

ENVIRONMENTAL EVALUATION NOTIFICATION FORM

Grantee/Contractor Laboratory: Princeton University/Princeton Plasma Physics Laboratory (PPPL)

Project/Activity Title: National Spherical Torus Experiment Upgrade (NSTX-U) Recovery Project

CH NEPA Tracking No.: \_\_\_\_\_ Type of Funding SC

B&R Code: \_\_\_\_\_ Total Estimated Cost: \$65,000,000

DOE Cognizant Secretarial Officer (CSO): J. Steve Binkley

Contractor Project Manager: \_\_\_\_\_ Signature: \_\_\_\_\_

Date: \_\_\_\_\_

Contractor NEPA Reviewer: Jerry D. Levine

Signature: 

Date: 8/15/17

**I. Description of Proposed Action:**

The National Spherical Torus eXperiment - Upgrade (NSTX-U) has a critical and unique role in the US fusion science program to explore unique parameter regimes to advance predictive capability for ITER and beyond, develop solutions for the plasma materials interaction challenge, and to advance the understanding of the spherical tokamak configuration for next-generation fusion devices. The NSTX-U device experienced a series of technical problems in 2016, which resulted in a comprehensive analysis of all of its systems. This analysis resulted in planned improvements that would include the following:

Redesign and Replace the Inner Poloidal Field (PF) Coils (see Figure 1): The six PF-1 magnet coils (PF-1aU, PF-1aL, PF-1bU, PF-1bL, PF-1cU, PF-1cL) would be replaced with new coils of improved design: they would be mandrel-less, have no joggles, and no braze joints. This new design would enhance the ability to perform turn-to turn testing prior to installation in NSTX-U. This activity would require coil fabrication in the PPPL CS Building Coil Shop, reassembly of the Center Stack with new components, and reassembly of the machine, requiring critical lifts.

Redesign and Replace Polar Regions of NSTX-U (see Figure 2): The top and bottom of the NSTX-U device would be redesigned with numerous design improvements. All single O-ring seals would be replaced by double O-rings or a metallic structure, the PF-1c vacuum interface would be made more robust, one of either the upper or lower ceramic insulators would be eliminated, and the PF-1b coil supports would be thermally isolated from the vessel. Much of this work would occur around and inside the torus vacuum vessel requiring Health Physics (radiation technician) support (due to residual tritium contamination in the vacuum vessel) and confined space entry (into the vacuum vessel). The residual tritium contamination is due to reaction products from previous deuterium plasma operations in NSTX-U, and migration into the vacuum vessel from NSTX-U neutral beam #2 which has residual tritium contamination from past operations on the Tokamak Fusion Test Reactor (TFTR). NSTX-U has not, and will not use tritium as fuel.

Redesign and Replace Plasma Facing Components: The Design Verification and Validation Review (DVVR) and Extent of Condition (EoC) process identified a number of deficiencies in the Plasma Facing Components (PFCs; interior surfaces of the vacuum

vessel exposed to the plasmas) related to both disruption loading and heat flux handling. These deficiencies would be remedied by a number of activities, including replacement of in-vessel tiles. This work would require work both inside the vacuum vessel, and in the South High Bay area adjacent to the NSTX-U Test Cell. The work in the vessel will require Health Physics support and confined space entry.

Design and Install Machine Instrumentation: A set of strain and displacement sensors would be installed on NSTX-U magnetic field coils and their supports. This instrumentation would be used to validate structural models that underlie the design and to provide trending of mechanical behavior. Installation of machine instrumentation would require work around the NSTX-U Vacuum Vessel potentially requiring fall protection and other personal protective equipment (PPE).

Design and Install Enhanced NSTX-U Test Cell Shielding: The NSTX-U test cell has a number of penetrations and doors that require improved neutron shielding. The shielding of these penetrations and doors would be significantly improved by installing additional concrete structures and penetration sealing materials with neutron shielding capabilities.

Design and Implement Bake-Out Systems Improvements: Improvements would be made to the bakeout (heating) systems for the Plasma Facing Components and the vacuum vessel to correct several code, safety and operational issues identified during the DVVR process. These improvements would include some modifications to systems configurations and controls; installation of new valves, flanges, heat shields and other components; insulation replacement; and relocation of power supplies.

- II. **Description of Affected Environment:** Work would take place in the D-Site NSTX-U Test Cell and the C-Site CS Building Coil Shop (see Figure 3, 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 ≥ 5,000 sq. ft.</i> <i>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<br><i>General shop chemicals (acetone, ethanol, etc.) would be in use.</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<br><i>Hazardous waste consisting of approx. 10 cubic feet of oil rags and 2 cubic feet of silver-plating waste would be generated over the course of the project. Disposal would be handled by the Environmental Services Division according to current procedure.</i>   | 24. Yes |
| 25. | Underground Storage Tanks  | 25. No  |
| 26. | Radioactive (AEA) Mixed Waste  | 26. No  |
| 27. | Radioactive Waste<br><i>Radioactive waste consisting of potentially tritium contaminated materials such as disposable gloves and booties, duct tape, and herculite would be generated at a rate of 8 cubic feet per week for approx. 104 weeks. Disposal would be handled by the Environmental Services Division according to current procedure.</i> | 27. Yes |
| 28. | Radiation Exposures<br><i>Personnel would be protected from exposure to small amounts of tritium contamination in the vacuum vessel by personal protective equipment (PPE), following provisions of radiation work permits and procedures as directed by Health Physics staff, and through radiation safety training.</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<br><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. This would include the use of job hazards analyses (JHAs) and their review by all workers at pre-job briefing prior to starting work tasks.</i> | 29. No        |
| 30. Siting/Construction/Major Modification of Waste Recovery, or TSD Facilities   | 30. No        |
| 31. Disturbance of Pre-existing Contamination<br><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.<br>(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.

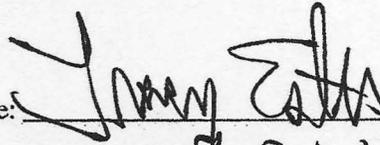
For classes of actions listed in Appendix B, the following conditions are integral elements; i.e., to fit within a class, the proposal must not:

- 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:



Date:

8-21-17

SC GLD: Michael M. McCann

Signature:



Date:

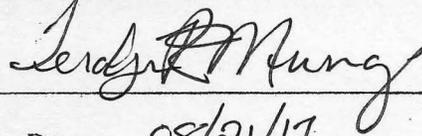
21 August 2017

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: Teralyn Murray

Signature:



Date:

08/21/17

# Inner PF Coils

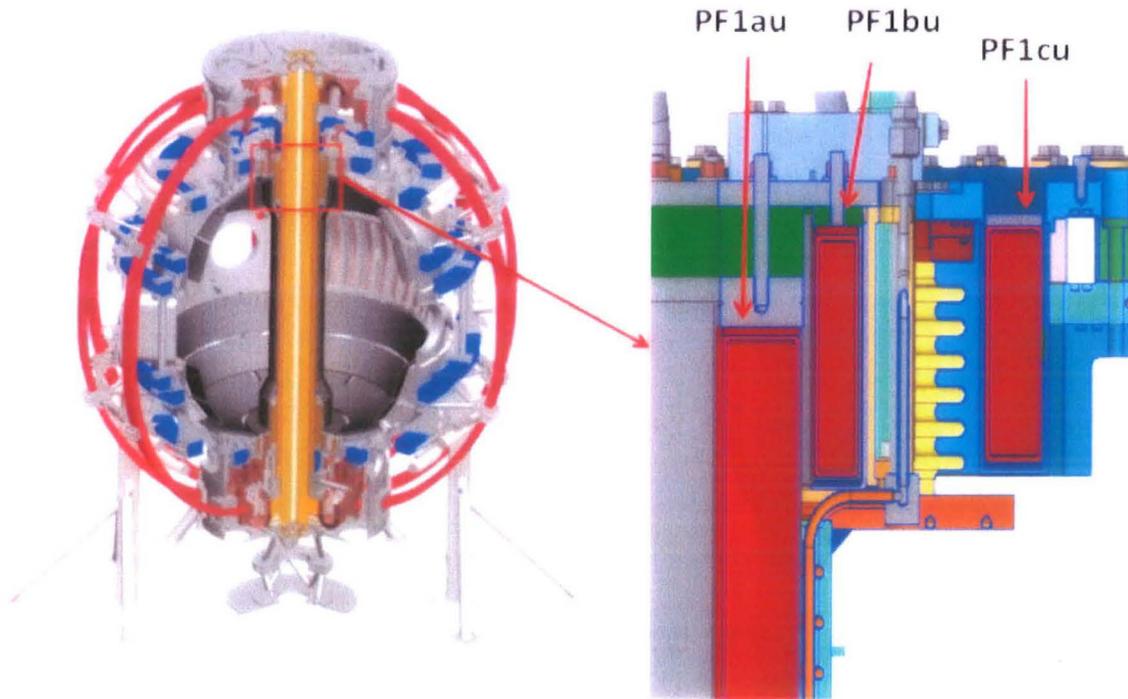


Figure 1

# Polar Region Cross Sections

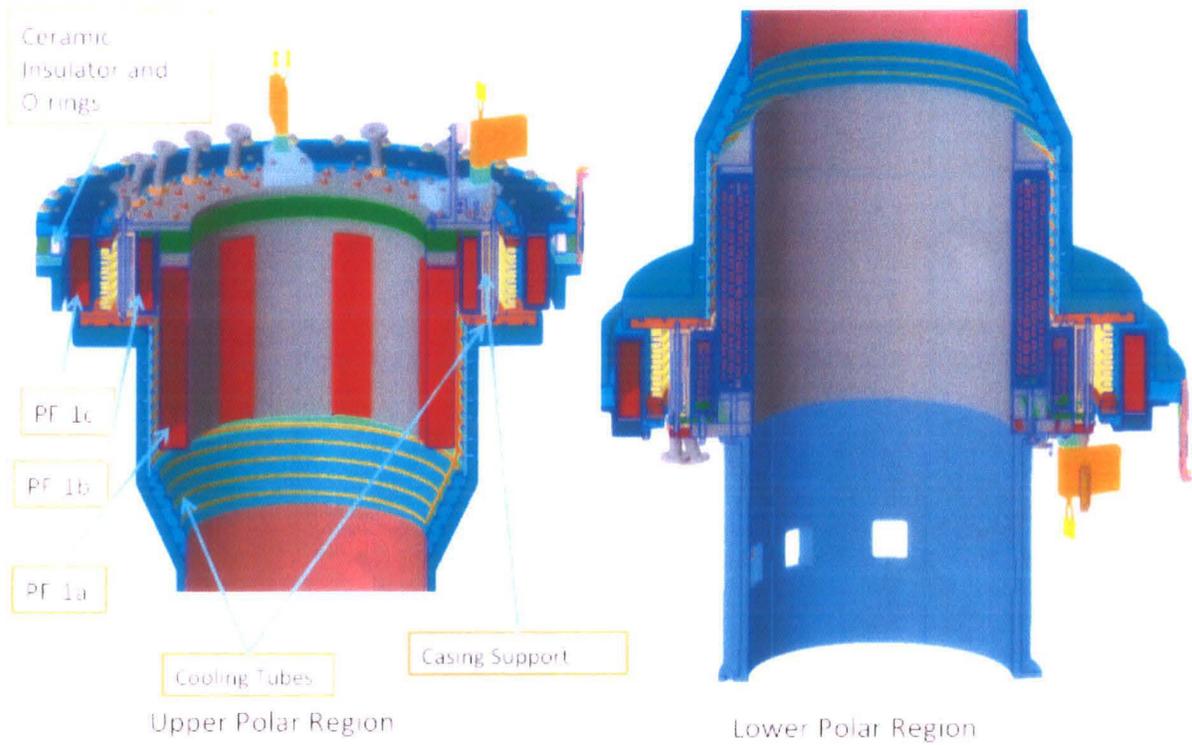
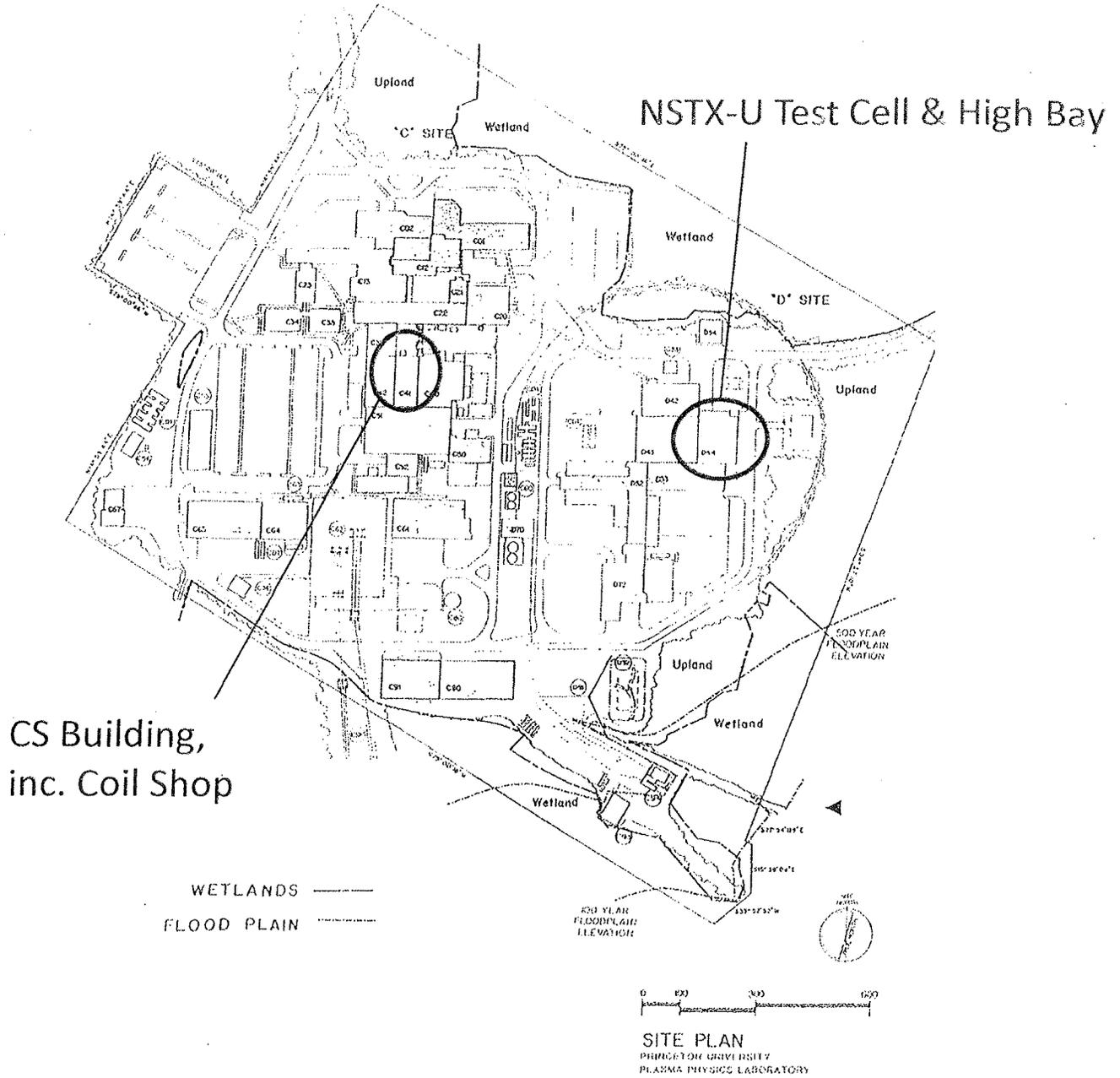


Figure 2



PPPL Site Map – Floodplain and Wetlands Boundaries

**NSTX-U Recovery Project, Figure 3**

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NO.	REVISION	BY	CH	SUP	APPROVED	DATE
1	REVISED SQ. FT. PER ECN-5342	JUN	JS		EJ	03/21/08
2	UPDATE AD-300 DRAWINGS TO REFLECT ACTUAL CONDITIONS PER ECN-7424	TK	DS	LM	MV	07/22/15
3	ADDED FIRE BARRIER(S) PER ECN-7876	TK	SD	LM	MD	01/04/17



RELEASED FOR FABRICATION / INSTALLATION  
 PPL Drawing: Lewis Morris

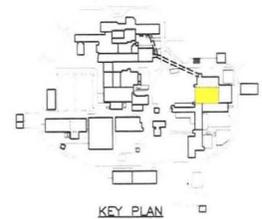
EXPERIMENTAL AREA, 1st FLOOR, D43  
 SCALE: 1/4" = 1'-0"

REFERENCE DWG(S).  
 1. GIFFELS, A-107

<span style="display:inline-block; width:15px; height:10px; background-color:yellow; border:1px solid black;"></span>	HIGH BAY	24,539 SQ. FT.
<span style="display:inline-block; width:15px; height:10px; background-color:green; border:1px solid black;"></span>	GENERAL DRY	1,860 SQ. FT.
<span style="display:inline-block; width:15px; height:10px; background-color:red; border:1px solid black;"></span>	COMMON	2,856 SQ. FT.
<span style="display:inline-block; width:15px; height:10px; background-color:lightgrey; border:1px solid black;"></span>	HALLS/WALLS	3,566 SQ. FT.
		32,821 SQ. FT.

EXPERIMENTAL AREA, 1st FLOOR	GSE	NSF	USF
	32,821	29,255	26,399

NSTX-U Recovery Project, Figure 4



**PRINCETON PLASMA PHYSICS LABORATORY**  
 PRINCETON UNIVERSITY

C & D SITES  
 BUILDING FLOOR PLANS  
 EXPERIMENTAL AREA, 1st FLOOR, D43

DIV: P.M. & E.	DATE: 01/14/2002	CADD FILE: 3BAD3056.DWG
ENG: C. POTENSKY	APPROVED	B-AD-300
DWN: J. SIEGEL		
CHK: S. FLOHR	CHK SF	SUPV CP
	SHEET 56	REV 3