

Occurrence Report

After 2003 Redesign

Firing Sites and HE Lab.

(Name of Facility)

Accelerators

(Facility Function)

Los Alamos National Laboratory

Los Alamos National Laboratory

(Site)

(Contractor)

Name: R. R. Sharp-Geiger

Title: WFO-Facility Operations Director

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(Facility Manager/Designee)

Name: HAKONSON-HAYES, AUDREY C

Title: OCCURRENCE INVESTIGATOR

Telephone No.: (505) 667-9364

(Originator/Transmitter)

Name: Kimberli Tanner

Date: 10/13/2009

(Authorized Classifier (AC))

1. Occurrence Report Number: NA--LASO-LANL-FIRNGHELAB-2009-0006

Management Concern: Discovery of Unanticipated DARHT Axis I Interlock Configuration

2. Report Type and Date: FINAL

	Date	Time
Notification:	03/30/2009	17:43 (ETZ)
Initial Update:	05/12/2009	15:22 (ETZ)
Latest Update:	10/13/2009	15:30 (ETZ)
Final:	10/13/2009	15:30 (ETZ)

3. Significance Category: 3

4. Division or Project: Axis 1

5. Secretarial Office: NA - National Nuclear Security Administration

6. System, Bldg., or Equipment: TA-15-312

7. UCNI?: No

8. Plant Area: DARHT

9. Date and Time Discovered: 03/16/2009 16:15 (MTZ)

10. Date and Time Categorized: 03/26/2009 12:00 (MTZ)

11. DOE HQ OC Notification:

Date	Time	Person Notified	Organization
NA	NA	NA	NA

12. Other Notifications:

Date	Time	Person Notified	Organization
03/26/2009	12:00 (MTZ)	Dave Stewart	NNSA

13. Subject or Title of Occurrence:

Management Concern: Discovery of Unanticipated DARHT Axis I Interlock Configuration

14. Reporting Criteria:

10(2) - An event, condition, or series of events that does not meet any of the other reporting criteria, but is determined by the Facility Manager or line management to be of safety significance or of concern to other facilities or activities in the DOE complex. One of the four significance categories should be assigned to the occurrence, based on an evaluation of the potential risks and the corrective actions taken. (1 of 4 criteria - This is a SC 3 occurrence)

15. Description of Occurrence:

Management Synopsis: On March 16, 2009, Hydrodynamic Experiments-DARHT Operations (HX-1) scientists and technicians were performing a class 4 laser alignment associated with the Dual Axis Radiographic Hydrotest (DARHT) axis 1 when it was discovered that an engineered control (interlock) did not function as anticipated. The laser was operated in accordance with American National Standards Institute (ANSI) requirements. This event was originally categorized as not reportable on 03/16/2009. When a critique was held on 03/26/2009, the Facility Operations Director (FOD) re-categorized this event, using the additional information presented, as a category 3 Management Concern.

Background: In its normal operations, the laser associated with DARHT axis 1 is used to generate electrons and x-rays. During this activity, the laser is operated enclosed as a class 1 laser. When the laser is re-aligned it is operated as a class 4 laser. The DARHT axis 1 logic box, which operates the systems interlocks, is custom designed and is unique to this facility. The interlocks are associated with both DARHT accelerator operations and laser alignment but perform two different functions as follows:

- 1) Prevent entry into the "hall" as part of a Personal Safety System (PSS) during accelerator operations that generate radiation.
- 2) Prevent entry into the "hall" during laser alignment activities but not part of a PSS.

In both cases sweeps are done prior to the activities; however, the sweeps are performed according to different

procedures and the steps involved in the sweeps are totally different. The interlock systems were verified to work according to both procedures but they were not tested for deviating from the procedures.

During the laser alignment activities, a HX-1 technician exited the accelerator hall. Per design, the lasers became inoperable when he opened the door to exit. When the door closed, the lasers became operable, which was unanticipated. The interlock system was designed to require a sweep button located in the accelerator hall to be pushed before the system would become operable after being dis-engaged when the access door was opened. The workers who remained in the accelerator hall did not engage the sweep button and, therefore, the lasers should not have been operable. The workers recognized the condition was abnormal and reported the event to the DARHT Operations Center. Personnel working with the laser wear laser safety glasses as personal protective equipment (PPE). No personal injuries occurred and there was no impact to either the facility or the equipment.

16. Is Subcontractor Involved? No

17. Operating Conditions of Facility at Time of Occurrence:

Normal

18. Activity Category:

03 - Normal Operations (other than Activities specifically listed in this Category)

19. Immediate Actions Taken and Results:

- 1) The keys to the DARHT facility were controlled.
- 2) Laser alignment was paused to determine the how the interlock function if the procedures is not followed.

20. ISM:

3) Develop and Implement Hazard Controls

21. Cause Code(s):

A1B2C01 - Design/Engineering Problem; Design output LTA; Design output scope LTA
A1B2C08 - Design/Engineering Problem; Design output LTA; Errors not detectable

22. Description of Cause:

ISM SUMMARY: During the commissioning process, DARHT was rigorously tested to ensure the Axis I Laser System would function as designed. However, this event revealed an unanticipated and un-desirable system configuration that resulted from a less than adequate failure mode analysis during the 1999 commissioning process. This event is the result of ISM Step 3, Develop and Implement Hazards Controls LTA.

Apparent Cause Analysis and the Causal Analysis Tree, as described in the DOE Occurrence Reporting Causal Analysis Guide (DOE G 231.1-2), were used to identify the causes for this event. Apparent causes are identified as the most probable causes of an event or condition that management has the control to fix and for which effective recommendations for corrective actions can be generated.

This event was also analyzed using Human Performance Improvement tools to identify error precursors and latent organizational conditions.

BACKGROUND

The Dual-Axis Radiographic Hydrodynamic Test (DARHT) facility Axis 1 became operational in November 1999. Axis 1 components include four Class A lasers that generate an electron beam for the accelerator.

DARHT Technical Procedure HX-DARHT-TP-114, Axis 1 Accelerator Operations Procedure, Section 6.5.2 establishes the specific steps required for laser operations. The steps include locking all access doors and performing a sweep during which sweep buttons are depressed in a specific order (working back from the accelerator towards the laser and egress point).

The system was thought to be designed to require the sweep button(s) be depressed, in the specified order, for the laser to become operational.

CAUSAL ANALYSIS

In this event, three workers were in the accelerator hall preparing for laser operations. They were performing the work under the moderate hazard Integrated Work Document (IWD) IWD-DARHT-15-312-115-006, Operate DARHT Axis 1 Laser with Covers Installed. Per IWD-DARHT-15-312-115-006 and procedure HX-DARHT-TP-114, the workers were wearing the minimum optical density (O.D) required for laser safety eyewear, in accordance with the Personal Protective Equipment (PPE) requirements.

In preparation for laser operations, all Axis 1 accelerator hall doors had been locked and the required sweep had been performed. During the laser alignment activity, one of the workers left the accelerator hall. In doing so, he exited through a redundant interlocked door. The accelerator hall side of the door had a crash bar that, when pushed, allowed egress so the door could remain locked and prevent personnel from entering the accelerator hall.

The interlock system was believed to have been designed to prohibit laser operations in the event an interlock switch circuit was opened, as was the case when the worker exited the accelerator hall, until the sweep buttons were depressed again. However, the two workers remaining in the accelerator hall heard the laser begin to power up in spite of their not having depressed the sweep buttons.

The most likely cause for this event is A1B2C01, Design Output Scope LTA, because the design did not consider possible failure modes. The most likely cause code for the error going undetected from the DARHT Axis 1 commissioning in 1999 to the event is A1B2C08, Errors Not Detectable. Corrective actions 1, 2 and 3 address these cause codes.

23. Evaluation (by Facility Manager/Designee):

Attention to operational conditions is vital to safe operations. In this case, the system did not respond as-expected, and operators recognized the abnormal operation and took prompt action to place the system in a safe configuration.

24. Is Further Evaluation Required?: No

25. Corrective Actions

(* = Date added/revised since final report was approved.)

1.

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Title: Modify DARHT Axis I Laser Interlocks Action: The DARHT Axis I Laser Interlocks will be modified to ensure Laser operations are not allowed to continue before the sweep buttons are depressed. Responsible Organization: HX-1 DARHT Operations Manager Deliverable: Copy of closed facility service request number 48988.

Target Completion Date: 05/11/2009

Completion Date: 05/11/2009

2. Title: Modify DARHT Axis I Accelerator Operating Procedure Action: The DARHT Axis I Accelerator Operating Procedure will be modified to require periodic check of Laser Interlocks. Responsible Organization: HX-1 DARHT Operations Manager Deliverable: Copy of revised operating procedure.

Target Completion Date: 09/28/2009

Completion Date: 09/28/2009

3. Title: Revise IWD-HX6-15-312-115-006, Operate DARHT Axis 1 Laser with Covers Installed Action: IWD-HX6-15-312-115-006 will be revised and implemented to include the hazard control of system design interlocks associated with the Laser Control Area will not be "made up" unless the Sweep buttons are depressed in the correct order. Responsible Organization: HX-1 DARHT Operations Manager Deliverable: Copy of revised IWD.

Target Completion Date: 07/01/2009

Completion Date: 07/01/2009

26. Lessons Learned:

Although systems are thoroughly tested during the commissioning phase, unanticipated configurations may be encountered during operations. Operators must be aware of the expected system response(s) during operation.

27. Similar Occurrence Report Numbers:

DP-ALO-LA-LANL-ACCELTECH-1991-1002

28. User-defined Field #1:

AT/ACH

29. User-defined Field #2:

LIMITS 2009-1160

30. HQ Keyword(s):

01G--Inadequate Conduct of Operations - Inadequate Procedure
 08C--OSHA Reportable/Industrial Hygiene - Industrial Hygiene Exposure
 11F--Other - Inadequate Design
 12B--EH Categories - Conduct of Operations
 14D--Quality Assurance - Documents and Records Deficiency
 14F--Quality Assurance - Design Deficiency
 14H--Quality Assurance - Inspection and Acceptance Testing Deficiency

31. HQ Summary:

On March 16, 2009, Hydrodynamic Experiments- Dual Axis Radiographic Hydrotest (DARHT) Operations (HX-1)

scientists and technicians were performing a class 4 laser alignment associated with the DARHT axis 1 when it was discovered that an engineered control (interlock) did not function as anticipated. During the laser alignment, a HX-1 technician failed to engage the interlock button associated with an exit before leaving the hall. The exterior light warning that laser operations were proceeding remained green indicating that it was safe to enter the hall, instead of being red. A second HX-1 technician noticed that the light was green during laser operations and immediately paused alignment operations. No injuries occurred and there was no impact to either the facility or the equipment.

32. DOE Facility Representative Input:

33. DOE Program Manager Input:

34. Approvals:

Approved by: R. R. Sharp-Geiger, Facility Manager/Designee

Date: 10/13/2009

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