PUBLIC
☐ Immediate Release
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☐ Other:

Reviewer: MMH Date: 3/31/16

UNIVERSITY OF
SOUTH DAKOTA

RECEIVED
MAR 31 2016
DNMS

March 25, 2016

Michelle M. Hammond, Health Physicist
U.S. Nuclear Regulatory Commission
Division of Nuclear Materials Safety
Nuclear Materials Safety, Branch B
1600 East Lamar Boulevard
Arlington, TX 76011-4511

Attn: License Amendment

Re: NRC License # 40-02331-19
Docket: 030-15186, Control: 589858

Dear Ms. Hammond:

Thank you for your careful reading of our application to revise our license, appointing Dr. Ryan MacLellan as our new Radiation Safety Officer. I am pleased to respond to your supplemental questions.

1. **Please provide Radiation Safety Officer and HazMat training certification for the proposed RSO.**

   Dr. MacLellan has not attended a Radiation Safety Officer certification course. We consider this superfluous, as the education in high energy physics he has received during his academic training and work experience far exceed those of a standard RSO course. I refer you to his CV, which is attached. Following his First Class Degree (with honors) in Astrophysics, Dr. MacLellan continued his education, attaining his Ph.D. in Physics while working in the laboratory of Nobel Prize winning physicist Dr. Arthur B. MacDonald, at Queen's University in Ontario, Canada. Throughout his career, Dr. MacLellan has studied in the field of particle physics, and is a laureate of the Breakthrough Prize, for his contributions in the exploration and discovery of neutrino oscillations, "revealing a new frontier beyond, and possibly far beyond, the standard model of particle physics."

   During his work at the University of Alabama Dr. MacLellan received extensive hands on experience working with neutron activated samples of material containing many different sources of radiation, including samples containing trace amounts of gold that were particularly radioactive. These samples required transfer from activation to counting vials during which these samples were unsealed. During his work at DOE's SLAC National Accelerator Laboratory he completed General Employee Radiation Safety and Radiological Worker I training, and also acquired hazmat training. Please refer to attached certificates.

   Upon Dr. MacLellan's arrival at the University of South Dakota we recognized that we had a superior candidate to serve as our Radiation Safety Officer. Over the past several months Dr. MacLellan has been receiving instruction in the duties of an RSO from our present incumbent, Kevin O'Kelley. Subjects covered during these regular training sessions include:

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ehs@usd.edu

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- The USD Radiation License
- Annual radiation program assessment
- Radioactive materials inventory
- Designated users and training requirements
- Personal dosimetry program
- Wipe surveys
- The Cs-137 calibration source
- Waste disposal
- Receipt of radioactive materials.

2. **Please provide any additional experience and/or training the proposed RSO has using the Cs-137 (sealed sources) calibrator.**

   Dr. MacLellan has no experience with the Cs-137 calibrator. This source has remained under lock and key, unused for several years. However, Dr. MacLellan has extensive practical experience with sealed Cs-137 sources and expects to utilize the source for high rate testing of germanium counters under development at USD.

3. **Please provide a Delegation of Authority including the signature of the proposed RSO's "stop work authority" in the event of unsafe practice(s).**

   Please see attached Delegation of Authority.

4. **Please confirm the contact e-mail and phone number of the proposed RSO and indicate if the proposed RSO is located onsite at the University campus.**

   Dr. MacLellan is a full-time Assistant Professor, and is located on campus. He can be contacted at ryan.maclellan@usd.edu, and by phone at (605) 677-3990.

Please do not hesitate to contact our incumbent Radiation Safety Officer, Kevin O'Kelley, with any questions or concerns.

Cordially,

Mary Berry, Ph.D.
Vice President for Research

Encl.

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cc: Kevin O'Kelley, Radiation Safety Officer
Ryan MacLellan, Ph.D.

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The certifying officer for the University of South Dakota is the Vice President for Research, Mary Berry, Ph.D. The Radiation Safety Officer reports directly to the Assistant Vice President for Research Compliance, in Dr. Berry's office.

Administrative approval and delegation of authority to the appointed Radiation Safety Officer:

Ryan MacLellan, upon NRC approval, will be appointed as the Radiation Safety Officer (RSO), and is authorized to review credentials, and approve users of byproduct radioactive materials. This authorization extends to all schools, colleges and departments of the University of South Dakota sited on the Vermillion, South Dakota campus. The RSO is explicitly given "stop work authority" in the event of unsafe practice(s). Further, the RSO is given full responsibility for the University's radiation safety program.

Mary Berry, Ph.D.

Vice President for Research

Ryan MacLellan, Ph.D.

Assistant Professor

Certificate of Completion

This is to certify that

RYAN F MACLELLAN

has completed the course

Course 115 - GERT

on

7/17/2014

SLAC

NATIONAL ACCELERATOR LABORATORY

Certificate of Completion

This is to certify that

RYAN F MACLELLAN

has completed the course

Course 116 - RWT I Training

on

7/17/2014

SLAC

NATIONAL ACCELERATOR LABORATORY

Certificate of Completion

This is to certify that

RYAN F MACLELLAN

has completed the course

Course 123 - HazMat Gen Awareness

on

2/4/2014

SLAC

NATIONAL ACCELERATOR LABORATORY

Ryan Francis MacLellan

CONTACT INFORMATION

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Akeley-Lawrence Science Center
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Vermillion SD 57069
USA

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E-mail: ryanmac@slac.stanford.edu

CITIZENSHIP

Canadian

RESEARCH INTERESTS

Particle physics. Specifically: neutrinoless double beta decay; direct detection dark matter searches

EDUCATION

Queen's University, Kingston, Ontario, Canada

Ph.D., Physics, May 2009

- Thesis title: The energy calibration for the solar neutrino analysis of all three phases of the Sudbury Neutrino Observatory
- Advisor: Professor Arthur B. McDonald
- Area of Study: Particle Astrophysics

Saint Mary's University, Halifax, Nova Scotia, Canada

B.Sc., Honours Astrophysics, May 2001

- Thesis Topic: Electron deuteron scattering in effective field theory
- Advisor: Professor Malcolm Butler
- First class standing

AWARDS

SLAC National Accelerator Lab

Bill Kirk MVP Award, SLAC Annual Softball Game 2013

Queen's University

Best Particle Physics Division oral presentation, Canadian Association of Physicists Congress, 2008
Natural Sciences and Engineering Research Council John C. Polanyi Award, awarded to the SNO collaboration in 2006
R. Samuel McLaughlin Fellowship, 2006
Ontario Graduate Scholarship in Science & Technology, 2005
Carl Reinhardt Fellowship, 2005
Ontario Graduate Scholarship in Science & Technology, 2004
Carl Reinhardt Fellowship, 2003
R. Samuel McLaughlin Fellowship, 2003
Natural Sciences and Engineering Research Council Postgraduate Scholarship, 2002
Carl Reinhardt Fellowship, 2001
Natural Sciences and Engineering Research Council Postgraduate Scholarship, 2001

Saint Mary's University

Saint Mary's University Faculty Union scholarship, 2000
Reuben & Helen Hornstein bursary, 2000
Natural Sciences and Engineering Research Council undergraduate student research award, 2000
Reuben & Helen Hornstein bursary, 1999

PROFESSIONAL EXPERIENCE

University of South Dakota, Vermillion, South Dakota, USA

Assistant Professor of Physics, 2014–present

SLAC National Accelerator Lab, Menlo Park, California, USA

Research Associate, 2012–2014

- Particle physics experimental seminar organizer
- EXO-200 in-situ backgrounds analysis group leader

University of Alabama, Tuscaloosa, Alabama, USA

Postdoctoral Fellow, 2009–2012

- Germanium detector and plastic scintillator calibration
- All aspects of neutron activation analysis
- Low background materials characterization
- Radioactive background impact assesment with Monte Carlo calculations
- Radioactive source characterization and certification
- Atmospheric sampling for radioactivity
- Low background counter (germanium detector) design and construction
- Plastic scintillator muon veto design and construction
- Coordination and supervision of underground clean lab activities
- EXO-200 system (muon veto) expert
- Analysis group leader (livetime and veto)
- Laboratory network and computing resource administrator

ACADEMIC EXPERIENCE

Queen's University, Kingston, Ontario, Canada

Graduate student

- M.Sc. candidate, 2001–2003
- Promoted directly to Ph.D. program, 2003
- Ph.D. candidate, 2003–2009

Teaching assistant

- Laboratory demonstrator, 2001–2007
- Marker, 2001–2007

Research assistant

- Ph.D. thesis research, 2001–2009
- Sudbury Neutrino Observatory detector operator, 2003–2008
- Sudbury Neutrino Observatory calibrations expert, 2003–2007
- Radioactive source deployment
- Detector Monte Carlo simulation
- Data analysis and detector calibration (mainly energy)
- Advanced techniques for simultaneous signal, background, and systematic error extraction from data

Summer Nuclear Institute at TRIUMF, Vancouver, British Columbia, Canada

CKM and MNS: Quark and Lepton Mixings, 2003

Saint Mary's University, Halifax, Nova Scotia, Canada

Undergraduate student, 1997-2001

- With honours
- First class standing

- Dean's list

Undergraduate research

- Space reddenings for fifteen Galactic Cepheids, 2000
- Inelastic electron-deuteron scattering in effective field theory, 2001

PUBLICATIONS

J.B. Albert et al., Search for Majorana neutrinos with the first two years of EXO-200, *Nature* 510 (2014)

B. Aharmim et al., A search for astrophysical burst signals at the Sudbury Neutrino Observatory, *Astropart. Phys.* 55 (2014)

J.B. Albert et al., An improved mearsurement of the $2\nu\beta\beta$ half-life of ^{136}Xe with EXO-200, *Phys. Rev.* C89 (2014)

M. Auger et al., Search for neutrinoless double-beta decay in ^{136}Xe with EXO-200, *Phys. Rev. Lett.* 109 (2012)

M. Auger et al., The EXO-200 detector, part I: Detector design and construction, *JINST* 7 (2012)

A. Dobi et al., Xenon purity analysis for EXO-200 via mass spectrometry, *Nucl. Instrum. Meth.* A675 (2012)

R. MacLellan, Neutron activation analysis: Techniques and applications, *AIP Conference Proceedings* No. 1338 (2011)

N. Ackerman et al., Observation of two-neutrino double-beta decay in ^{136}Xe with EXO-200, *Phys. Rev. Lett.* 107 (2011)

B. Aharmim et al., Combined Analysis of all three phases of solar neutrino data from the Sudbury Neutrino Observatory, *Phys. Rev.* C88 (2013)

B. Aharmim et al., Measurement of the ν_e and total ^{8}B solar neutrino fluxes with the Sudbury Neutrino Observatory phase-III data set, *Phys. Rev. Lett.* 107 (2011)

D.G. Turner, R.F. MacLellan, A.A. Henden, and L.N. Berdnikov., Space reddenings for fifteen Galactic Cepheids, *RevMexAA* 47 (2011)

A. Dobi et al., A xenon gas purity monitor for EXO, *Nucl. Instrum. Meth.* A659 (2011)

F. LePort et al., A magnetically-driven piston pump for ultra-clean applications, *Rev. Sci. Instrum.* 82 (2011)

B. Aharmim et al., Low multiplicity burst search at the Sudbury Neutrino Observatory, *Astrophys. J.* 728 (2011)

M. Montero Diez et al., A simple radionuclide-driven single-ion source, *Rev. Sci. Instrum.* 81 (2010)

B. Aharmim et al., Low energy threshold analysis of the phase I and phase II data sets of the Sudbury Neutrino Observatory, *Phys. Rev.* C81 (2010)

B. Aharmim et al., Searches for high frequency variations in the ^{8}B solar neutrino flux at the Sudbury Neutrino Observatory, *Astrophys. J.* 710 (2011)

B. Aharmim et al., Measurement of the cosmic ray and neutrino-induced muon flux at the Sudbury Neutrino Observatory, *Phys. Rev.* D80 (2009)

B. Aharmim et al., An independent measurement of the total active ^{8}B solar neutrino flux using an array of ^{3}He proportional counters at the Sudbury Neutrino Observatory, *Phys. Rev. Lett.* 101 (2008)

B. Aharmim et al., Measurement of the ν_e and total ^{8}B solar neutrino fluxes with the Sudbury Neutrino Observatory phase I data set, *Phys. Rev.* C75 (2007)

B. Aharmim et al., A search for neutrinos from the solar *hep* reaction and the diffuse supernova neutrino background with the Sudbury Neutrino Observatory, *Astrophys. J.* 653 (2006)

B. Aharmim et al., Electron energy spectra, fluxes, and day-night asymmetries of ^{8}B solar neutrinos from the 391-day salt phase SNO data set, *Phys. Rev.* C72 (2005)

B. Aharmim et al., A search for periodicities in the ^{8}B solar neutrino flux measured by the Sudbury Neutrino Observatory, *Phys. Rev.* D72 (2005)

S. N. Ahmed et al., Measurement of the total active ^{8}B solar neutrino flux at the Sudbury Neutrino Observatory with enhanced neutral current sensitivity, *Phys. Rev. Lett.* 92 (2004)

B. Aharmim et al., Electron antineutrino search at the Sudbury Neutrino Observatory, *Phys. Rev.* D70 (2004)

S. N. Ahmed et al., Constraints on nucleon decay via 'invisible' modes from the Sudbury Neutrino Observatory, *Phys. Rev. Lett.* 92 (2004)

Seminars and Conference Presentations

Invited

R. MacLellan, The Enriched Xenon Observatory: New results from EXO-200, ArtFest Scientific Symposium (2014)

R. MacLellan, The nature of neutrinos through double-beta decay: Current status and prospects of EXO's search, University of South Dakota colloquium (2014)

R. MacLellan, EXO-200 results and sensitivity: Precision double-beta decay measurement, PPC2013, Deadwood SD (2013)

R. MacLellan, Enriched Xenon Observatory search for $0\nu\beta\beta$: Latest results from EXO-200, Lake Louise Winter Institute, Lake Louise AL (2013)

R. MacLellan, Enriched Xenon Observatory search for $0\nu\beta\beta$: Latest results from EXO-200, SLAC Users Organization Annual Meeting, SLAC National Accelerator Lab (2012)

R. MacLellan, Searching for neutrinoless double-beta decay with EXO-200, SLAC Experimental Seminar, SLAC National Accelerator Lab (2012)

R. MacLellan, Review of neutrinoless double beta decay searches and recent results from EXO-200, Rencontres de Moriond EW 2012, La Thuile Italy (2012)

R. MacLellan, Neutron activation analysis techniques and applications, Low Radioactivity Techniques 2010, SNOLAB (2010)

Contributed

R. MacLellan, Status of the EXO-200 double beta decay search, APS April Meeting 2012, Atlanta GA (2012)

R. MacLellan, Status of the EXO-200 double beta decay search, APS Fall DNP Meeting 2010, Santa Fe NM (2010)

R. MacLellan, A low energy threshold analysis of the first two phases of the Sudbury Neutrino Observatory, Canadian Association of Physicists Congress, Université Laval (2008)

R. MacLellan, A measurement of the total active solar neutrino flux from the neutral-current interactions in the Sudbury Neutrino Observatory, Joint meeting of the Canadian, American and Mexican Physical Societies, Merida Mexico (2003)

R. MacLellan, Inelastic electron-deuteron scattering in effective field theory, Atlantic Undergraduate Physics and Astronomy Conference, Acadia University (2001)

TECHNICAL SKILLS

I have extensive work experience as an experimental physicist in two underground laboratories. I am proficient in clean room procedures and laboratory safety including working with solvents, acids, and sealed and unsealed radioactive materials. I have experience in working with NIM electronics modules and CAMAC data collection. I have experience with vacuum and cryogenic systems, rigging and lead stacking. In addition I am proficient in working with the following computer based tools:

Analysis and Monte Carlo packages

- ROOT: An object-oriented data analysis framework
- EGS: Electron Gamma Shower Monte Carlo radiation transport code
- CERN program library
- GEANT3 and Geant 4

Programming languages

- FORTRAN
- C
- C++
- UNIX shell scripting
- PERL
- Python

Applications

- Vim, Emacs, and other common open source editors
- LaTeX, BibTeX
- Open Office
- Microsoft Office
- Maple, Mathematica
- National Instruments Labview
- AutoCAD

Operating systems

- Linux (Red Hat and clones, Debian)
- Sun Solaris
- Microsoft Windows 7, XP, and earlier

REFERENCES

Professor **Marty Breidenbach**
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*E-mail:*mib@slac.stanford.edu

Professor **Andreas Piepke**
Department of Physics
University of Alabama
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Sudbury Neutrino Observatory Director, Gray Chair in Particle Astrophysics,
Professor **Arthur B. McDonald**
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