

**Operational Readiness Clearance**

**SeaQuest (E906)**

**7 Mar 2016**

AUTHORIZATION TO RESUME THE REMOTE OPERATION OF  
SeaQuest IN NM4 WITH ADDED TRACKING STATION

**REVIEWED AND APPROVED BY:**

**DATE**

\_\_\_\_\_  
Particle Physics Division Head  
Comments/Exceptions:

\_\_\_\_\_  
Accelerator Division Head  
Comments/Exceptions:

\_\_\_\_\_  
Accelerator Division Operations Department Head  
Comments/Exceptions:

\_\_\_\_\_  
Accelerator Division Radiation Safety Officer  
Comments/Exceptions:

\_\_\_\_\_  
Particle Physics Senior Safety Officer  
Comments/Exceptions:

Leo Bellantoni  
\_\_\_\_\_  
Committee Chair  
Comments/Exceptions: Verbal OK, Steve Chappa

\_\_\_\_\_  
7 Mar 2016

**Submitted By:**

Paul E Reimer  
\_\_\_\_\_  
Requester Paul Reimer

\_\_\_\_\_  
7 Mar 2016

Electronic approvals for this form are acceptable. Please forward your responses to all recipients. A signed paper form (copy) of this document will exist in the Particle Physics Division Office. The original signed document will stay with the experiment requesting clearance.

**From:** David Mertz mertz@fnal.gov 🇺🇸

**Subject:** RE: Summary of SeaQuest walk-through today

**Date:** March 4, 2016 at 12:49 PM

**To:** Leo Bellantoni bellanto@fnal.gov

**Cc:** Kathy J Graden graden@fnal.gov, Steve J Chappa chappa@fnal.gov, Madelyn Wolter maddiew@fnal.gov, James L. Priest priest@fnal.gov, Karen M Kephart karenk@fnal.gov, Teri L Dykhuis dykhuis@fnal.gov, Robert J Bushek bushek@fnal.gov, Eric D McHugh emchugh@fnal.gov, Gary L Lauten glauten@fnal.gov, Michael G. Herr michael.herr@science.doe.gov, Yun He yunhe@fnal.gov, Bridget K Scerini iverson@fnal.gov, Terry E Tope tope@fnal.gov, Richard L Schmitt rlschmitt@fnal.gov, David C Christian dcc@fnal.gov, Paul E Reimer reimer@fnal.gov, Russell A Rucinski rucinski@fnal.gov

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Dr. Leo, since I will be away from the lab in a couple hours, I delegate my approval of this installation to Steve.

Thanks

Dave

---

**From:** Leo Bellantoni

**Sent:** Friday, March 04, 2016 12:33 PM

**To:** Russell A Rucinski <rucinski@fnal.gov>

**Cc:** Kathy J Graden <graden@fnal.gov>; Steve J Chappa <chappa@fnal.gov>; Madelyn Wolter <maddiew@fnal.gov>; David Mertz <mertz@fnal.gov>; James L. Priest <priest@fnal.gov>; Karen M Kephart <karenk@fnal.gov>; Teri L Dykhuis <dykhuis@fnal.gov>; Robert J Bushek <bushek@fnal.gov>; Eric D McHugh <emchugh@fnal.gov>; Gary L Lauten <glauten@fnal.gov>; Michael G. Herr <michael.herr@science.doe.gov>; Yun He <yunhe@fnal.gov>; Bridget K Scerini <iverson@fnal.gov>; Terry E Tope <tope@fnal.gov>; Richard L Schmitt <rlschmitt@fnal.gov>; David C Christian <dcc@fnal.gov>; Paul E Reimer <reimer@fnal.gov>

**Subject:** Re: Summary of SeaQuest walk-through today

Thanks much Russ! And Yun He, you concur?

Yours truly,

**Leo Bellantoni**

*Scientist*

Fermi National Accelerator Laboratory

630 730 2155

[bellanto@fnal.gov](mailto:bellanto@fnal.gov)

On Mar 4, 2016, at 12:29 PM, Russell A Rucinski <[rucinski@fnal.gov](mailto:rucinski@fnal.gov)> wrote:

I reviewed the engineering note and the extension of the beam and find it to be acceptable. The beam has extra welding on the flanges that go beyond those used in the analysis and is even more conservatively acceptable. Mechanically, I recommend approval.

**From:** Russell A Rucinski rucinski@fnal.gov 🚩  
**Subject:** RE: Summary of SeaQuest walk-through today  
**Date:** March 4, 2016 at 12:29 PM

**To:** Leo Bellantoni bellanto@fnal.gov, Kathy J Graden graden@fnal.gov, Steve J Chappa chappa@fnal.gov, Madelyn Wolter maddiew@fnal.gov, David Mertz mertz@fnal.gov, James L. Priest priest@fnal.gov, Karen M Kephart karenk@fnal.gov, Teri L Dykhuis dykhuis@fnal.gov, Robert J Bushek bushek@fnal.gov, Eric D McHugh emchugh@fnal.gov, Gary L Lauten glauten@fnal.gov, Michael G. Herr michael.herr@science.doe.gov, Yun He yunhe@fnal.gov, Bridget K Scerini iverson@fnal.gov, Terry E Tope tope@fnal.gov, Richard L Schmitt rlschmitt@fnal.gov, David C Christian dcc@fnal.gov, Paul E Reimer reimer@anl.gov

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Russ Rucinski

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**From:** Leo Bellantoni  
**Sent:** Friday, March 04, 2016 12:18 PM  
**To:** Kathy J Graden <graden@fnal.gov>; Steve J Chappa <chappa@fnal.gov>; Madelyn Wolter <maddiew@fnal.gov>; David Mertz <mertz@fnal.gov>; James L. Priest <priest@fnal.gov>; Karen M Kephart <karenk@fnal.gov>; Teri L Dykhuis <dykhuis@fnal.gov>; Robert J Bushek <bushek@fnal.gov>; Eric D McHugh <emchugh@fnal.gov>; Russell A Rucinski <rucinski@fnal.gov>; Gary L Lauten <glauten@fnal.gov>; Michael G. Herr <michael.herr@science.doe.gov>; Yun He <yunhe@fnal.gov>; Bridget K Scerini <iverson@fnal.gov>; Terry E Tope <tope@fnal.gov>; Richard L Schmitt <rlschmitt@fnal.gov>; David C Christian <dcc@fnal.gov>; Paul E Reimer <reimer@anl.gov>  
**Subject:** Summary of SeaQuest walk-through today

Dear colleagues,

Today we examined the Station 0/Station 1 assembly in SeaQuest. Herewith, my notes:

- 1) Russ and Yun He have reviewed the mechanical notes and the extensions to the I-beam, finding that as-engineered and as-implemented are indeed the same; they will send emails to add to the bundle indicating their OK
- 2) The flammable gas related issues were reviewed by Terry Tope and Rich Schmitt on 2 Mar. Rich has sent me an email recommending labels reading "Danger Flammable Gasses, no ignition sources" for the gas rack and at the chamber. These have been installed. The other requirement for their recommendation to operate is a successful leak check.
- 3) Electronics and indeed the Station 1 chamber are still in the process of installation. Although the individual components have all been previously reviewed, there are possible installation issues; this precludes a positive recommendation re. safety issues at this time.
- 4) SeaQuesters will strive mightily over the weekend, as is no doubt their habitual nature. They are \*hoping\* to have the installation complete Sunday afternoon.
- 5) At 8:30AM on Monday, Steve Chappa and I will re-examine the electrical and other possible general issues regarding the installation; I will bring an ORC bundle ready-to go to that meeting.
- 6) Eric McHugh might examine the installation this afternoon.

Yours truly,

Leo Bellantoni

**From:** Yun He [yunhe@fnal.gov](mailto:yunhe@fnal.gov)  
**Subject:** RE: Summary of SeaQuest walk-through today  
**Date:** March 4, 2016 at 1:20 PM  
**To:** Leo Bellantoni [bellanto@fnal.gov](mailto:bellanto@fnal.gov), Russell A Rucinski [rucinski@fnal.gov](mailto:rucinski@fnal.gov)  
**Cc:** Kathy J Graden [graden@fnal.gov](mailto:graden@fnal.gov), Steve J Chappa [chappa@fnal.gov](mailto:chappa@fnal.gov), Madelyn Wolter [maddiew@fnal.gov](mailto:maddiew@fnal.gov), David Mertz [mertz@fnal.gov](mailto:mertz@fnal.gov), James L. Priest [priest@fnal.gov](mailto:priest@fnal.gov), Karen M Kephart [karenk@fnal.gov](mailto:karenk@fnal.gov), Teri L Dykhuis [dykhuis@fnal.gov](mailto:dykhuis@fnal.gov), Robert J Bushek [bushek@fnal.gov](mailto:bushek@fnal.gov), Eric D McHugh [emchugh@fnal.gov](mailto:emchugh@fnal.gov), Gary L Lauten [glauten@fnal.gov](mailto:glauten@fnal.gov), Michael G. Herr [michael.herr@science.doe.gov](mailto:michael.herr@science.doe.gov), Bridget K Scerini [iverson@fnal.gov](mailto:iverson@fnal.gov), Terry E Tope [tope@fnal.gov](mailto:tope@fnal.gov), Richard L Schmitt [rlschmitt@fnal.gov](mailto:rlschmitt@fnal.gov), David C Christian [dcc@fnal.gov](mailto:dcc@fnal.gov), Paul E Reimer [reimer@anl.gov](mailto:reimer@anl.gov)

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Yes, I concur with Russ's comments, and recommend approval on the mechanical aspect.

Regards,  
Yun HE

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**From:** Leo Bellantoni  
**Sent:** Friday, March 04, 2016 12:33 PM  
**To:** Russell A Rucinski <[rucinski@fnal.gov](mailto:rucinski@fnal.gov)>  
**Cc:** Kathy J Graden <[graden@fnal.gov](mailto:graden@fnal.gov)>; Steve J Chappa <[chappa@fnal.gov](mailto:chappa@fnal.gov)>; Madelyn Wolter <[maddiew@fnal.gov](mailto:maddiew@fnal.gov)>; David Mertz <[mertz@fnal.gov](mailto:mertz@fnal.gov)>; James L. Priest <[priest@fnal.gov](mailto:priest@fnal.gov)>; Karen M Kephart <[karenk@fnal.gov](mailto:karenk@fnal.gov)>; Teri L Dykhuis <[dykhuis@fnal.gov](mailto:dykhuis@fnal.gov)>; Robert J Bushek <[bushek@fnal.gov](mailto:bushek@fnal.gov)>; Eric D McHugh <[emchugh@fnal.gov](mailto:emchugh@fnal.gov)>; Gary L Lauten <[glauten@fnal.gov](mailto:glauten@fnal.gov)>; Michael G. Herr <[michael.herr@science.doe.gov](mailto:michael.herr@science.doe.gov)>; Yun He <[yunhe@fnal.gov](mailto:yunhe@fnal.gov)>; Bridget K Scerini <[iverson@fnal.gov](mailto:iverson@fnal.gov)>; Terry E Tope <[tope@fnal.gov](mailto:tope@fnal.gov)>; Richard L Schmitt <[rlschmitt@fnal.gov](mailto:rlschmitt@fnal.gov)>; David C Christian <[dcc@fnal.gov](mailto:dcc@fnal.gov)>; Paul E Reimer <[reimer@anl.gov](mailto:reimer@anl.gov)>  
**Subject:** Re: Summary of SeaQuest walk-through today

Thanks much Russ! And Yun He, you concur?

Yours truly,

**Leo Bellantoni**  
*Scientist*

Fermi National Accelerator Laboratory  
630 730 2155  
[bellanto@fnal.gov](mailto:bellanto@fnal.gov)

On Mar 4, 2016, at 12:29 PM, Russell A Rucinski <[rucinski@fnal.gov](mailto:rucinski@fnal.gov)> wrote:

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**From:** David C Christian dcc@fnal.gov 🇺🇸  
**Subject:** Non flammable gas  
**Date:** March 4, 2016 at 11:57 AM  
**To:** Leo Bellantoni bellanto@fnal.gov

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Hi Leo,

All of the SeaQuest chambers except the Colorado Station 1 chamber use a gas mix of 8% CH<sub>4</sub>, 4% CF<sub>4</sub>, balance Argon.

- Dave

Sent from my cell phone

**From:** David Christian dcc@fnal.gov 🇺🇸  
**Subject:** SeaQuest flammable gas  
**Date:** March 3, 2016 at 11:45 AM  
**To:** Leo Bellantoni bellanto@fnal.gov  
**Cc:** dcc dcc@fnal.gov, Paul E. Reimer reimer@anl.gov

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Dear Leo,

The purpose of this email is to document the “new” flammable gas mixture that we are using for the large chamber at station 1 in SeaQuest (the “Colorado chamber”).

Our original gas mixture is 2.5% methylal, 13% isobutane, 16% CF<sub>4</sub>, 68.5% Argon. We realized fairly recently that we could operate the chamber efficiently at lower HV with a gas mixture that contains less CF<sub>4</sub>, so we have purchased a second gas mix. The new mixture is 1.5% methylal, 11.5% isobutane, 87% argon (no CF<sub>4</sub>). We intend to operate the Colorado chamber with a mixture of these two gas mixtures. Since the concentration of the two flammable components (methylal and isobutane) is less in the new mix than in the original mix, the gas in the chamber will be less flammable than it was with the original mixture.

Cylinders of the new mixture purchased from Matheson contain 28 SCF of gas, so we can continue to ensure that the gas shed is class 0 by storing no more than 5 cylinders of premixed flammable gas in the shed.

I apologize for taking so long to send you this note.

- Dave

**From:** Richard L Schmitt rlschmitt@fnal.gov 🇺🇸  
**Subject:** RE: Unidentified hazard  
**Date:** March 2, 2016 at 9:03 AM  
**To:** Paul E Reimer reimer@anl.gov, Terry E Tope tope@fnal.gov, James L. Priest priest@fnal.gov  
**Cc:** Leo Bellantoni bellanto@fnal.gov, David C Christian dcc@fnal.gov, James H Niehoff niehoff@fnal.gov, Eric D McHugh emchugh@fnal.gov

---

Jim,

The new gas mixture is less flammable than earlier. With this minor change and a previously reviewed system I agree with Terry that no further review from the FSS is needed. I would recommend operation as long as project continues to follow the requirements of ESH&Q 6020.3 for risk class zero installations.

Richard Schmitt  
Office 630-840-4849  
Mobile 630-212-8485

---

**From:** Paul E Reimer [mailto:reimer@anl.gov]  
**Sent:** Tuesday, March 01, 2016 6:38 PM  
**To:** Terry E Tope <tope@fnal.gov>; James L. Priest <priest@fnal.gov>  
**Cc:** Leo Bellantoni <bellanto@fnal.gov>; David C Christian <dcc@fnal.gov>; Richard L Schmitt <rlschmitt@fnal.gov>; James H Niehoff <niehoff@fnal.gov>; Eric D McHugh <emchugh@fnal.gov>  
**Subject:** Re: Unidentified hazard

Hello,

Sorry, I sent the protected link. Here is the unprotected link <http://sequest-docdb.fnal.gov/cgi-bin/ShowDocument?docid=1502>.

Paul

On 3/1/16 5:02 PM, Terry E Tope wrote:

Hi All -

I don't have the docdb password to see the documentation. I'm unfamiliar with this entire system, but if an already approved chamber will use a slightly different gas mixture and the slightly different gas mixture doesn't require any piping/hardware changes to modify the mix I don't see why it would require an additional review.

Regards,

Terry

On Mar 1, 2016, at 4:44 PM, James L. Priest <[priest@fnal.gov](mailto:priest@fnal.gov)> wrote:

Thanks. If Terry has no issues after the review he can recommend operation

Jim

**James Priest PhD.**  
Fire Strategist/Researcher/Pyroscientist

ESH&Q Section  
Fermi National Accelerator Lab  
PO Box 500, MS 119  
Batavia, IL 60510  
11SA

**From:** Richard L Schmitt [rlschmitt@fnal.gov](mailto:rlschmitt@fnal.gov) 🇺🇸  
**Subject:** RE: Unidentified hazard  
**Date:** March 2, 2016 at 3:37 PM  
**To:** Paul E Reimer [reimer@anl.gov](mailto:reimer@anl.gov), Terry E Tope [tope@fnal.gov](mailto:tope@fnal.gov), James L. Priest [priest@fnal.gov](mailto:priest@fnal.gov)  
**Cc:** Leo Bellantoni [bellanto@fnal.gov](mailto:bellanto@fnal.gov), David C Christian [dcc@fnal.gov](mailto:dcc@fnal.gov), James H Niehoff [niehoff@fnal.gov](mailto:niehoff@fnal.gov), Eric D McHugh [emchugh@fnal.gov](mailto:emchugh@fnal.gov)

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Jim,

Terry and I toured Seaquest this afternoon. The gas house meets the requirements of ESH&Q for a risk class zero system.

About twenty premix gas cylinders are stored outside. The area is appropriately labelled and there is little other combustible material in the vicinity.

The chamber that will use flammable gas was temporarily removed from service for repairs. It will be leak tested with the bubbler system after installation and is normally found to be less than 0.06 SCFM.

A pile of signal cables near the chamber gas rack and the chamber operating location will be installed before operation. The gas rack was labelled "flammable gas" but did not have the "Danger-flammable gasses, no ignition sources" sign specified in ESH&Q paragraph 6.1.1. Labels of this type should be posted on the gas rack and the chamber.

Other than the labels, the relevant requirements of ESH&Q 6020.3 have been met. We would recommend operation if the labels in the chamber area are affixed and the leak test is successful.

Richard Schmitt  
Office 630-840-4849  
Mobile 630-212-8485

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**From:** Richard L Schmitt  
**Sent:** Wednesday, March 02, 2016 9:04 AM  
**To:** Paul E Reimer <[reimer@anl.gov](mailto:reimer@anl.gov)>; Terry E Tope <[tope@fnal.gov](mailto:tope@fnal.gov)>; James L. Priest <[priest@fnal.gov](mailto:priest@fnal.gov)>  
**Cc:** Leo Bellantoni <[bellanto@fnal.gov](mailto:bellanto@fnal.gov)>; David C Christian <[dcc@fnal.gov](mailto:dcc@fnal.gov)>; James H Niehoff <[niehoff@fnal.gov](mailto:niehoff@fnal.gov)>; Eric D McHugh <[emchugh@fnal.gov](mailto:emchugh@fnal.gov)>  
**Subject:** RE: Unidentified hazard

Jim,

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**Cc:** Leo Bellantoni <[bellanto@fnal.gov](mailto:bellanto@fnal.gov)>; David C Christian <[dcc@fnal.gov](mailto:dcc@fnal.gov)>; Richard L Schmitt <[rlschmitt@fnal.gov](mailto:rlschmitt@fnal.gov)>; James H Niehoff <[niehoff@fnal.gov](mailto:niehoff@fnal.gov)>; Eric D McHugh <[emchugh@fnal.gov](mailto:emchugh@fnal.gov)>  
**Subject:** Re: Unidentified hazard

Hello,

**From:** David Christian dcc@fnal.gov 🇺🇸  
**Subject:** Re: Unidentified hazard  
**Date:** March 1, 2016 at 12:52 PM  
**To:** Leo Bellantoni bellanto@fnal.gov, Paul E Reimer reimer@anl.gov  
**Cc:** Terry E Tope tope@fnal.gov, Richard L Schmitt rlschmitt@fnal.gov, James H Niehoff niehoff@fnal.gov, James L. Priest priest@fnal.gov, Eric D McHugh emchugh@fnal.gov, dcc dcc@fnal.gov

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Hi Leo,

I think there is some confusion about what we're planning to do. The old Station 1 chambers will not use flammable gas (they leak too much). We leak check the Colorado chamber every time we rig it out & rig it back in (by making sure that we see bubbles on the exhaust at very low flow rate).

I do still owe you a document on the slightly modified gas mixture we plan to use in the Colorado chamber. As I told you, the modified mixture is slightly less flammable than the mixture we documented.

- Dave

On 3/1/16 12:36 PM, Leo Bellantoni wrote:

Dear Paul, Dear Dave,

At lunch today I spoke with Jim and realized that we have a previously unidentified hazard involved here with the new station 1 apparatus, to wit, flammable gas. Jim perceptively asked "Have they leak checked it?" and noted that the flammable gas calculations of earlier should be revisited.

It also happens that Jim is out of town on Friday. Possible replacement reviewers are cc'd here. They will need to see the revised documentation.

Yours truly,

**Leo Bellantoni**  
*Scientist*

Fermi National Accelerator Laboratory  
630 730 2155  
[bellanto@fnal.gov](mailto:bellanto@fnal.gov)