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Facility: From Construction to Operation

Perspective from SNS

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Perspective

When was that?

What was my role at the time?

What was my experience up to that point?

What is significantly different for ESS than for SNS at the time?

What were the challenges I recall facing?

Perspective

When was that?

SNS shifted from pure construction to a mix of operations and construction in their experimental halls in 2006 (first neutrons).

What was my role at the time?

I was working as an Installation Coordinator/IPL. In 2011, I shifted to an SA (IOE equivalent) supervisor role.

What was my experience up to that point?

I had worked as the equivalent of an IOE for 6 years at IPNS before working on Instrument Construction at SNS in 2004.

What is significantly different for ESS than for SNS at the time?

1) Schedule Compression

   The primary SNS project had 5 initial instruments which saw scope reduced by BoT to 3 instruments complete and 2 “with all components present”.

   Additional projects (SING and SING II) brought in other instruments and were going on in parallel, but time shifted.

2) Starting a new facility inside an existing laboratory.

   Oak Ridge National Laboratory had decades of experience in radiation safety, a strong central organization, and had been running the HFIR reactor for decades.

3) Worse mismatch on stakeholder expectations

   The US Department of Energy (funding body) expected the user program start almost as soon as the facility turned on. There was insufficient communication on the need to hot commission the initial instruments with beam.

What were the challenges I recall facing?

"Growing Pains"

- Facility level
  - Communications
  - Roles and responsibilities
  - Unexpected events
- Hall Operations
  - Communications
  - Radiation Safety
  - Boundaries Construction/Operations
- Instrument Operations
  - Planning
  - Maintaining the safety envelope
  - Unexpected events

What were the challenges I recall facing?

- Lack of defined hot commissioning plans.
- Confusion on priorities between operations support and construction for both materials and people.
  - Motion Control
- Growing pains on manging radioactive samples
  - Powgen sample can breakage
  - Unloading samples in a stairwell
- People growing into their roles and the organization understanding what the roles needed to do.
- Accelerator staff learning that they needed
- Developing a routine regarding communications across the organization
- Unexpected events – facility level (water, cleanup)
- Unexpected events – instrument level
  - Toe pinch ARCS
- Training to stay within safety envelope of experiments; using instruments in novel ways (no sample lid, gas in well)

Facility Level

Communications

It took a while to understand how best to communicate across the organization

Roles and responsibilities

People had to learn what their responsibilities were and how the various roles in the organization needed to adapt as SNS transitioned into a more operational posture.

Accelerator: reliability more important than “perfection”

Hall Coordinators and MCR Operators: find the right balance

Instrument staff and Technology groups

Unexpected events

Accelerator: RF Modulators design flaws led to much down time; years to fix

Target: Early failures had to be understood

Facility: Not everything worked exactly as expected

Hall Operations

- Communications
- Radiation Safety
  - RP responsibilities
  - Sample Handling
  - Shielding configuration
- Boundaries Construction/Operations
  - Configurations of the halls changed regularly (PPE/Access issues)
  - Priorities between Construction and Operations

Construction and Operations

Management statement to technology groups: Keeping instruments operating is the first priority

Staff shifting quickly from installation or testing to troubleshoot an operational problem caused delays:

Equivalent to MCA was two people

Detector/DAQ staff took components bought by one instrument project to be used as spares for an operational instrument

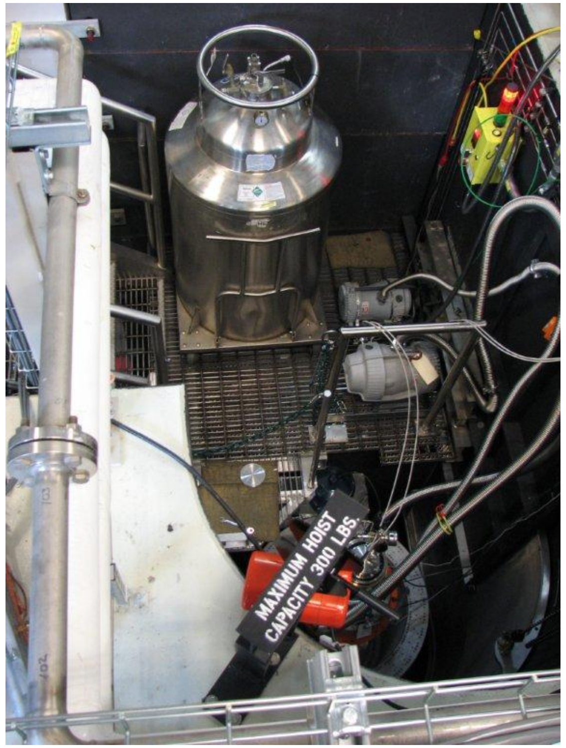
Instrument Operations

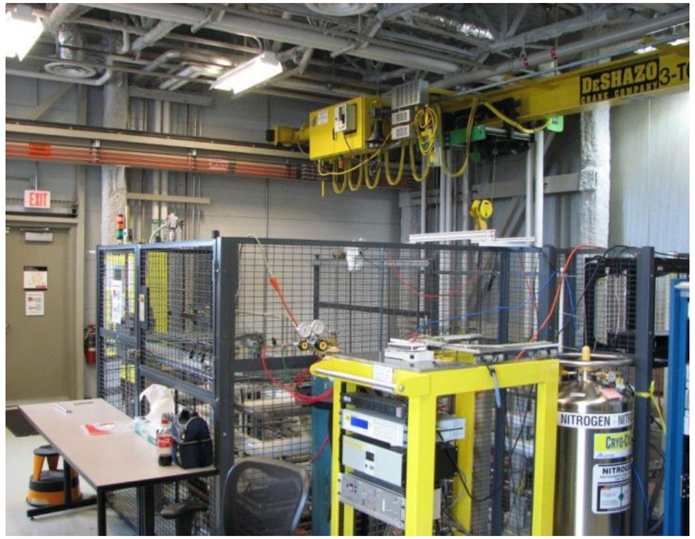
- Planning
  - Lack of written plans for hot commissioning:
    - Extended the duration (harder to judge when done/good enough)
    - Caused resource issues (lack of a plan allowed for conflicts for people and/or equipment)
  - Maintaining the safety envelope
    - Limited plans on handling radioactive samples
    - Using instruments in novel ways without hazard assessment
  - Unexpected events
    - Sample can breaks
    - Water in unexpected places
    - Magnet quenches

Magnet Quench

The 16 Tesla superconducting magnet installed as the sample environment at Beam Line 5 "quenched"

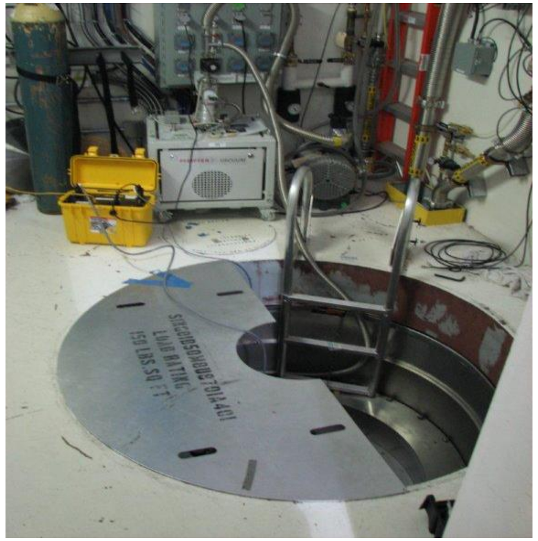
- Large volume of cryogenic liquid helium and nitrogen released quickly (~200 liquid liters)
- Area monitored by ODH sensor; senor alarmed
- Training directs personnel to exit when ODH sensor alarms
- Personnel went to exit door which was left open to allow helium to escape, but remained near the open exit door to video the release
- Room was checked before reentry and resumption of work activities





Unreviewed Hazard

- A Beam Line staff scientist was assisting a user with an experiment where the sample is placed in a tank.
- High background was compromising the User's experiment.
- Relating this problem to past experience with other sample environment that utilized argon gas in the tank to reduce background, the staff scientist decided to fill the tank with argon.
- A Scientific Associate Team Lead performing a walk-around discovered the use of argon, recognized it as an unreviewed hazard, and suspended the activity.
- The sample room was checked by instrument operations staff with a portable oxygen sensor prior to entry. The tank was then pumped out until it was free of argon.

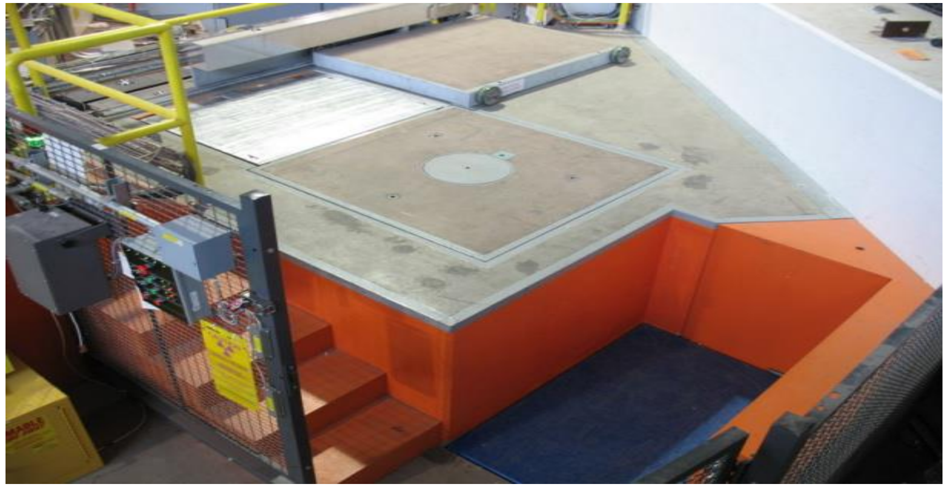


Event involving equipment lift

While moving two liquid nitrogen dewars from the Beam Line 18 cave using a vertical lift, a technician inadvertently moved their foot in the descent path of the lift pinning their foot to the floor.

The lift stalled on top of the individual's safety shoe. A second technician engaged the emergency stop.

Technician was wearing the appropriate PPE as specified in the JHA and beam line procedure and was not injured.



Other Lessons

Some of which ESS has taken measures against

1. Background

   CNCS has shown that additional means of reducing background to reduce the signal to noise ratio are likely to be needed after construction is complete.

   For instruments located inside concrete caves, be aware that the interior becomes a "sea" of thermal neutrons and that the concrete walls act as second moderator

2. Instruments should not enter into the General User Program without the demonstrated ability to carry out specific classes of real experiments and produce analyzed results. Putting low quality instruments into the user program causes significant and long term damage to the facility's reputation.

Takeaway

ESS and it's partners have tried to take notice of as many lessons learned from other operating scientific user facilities as possible. We will have succeeded in some, but not all cases to avoid some of the issues they have had.

For example, NSS leadership has had many discussions internally regarding the capacity to support instrument operations at the same time as continuing to build the remaining instruments. I predict we won't be perfect, but we are taking steps in order to be prepared. Across ESS, this is the case.

What can you do?

1. Be prepared for the fact that some things will go wrong or even poorly.

   We need to be ready to work those issues as they arise.

2. Ask for help and don't be afraid to say "I don't know"

   We are not going to succeed as individuals or divisions or as a directorate, but as a facility. We need to continue to work together to make it so.

3. We all need to ensure when things do go wrong, that we are taking appropriate and safe actions.

The Science Directorate is filled with smart, motivated, and dedicated people that are trained to analyze and solve problems. We need to work together, support each other, but also be prepared to appropriately question what others are doing.

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Motion Control – limited by resources. Apparently only Gayle Greene and Andre Parizzi are on staff to deal with the myriad of motion control issues and if the operating instruments need them,then the installation stalls.

Address Background Shielding Needs Early – Soon after the instrument configuration is known (aboutthe time the first draft of the P&ID is available) address the need for shielding to allow only neutronsscattering from the sample to reach the detectors (called background or detector shielding). The designgoal should be to minimize exposure of the detectors to neutrons arriving from any location other than thesample position. The view from the detector should be either neutron absorber or sample. Forinstruments located inside concrete structures (caves), be aware that the interior becomes a “sea” of thermal neutrons and that the concrete walls act as second moderator

Entry into User Program- Instruments should not enter into the General User Program without the demonstrated ability to carry out specific classes of real experiments and produce analyzed results. This must be the final criterion for achieving ‘CD5’ and should be signed off by the ALD. Putting low quality instruments into the user program causes significant and long term damage to the facility’s reputation.

CNCS has shown that additional means of reducing background to reduce the signal to noise ratio are likely to be needed after construction is complete.

on May 17 involving argon gas·On May 17, a Beam Line 1B staff scientist was assisting a user with an experiment where the sample is placed in a tank.·High background was compromising the User's experiment.·Relating this problem to past experience with other sample environment that utilized argon gas in the tank to reduce background, the staff scientist decided to fill the tank with argon.·A Scientific Associate Team Lead performing a walk-around discovered the use of argon, recognized it as an unreviewed hazard, and suspended the activity.·The sample room was checked by instrument operations staff with a portable oxygen sensor prior to entry. The tank was then pumped out until it was free of argon.