

ENVIRONMENTAL EVALUATION NOTIFICATION FORM

Grantee/Contractor Laboratory: Princeton University/Princeton Plasma Physics Laboratory (PPPL)
Project/Activity Title: Upgrade of Lithium Tokamak eXperiment (LTX) Experimental Device (LTX-β)

CH NEPA Tracking No.: _____ Type of Funding SC

B&R Code: _____ Total Estimated Cost: \$1,716,000

DOE Cognizant Secretarial Officer (CSO): Ms. Cherry Murray

Contractor Project Manager: _____ Signature: _____

Date: _____

Contractor NEPA Reviewer: Jerry D. Levine Signature: 

Date: 7/14/17

- Description of Proposed Action:** The Lithium Tokamak eXperiment (LTX) allows for the study of the application of lithium to a tokamak wall and lithium's effect on plasma temperatures in both spherical and conventional tokamak models. The upgrade would include a 700 kW (35 A, 17-23 kV) neutral beam on loan from Tri-Alpha Energy for fueling, diagnostics, and heating. An upgraded toroidal field power supply would increase the toroidal field from 1.7 kG to 3.2 kG and the plasma current from 80 kA to 150 kA and an expanded Ohmic power supply would provide longer discharges at improved plasma current. An active Charge Exchange Recombination spectroscopy (CHERS) diagnostic, provided by Oak Ridge National Laboratory (ORNL), would be installed to provide core ion temperature and rotation profiles. An upgrade to the existing microwave reflectometer, provided by the University of California, Los Angeles (UCLA), would provide core electrostatic fluctuation diagnostics.

Improved vacuum pumping with a goal of reducing background water pressure to the 10^{-11} Torr range would be achieved through the installation of a 2,300 L/s turbo pump backed up by a dry scroll pump. A second 2,000 L/s cryopump would be added to the one currently in use on LTX. A 1,000 L/s turbo pump and a 1,500 L/s turbo pump would be installed for the neutral beam and together with a titanium getter pump would further aid in achieving vacuum. An existing 500 L/s turbo pump that runs off of uninterruptible power would be backed by a dry scroll pump in place of the existing oil-sealed forepump. The additional pumping and improved bakeout capability (see below) would further reduce undesirable concentrations of water vapor in the vacuum vessel and would permit between-shots application of lithium coatings to further improve vacuum conditions and reduce the rate at which background gases coat the lithium surface.

An enhanced electron cyclotron heating unit (ECH) would be employed for LTX plasma start-up by installing a 10.36 GHz system with a maximum power output of 2 kW to replace the 5.66 GHz (1 kW) system currently in use.

No physical changes to the bakeout system would take place but food-grade propylene glycol would be used in place of water in the bakeout and cooling system to allow operation to 100° C.

- II. **Description of Affected Environment:** Work would take place in the C-Site Laboratory Building, Rooms 208, 209, 210/211 (see Figures 1 and 2, attached). No environmentally sensitive resources would be affected.

PPPL is located on Princeton University's James Forrestal Campus in Plainsboro Township, Middlesex County (central New Jersey), adjacent to the municipalities of Princeton, Kingston, East and West Windsor, and Cranbury, NJ. It occupies approximately 88.5 acres in the areas known as "C- and D-Sites." PPPL has operated on the current site since 1959. The closest urban centers are New Brunswick, 14 miles (22.5 km) to the northeast, and Trenton, 12 miles (19 km) to the southwest. Within a 50-mile (80 km) radius are the major urban centers of New York City, Philadelphia, and Newark. Princeton University's main campus is approximately three miles west of the site, primarily located within the borough of Princeton.

The estimated resident population within 10 miles (16 km) of PPPL is approximately 500,000. The total estimated population within a 50-mile radius (80km) of PPPL is approximately 17,735,164.

Surrounding the site are lands of preserved and undisturbed areas including upland forest, wetlands, open grassy areas, and a minor stream, Bee Brook, which flows along PPPL's eastern boundary. These areas are designated as open space in the James Forrestal Campus (JFC) site development plan.

The climate of central New Jersey is classified as mid-latitude, rainy climate with mild winters, hot summers, and no dry season. Temperatures may range from below zero to above 100 degrees Fahrenheit (°F) (-17.8° Celsius (C) to 37.8° C); extreme temperatures typically occur once every five years. Approximately half the year, from late April until mid-October, the days are freeze-free. Normally the climate is moderately humid with a total average precipitation of about 46 inches (116 cm) evenly distributed throughout the year.

- III. **Potential Environmental Effects:** (Attach explanation for each "yes" response, and "no" responses if additional information is available and could be significant in the decision making process.)

A. Sensitive Resources: Will the proposed action result in changes and/or disturbances to any of the following resources?

	<u>Yes/No</u>
1. Threatened/Endangered Species and/or Critical Habitats	1. No
2. Other Protected Species (e.g. Burros, Migratory Birds)	2. No
3. Wetlands	3. No
4. Archaeological/Historic Resources	4. No
5. Prime, Unique or Important Farmland	5. No
6. Non-Attainment Areas	6. No
7. Class I Air Quality Control Region	7. No

- | | | |
|-----|---|--------|
| 8. | Special Sources of Groundwater (e.g. Sole Source Aquifer) | 8. No |
| 9. | Navigable Air Space | 9. No |
| 10. | Coastal Zones | 10. No |
| 11. | Areas w/ Special National Designation
(e.g. National Forests, Parks, Trails) | 11. No |
| 12. | Floodplain | 12. No |

B. Regulated Substances/Activities: Will the proposed action involve any of the following regulated substances or activities?

- | | <u>Yes/No</u> |
|--|---------------|
| 13. Clearing or Excavation (indicate if greater than 1 acre; if more than 5,000 sq. ft., a Soil Erosion / Sediment Control Permit may be required from Freehold Soil Conservation District.)
<i>Note: Soil disturbance includes clearing, grading, excavation, storage, and filling. Soil erosion and sediment control permits required if $\geq 5,000$ sq. ft.
Note: Excavations expected to encounter ground water may require a permit.</i> | 13. No |
| 14. Dredge or Fill (under Clean Water Act section 404; indicate if greater than 1 acre) | 14. No |
| 15. Noise (in excess of regulations) | 15. No |
| 16. Asbestos Removal | 16. No |
| 17. PCBs | 17. No |
| 18. Import, Manufacture or Processing of Toxic Substances | 18. No |
| 19. Chemical Storage/Use
<i>The maximum lithium use would remain at 226 grams. Anticipated use is less than 100 grams of lithium, based on a typical two-year operational campaign, which is approximately a factor of two greater than current typical LTX usage. Hydrogen gas would be used and safely vented to the outside, as it is for current LTX operation. The total amount of hydrogen vented per year would be primarily affected by a doubling of the discharge length in LTX-β. It is anticipated that less than 2000 liters of hydrogen will be vented per year, at standard atmospheric pressure. This is approximately twice the current LTX rate.</i> | 19. Yes |
| 20. Pesticide Use | 20. No |
| 21. Hazardous, Toxic, or Criteria Pollutant Air Emissions | 21. No |
| 22. Liquid Effluent | 22. No |
| 23. Underground Injection | 23. No |
| 24. Hazardous Waste
<i>Lithium disposal is anticipated to be approximately 200 grams every second year (or ~100 grams/year, average, for a two-year campaign). This would also be an increase by a factor of approximately two over current LTX disposal amounts. Lithium disposal would be handled by the PPPL Waste Management Group in accordance with PPPL procedures and regulatory requirements.</i> | 24. Yes |
| 25. Underground Storage Tanks | 25. No |
| 26. Radioactive (AEA) Mixed Waste | 26. No |
| 27. Radioactive Waste | 27. No |
| 28. Radiation Exposures
<i>The upgraded LTX machine would operate at the same loop voltage as the existing LTX to assure that runaway electrons and the accompanying x-ray radiation are not produced. The use of hydrogen plasmas would prevent the generation of neutrons. Radio frequency (RF) surveys, shielding, leakage measurements, physical barriers, interlocks, and procedures would protect workers and others from potential RF exposure.</i> | 28. Yes |

C. Other Relevant Disclosures. Will the proposed action involve the following?

	<u>Yes/No</u>
29. A threatened violation of ES&H regulations/permit requirements <i>The requirements of 10CFR851(as implemented under the DOE-approved PPPL Worker Safety and Health Program) would be applied to work at PPPL under this proposed action.</i>	29. No
30. Siting/Construction/Major Modification of Waste Recovery, or TSD Facilities	30. No
31. Disturbance of Pre-existing Contamination <i>Note: Excavations that encounter contaminated ground water require a permit.</i>	31. No
32. New or Modified Federal/State Permits	32. No
33. Public controversy	33. No
34. Action/involvement of Another Federal Agency (e.g. license, funding, approval)	34. No
35. Action of a State Agency in a State with NEPA-type law. (Does the State Environmental Quality Review Act Apply?)	35. No
36. Public Utilities/Services	36. No
37. Depletion of a Non-Renewable Resource	37. No

IV. **Section D Determination:** Is the project/activity appropriate for a determination under Subpart D of the DOE NEPA Regulations for compliance with NEPA?

DOE-PSO NEPA Compliance Officer (NCO) Review:

Concurrence with Proposed Class of Action Recommended

CX EA EIS

Category B3.13 (Magnetic fusion experiments)

For Categorical Exclusions (CXs):

A. The proposed action fits within a class of actions that is listed in Appendix A or B to Subpart D.

For classes of actions listed in Appendix B, the following conditions are integral elements; i.e., to fit within a class, the proposal must not:

- 1) Threaten a violation of applicable statutory, regulatory, or permit requirements for environment, safety, and health, including DOE and/or Executive Orders;
- 2) Require siting, construction, or major expansion of waste storage, disposal, recovery, or treatment facilities, but may include such categorically excluded facilities;
- 3) Disturb hazardous substances, pollutants, contaminants, or CERCLA-excluded petroleum and natural gas products that pre-exist in the environment such that there would be uncontrolled or unpermitted releases; or
- 4) Adversely affect environmentally sensitive resources.

B. There are no extraordinary circumstances related to the proposal that may affect the significance of the environmental effects of the proposal; and

C. The proposal is not "connected" to other actions with potentially significant impacts, is not related to other proposed actions with cumulatively significant impacts, and is not precluded by 40 CFR 1506.1 or 10 CFR 1021.211.

V. DOE Recommendation Approval:

PSO Staff: Tracy Estes

Signature:

TRACY
ESTES

Digitally signed by TRACY ESTES
DN: c=US, o=U.S. Government,
ou=Department of Energy, cn=TRACY
ESTES,
0.9.2342.19200300.100.1.1=89001001899
231
Date: 2017.02.01 10:22:43 -05'00'

Date: _____

SC GLD: Michael M. McCann

Signature:



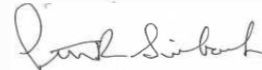
Date: 2/1/17

VI. NEPA Compliance Officer Subpart D CX Determination and Approval:

Based on my review of information conveyed to me and in my possession (or attached) concerning the proposed action, as NEPA Compliance Officer, I have determined that the proposed action fits within the specified class of actions, the other regulatory requirements set forth above are met, and the proposed action is hereby categorically excluded from further NEPA review.

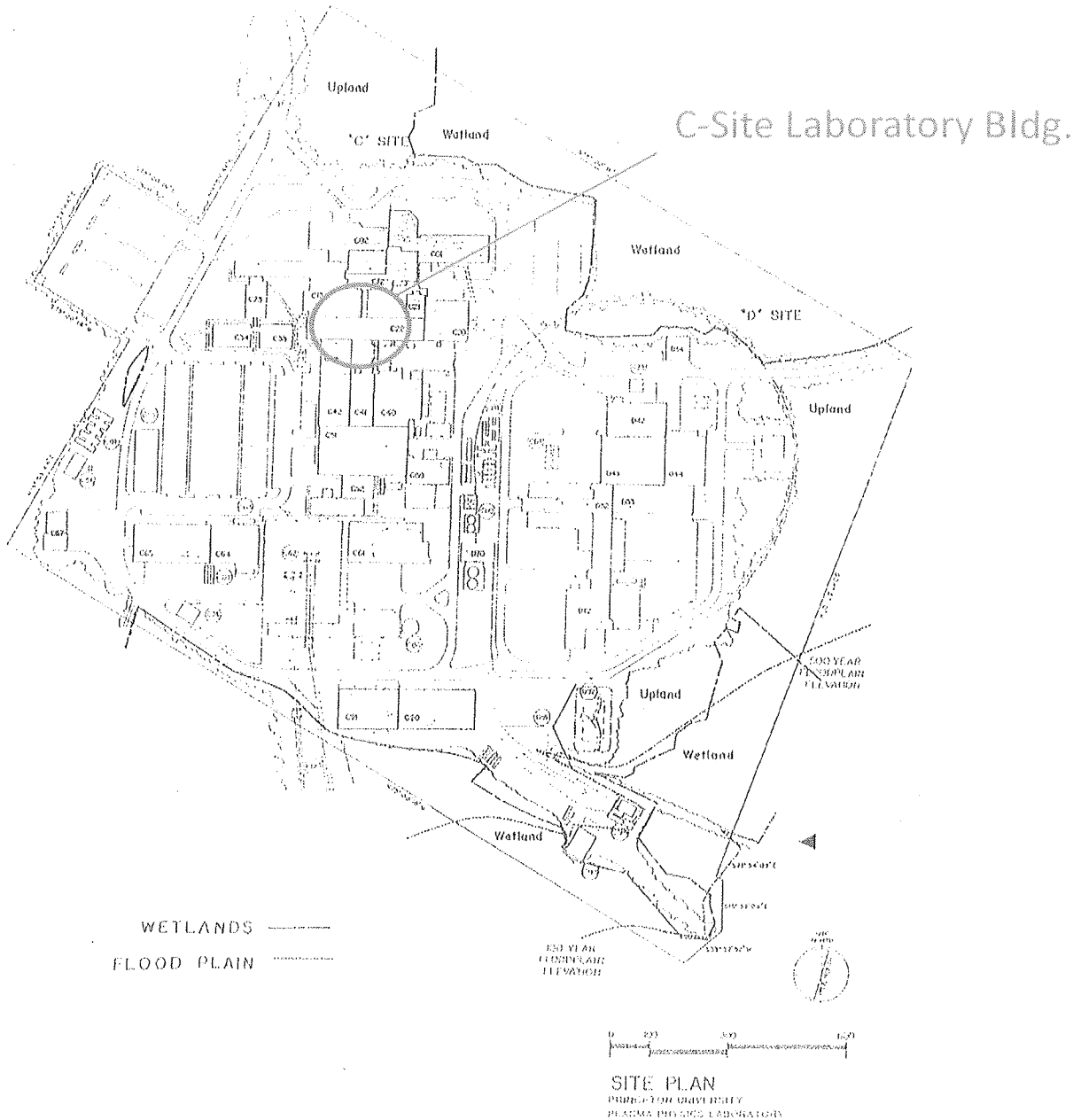
PSO NCO: Peter Siebach

Signature:



Date: 2/1/2017

PPPL	PRINCETON PLASMA PHYSICS LABORATORY	PROCEDURE	No. ESH-014 Rev 5 Attachment 4
	Map (Floodplains and Wetlands)		page 1 of 1



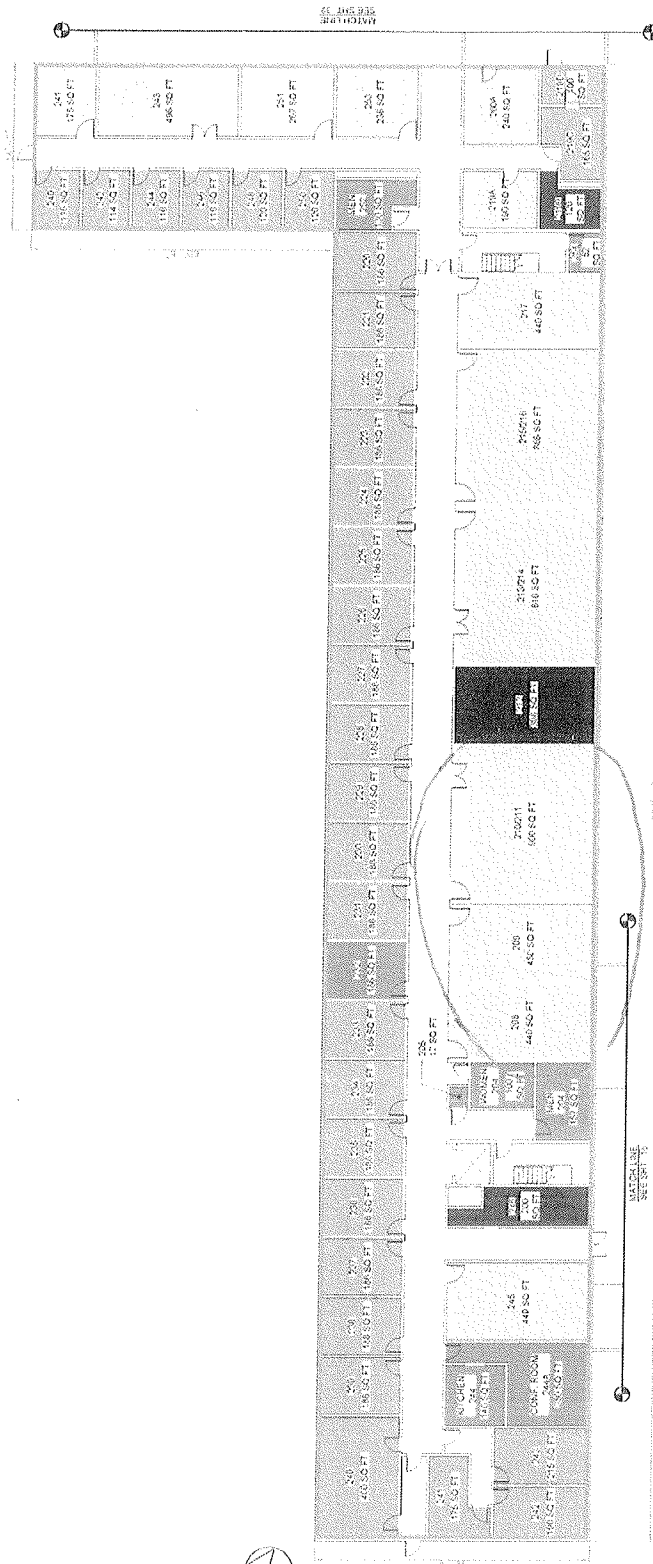
PPPL Site Map – Floodplain and Wetlands Boundaries

NEPA 1614 – Upgrade of LTX Experimental Device, Figure 1

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Upgrade of Lithium Tokamak experiment (LTX) Experimental Device, Figure 2

NO.	REVISION	BY	CH	SUP	APPROVED	DATE
1	REVISED SQ. FT. PER ECN-5342	JUN	JS		ES	03/21/08
2	UPDATE 2D-300 DRAWINGS TO REFLECT ACTUAL CONDITIONS PER ECN-7424. CREATED FROM P. IMPRESSION 9 REVIT MODEL	TK	DS	JM	WV	05/21/15



P. ENTRANCE

GENERAL DRY	5,792 SQ. FT.	USE	16,610
OFFICE	4,798 SQ. FT. <td>USE <td>13,000</td> </td>	USE <td>13,000</td>	13,000
COMMON	820 SQ. FT. <td>USE <td>11,309</td> </td>	USE <td>11,309</td>	11,309
STORAGE	320 SQ. FT. <td></td> <td></td>		
PI	398 SQ. FT. <td></td> <td></td>		
HALLS/WALLS	4,481 SQ. FT. <td></td> <td></td>		
	16,610 SQ. FT. <td></td> <td></td>		

GENERAL DRY	1,054 SQ. FT.	USE	2,760
OFFICE <td>470 SQ. FT. <td>USE <td>1,524</td> </td></td>	470 SQ. FT. <td>USE <td>1,524</td> </td>	USE <td>1,524</td>	1,524
HALLS/WALLS <td>536 SQ. FT. <td></td> <td></td> </td>	536 SQ. FT. <td></td> <td></td>		
	2,160 SQ. FT. <td></td> <td></td>		

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	2,160 SQ. FT. <td></td> <td></td>		

LAB BUILDING (C22) & L-WING (C21), 2nd FLOOR

SCALE: 1/4" = 1'-0"

PRINCETON PLASMA PHYSICS LABORATORY
PRINCETON UNIVERSITY

C & D SITES
BUILDING FLOOR PLANS
LAB BUILDING (C22) & L-WING (C21), 2nd FLOOR

DRW: P.M. & E. DATE: 05/22/2002 (CADD FILE: 2B-AD3015.DWG)

ENG: C. POTENSKY APPROVED

OWN: F. MAURO

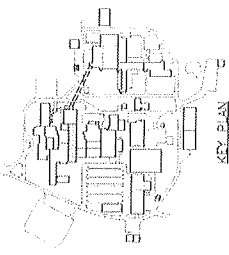
CHK: S. FOHR

CHK: SUP: SF CAP

B-AD-300

SHEET 15

REV 2



PREPARED FOR
PRINCETON UNIVERSITY
PLASMA PHYSICS LABORATORY
LITHIUM TOKAMAK EXPERIMENT