide.	√
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.)	10/10/2016 * delayed due to schedule conflicts
Role	Name	Department/Group	Phone
Lead Investigator	Harry Fanning	ACC- DSO	7619
Co- Lead	Keith Welch	ESH&Q- RadCon	7212
SME	Paul Vasilauskis	ACC- Ops Manager	6059
Reporting Officer	Tina Johnson	ESH&Q	7611
<u>TJSO Observer</u>	Patty Hunt	TJSO	7039

Environmental Aspects	
Type of Material Released:	Quantity:
Source:	Time Flow was Halted or Controlled:
For Investigation Team (√ All That Apply):	
<input type="checkbox"/> Reportable Quantity	<input type="checkbox"/> Impact Ground/Soil
<input type="checkbox"/> Storm Water Channel/Drain	<input type="checkbox"/> Sanitary Sewer

Categorization and Reporting

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

ORPS Determination:

Date:

10/04/2016

Time:

1641

*ACC-16-1003

High Radiation Area/ Radiation Area

Oct 04

Were Not Properly Posted

From: Tina Johnson

To: Patty Hunt

Cc: Harry Fanning Tina Johnson Mary Logue Paul Vasilauskis

Keith Welch

Patty,

As you know, yesterday, October 3, 2016, at about 1:30 pm, an employee in the South Linac came upon a radiological area and questioned the posting. The worker informed the Operability Manager who then contacted RadCon. RadCon investigated the South Linac, and determined that a high radiation area and radiation area were not appropriately posted as required under 10 CFR 835. The condition was immediately corrected.

This is a violation of 10 CFR 835, and has been classified as a Notable Event. The lab has determined that is is not an ORPS/NTS reportable at this time.

Regards,

Tina Johnson
Reporting Officer

10 CFR 851 Screen:

Date:

10/04/2016

Time:

1641

Negative: This event does not meet the voluntary criteria as a discreet programmatic weakness.

Final Distribution:

ES&H Reporting Officer (Original)
Associate Director/Department Manager
Division Safety Officer
Investigation Team Members
ESH&Q Liaisons

Form Revision Summary

- Revision 1.6 – 02/22/16** – Updated form to reflect extent of condition ensuring it covers failed equipment per MOA
- Revision 1.5 – 10/04/13** – Changed COE to Lessons Learned; updated links.
- Revision 1.4 – 09/06/12** – Qualifying Periodic Review. Clarification of content only.
- 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.
- Revision 1.0 – 11/23/10** – Updated to reflect current laboratory operations.

ISSUING AUTHORITY	FORM TECHNICAL POINT-OF-CONTACT	APPROVAL DATE	REVIEW DATE	REV.
ESH&Q Division	<u>Tina Johnson</u>	02/22/16	02/22/19	1.6

This document is controlled as an on line file. It may be printed but the print copy is not a controlled document. It is the user's responsibility to ensure that the document is the same revision as the current on line file. This copy was printed on 12/19/2016.