ENVIRONMENTAL EVALUATION NOTIFICATION FORM

Grantee/Contractor Laboratory: Princeton University/Princeton Plasma Physics Laboratory (PPPL)
Project/Activity Title: STS-100 Test Stand Experiment
NEPA Tracking No.:__________ Type of Funding SC
B&R Code:__________ Total Estimated Cost: $200,000

DOE Cognizant Secretarial Officer (CSO): William F. Brinkman
Contractor Project Manager: ---------- Signature: ------------
Date: ------------

Contractor NEPA Reviewer: Jerry D. Levine Signature: [signature]
Date: 4/29/10

I. **Description of Proposed Action:** The proposed action would consist of operation of a 100 kilovolt (kV) test stand, the STS-100, acquired from the Lawrence Berkeley National Laboratory (LBNL), in which advanced plasma sources will be developed and ion-ion plasmas will be studied at PPPL. The STS-100 includes: a large vacuum chamber, an RF (radiofrequency) plasma source, a pulser oil tank, an oil transfer tank, a slit-slit emittance scanner, energy analyzer, and a Faraday cup. The plasma source that would be used for ion-ion plasma experiments is a multi-cusp RF source that employs a compact oscillator operating at 13.56 MHz which can provide pulses of 18 kilowatts (kW) for durations of 500 microseconds (μs). The STS-100 would be used to generate 100keV ion beams, as well as a general purpose vacuum chamber with excellent diagnostic access. An excimer laser fed by fiber from across the hall would also be used in experiments. Potential exposures to ionizing (X-rays) and non-ionizing (laser, radiofrequency and magnetic fields) radiation would be controlled in accordance with existing practices and procedures. Details of the proposed work are provided in the attachment.

II. **Description of Affected Environment:** Work would take place in Room L-110 of the existing Lab Building at C-Site (see attached map). No environmentally sensitive resources would be affected.

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?

		Yes/No
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?

		Yes/No
13.	Clearing or Excavation (indicate if greater than 5 acres)	13. No
14.	Dredge or Fill (under Clean Water Act section 404; indicate if greater than 10 acres)	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 *The experiment would require a chlorine gas cylinder. This cylinder would be kept in a ventilated gas cabinet, and a double-walled gas feed system would be employed. Chlorine exhaust would be fed to a stack above the building roof. Chlorine leak detection systems would be installed. Other chemicals that would be used include argon gas, Diala AX oil, ethanol and acetone.*	19. Yes
20.	Pesticide Use	20. No
21.	Hazardous, Toxic, or Criteria Pollutant Air Emissions *Small quantities (<1sccm) of chlorine gas would be exhausted into the atmosphere through a designated venting system to the roof of the building. Annual emissions would be <250 grams per year of chlorine. No need for an air permit from the State would be anticipated for this discharge.*	21. Yes
22.	Liquid Effluent	22. No
23.	Underground Injection	23. No
24.	Hazardous Waste *Very small volumes of hazardous waste (e.g., solvent soaked rags) may be generated and would be handled in accordance with current PPPL practices and procedures.*	24. Yes
25.	Underground Storage Tanks	25. No
26.	Radioactive (AEA) Mixed Waste	26. No
27.	Radioactive Waste	27. No
28.	Radiation Exposures *The 100keV ion beam would generate a small flux of Bremsstrahlung X-rays with energies <100keV. Operators would wear personal dosimeters and a card reader lock would be installed in L110. Shielding would be provided as needed to limit exposures to below PPPL and DOE limits. The room would be posted and controlled as a radiologically controlled area per PPPL requirements, and appropriate access controls provided with support of PPPL Health Physics Division.*	28. Yes

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

		Yes/No
29.	A threatened violation of ES&H regulations/permit requirements *The requirements of the PPPL ES&H Manual and the use of Job Hazard Analyses would be implemented. The PPPL ES&H Department would support the safe operation of this test stand.*	29. No
30.	Siting/Construction/Major Modification of Waste Recovery, or TSD Facilities	30. No
31.	Disturbance of Pre-existing Contamination	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?

Yes

DOE-PSO NEPA Compliance Officer (NCO) Review:

Concurrence with Proposed Class of Action Recommended

CX EA EIS

Category B3.6 Siting/construction/operation/decommissioning of facilities for bench-scale research, conventional laboratory operations, small-scale research and development and pilot projects.

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:**

SC GLD: Michael M. McCann Signature: [signature]

Date: 5/4/2010

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: H. Allen Wrigley Signature: [signature]

Date: 05/04/2010

ADDITIONAL INFORMATION

STS-100 Test Stand Experiment

The primary research objectives of this experiment would be as follows:

1. **Development of high-density, large-volume plasma sources**

- Candidates include: laser-ionized gas jets and metallic vapor jets, laser ablation of solids, pulsed high voltage discharges using ceramic or plastic materials, and plasma jet methods.
- As these candidate plasma sources are evaluated, plasma source characterization would include: the plasma density, the plasma volume, the plasma temperature, the degree of ionization, the plasma lifetime, and the extent that the vacuum conditions are perturbed. Advanced simulations and modeling of the plasma sources would be pursued as an integral part of the sources' development and evaluation.

2. **Plasma transport in fringe-fields of multi-Tesla solenoidal magnetic fields**

- Experiments would be carried out using a variety of plasma sources, together with a 5 Telsa solenoid from Lawrence Berkeley National Laboratory (LBNL), to study the interaction of the plasma sources with a solenoidal magnetic field.
- The impact of the magnetic field on the generation of high density plasmas would be evaluated.

3. **Study of negative and positive ion beams extracted from ion – ion plasmas**

- Ion-ion halogen plasmas would be produced in the test stand to study their suitability for use as either positive or negative ion beam sources.
- The emittances of Cl+, Cl-, and Ar+ beams would be measured and compared in order to determine if halogen ion beams can be extracted that are as cold, or colder, than the Ar+ beam extracted from an ordinary electron-ion plasma.

4. **Fundamental studies of electronegative ion–ion plasmas**

- Basic studies of ion-ion plasmas would be performed with the unique approach of analyzing the properties of the negative ions, positive ions, and electrons extracted from the plasma.
- A variety of feedstock gasses would be used to determine the dependence of the ion-ion plasma properties on the electronegativity of the ion species.
- By using a combination of in-source and beam diagnostics, an experimental determination of how ion-ion sheaths differ from electron-ion sheaths would be made.

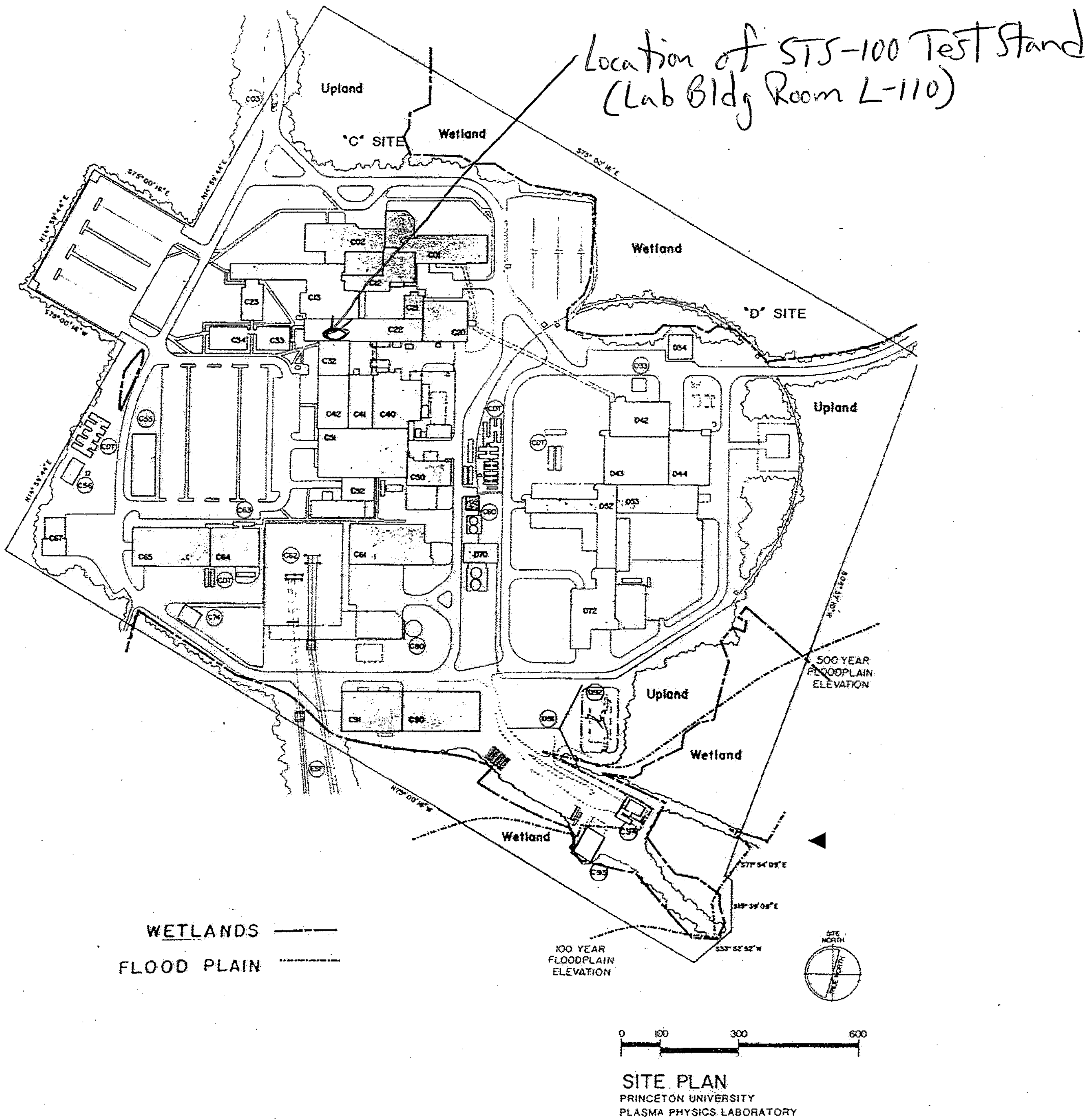
5. **Short pulse beam control of ions from aluminosilicate sources**

- The test stand would be used to perform experiments on the ability to create short ion beam pulses by flash-heating an aluminosilicate source with a bright pulsed radiant heat source such as a laser or a xenon flash lamp.
- If such ion beam pulses could be created, their rapid rise time and short pulse length would benefit warm dense matter and ion beam driver experiments for heavy ion fusion, and the ion source lifetime could be extended as compared to an aluminosilicate source used in a

STS-100 100kV Pulser Tank

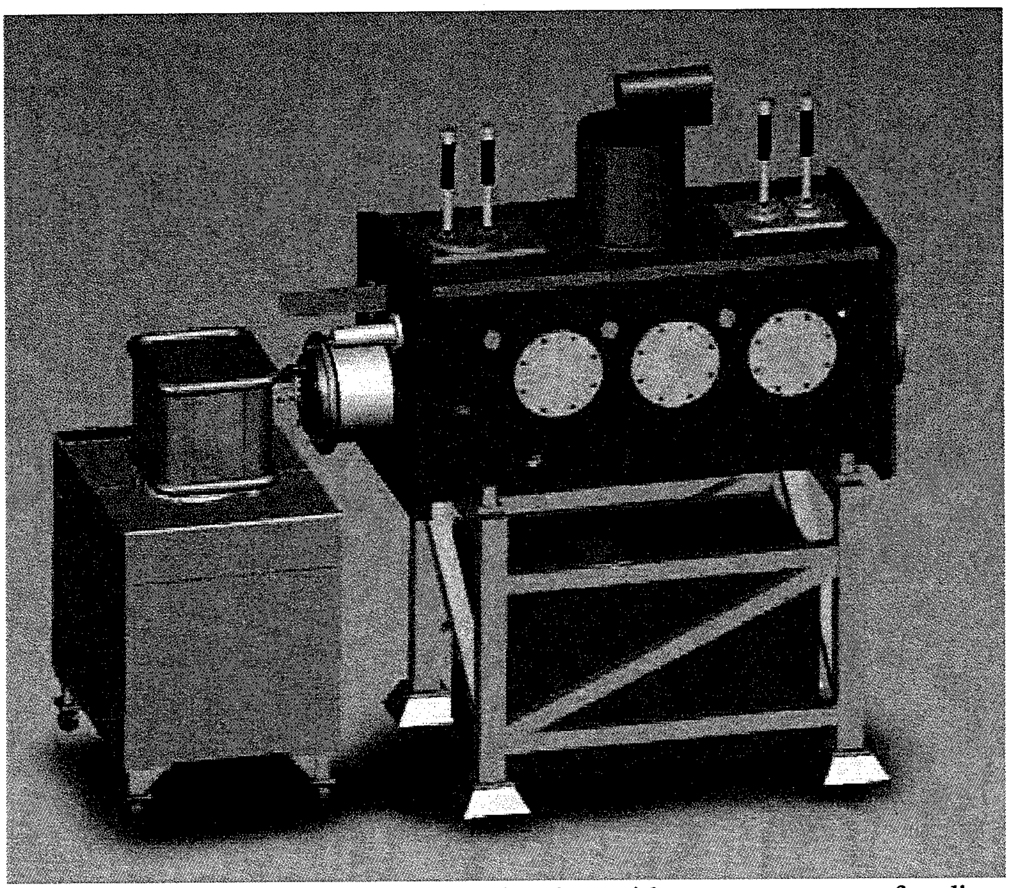
STS-100 Vacuum Chamber

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

resistively heated, steady-state mode.



A drawing of the STS-100 showing the main chamber with numerous ports for diagnostics and pumping. The RF plasma source sits atop the high-voltage bias oil tank and an oil transfer tank is included.