Critique of Recent Incidents On the NSLS Experimental Floor

Occurring in Calendar Year 2002

Prepared by W. R. Casey

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I. Purpose

This review was conducted to examine the NSLS safety program as it applies to the activities of NSLS users and staff who conduct research on the experimental floor. The intent is to identify potential underlying causes of a series of unrelated events that took place during calendar year 2002 and to establish appropriate actions to improve the performance of the program.

II. Introduction

The NSLS had inconsistent safety performance during the first 10 months of 2002. While a number of important performance indicators remained excellent (e.g. total radiation exposure was low, # of injuries was low, amount of hazardous waste generated continued to decrease, no noteworthy spills occurred), there were 5 events involving our user community requiring investigation and follow-up. No one was hurt in these incidents; however, each event involved a failure to adhere to one or more important requirements that users and staff are expected to follow while working on the experimental floor. These incidents raised concerns that there may be underlying issues requiring attention.

After each incident a review was conducted and a number of corrective actions were initiated to address the causes contributing to that incident. This critique is intended to go further and seeks to identify broader underlying issues within the program which may have played a part in the increase. This critique was conducted over several months and included meetings with NSLS beam line staff, members of the NSLS User Executive Committee, NSLS ESH and Training personnel, and NSLS management. In addition, a survey and discussion was conducted with 54 users working on the experimental floor during the time period 11/21-22, 2002. This process was designed to get a wide range of input and opinions regarding issues that may need improvement.

III. Description of Incidents

A brief description of each incident follows:

Incident # 1 – A first time General User[1] arrived at the NSLS with a number of small samples of biological material. One of these materials had been designated by the Centers for Disease Control as a biological "Select Agent", which invokes a special set of requirements potentially involving a lengthy review and approval process external to BNL. Failure to comply with these requirements also carries the potential for very significant fines by the federal government. While this incident was resolved within a few hours to everyone's satisfaction, resolution of the issue rose to the level of the Laboratory's Deputy Director for Operations and the Lab's Chief Counsel. Failures by the user to submit his experiment Safety Approval Form (SAF) in a timely manner and to confirm approval to bring the materials to the NSLS were the principal underlying factors.

Incident # 2 – A new beam line was being commissioned by an experienced beam line group. Difficulties with a monochromator required the beam line to be opened and a number of adjustments to be made. In reconfiguring the beam line prior to resumption of commissioning, a lead glass cover required to control radiation levels through a view port was not replaced. Although no significant radiation exposure occurred before the omission was corrected, the failure to maintain a required shield on the view port during operation was a significant violation of NSLS requirements.

[1] General User is a term applied to a member of a research team not associated with the management and operation of a beam line. See Section IV. A for more discussion.

Incident # 3 – A post-doc serving as a Local Contact[2] for one of the beam lines received an electrical shock when he touched an exposed surface energized by a 1000 volt, 100 mA dc power supply. He had made modifications to his equipment in an effort to address a problem created by a failed thermocouple. Inadequate planning and analysis of the changes resulted in the individual unknowingly working with surfaces exposed at 1000 V.

Incident # 4 - Two General Users from a near-by university arrived at a beam line on a Sunday morning and found the hutch posted as a "Radioactive Material Area – Radiation Work Permit Required." The users disregarded the sign since it was posted for a previous experiment and did not apply to their work. Although no conditions existed within the hutch warranting a permit, their failure to comply with an existing radiological posting until removed by authorized personnel was cited by the BNL Price Anderson Act Coordinator as a non-compliance with BNL and DOE radiological requirements.

Incident # 5 - Four General Users arrived at a beam line on a Sunday morning not wearing radiation dosimetry badges. A fifth user from the same group reported to the beam line wearing a radiation badge assigned to another worker. The failure of the group to wear proper dosimetry resulted in cancellation of the experiment and the revocation of their research privileges at the NSLS for 90 days. This incident was also cited by the BNL Price Anderson Act Coordinator as a non-compliance with BNL and DOE radiological requirements. All five users were from universities located in different parts of the United States.

Following each of the incidents, specific corrective actions involving issues such as training, procedures, planning, and accountability were identified and addressed (see appendix A). Each of these actions addressed direct and contributing causes of the incident.

As was noted in the introduction, over-all NSLS safety performance remains at a high level. The existing program has effectively addressed the identification and control of hazards among a very diverse and changing group. It is clear that the program remained effective in 2002 as the over-all incidence rate of non-compliance with requirements was low and the over-all safety performance parameters remained excellent. Notwithstanding the record, there was a strong desire to evaluate potential underlying causes of the trend observed during 2002 to ensure continued excellence of performance in the future.

IV. Discussion

Early on in this critique, it was noted that a common factor in four of the five incidents was the involvement of inexperienced or infrequent users. As described above, incidents # 1, 4, and 5 all involved General Users who didn't follow a NSLS requirement.[3] Incident # 3 involved a young and relatively inexperienced member of the PRT responsible for the beam line. The PRT had limited resources and provided staff for only those occasions when they were conducting an experiment. Therefore, the individual involved in the incident was only present at the NSLS several times a year. Although serving as the Local Contact for the PRT, his presence at the beam line and his over-all experience was not substantially different from that of a General User.

These observations immediately pointed to the potential import of two important trends at the NSLS: management of the beam lines, and demographics of the typical user.

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[2] Beam lines at the NSLS have historically been managed and operated by a Participating Research Team (PRT). The PRTs typically consist of one or more outside organizations who manage the beam line in exchange for control and scheduling of the beam line. The term Local Contact is applied to the person who has a day-to-day responsibility at the beam line for its operation. See the discussion below in IV. A for more information.

[3] It should be noted that intensive discussions following each incident did not indicate any poor attitude or disdain toward safety requirements. In each case, the reviewers concluded that there was no willful intention to ignore a requirement.

A. Beam Line Management

For most of the past 20 years at the NSLS, management of each beam line was the responsibility of a Participating Research Team (PRT). A basic responsibility of the PRT staff has been operation and maintenance of the beam lines. As the manager of the beam line, the PRT has access to the beam line for up to 75% of available time, but is obligated to provide and schedule the remaining 25% to scientific teams not affiliated with the PRT (General Users). It was also the responsibility of the PRT to provide support to the General Users when operating at the beam line. This model of beam line management has been adopted throughout the U.S. synchrotron light source community.

In recent years, this approach has faltered in some situations at the NSLS for two reasons: Some strong PRTs have moved to the newer light sources to utilize the increased capability of those machines. In addition, PRT funding in general has declined and the ability of the PRTs to staff and manage effectively the beam lines has weakened in some cases. As was the case in incident # 3, some PRTs have become part-time users of the beam lines and are not capable of providing on-going support to General Users.

Symptoms of this problem were first noticed in recent years with regard to the increasing need for NSLS support to PRTs and the increasing obsolescence of some beam lines. The problem associated with incident # 3 indicates that the lack of experience and limited resources at the beam line can have safety implications as well.

This developing problem has been discussed between NSLS and DOE program management. This discussion has resulted in plans for a substantial modification to the existing beam line management concept discussed above. New user access and beam line management policies have been drafted which call for increasing responsibility by NSLS beam line staff to operate the beam lines. PRTs will continue to exist in many cases, but responsibility for a greater number of beam lines will reside with the NSLS personnel. Large increases in NSLS staff level (already started in FY2002) will be needed to provide adequate resources to operate these beam lines. The new policy documents defining the access policies for beam line staff and General Users are expected to be finalized in first half of CY 2003.

B. User Profile

Appendix B provides key data regarding the profile of the users who conduct research at the NSLS. As can be seen, a very large fraction of NSLS users come from the General User group. This represents a significant shift from earlier years when more users were associated with one of the PRTs. Members of PRTs tend to be much more experienced as the result of the PRT management of the beam line. General Users are typically present at the NSLS only one or two times a year, spending the rest of their time working at their home institution.

In addition, it can be seen from Appendix B that most of the NSLS users are relatively young and come from academia. This information is important since it indicates that a very large and increasing fraction of the NSLS users are relatively inexperienced, and come from institutional settings where the safety culture and associated expectations may be significantly different from that expected by NSLS, BNL and DOE management.

As was noted earlier, three of the five incidents in 2003 were associated with General Users coming from academic institutions.

In addition to the trends discussed in IV. A and IV. B above, important input to the improvement of the User Safety Program was obtained from several sources and is discussed below:

C. User Survey

An eleven-question survey was given to 54 users on November 21-22, 2002. The survey was conducted through one-on-one discussions that lasted 20 – 30 minutes each. In addition to evaluating user comprehension of specific ESH requirements at the NSLS, each interview allowed the opportunity for user commentary on a wide range of ESH topics. The results of the user survey are shown in Appendix C, and the analysis of the survey is shown in Appendix D.

There were several relevant conclusions that came out of this survey:

- There was wide spread agreement that the web based training was an effective mechanism for providing training to the user community. It greatly facilitates preparation for working at the NSLS and is highly effective at expediting the check-in process. However, there were also a number of comments that suggest simplification and improvement of tutorial method in the facility specific training should be pursued. In general it was concluded that the key requirements need additional emphasis so that they clearly stand out in the training message.

- The current posting of warning signs, though generally thought effective, needs to be approached with more attention to the target audience – both clutter and unchanging signs cause people to gradually tune out rather than read signs. It was also suggested that use of carefully selected terminology and graphics might alert people more effectively.

- An important conclusion of the group reviewing the survey results was that "… the broad diversity of users from different countries, institutions and cultures creates a wide difference in a practical understanding of the various safety issues encountered on the experimental floor. These factors suggest that close beam line support and oversight of less experienced users is important to ensure that NSLS program requirements are understood and addressed adequately."

D. User Executive Committee

Input was requested from the NSLS users' association regarding potential improvements to the ESH program that would reduce the frequency of incidents seen in 2002. Two members of the Users' Executive Committee (UEC) were named to a small working group and participated in two lengthy conference calls discussing NSLS safety issues (see Appendix E for summary of conference calls). Important points raised by the UEC Working Group in these discussions included:

- The NSLS has an extremely effective and user-friendly process for getting users to the beam lines. While this process is desirable and appreciated by the users, it is also very important that key safety requirements be reinforced before people get to the beam line since training may have taken place up to two years prior. This reinforcement was felt to be particularly important for new or inexperienced users.

- Safety support and oversight of General Users is a shared responsibility between the beam line managers and the NSLS staff. It was suggested that the definition of these responsibilities be re-examined and redefined to ensure clarity and understanding between all parties. In particular, in light of the newly developing user access policies, this redefinition of responsibilities should include PRTs, the user experimental team, and NSLS ESH and operations staff.

- In general, a number of the problems from last year involved the lack of rigor with well-known requirements. It was suggested that there be a sustained emphasis on working safely and in compliance with requirements so that all members of the user community clearly understand that working safely is a very high priority at the NSLS.

E. NSLS ESH and Beam Line Personnel

A variety of meetings took place with NSLS ESH staff and with members of the NSLS User Science Division who operate beam lines. The purpose of these meetings was to evaluate current ESH program elements in an effort to determine potential areas needing improvement. Important points coming from these discussion included:

- The role of beam line staff in assisting General Users in the discharge of ESH requirements is very important and needs improved definition and re-enforcement.
- The SAF system has many interface problems for users that need to be addressed in the upgrade planned for this year. The difficulty in utilizing the SAF system by an inexperienced user can result in incomplete or late submissions.
- Review of research activities is fully implemented through the SAF process. However, routine work by beam line staff beyond the scope of the experimental review is not consistently covered under the existing routine work-planning program. The lack of routine work planning played an important part in the electrical shock involved in incident # 3.
- Caution and warning signs play an important part in alerting users to important safety issues. Postings at access doors should be examined to ensure that the entry requirements are being effectively communicated.

V. Analysis

The nature of the incidents during 2002 raises issues that warrant attention, particularly with regard to support and oversight of general uses on the experimental floor. These issues may be strongly coupled with current trends involving the reduced ability of some PRTs to manage and support beam line activities, and to the increasing number of less experienced users from university backgrounds. These issues represent a potential vulnerability for the safety program which was expressed in four of the five incidents in 2002. The planned changes in the user access policies for management and support of the beam lines provide an excellent opportunity to address this concern.

In addition, the training for beam line staff is principally provided through the NSLS facility specific training. A number of important topics relating to experimental floor conditions warrant more discussion and awareness by permanent beam line staff (whether PRT or NSLS staff) of specific BNL requirements. These topics include electrical safety, cryogenic safety, compressed gas safety and others. It is important to improve the training of long-term beam line personnel to reinforce awareness and understanding of BNL requirements.

The facility specific training remains a very important component for the shorter-term users. One important conclusion coming from this critique is that this training needs to call clearer attention to key ESH issues, and that these issues need constant re-enforcement to ensure awareness and understanding by our more transient users.

Finally, it was noted during this critique that routine work planning may have gaps for some beam line activities. Activities related to the conduct of an experiment are fully reviewed by the experimental safety review, and some beam line work is covered under the safety system work authorization process. However, other activities, e.g. maintenance and repair of equipment, construction or beam line modifications, do not appear to be fully addressed and should be improved.

VI. Corrective Actions

. The following actions will be taken to address the principal issues raised in this review:

1. The roles and responsibilities of NSLS and PRT beam line staff for safety and oversight will be defined and promulgated as a part of the redevelopment of NSLS User Access Policies. Personnel will be held rigorously accountable for performance of these responsibilities.

2. Safety training requirements for PRT and NSLS beam line staff will be upgraded and included in the User Access Policies and Procedures.

3. Work planning requirements for routine duties at the beam lines will be improved and included in the User Access Policies and Procedures.

4. NSLS facility specific training will be improved.

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Appendix A

Causes Identified in Previous Investigations

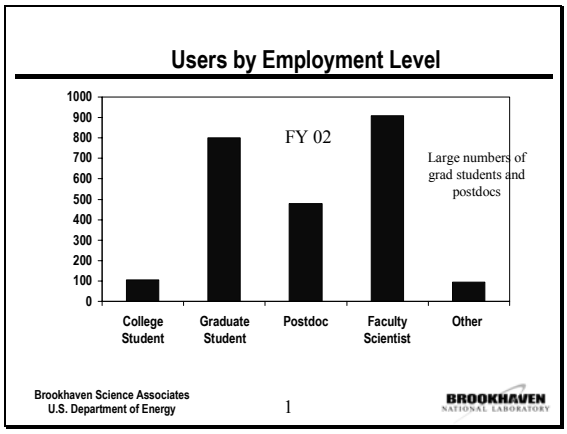
In each of the five incidents, reviews were conducted to determine causes and appropriate corrective actions. The following list is a synopsis of the contributing causes identified for each of the incidents.

- Lack of emphasis in NSLS training of the need to confirm Safety Approval Form (SAF) approval
- Failure of user to contact the Safety Officer to determine if SAF & material approved
- Failure of user to advise the NSLS Safety Officer and the Operations Coordinators of the beam line configuration change
- Lack of clarity in safety check-list guidelines
- Inadequate planning and analysis by user of equipment modification
- Inadequate emphasis in NSLS training of electrical safety requirements
- Inadequate PRT procedures and guidance regarding access to hutch in posted condition
- Failure of user to adhere to known requirements

Appendix B

NSLS Users Demographics

Slide 1



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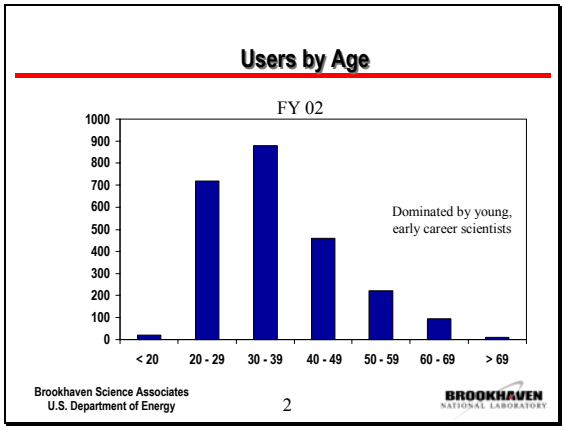

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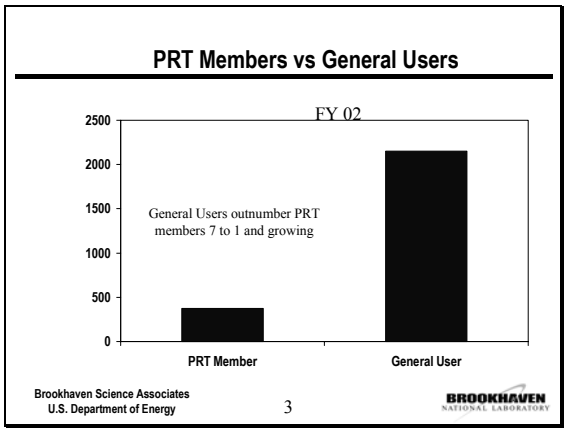

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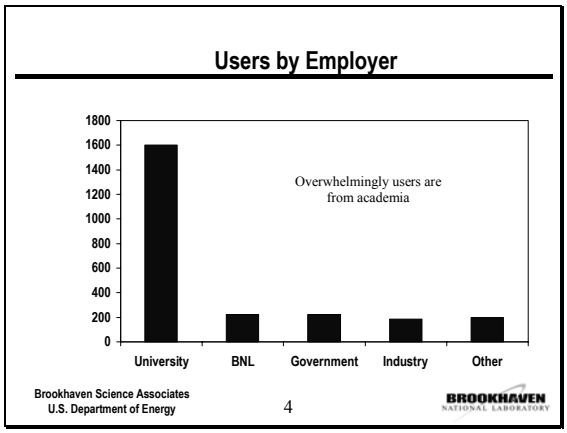

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Appendix C

NSLS USER SURVEY

NSLS Staff interviewed 54 users on November 21-22, 2002, which represented virtually every user on the Experimental Floor during that period. With such a small sample size resulting in an error range of ± 15%, there should not be much importance attached to small differences in statistics. However, some attempt at interpreting the results will be made anyway.

SECTION 1: Analysis of Individual Questions

SECTION 2: Analysis by Category:

- User's Institution Type: University, Industry, US Government Lab, Other (including other US non-government labs and foreign government labs)
- Facility Usage: The intensity of visits, with approximately 60 days/year on site as the dividing line.
- Length of Time at Facility: How many years a user has been coming to the facility, regardless of the frequency of visits within a year. Four years was established as the dividing line.
- Months Since Last Trained: Intervals were broken down into 1-4 months, 5-9 months, 11-16 months, and 18-24 months, following groupings which arose from studying the data.
- Work on Electrical Equipment: Responses to the questions dealing with electrical safety will be grouped by whether the user actually works on or repairs electrical equipment, or not.

SECTION 3: Compilation of User Comments

SECTION 1: ANALYSIS OF INDIVIDUAL QUESTIONS

Electrical Safety (Questions 1 though 5)

1. Explain what "working hot" means. (Overall score = 74%)
There were occasional problems with the term "working hot", especially with people who spoke English as a second language.

2. You should not work on exposed energized equipment higher than what voltage (AC or DC)? If you are not sure, whom would you ask for help in determining the requirements for working on such equipment?
(Overall score = 56%)
Users received half credit if they did not know the exact voltage but did know whom to ask. This happened in many cases.
Users received full credit if their answer was anything less than 50 V (e.g. 36 V, 12 V). Such lower limits, it was discovered, were imposed by the user's home institution and are not in conflict with BNL's limit.
NOTE: The actual limit of 50 V as "working hot" was not in the safety training until 11/18/2002. It was therefore not expected that most people would be able to answer the numeric part of this question.

3. What should you do if you get an electrical shock? (Overall score = 88%)
Most users answered correctly, to notify the Control Room. One user said she knew that the correct answer was to notify the Control Room, but that she would probably not do so if it were only a small shock. The user was Asian, and the interviewer sensed there might be cultural issues and/or character traits related to reporting or "admitting" something that could be interpreted as a "mistake".

4. BNC connectors can be used for greater than 50 V, less than or equal to 50 V, or both types of applications? (Overall score = 75%)
Many of the people who could not answer this question said they either never used BNC connectors, or did not even know what a BNC connector was. All 13 users who worked on electrical equipment answered correctly, except one person who knew the limits for other types of connectors but not specifically BNC. (That user received half credit for this question).

5. If you see a red "Hold" or yellow "Caution" tag attached to a piece of equipment, and you need to use this equipment, what do you do? (overall score = 96%)
Four people got half-credit, one because they truly had to be coached through the answer, and the other three because they indicated they would contact an OpCo rather than the person whose name was on the tag. (Note: Other surveyors may have awarded full credit as long as the user said they would contact SOMEBODY rather than attempting to unlock or operate the equipment themselves. So there are likely other users who answered they would contact an OpCo, but were marked correct.)

Radiological Safety (Questions 6-8 and 10-11)

6. While working on an experiment at an NSLS beamline, you must wear your TLD
a. Only while actually operating the beamline (beam is on)
b. At all times on the experimental floor (or in any Controlled Area)
c. You don't have to wear a TLD as long as someone else in your group is wearing one
(overall score = 100%)
The question was worded specifically for the case of someone working on an experiment (as opposed to merely observing). Everyone picked up on this and answered correctly.

7. You must start your experiment right away and you need a TLD before you enter the experimental floor. Where would you obtain a TLD?

a. During regular business hours?

b. After regular business hours?

(overall score = 94%)

The seven people who answered this question incorrectly all got half credit – six of them because they did not know they could obtain a TLD from the Control Room after hours. (One because they did not know to get them from the User Office during regular business hours.) One person thought they could use any "temp" badge if they needed one after hours (this person spoke English as a second language).

8. When you leave the NSLS building and no longer need the TLD that day, what should you do with it? (overall score = 97%)

Three people received half credit for their responses, and two of these surveys had details:
One knew what to do when he left BNL at end of run, just not what to do with the TLD at the end of the day.
One knew the TLD belongs on board, but does not use board because it is in an inconvenient location.

10. Do you know who the beamline Local Contact is for this beamline, and how to reach that person? (overall score = 100%)

Users clearly knew who the Local Contacts were, and knew to look on the safety boards.

11. You have an untrained, unbadged Visitor. How do you bring that person onto the experimental floor? What are the restrictions for that Visitor? (overall score = 71%)

A total of 28 out of 54 surveyed knew the complete answer.
The users who answered at least partly correctly knew about the Visitor Escort form, they just did not know all the details about the restrictions. Specifically the 8-hour limit was a problem - a third of the credit was withheld in 12 cases. (The 8-hour limit is buried in the text of the paragraph on the Visitor Escort form – this could be improved). About 6 users knew about the Form, but not the details about the restrictions and received half credit. Finally, eight users were unaware of the form at all and/or did not know that visitors were permitted.

BLOSA (Question 9)

9. Please show the location of the emergency STOP button(s) on this beamline.
What does the STOP button do? (overall score = 96%)

Two users had trouble. One received half credit for their answer, the other none.

In some cases there were no stop buttons, or hutch was secure for an experiment in progress. Credit was given if they could explain what a stop button was for and if they could point to one or two buttons visible from the locked hutch door.

SECTION 2: ANALYSIS BY CATEGORY

A SURVEY RESULTS BY INSTITUTION TYPE

Type	Number / % of respondents	Electrical (ave = 78%)	Radiological (ave = 92%)
National Lab	14 users / 26%	79%	96%
Industrial	2 users / 4%	100%	90%
University	32 users / 59%	76%	92%
Other	6 users / 11%	77%	86%

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National (U.S.) Laboratories:
If other U.S. government laboratories have training programs much like BNL's, then users from those institutions probably did well on this survey because of the combined training at home and here. Many of those laboratories offer GERT and have TLD programs similar to BNL's.

Industrial:
Only two users were from industry so conclusions really can't be drawn based on that sample size, but they both did well.

Universities (including US and foreign wherever specified):
Only seven out of the 32 university users said they worked on electrical equipment which is probably why they did not attach much importance to learning the details of this subject. University users were the largest proportion of the group surveyed, and also historically of the overall users' community, so the results for this group heavily weigh the average.

Other:
In the "Other" category, we can make very few generalizations about the size and quality of the safety and training programs at the home institutions. There were only 6 respondents in this category, most of them long-time but infrequent users of the NSLS. That usage pattern combined with unknown safety cultures (at worst, safety standards much below those of the U.S.) makes for a predictably lower performance for this group.

B SURVEY RESULTS BY FACILITY USAGE

Usage	Criteria	Number / %	Electrical (ave = 78%)	Radiological (ave = 92%)
Heavy	> 60 days per year	23 users / 43%	81%	96%
Infrequent	< 60 days per year	23 users / 43%	73%	90%
New	< 4 months, no pattern	4 users / 7%	73%	85%
Unknown		4 users / 7%	90%	92%

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Electrical Safety Questions:
Heavy users scored better than Infrequent users, either because they were more familiar with NSLS safety practices in general, or more, likely, because they as a group were more commonly involved in working with electrical equipment. Of the Heavy users, 11out of the 23 said they worked on electrical equipment, which could explain why they were more cognizant of the electrical safety issues in the survey. Only one of the 23 Infrequent users said they ever worked on electrical equipment – as a group, the infrequent users were below average in this area. Again, they were probably tuning out information that they felt did not pertain to them. The four New users were from universities and none said they worked on electrical equipment, so they did below average on the electrical questions as might be expected from previous patterns.

Radiological Questions:
Frequency of use seemed to affect the responses to the radiological questions as well, with the heavy users scoring better. This indicates that some fraction of the safety information is absorbed with increased familiarity with the facility, as opposed to immediately learned and completely internalized upon training.

NOTE: There was no correlation between the last time they were trained and whether they were a heavy or infrequent user. Training is performed every two years and the training/appointment cycle is initiated upon their first arrival at NSLS, which is independent of their usage patterns.

C SURVEY RESULTS BY LENGTH OF TIME AT FACILITY

Time	Criteria	Number / %	Electrical (ave = 78%)	Radiological (ave = 92%)
Long	(> 4 years)	29 users / 54%	84%	95%
Short	(< 4 years)	21 users / 39%	70%	90%
New	< 4 months, no pattern	4 users / 7%	73%	85%

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The span of time spent at the facility does not take into account the frequency of visits – it is simply a measure of how many years the user has been coming to the facility.

It seems that the longer the user has been coming to the NSLS, the better they scored on the survey. This seems to indicate that some fraction of safety information is absorbed over time and not all is absorbed during training. Also, the group of people who have been coming here for a long time usually includes beamline staff, whose responsibilities make them more sensitive to safety issues.

D SURVEY RESULTS BY MONTHS SINCE LAST TRAINED

Months	Training	Number / %	Electrical (ave = 78%)	Radiological (ave = 92%)
1 to 4	New electrical safety material inserted into web training in August.	21 users / 39%	86%	93%
5 to 9	web training since June 2001	13 users / 24%	62%	91%
11 to 16	web training since June 2001	13 users / 24%	72%	93%
18 to 24	last saw old video	7 users / 13%	94%	93%

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The months were grouped based on the way data appeared to fall and on changes in the training program.

New material on electrical safety was added to the web training in August 2002. The users trained since then (months 1-4) seem to have done better on the electrical safety questions than users trained on the previous web-based material. The various safety bulletins and lessons-learned documents related to an incident last summer contributed to the heightened awareness of this topic.

The months 18 to 24 group includes six people (out of the seven total) who have worked at the facility long term (more than four years). Of those, five are also classified as Heavy users. This almost certainly explains the above average performance for this group despite the fact their training was the farthest in the past. The last time this group did train was almost certainly with the video. The video format compared to the web-based reading is probably not an important factor compared to their familiarity with the facility due to their both frequent and long-term use.

E SURVEY RESULTS BY "Do you work on or repair electrical equipment?"

Work?	Number / %	Electrical (ave = 78%)
Yes	13 users / 24%	94%
No	40 users / 74%	72%
Unknown	1 user / 2%	100%

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Users answering affirmatively to the question about working on repairing electrical equipment did significantly better than those who did not work on such equipment.

SECTION 3: COMPILATION OF USER COMMENTS

SIGNAGE

- Good work to keep signs simple and minimize number.
- Pretty clear.
- Rad posting is fine. Liked picture with TLD.
- Very good.
- Keep doors plain / simple –good now.
- Reasonably clear and useful.
- Signs are noticeable and effective.
- Radiation / TLD badge signs need to stand out more.

- Need a "TLD required" sign that gets your attention.
- Better signs with pictures.
- Checklist for entry onto floor.
- Yellow board is cluttered.
- All doors should say where to get TLD.
- Users sometimes get confused as to which badge is referred.
- Check wording of "Do not linger"' sign over VUV transport - "linger" is not clear. Other signs are fine.
- Hutch sign bulbs / signs should be better quality.
- Potentially better voltage sign on power supplies. Would help users realize that P.S.'s are dangerous.
- Fewer, more clear signs.
- Become immune over time – need to change periodically to catch eye.
- Did notice signs but became immune.
- Signs are explicit. Immune over time. APS has better signs.
- Sign overload. Immune to signs over time.
- Signs not noticed.
- Signs not so much noticed. Magnet sign noticed.
- See them often – immune.
- Really don't notice the signs because I have been coming here for so long.

TRAINING

- Initial training is overwhelming. Is there a procedure / doc on web site that a user can reference when needed?
- We teach safety rules but don't teach safety practices.
- Training pitched at right level – not overly "in your face".
- Web training: Could shorten text by just having bullets, but provide hyperlinks for more detailed information.
- ESRF training is very rad oriented. NSLS training is better due to more topics discussed – BUT there is way too much information, hard to decide which items are most important.
- Too much information, not well grouped. Simplify. Think from a user's perspective.
- 100 and 360 are same order of magnitude. Delete 100. [I think he is relating to the dose levels, limit for GERT trained worker and the average background.]
- More electrical training.
- Some training does not apply. [I do] just simple experiments, no risk, so paid little attention.

- Agrees with having a survey such as this one. Thinks it's a great idea.
- Option for added training – links to training that could be optional.
- Pleased with web training.
- Move to web is good. Option for web video = good.
- Good. Thinking of emulating at home institution.
- Training - simple. Web - convenient.
- Web good – convenient.
- Prefers video – more effective but web has advantages too.
- Liked web-based training ahead of time; can focus on work.
- Could give test here or give set of bullets.
- Give out updates.
- Some pictures would be an improvement.
- Training has no pictures – bad.
- Good that we accepted LANL training.
- Nobody to answer questions during training – bad.
- Likes the BLOSA forms.
- BLOSA training – beamline wants to be able to use a log, not depend on computer database for listing who has BLOSA training.

GENERAL QUALITY OF NSLS SAFETY PROGRAMS

- Well taken care of.
- Likes the availability of safety materials / personnel.
- BNL is very safe, safer than other facilities visited.
- Always able to find assistance as needed.
- Appreciate safety memos.
- Better punishment is needed for those who break rules.
- John [Aloi], Andrew [Ackerman], and Nick [Gmur] are here to help and not get in the way.
- Culture thing – science is paramount. There is a lot of pressure to get things done and we are going full steam ahead 24/7. Sometimes we have to cut corners because we are tired. Rules aren't as strict as APS, which is a good thing.

RADIATION / CONTROLLED AREAS

- Rad surveys should be done on TOP of hutches if people ever work above them (like roofers).
- How often are the beamline surveys and what are the results? Users depend on NSLS to survey – they are checking shielding is in place on beamline but is anyone checking shielding for effectiveness.
- More routine surveying of beamlines.

- How often are surveys performed on beamlines? Users are not aware of surveys performed.
- Temp TLD slots at exit near X27C are always filled.

CHEMICALS

- Better ventilation in hutches in terms of chemicals.
- People responsible for chem labs should be more active.
- Concerned about chemical smell – had to leave area because of strong chemical odor/smell. Unsure what it is or what they are doing with it.

MISCELLANEOUS

- Crane near stockroom needs replacement – not structurally sound – too much flex. Bldg wish list.
- Improve plowing of sidewalks in winter.
- The cable-laying people used new tie-ups. They simply cut the old ones off and left them on the floor. User slipped and almost fell since they are white like floor and hard to see. Ties were swept up next day by custodians. User feels that cable layers should be responsible for cleaning up after themselves, or arranging for it immediately.
- Mech pumps should not be vented onto floor.
- Usually safer here than on my campus (referred specifically to snow plowing).
- Great job with lighting and acoustic panels.
- Cramped while working on beamlines. For example, during survey, LN2 fill line burst off of LN2 tank right next to user. Open space, provide furniture that is more consolidating.
- Roof leaked during rainstorm – leaking onto equipment. Potential disaster waiting to happen.
- [18 year resident] has a problem with SAF close-out procedure: He accepts responsibility for closing out the experiment, then why should he have to call and give someone else's name to close out.
- Concerned about safety issues on neighboring beamlines. They are so close (e.g. radiation). Can control own beamline, but not neighboring.
- Want a way to bring first time visitor out of hours.
- Reminder notice to inform users that their SAF will expire.
- High voltage wires from power supply on the floor – unprotected wires are a rat's nest and dangerous.
- Agrees with doing the survey – likes the idea of NSLS requesting feedback like this.

Appendix D

Critique of User Training Survey Results

The results of the recent user survey were critiqued at a meeting on 12/2/02 attended by A. Ackerman, M. Buckley, B. Casey, N. Gmur, and E. Rothman

The following conclusions were established:

Conclusions

- Overall performance in radiological area was satisfactory.
- Performance in electrical safety issues was marginal. Users who routinely worked with electrical equipment performed better than those who did not.
- Although not evident from statistics, interviewers believed that new users and infrequent users were less sure of their answers.
- Interviewers believed that experienced beam line personnel at the NSLS, and users from national labs and industrial firms were more confident of their answers compared to users from universities.
- There were many comments and suggestions relating to the facility specific training that suggest simplification and improvement of tutorial method are worthwhile. It was also clear that web based training was well accepted and of considerable value to the user community.
- The current signage, though generally thought effective, needs to be approached with more attention to the target audience – both clutter and unchanging signs cause people to tune out rather than read signs, and carefully selected terminology and graphics can reach more people better.
- A repeat of this survey may be of value following implementation of corrective actions.

Analysis

The strong performance in the radiological area was expected and is the result of strong emphasis over many years, constant reinforcement through verbal instructions and postings and emails during badge change periods, and the fact that radiation requirements are similar at all DOE institutions.

The marginal response in electrical safety is not unexpected either since training emphasis and requirements have changed only in recent months and consequently personnel not at the facility during this time period may not be aware of the changes. It is

also clear that many users are not involved in electrical safety matters while working at the NSLS and therefore have limited use or reinforcement of these requirements.

It also appears clear that the broad diversity of users from different countries, institutions and cultures creates a wide difference in a practical understanding of the various safety issues encountered on the experimental floor. These factors suggest that close beam line support and oversight of less experienced users is important to ensure that NSLS program requirements are understood and addressed adequately.

In response to the weaknesses identified during this discussion, the following actions were proposed:

TRAINING

1. Training Module Improvements
   a. Make it more succinct, use more pictures/graphics, make the testing interactive, and add a bulletized review list/learning objectives which are directly tested. (Consideration should be given to providing the bulletized list in multiple languages to facilitate comprehension by foreign users.)
   b. It is noted that we considered requiring that the user-training test be conducted locally, rather than via the web. This was generally felt to be unnecessary, especially if the test could be programmed to be more interactive. This action will be put on hold for consideration at a later time.

2. Training Reinforcement
   a. Provide an ability to reference training material afterwards. More accessible links to other info (like on-line User Guide and SBMS) should also be considered.
   b. Changes / updates in requirements need to be communicated to everybody, rather than waiting for the next training requalification.
   c. TLD wearer's instructions need to be shortened to a few points, and scripted for User Office and Control Room to deliver verbally.
   d. Establish check-in requirements for users to meet with designated beamline staff at the beamline, where as a part of BLOSA, critical training topics will be reviewed. This would complement c. above.
   e. Revise policy to restrict BLOSA training to designated personnel.

TARGETED TRAINING

1. Key training better into experimental review / SAF submittals (take advantage of programming electronic forms and databases etc.).
2. Establish practical "hands-on" for selected topics (e.g. cryogenic dewars)

A number of suggestions were made by the users during the survey that will be considered further.

SIGNAGE

1. Signs become routine and should be rotated to make them periodically different.
2. Improve power supply signs.
3. Review Yellow Boards and seek to reduce clutter.
4. Generally, avoid clutter of signs.
5. Reconsider words on signs to ensure clarity. i.e. “do not linger”, “badge”, and be sensitive to use of acronyms.
6. Electronic sign over doors to Controlled Areas – lights and flashing would gain better attention and sign would be visible even if door is open (when paper signs are hidden). Simple message could flash, such as “Are you wearing your TLD?” and/or “TLD required beyond this point!”
7. Improve current “Controlled Area” signs.

RADIOLOGICAL SURVEYS

1. Beamline staff need more feedback regarding surveys:
   a. How often are they done?
   b. Confirm shielding is adequate
   c. Impact of one beamline on another
2. Are surveys performed when hutch roofs are worked on?
3. Survey status could be posted on designated spot at each beamline (e.g. beamline last surveyed on xx/xx/xxx by xxx” maybe even a copy of the survey diagram with readings.)

GENERAL OBSERVATIONS

1. General concern about potential impact of a beamline on neighboring beamlines.
2. Stewardship in chemical labs – need a definition of responsibilities.
3. Leaks in roof and safety implications.
4. Electrical cable disarray.
5. Discharge of mechanical pumps to room.
6. Cable ties left on floor after work (slip hazard). Broader issue of housekeeping.

Appendix E

Summary of UEC Commentary Regarding NSLS Safety Issues
Prepared by B. Casey based on
Conference Calls with S. Bare and P. Stevens on
12/17/02 & 1/8/03

Training Issues

- Reinforcement of safety requirements is needed before users get to the beam lines, particularly for new or inexperienced users. Web training is so convenient and streamlined that a person can arrive and get to the beam line without having to think about the importance of safety.
- BLOSA training should be limited to designated personnel. Too much flexibility is provided in the administration of BLOSA training at this point.
- There needs to be more practical training to ensure that a person really can perform certain tasks safely. The current training is too much directed to provision of information that may not lead to safe performance.

Definition of ESH Responsibilities

- A concern was expressed that there are responsibilities assigned to the PRT that others control. For example, PRTs are unaware of the special requirements that may be imposed by the Safety Officer during the SAF review. It was suggested that the roles of other participating personnel (such as the Safety Officer & the OpCos) be more fully defined so that the relationship of the shared actions are better defined.
- It was recommended that the responsibilities of the Principal Investigator and other users for insuring safety be more fully defined.
- The responsibilities of persons responsible for the various labs within the NSLS need to be defined.

General Comments

- Improving safety performance with the user community will require more rigor by the user and in our expectations of the user. There needs to be a sustained emphasis so that all members of the user community clearly understand that working safely and in compliance with regulations is a very high priority at the NSLS.
- There is a great effort by NSLS to streamline demands on the user and to facilitate access in and out of the facility. While this is extremely desirable, it can work against the need to insure that the safety requirements are always fully addressed, and can create the impression that safety is not an important priority. In particular, the issue of SAFs being submitted upon arrival or shortly before arrival is a practice that should not be accepted.

- At the same time that rigor is improved, we also need to stimulate involvement and encourage exchange of information regarding safety problems. All avenues for communication should be utilized, including the Annual Users' Meeting. Examples of improved communication are:
    - Beam line staff need to be more involved in safety inspections and other safety activities involving the beam lines to improve awareness and understanding.
    - An effort should be made facilitate and encourage interactions between safety staff, OpCos and the users. Proactive discussions at the beam line can often encourage better understanding and compliance than investigations of an incident after the event has occurred.
    - Information about safety performance issues (e.g. results of safety inspections, injury and accident incidence, etc.) needs to be more frequently discussed with the user community. In particular, PRTs and principal investigators need to receive information relating to poor performance at their beam line or with their experimental team.
- We basically assume that all users who arrive at the NSLS possess a basic competency to perform work safely on the floor. We need to hold the principal investigators to a higher standard to ensure that personnel who participate in experiments are capable of independent and safe work while on the experimental floor. Passing the exam associated with the facility specific training does not make a person competent to work safely on the floor anymore than obtaining a driver's license makes a person safe to drive a car.