

August 1, 2003

Ms. Leah Dever, Associate Director  
Office of Laboratory Operations  
and Environment, Safety and Health  
Office of Science  
SC80/Germantown Building  
U.S. Department of Energy  
1000 Independence Avenue, SW  
Washington, DC 20585

This letter transmits the results of the compliance audit performed by the Nuclear Regulatory Commission (NRC) at Princeton Plasma Physics Laboratory (PPPL) during July, 2003.

The audit did not identify the need for any significant new programs or physical modifications. The audit findings are mainly in the area of administrative actions required to obtain an NRC license. Nearly all aspects of current Laboratory operations were in compliance with NRC regulations.

The purpose of this audit was to carry out the congressional direction given in the February 13, 2003, Conference Report accompanying House Joint Resolution 2, Consolidated Appropriations Resolution of 2003. Specifically, NRC was directed to conduct compliance audits for ten Department of Energy (DOE) Science laboratories not later than March 31, 2004, with the first four being completed by September 30, 2003. From this information, DOE's Office of Science is to develop estimates of the costs necessary to bring the laboratories into compliance with NRC safety standards.

Consistent with policy positions stated during the earlier DOE external oversight pilot projects<sup>1</sup>, PPPL was evaluated using the criteria for NRC Type A Licenses of Broad Scope, as described in NUREG 1556, Volume 11, "Consolidated Guidance About Materials Licensees: Program-Specific Guidance About Licenses of Broad Scope."

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<sup>1</sup>See NUREG 1708, "External Regulation of Department of Energy Nuclear Facilities;" DOE/EH-0594, "Report on the Pilot Project on External Regulation of DOE Facilities at Lawrence Berkeley National Laboratory, Appendix G;" and DOE/EH-0596, "Report on the Pilot Project on External Regulation of DOE Facilities at Radiochemical Engineering Development Center (REDC) Oak Ridge National Laboratory, Appendix F."

The current NRC review of PPPL included an evaluation of all sources of ionizing radiation, including the accelerators and other sources not currently regulated by the NRC. The review focused on: whether the occupational radiation protection programs associated with the potential Type A broad scope license adequately addressed all ionizing radiation sources; whether existing operational controls were adequate to protect members of the public, both on- and off-site, consistent with NRC regulations; and whether existing process and program controls were adequate to protect the environment and members of the public from releases, such as those of gaseous effluents and activated materials.

The reviews were targeted to identify major licensing issues, such as the following:

- physical changes to facilities and equipment that would be required to satisfy NRC licensing requirements (e.g., seismic upgrades to a building, addition of locks for very high radiation areas, and installation of criticality monitors.); and
- significant administrative or organizational changes required to satisfy NRC regulation that may impact on-going operational expenses as well as incur implementation costs (e.g., establishing a configuration management system, implementing a source inventory system, adding licensed operators; and setting up a Radiation Safety Committee).

In performing this review, as-found hardware configurations; organizational structure; and policy, programs and procedures were assessed against NRC's applicable regulations and guidance. Deviations were assessed, and proposed changes evaluated. NRC will prepare a final summary report of the project to evaluate the ten DOE Science laboratories. This report will be a compilation of the evaluations performed for each of the ten laboratories.

The NRC would like to thank the staff and management at PPPL, as well as the DOE Field and Headquarters' staff, for their assistance and cooperation during this project.

Sincerely,

Charles L. Miller, Director  
Division of Industrial and  
Medical Nuclear Safety  
Office of Nuclear Material Safety  
and Safeguards

Enclosure: Findings of NRC review of  
Princeton Plasma Physics Laboratory (PPPL)

cc: Director, Princeton Plasma Physics Laboratory  
Director, DOE Area Office, Princeton  
NRC Region I  
NRC Office of Congressional Affairs  
OSHA  
OSTP

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/RA/Patricia K. Holahan, for  
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# Findings of NRC review of Princeton Plasma Physics Laboratory (PPPL)

## Period of Performance:

July 21 through July 30, 2003

## Review Team Members:

James P. Dwyer,  
Senior Health Physicist, RI  
James L. Montgomery,  
Senior Health Physicist, RIV  
Betsy Ullrich,  
Senior Health Physicist, RI

## Findings Approved by:

<u>/RA/</u>	<u>08/01/2003</u>
Frederick D. Brown	Date
Program Manager, NMSS	

Enclosure

The NRC reviewed Princeton Plasma Physics Laboratory (PPPL) using the methodology described in the project work plan, a copy of which is attached.

The review team identified the action items that PPPL would need to address in order to provide high confidence that NRC could issue a license to the laboratory. The review included all aspects of laboratory operations involving ionizing radiation producing materials and machines.

The baseline for the action items was the existing PPPL policies, procedures, and practices.

Generic Items:

PPPL would need to develop a license application as required in 10 CFR 30.32, 10 CFR 33.11(a), 10 CFR 40.31, 10 CFR 70.22. Existing procedures, programs, and practices described by PPPL staff could serve as the basis for a Broad Scope license application. (10 CFR 30.32, 10 CFR 33.11(a), 10 CFR 40.31, 10 CFR 70.22)

PPPL would need to submit an Environmental Report to support development of an Environmental Assessment for replacing the existing operating authority with an NRC license. The scope of the Environmental Report would be limited to the change in regulatory requirement in going from DOE self regulation to NRC regulation. Specifically, the report would be directed at changes of requirements applicable to PPPL that could impact exposures, releases, or otherwise impact the environment. A rebaselining of environmental impacts would not be required. The Environmental Assessment will be developed by NRC.

PPPL would need to prepare a Decommissioning Funding Plan and provide a Letter of Intent to provide for ultimate site decommissioning. The Letter of Intent would be provided by DOE, regardless of the actual licensee. (10 CFR 30.35, 10 CFR 40.36, 10 CFR 70.25)

PPPL would need to establish a Radiation Safety Committee (RSC). The relationship of the RSC to other existing PPPL review committees would have to be defined in the application. (10 CFR 33.13(c)(1))

- PPPL would need to revise the responsibilities and organizational reporting structure associated with the current Manager, Health Physics, or other designee, to meet the NRC's definition of a Radiation Safety Officer (RSO). (10 CFR 33.13(c)(2))

PPPL would need to revise existing posting and labeling programs to match NRC regulatory requirements. The principal changes require: (1) labeling smaller quantities of radioactive material; and (2) posting "restricted areas" as opposed to "controlled areas." In addition, the NRC and DOE practices for posting "radioactive material areas" differ (10 CFR 20.1902 and 10 CFR 20.1904).

## DOE Science Lab Audit Methodology and Review Plan

### Background:

In NUREG 1708, "External Regulation of Department of Energy Nuclear Facilities", NRC stated that the DOE Science Laboratories could be licensed under Type A broad scope materials licenses, with special provisions for Part 70 requirements at the labs possessing greater than a critical mass of SNM (a part 70 Type A license). The DOE pilot reports for Lawrence Berkeley National Laboratory (LBNL) and the Radiochemical Engineering Development Center at Oak Ridge National Laboratory (ORNL) also reflected this position. Accordingly, draft licenses were developed for LBNL and ORNL's REDC, and were included in the DOE pilot reports.

### Regulatory Basis:

Typically, NRC issues Type A licenses of broad scope to large institutions. Type A broad scope licensees use a Radiation Safety Committee (RSC), Radiation Safety Officer (RSO), and criteria developed and submitted by the licensee and approved by NRC during the licensing process, to review and approve all uses and users under the license. An applicant for a Type A broad scope license must establish administrative controls and provisions relating to organization and management, procedures, record keeping, radiation safety, and management review that are necessary to assure safe operations, including:

- Establishment of a RSC
- Appointment of a qualified RSO
- Establishment of appropriate administrative procedures to assure:
  - ▶ control of procurement and use of byproduct material;
  - ▶ completion of safety evaluations of proposed uses that take into consideration
  - ▶ adequacy of facilities and equipment, training and experience of the user, and operating and handling procedures; and
  - ▶ review, approval, and recording by the RSC of safety evaluations of proposed uses.

For Laboratories that possess special nuclear material in quantities greater than a critical mass, as defined in NRC regulations, the review will also consist of an evaluation of physical security, material control and accountability, nuclear criticality safety, and safeguards. NRC's review will consider both the adequacy of current controls as well as the robustness of the licensee's processes and programs for managing future changes, where applicable.

### Scope:

In order to complete the review of ten DOE laboratories in the time provided by Congress, the NRC will focus on identifying items that have the potential for causing substantive costs. The NRC considers substantive costs to be those that required capital expenditures for physical changes to facilities or hardware, and those that will require diversion of existing human resources or the application of additional resources beyond those currently available.

Consistent with this focus, the reviews will be targeted to identify:

- physical changes to facilities and equipment that would be required to satisfy NRC licensing requirements (e.g., seismic upgrades to a building, addition of locks for a very high radiation area, installation of criticality monitors, etc. ); and
- significant administrative or organizational changes required to satisfy NRC regulation that may impact on-going operational expenses as well as having implementation costs

(e.g., establishing a configuration management system, implementing a source inventory system, adding licensed operators; setting-up a RSC, etc.);

There is the potential that a full and complete licensing review would identify the need for changes in the implementation of existing programs. It is assumed that the costs for these types of changes would not be substantive. Where the need for such changes are identified, they will be included in the findings of the review. Identifying these types of minor changes is, however, not be the focus of the review.

#### Review Plan:

The review team will evaluate lab conformance with the following specific sections of the referenced standard review plans:

For all labs:

- NUREG 1556, Volume 11: Sections 8.5 - 8.11.  
<http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1556/v11/index.html>

For labs with accelerators or other machines producing radiation at levels to be life threatening:

- NUREG 1556, Volume 6: Sections 8.8 - 8.10 (as guidance, excluding non-applicable provisions).  
<http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1556/v6/index.htm>
- Suggested State Regulations, Part I, "Accelerators"  
<http://www.state.de.us/dhss/dph/hsp/radcontprt12i.pdf>
- Suggested Sstate regulations for analytical x-rays devices and for industrial radiography including x-ray devices.  
[http://www.crcpd.org/SSRCRs/TOC\\_8-2001.htm](http://www.crcpd.org/SSRCRs/TOC_8-2001.htm)

For labs with greater than a critical mass of special nuclear material:

- NUREG 1520: Sections 3 (subject to prior team discussion), 5, 6, 7, 8, and 11.  
<http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1520/index.html>

Potential additional references:

- NUREG 1556, Volume 17: Program-Specific Guidance About Special Nuclear Material of Less than Critical Mass Licenses  
<http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1556/v17/index.html>
- NUREG 1556, Volume 5: Program-Specific Guidance About Self-Shielded Irradiators  
<http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1556/v5/index.html>
- Reg Guides 8.11 (uranium bioassay) and 10.4 (processing source material).  
Hard copy only - available from NRC Headquarters Distribution.

#### Review Process and Information Needed:

Provide prior to visit:

- A short paper (preferably from an existing source) providing a narrative over-view of the Laboratory and its use of radiation producing machines and materials.
- A copy of all facility SARs and SADs.
- Except for isotopes below, a list, by building, of radioactive materials (in curies), including form (sealed source, oxide dry bulk, solution, fuel element, etc.)
- For the four isotopes /nuclides of special interest to NRC (U-233, all Plutonium isotopes, U-235 enriched to equal to or greater than 10% and less than 20%, and U235 enriched equal to or greater than 20%) a list, by building, providing total quantity (in grams), quantity in irradiated fuel (in grams), and form of the material. In addition, please provide a list of the non-irradiated Plutonium quantities, by isotope, by building.
- A list of all (ionizing) radiation producing machines.

#### First day of visit:

Start the visit with an over-view presentation (about an hour), describing the major facilities at the Laboratory. Also provide a discussion of the types of uses of radioactive materials, and the involved quantities (e.g.: hot cell analysis of irradiated fuel elements, quantity limited to hundreds of grams; extraction of micro- and millicurie quantities of Berkelium, Californium, and other transuranics from irradiated targets of up to a kg of Curium). This presentation would complement the narrative description provided prior to the visit.

#### Items to plan on within first couple of days during the visit:

- Crit safety reviewer will want to meet with the Crit Safety leader or review group head, and tour fissile material work and storage areas.
- Security reviewer will want to meet with the Security Program manager and tour the various security area boundaries (site, facility), alarm stations, etc.
- MC&A reviewer will want to review the nuclear material accountability program with the responsible manager, and will want copies of associated program documents.
- Accelerator reviewer (and possibly a Broad Scope reviewer) will want to tour accelerators and large radiation producing machines. Areas of special interest: interlock criteria, project review and approval process, training of authorized users, configuration management, normal and accident off-site dose considerations.
- Broad Scope reviewers will want to discuss how projects (new uses) involving radioactive material are evaluated and approved within the Lab, including observing any review meetings that may occur during the visit, and to review previous minutes. Will also want to meet RSO or RPP Managers for major facilities. Will want to review ES&H Manual Volume 2, Chapter 5.
- Part 70 reviewer will want to tour hot cells and facilities handling greater than a critical mass of U or Pu. Will also want to talk to someone familiar with the Fire Hazards Analysis for the Lab and/or facilities.

Note: One aspect of the NRC review that will principally effect multi-purpose labs is that overlap of interest in facilities exists, but with different focuses. For instance, nearly all the reviewers will be interested in hot cells handling irradiated fuel, but with different information interests. The Labs may want to consider scheduling tours of these type facilities during the first few days of the review. The Labs should consider whether they can better support a series of tours and discussions with individual reviewers or a consolidated visit and discussion that will take a longer single block of time and be slightly less efficient for the review team.



Evaluation Criteria and Documentation:

In performing this review, as-found hardware configurations, organizational structure, policy, programs and procedures, to the extent practicable, will be assessed against NRC's applicable regulations and guidance. Deviations will be assessed, and proposed changes evaluated.

Where information is not available to support quantitative cost benefit methods, qualitative techniques are to be used to evaluate changes from the as-found condition. The findings for each laboratory shall reflect the outcome of this evaluation. Draft findings will be provided at the conclusion of each site review. Final findings will be transmitted about one week after the

- conclusion of the review. A description of the evaluations performed for each of the laboratories, and a list of any required exemptions necessary to issue licenses consistent with those findings, will be contained in a site specific audit report. The ten audit reports will be included in a summary project report, that will be completed at the conclusion of the project.

## References:

**Background Material** prepared by NRC during earlier activities in support of external regulation of DOE facilities, is found in:

SECY-02-0900

<http://www.nrc.gov/reading-rm/doc-collections/commission/secys/2002/>.

"NUREG 1708"

<https://reports.eh.doe.gov/extreg/docs/pilot/pilots/nureg/sr1708.pdf>

## Applicable to All:

10 CFR Part 19, Worker Issues:

<http://www.nrc.gov/reading-rm/doc-collections/cfr/part019/index.html>

10 CFR Part 20, Radiation Safety:

<http://www.nrc.gov/reading-rm/doc-collections/cfr/part020/index.html>

10 CFR Part 30, Materials Licensing:

<http://www.nrc.gov/reading-rm/doc-collections/cfr/part030/index.html>

10 CFR Part 33, Broad Scope Licensing:

<http://www.nrc.gov/reading-rm/doc-collections/cfr/part033/index.html>

10CFR Part40, Domestic Licensing of Source Material:

<http://www.nrc.gov/reading-rm/doc-collections/cfr/part040/index.html>

10CFR Part70 Domestic Licensing of Special Nuclear Material

<http://www.nrc.gov/reading-rm/doc-collections/cfr/part070/index.html>

10 CFR Part 71, Transportation:

<http://www.nrc.gov/reading-rm/doc-collections/cfr/part071/index.html>

NUREG 1556, Vol. 11, Licensing Guidance for Broad Scope Licenses:

<http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1556/v11/index.html>

## Inspection Procedures:

Inspection Manual Chapter 2800 (Currently using Temporary Instruction 2800/033, Revision 2), see Appendix A in the link that follows:

<http://www.nrc.gov/reading-rm/doc-collections/insp-manual/temp-instructions/ti2800033r2.pdf>

Inspection Procedure for Transportation:

<http://www.nrc.gov/reading-rm/doc-collections/insp-manual/inspection-procedure/ip86740.pdf>

Inspection Procedure for Broad Scope (non-medical) Licensees:

<http://www.nrc.gov/reading-rm/doc-collections/insp-manual/inspection-procedure/ip87126.pdf>

**Applicable to ORNL, PNNL, BNL, and ANL-E:**

10 CFR Part 70, Special Nuclear Material Licensing:

<http://www.nrc.gov/reading-rm/doc-collections/cfr/part070/index.html>

NUREG 1520, Standard Review Plan for Fuel Cycle Licenses under Part 70 (not entirely applicable):

<http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1520/>

10 CFR Part 73, Special Nuclear Material Security:

<http://www.nrc.gov/reading-rm/doc-collections/cfr/part073/index.html>

10 CFR Part 74, Special Nuclear Material Accounting:

<http://www.nrc.gov/reading-rm/doc-collections/cfr/part074/index.html>

10 CFR Part 25, Access Authorization:

<http://www.nrc.gov/reading-rm/doc-collections/cfr/part025/index.html>

Unlikely to apply, but might effect these labs:

10 CFR Part 26, Fitness for Duty:

<http://www.nrc.gov/reading-rm/doc-collections/cfr/part026/index.html>

**Applicable only to ORNL:**

10 CFR Part 50, Reactor Licensing:

<http://www.nrc.gov/reading-rm/doc-collections/cfr/part050/index.html>

10 CFR Part 55, Reactor Operator Licensing:

<http://www.nrc.gov/reading-rm/doc-collections/cfr/part055/index.html>

10 CFR Part 100, Reactor Site Criteria:

**Applicable to facilities with Accelerators:**

Suggested State Regulations for Accelerators (copy attached in .pdf file)

Part 36 regulations for panoramic Irradiator:

<http://www.nrc.gov/reading-rm/doc-collections/cfr/part036/full-text.html>

implementing guidance:

[http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1556/v6/index.html#\\_1\\_54](http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1556/v6/index.html#_1_54)

