NEPA PLANNING FORM# 1261 (by ES&H)

Applicability: this form shall be prepared as early as possible for each new or continuing activity at PPPL. **Physical implementation of PPPL activities shall not proceed prior to NEPA certification of this form.**

Originator: Jim Chrzanowski JAC **WP/Project #:** 171

Project/Organization: NCSX **Total Estimated Cost:** $69.0 M

Title of Activity/Change: *Construction & Operation of NCSX*

Description of Activity: [include physical description of activity, purpose, location, and changes to any operating Parameters or approved environmentally related limits, potential or actual ES&H impacts, as applicable. [Attach additional sheets if needed] Circle one of these choices: GENERIC ***UNIQUE***

- "Safe" and dismantle PBX device – Clear all equipment in the PBX/PLT Test Cells and TCB
- "Safe" and clear PBX/PLT Control and Computer Rooms
- Construct new NCSX Control Room (walls, power, lighting, ceiling, etc.)
- Clear FCPC 2nd. Floor for NCSX Power Systems/ Install new floor penetrations
- Remove existing shield wall between PLT/PBX Test Cells/ Reconstruct and seismically upgrade shield walls
- Prepare D-site Test Cell for Field Period Assemblies, including Helium bakeout gas piping run from NSTX
- Assembly of (3) Field Periods in D-site Test Cell
- Install and assemble the NCSX device in C-site Test Cell including main Torus components (coils, vacuum vessel, cryostat, PFC's, bussing, etc.)
- Install Neutral Beams, diagnostics and supporting hardware
- Install new Test Cell platform, fire suppression system, lighting etc.
- Install and connect new electrical systems (AC/DC); cooling systems (water/Cryo) and vacuum systems
- Install Data Acquisition & Control computers; and Control & Safety equipment
- Operate NCSX Machine

ES&H Considerations: Will the change/activity, either individually or cumulatively with other known activities, result in changes and/or disturbances to the following entities (see Attachment 2 for directions on answering)*

	YES	NO		YES	NO
1: Air Emissions	X		13: Sewage System		X
2: Liquid Effluent		X	14: Water Use	X	
3: Domestic Waste *	X		15: Pesticide Use		X
4: Radioactive Waste	X		16: Chemical Use/Storage	X	
5: Hazardous Waste **	X		17: Petroleum Use/Storage	X	
6: Mixed Waste		X	18: Radiation Exposure	X	
7: Asbestos Waste	X		19: Impacts to Workers	X	
8: Wetlands		X	20: Noise Levels		X
9: Floodplains		X	21: Pollution Prevention Applies		X
10: Indoor/Outdoor Clearing or Excavation	X		22: Stored Energy	X	
11: Soil Movement		X	23: Fire Safety Issues	X	
12: PPPL Water Systems		X	24: Electrical/RF/Lasers	X	

* Provide any necessary explanations on a separate sheet attached to this form

pg 2 of 2 NEPA PLANNING FORM # 126

NEPA Evaluation: (attach "Environmental Evaluation for PPPL Change Proposal" and "Environmental Evaluation Notification Form")

TO BE COMPLETED BY ES&H

	YES	NO
Covered by an existing DOE approved categorical exclusion?	___	✓
If yes, specify _____		
Approval for categorical exclusion required from DOE ?	___	✓
DOE approval: _____ Date: _____		
Other NEPA documentation required ?	✓	___

If yes, specify DOE/EA-1437 approved and FONSI signed by DOE-CH on 10/25/02

NEPA Review for this Activity has been Completed :

NEPA Compliance Manager (or designee) — Date: 10/25/02

Distribution: Original to ES&H File
cc: Originator, Cognizant Person, Division Head

- Revised 9/8/04 to address several changes - see attached document dated Sept. 2004. The most significant change is the plan to supply initial power for the coils from existing C-site equipment (basement of ESAT bldg) instead of from D-site via the DC transmission line from D-site to C-site. No impacts on EA analysis or the FONSI. 9/8/04

Sept. 2004

Attachment [1] – Detailed Description of Change

Modular Coil Winding Form (MCWF) Procurement (WBS 141)

The NCSX project recently received two fixed-price and-schedule proposals for fabricating the production winding forms. The scope of work included casting seventeen winding forms and machining eighteen. A pre-production casting being fabricated under the current manufacturing development and prototype fabrication contract will be machined under the production contract and used as the first winding form.

We are in final negotiations with the successful offerer. The price for the production winding forms is $8.0M. Assuming a contract start date of 15 September 2004, the first winding form would be delivered on or before 13 May 2005, with subsequent winding forms being delivered every 4 weeks (29 days) thereafter. The last winding form would be received on or before 15 September 2006. Payments would be made monthly between 15 October 2004 and 15 September 2006.

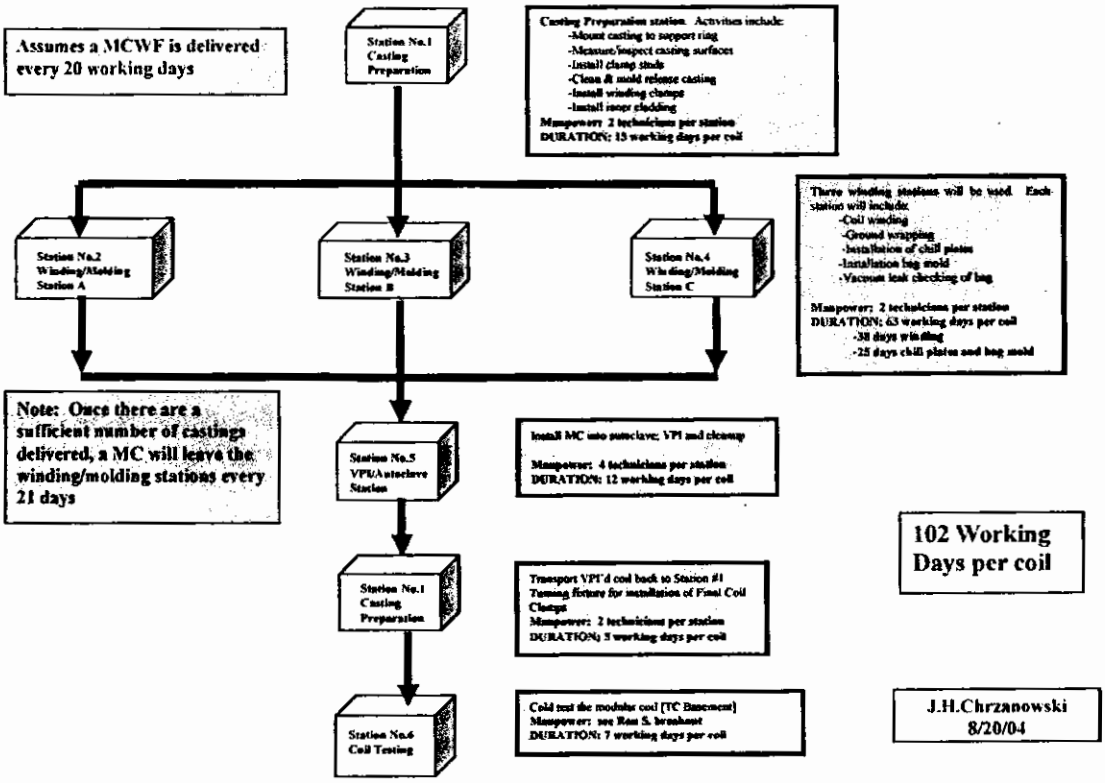
Work on the prototype winding forms has been stopped by both suppliers, saving $118K and $196K respectively.

Pre-production casting activities (added scope per ECP-04-008) were initiated by the two MCWF suppliers, but have now been stopped by the supplier which was unsuccessful in the production procurement. The initial cost estimates for the pre-production castings were based on using the same pattern process that was used for the prototype. The successful supplier has identified the need to change the pattern design, moving from foam patterns to hard (wood) patterns because of the heavier than anticipated weight of the casting. The wood patterns are re-usable, which is advantageous, but they cost more and require more time to fabricate. The fixed price proposal was predicated on using a hard Type C pattern produced as part of the pre-production casting activities. It is estimated that an additional $329K will be required to complete the pre-production casting activities with the successful supplier and an additional $20K will be required to close out pre-production casting activities with the other supplier.

The budgeted direct cost for the MCWF fabrication procurement was $4.8M. The budgeted cost and schedule were derived from input from both suppliers participating in the Manufacturing Development and Prototype Fabrication phase. The contract was scheduled to run from 01 October 2004 through 24 April 2006. The first winding form would arrive on 20 January 2005. The last winding form would be received by 24 April 2006. This assumed that a winding form would be arriving on average every 27 days. The planned Budget Authorization (BA) was $0.6M in FY04, $3.2M in FY05, and $1.0M in FY06.

The impacts of the actual proposal which has been accepted are clear:

1. **Cost increase**. An (unloaded) cost increase of $3.2M.
2. **Schedule delays**. A delay in receiving the first winding form of 16 weeks. A delay in receiving the last winding form of 20 weeks. These delays impact the critical path of the project.



VV Outer Port Extensions and NB Transition Ducts (WBS 121)

The VVSA design features an Inconel shell with Inconel port extensions that are welded on during field period assembly. The port extensions extend through the modular coil shell and have vacuum flanges at the ends. Outer port extensions, made of stainless steel, will be attached at these flanges to extend the ports through the cryostat. For initial operation, there are no diagnostics which use these outer port extensions so they were removed from the MIE project scope. Likewise, the three NB transition ducts are not required for initial operation and were removed from the MIE project scope. The vacuum pumping system, which will ultimately be connected to a NB transition duct, can be connected to one of the vertical ports or to the large port adjacent to the NB transition duct for initial operation. Elimination of the outer port extensions and NB transition ducts from the MIE project will save $250K.

Modular Coil Winding From Title III Engineering (WBS 141)

Title III Engineering costs were reduced to levels more in line with our experience during the Manufacturing Development and Prototype Fabrication phase saving $150K.

Laser-based GPS (WBS 187)

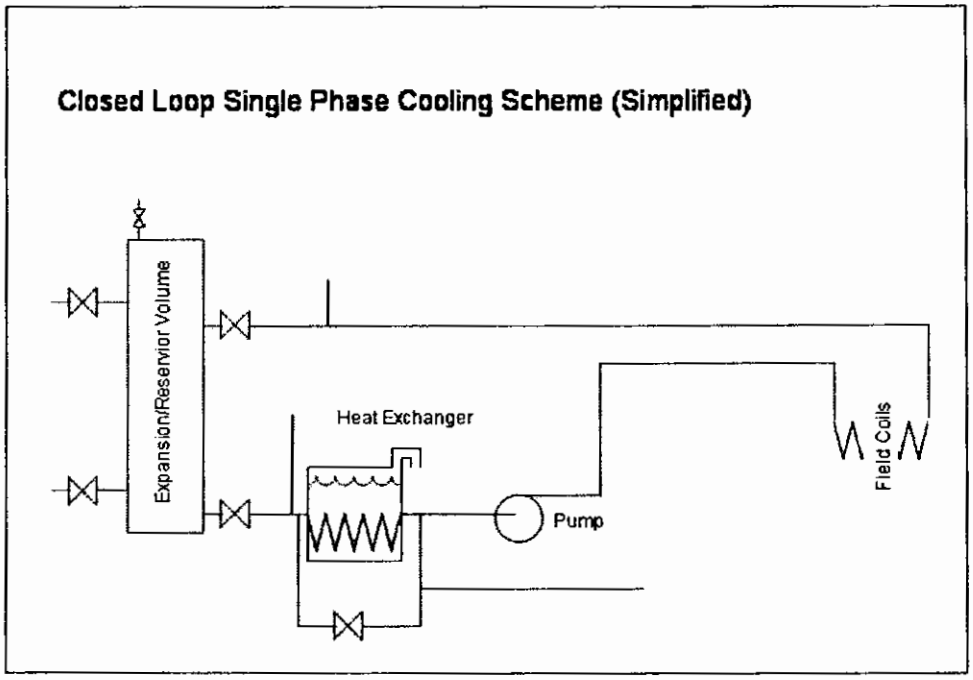
The laser-based GPS was eliminated saving $129K. Metrology needs can be satisfied using two multi-link coordinate measurement machines (Romer arms) and one Leica laser tracker.

Neutral Beams (WBS 25)

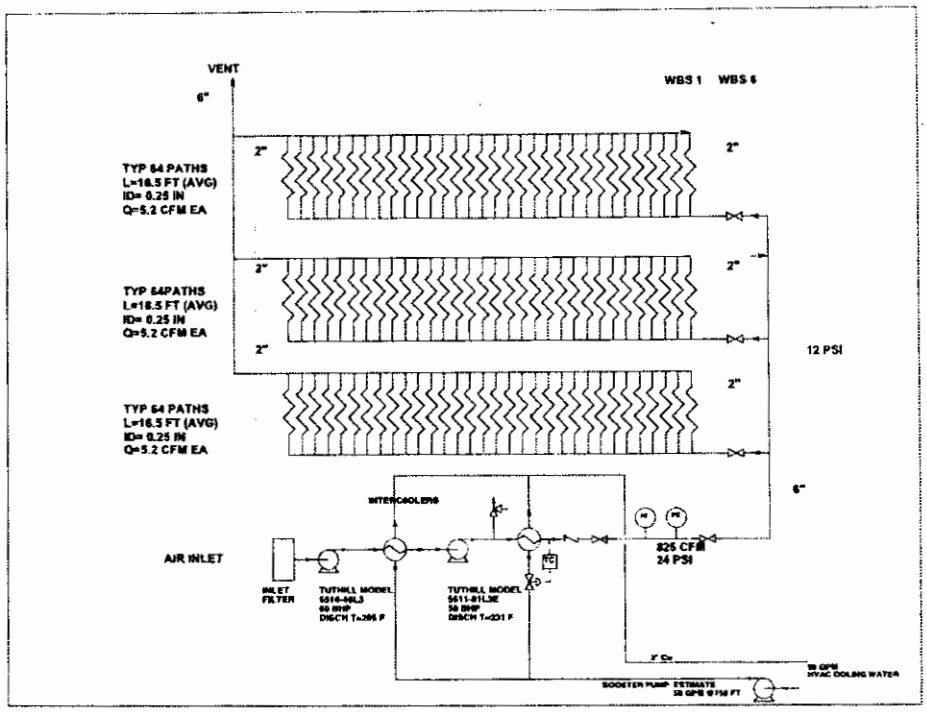
The NB equipment tests required for CD-4 will be satisfied by the end of FY-04. The equipment has been shown to be in good condition. Remaining project tasks would make

Cryogenic Cooling Supply (WBS 622)

The baseline NCSX cryogenic cooling design provides liquid cryogen transfer lines from the existing 9200 gallon tank to the NCSX device. Also planned was a sub-cooled single phase (all liquid) cooling circuit for the NCSX field windings. A simplified representation of such a system is shown in the figure. Key points are that the expansion volume maintains the minimum system (pump suction) pressure above the saturation pressure (boiling point) associated with the warmest points in the windings: The system stays in the liquid phase. The single phase aspect of the system coupled with redundant pumps (less mechanical downtime) yields a design that supports the heat rejection rate requirements at full machine performance. A final notable feature is that the heat exchanger for the liquid circuit is cooled by boiling atmospheric pressure liquid nitrogen whose off-gas is used to cool the machine cryostat.



To meet CD-4 requirements, a simplified single phase approach is proposed that will cool the NCSX windings with liquid nitrogen that is prevented from boiling in the cooling circuits by an appropriate back-pressure valve and control scheme (see figure below). The back-pressure can be maintained at a useful level that remains less that the supply pressure from the 9200 gallon storage tank: The differential pressure between the tank and the back-pressure control drives flow through the winding's coolant passages. This low-cost design will allow enough heat rejection capacity to support recently-issued first plasma and field line mapping scenarios. A further cost-saving measure in this proposal



Startup (WBS 85)

The revised startup testing schedule completes the final CD-4 tests in two months, recouping most of the schedule impact from the late delivery of the modular coil winding forms. E-beam mapping will be limited to confirming that the basic magnet system produces magnetic surfaces. Coil and power supply tests and First Plasma will be performed at cryogenic temperature. The startup period was reduced by moving tasks (e.g., cryostat installation, close out "punch list" of construction items, and the ACC safety assessment) formerly in the startup phase forward into the construction phase and revising the logic such that some tasks were taken off the critical path and will instead be performed in parallel with critical-path tasks. Cryostat installation will occur during the construction phase. E-beam mapping will be performed only at cryogenic temperature.

NEPA PLANNING FORM# 1261 (by ES&H)

The undersigned have reviewed the description and assessment of ES&H considerations and state that they are accurate and complete.

Work will not proceed until NEPA certified form (page 2) is received by cognizant person.

COGNIZANT PERSON: Wayne T. Reiersen **DATE:** 1/14/02

DIVISION HEAD: G.H. Neilson **DATE:** 1/14/02

Description of ES&H Considerations

1) Air Emissions:
Includes release of spent Helium and Nitrogen into the atmosphere plus minimal air emission would be generated during the operation of vacuum pumps

3) Domestic waste:
Domestic waste will be generated during the dismantling of the PBX device, existing control room and computer room.

4) Radioactive Waste:
Potential tritium contamination of vacuum pump oil during NCSX Deuterium operation

5) Hazardous waste:
Hazardous waste generated by this project will be given to Haz Mat Group for proper disposal according to PPPL/DOE regulations.
Machinist coolant
Used vacuum pump oil
Epoxy/ cements
Waste solvents
Solvent soaked rags

7) Asbestos Waste:
The test cell walls are made of asbestos panels. Modifications to these walls such as the addition of penetrations could result in asbestos waste

10) Outdoor Clearing or excavation
The power runs between D-site and C-site would require the erection of towers to support the power cables. (see attached routing sketch)

14) Water Use:
The proposed Project would use existing water-cooling systems used by PBX. Water would flow through a closed loop system to various components in the machine for cooling the equipment.

16) Chemical Use & Storage
The following chemicals would be used and stored according to PPPL/DOE regulated guidelines.
Ethanol
Acetone
Epoxy
RTV Sealant
Insulating compounds
(MSDS sheets would be provided to the IH Group for the various materials to be used)

The following gases will be used during operation of this experiment.
Hydrogen
Deuterium
Helium
Argon
Nitrogen

17) Petroleum use & Storage
Petroleum oil will be used in the vacuum pumps and possible other equipment.

18) Radiation Exposure
Potential worker and public radiation exposures during NCSX operation are expected.

19) Impacts to Workers
Construction activities present personnel safety and Industrial Hygiene issues will have to be addressed throughout the project.

22) Stored Energy
Capacitor banks will be utilized for some of the electrical systems. The coils will be cryogenically cooled with either Nitrogen or Helium gas system. A Helium Gas Bakeout system will be utilized for baking out vacuum vessel and PFC components.

23) Fire Safety Issues
Sprinkler / heat & smoke sensor systems will have to be modified or newly installed

24) Electrical/RF/Lasers
The NCSX coils will operate via DC electrical power generated from FCPC at D-site. Energized circuits are required for machine operation. As a future upgrade, 6 MW of RF power will be added.

ATTACHMENTS

1) General requirements of NCSX
2) Schematic showing routing of power transmission lines between D and C sites.
3) Memo- from H. Kugel describing the proposed Neutron limits for NCSX
4) Cryogenic requirements and expectations

U.S. Department of Energy

Finding of No Significant Impact

Proposed National Compact Stellarator Experiment

Princeton Plasma Physics Laboratory, New Jersey

AGENCY: U.S. Department of Energy

ACTION: Finding of No Significant Impact

SUMMARY: The Department of Energy (DOE) has prepared an Environmental Assessment (EA), DOE/EA-1437, evaluating the environmental effects of the proposed fabrication, assembly and operation of a National Compact Stellarator Experiment (NCSX) within the existing C-Stellarator (CS) Building at C-Site of the Princeton Plasma Physics Laboratory (PPPL), Princeton, New Jersey. The purpose of the NCSX is to provide an experimental device to investigate the attractiveness of a compact stellarator as the basis for a fusion power reactor. Fusion energy has the potential to help compensate for dwindling supplies of fossil fuels, the eventual depletion of fissionable uranium used in present-day nuclear reactors, and the limitations of solar, hydro and wind alternatives.

Based on the analyses in the EA, the DOE has determined that the proposed action does not constitute a major federal action significantly affecting the quality of the human environment within the meaning of the National Environmental Policy Act (NEPA) of 1969, 42 U.S.C. 4321, et seq.

The preparation of an Environmental Impact Statement is not required. Thus, the DOE is issuing a FONSI pursuant to the Council on Environmental Quality regulations implementing NEPA (40 CFR Parts 1500-1508) and the DOE NEPA implementing regulations (10 CFR Part 1021).

DESCRIPTION OF THE PROPOSED ACTION:

The proposed action consists of the proposed fabrication, assembly and operation of a National Compact Stellarator Experiment (NCSX) within the existing C-Stellarator (CS) Building at C-Site of PPPL. The NCSX would be installed in an existing building, formerly occupied by two other fusion devices, which would be refurbished to accommodate the new experiment. Existing equipment and systems would be re-used for NCSX, including cooling and other utilities; plasma heating, fueling and pumping equipment; and, power supplies. All existing parts that would be used to assemble the NCSX, as well as the resulting waste, would be non-radioactive.

The NCSX experimental program would be conducted at PPPL by a nationally-based research team. Key features of NCSX relative to determining the attractiveness of the compact stellarator concept would include maintaining plasma stability without active feedback control, the capability for testing features favorable for steady state operation, and provision of enhanced efficiency for plasma confinement compared with conventional stellarators. NCSX would be unique in its ability to investigate all of these aspects in a single experimental device.

Design, fabrication and assembly of NCSX would occur in fiscal years (FY) 2003-2007, with operations conducted over approximately a 10-year period beginning in June 2007. The total estimated cost for design, fabrication and assembly of NCSX is estimated at about $70-75M. Fusion reactions that would occur in the NCSX device would involve various combinations of hydrogen, helium and deuterium gases. The NCSX mission would be pursued in a series of planned phases, beginning with initial modest operation and system checkout, and proceeding to increasingly greater plasma heating capabilities and longer pulse lengths.

ALTERNATIVES:

Two alternatives were considered: (1) the proposed action, fabrication, assembly and operation of NCSX at PPPL, and (2) no action. The no action alternative would preclude efforts to investigate a potentially attractive fusion reactor solution that would also broaden understanding of magnetic fusion science. There would be no additional environmental impacts from the no action alternative, and activities at PPPL would proceed at about current levels with continued operations of existing fusion and plasma physics experiments.

ENVIRONMENTAL IMPACTS:

The impacts of the fabrication, assembly and operation of the NCSX on the environment were analyzed in the Environmental Assessment. The Environmental Assessment considered impacts to wetlands, floodplains, air quality, noise, water quality and quantity, aquatic and terrestrial ecology (including threatened and endangered species), visual environment, land use, historical, cultural, and archaeological resources, socioeconomic environment, radiological conditions, workers, and impacts of potential accidents. No significant environmental impacts associated with the proposed action are anticipated.

The potential exists for one lost work case (work related injuries requiring time-off from work or restrictions from normal work activity) over the NCSX fabrication and assembly period. Non-radioactive waste material generated during this work would be sent to a local landfill, which would not be adversely impacted due to the small volume of waste compared to the capacity of the disposal facility.

Releases of non-radioactive plasma exhaust and liquid nitrogen boiloff gases to the environment during NCSX operation would be of similar nature to those that have occurred during operation of PPPL's past and current experimental devices. No adverse environmental impacts from this

operation are anticipated. Radiation exposures to workers during NCSX operation would not be expected to exceed 0.5 rem per year. This occupational dose would result in an increased probability of fatal cancers of less than 2 chances in 10,000. Less than 0.014 Curies per year of tritium may be produced and vented to the environment during NCSX D-D operation. The annual effective dose equivalent to a hypothetical maximally exposed individual at the site boundary from this released tritium plus direct and scattered radiation produced during NCSX D-D operations would be less than 0.002 rem per year, resulting in an increased probability of fatal cancers of less than 1 chance in 1,000,000 to a member of the public. No accident scenario has been identified that would cause a release of hazardous material from NCSX to the offsite environment. Wastes may include small amounts of hazardous wastes such as waste solvents and solvent soaked rags. The only anticipated radioactive waste would be tritium contaminated pump oil wastes (less than 0.001 Curies per year), which would be expected to qualify as low level radioactive waste and would be disposed of at an appropriate DOE waste disposal facility.

CUMULATIVE AND LONG TERM IMPACTS:

No adverse cumulative or long term impacts from the proposed action are anticipated based on operating experience of similar devices such as the National Spherical Torus Experiment (NSTX), the current absence of measurable cumulative impacts between PPPL and other facilities in the region, and the very low potential impacts from the proposed action.

DETERMINATION:

Based on the analyses in the Environmental Assessment, the DOE has determined that the proposed action at the PPPL is not a major Federal action significantly affecting the quality of the human environment within the meaning of the NEPA; consequently, an environmental impact statement is not required.

PUBLIC AVAILABILITY: Copies of this EA (DOE/EA-1437) are available from:

Mr. Jerry Wm. Faul, Manager
Princeton Area Office, U.S. Department of Energy
P.O. Box 102
Princeton, New Jersey 08542
(609) 243-3706

For further information regarding the DOE NEPA review process, contact:

Mr. Peter R. Siebach
U.S. Department of Energy
9800 South Cass Avenue
Argonne, Illinois 60439
(630) 252-2007

Issued in Argonne, Illinois., this 25th day of October, 2002.

Marvin E. Gunn, Jr
Manager
Chicago Operations Office

1261

ATT. #1
REVISED 4/27/99

NEPA & SAFETY ANALYSIS REVIEW STATUS FORM

ACTIVITY: Construction & Operation of NCSX

DATE RECEIVED & LOGGED IN: 1/16/02

READY FOR REVIEW: ☑

NEPA PROCESS ON HOLD: Awaiting additional info Request to PAO for EA determination sent 3/15/02

REASON

SAFETY ANALYSIS REVIEW

SAFETY ANALYSIS REVIEWER/DATE: 10/25/02

SAFETY REVIEW/DOCUMENT. REQTS See DOE/EA-1437. SAD to be prepared.

REVIEW COMPLETE ☑
ENV EVALUATIONS COMPLETED AND SIGNED BY
ENVIRONMENTAL ENGINEER OR ALTERNATE)

NEPA FORMS READY TO BE SENT OUT ☑
(NEPA PLANNING FORM CERTIFIED BY
NEPA COMPLIANCE MANAGER)

NEPA FORMS SENT OUT ☑

- ONE COPY-ORIGINATOR
- ONE COPY-COGNIZANT PERSON
- ONE COPY-DIVISION HEAD
- ONE COPY-FACILITY MANAGER(S) FOR THE AREA(S) AFFECTED (Von Halle)
- ONE COPY-INDUSTRIAL HYGIENIST
- ONE COPY-ER/WM DIVISION HEAD [IF HAZARDOUS OR RADIOACTIVE WASTES ARE INVOLVED]
- ONE COPY-ENVIRONMENTAL ENGINEER [IF AIR EMISSIONS ARE INVOLVED]
- ONE COPY-SITE PROTECTION DIVISION HEAD [IF HAZARDOUS MATERIALS ARE INVOLVED]

ONE COPY-OPERATIONS CENTER [IF A D-SITE CHANGE IS INVOLVED]
ONE COPY-SAFETY ANALYSIS REVIEWER (IF APPLICABLE)
ONE COPY-OTHERS _____
ORIGINAL-NEPA FILES)

ENVIRONMENTAL EVALUATION FOR PPPL CHANGE PROPOSAL

CONSTRUCTION AND OPERATION OF NATIONAL COMPACT STELLERATOR EXPERIMENT (NCSX)
TITLE OF CHANGE OR PROJECT

W. REIERSEN
COGNIZANT PERSON

WP #171
PROJECT NUMBER

Evaluation

ISSUE	APPLICABILITY A	APPLICABILITY NA	POTENTIAL IMPACT N	POTENTIAL IMPACT NAI	POTENTIAL IMPACT AI
CONSTRUCTION ACTIVITY					
DUST	☐	☑	☐	☐	☐
NOISE	☐	☑	☐	☐	☐
OTHER	☐	☑	☐	☐	☐
EFFLUENTS AND CONTAMINANTS					
SOLIDS	☑	☐	☐	☑	☐
LIQUIDS	☐	☑	☐	☐	☐
GASES	☑	☐	☐	☑	☐
ENERGY EMISSIONS					
RADIATION	☑	☐	☐	☑	☐
OTHER	☐	☑	☐	☐	☐

ISSUE	APPLICABILITY A	APPLICABILITY NA	POTENTIAL IMPACT N	POTENTIAL IMPACT NAI	POTENTIAL IMPACT AI
LAND USE CONSIDERATION					
WETLANDS/ FLOODPLAINS	☐	☑	☐	☐	☐
CRITICAL HABITATS	☐	☑	☐	☐	☐
ARCHAEOLOGICAL SITES	☐	☑	☐	☐	☐
FACILITY CONSIDERATIONS					
AESTHETICS	☐	☑	☐	☐	☐
PUBLIC RELATIONS	☐	☑	☐	☐	☐
OTHER LN_2 Deliveries	☑	☐	☐	☑	☐
CATEGORICAL EXCLUSION		YES ☐ NO ☑			

An Environmental Assessment (EA) will be prepared for this proposed action.

APPLICABILITY: A- APPLICABLE, NA - NOT APPLICABLE
POTENTIAL IMPACT: N - NONE, NAI - NO ADVERSE IMPACT (POSSIBLE IMPACT BUT NOT EXPECTED TO BE HARMFUL), AI - ADVERSE IMPACT

COMMENTS & CONCLUSIONS

ANY APPLICABLE ISSUE REQUIRES COMMENT STATEMENT - USE ADDITIONAL PAGES IF NECESSARY.

Construction activities would involve the removal of approximately 160 tons of stainless steel, 80 tons of copper and 5 tons of aluminum that would be recycled to the maximum extent possible and several tons of non-metals (plastics, wood and fiberglass) that would be disposed of as domestic waste. About 140 tons of material (stainless steel, copper, inconel, graphite, aluminum, glass & foam) would be used to fabricate the NCSX device, and 30-35 tons of copper cable (over a length of about 500 ft) would be run between D-Site and C-Site to power the coil systems. Sheet rock, new lighting, and new floors and ceiling would be used to construct the NCSX Control Room. Wastes may also include small amounts of hazardous wastes (i.e., machinist coolant, used vacuum pump oil, epoxy/cements, waste solvents, and solvent soaked rags), and very small amounts (< 0.001 Ci per year) of tritium contaminated vacuum pump oil. Air emissions during operations may include small quantities of gases used in experiments (hydrogen, deuterium, helium, argon, nitrogen), 10,000-30,000 gallons per week of vaporized liquid nitrogen after use mainly in the cryostat (to cool the coils), and about 1 Ci/yr of tritium. Liquid nitrogen would be brought to the site via three truck deliveries per day during run periods. It is anticipated that NCSX would generate up to about 4×10^{14} D-D neutrons/sec. Site boundary dose would be less than 2 mrem/yr (compared to the design objective of 10 mrem/yr).

EVALUATOR

3/11/02
EVALUATION DATE

PPPL ENVIRONMENTAL ENGINEER (OR DESIGNEE)

3-12-02
APPROVAL DATE

MAY 2 1 2002

Jerry Wm. Faul, Area Manager
Princeton Area Office

SUBJECT: NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) DETERMINATION FOR PROPOSED CONSTRUCTION AND OPERATION OF THE NATIONAL COMPACT STELLERATOR EXPERIMENT (NCSX)

Reference: Memorandum, Faul to Siebach, dated April 25, 2002, Subject: Proposed NEPA Determination for Construction and Operation of the NCSX

My staff has evaluated the proposed project. Considering your recommendation along with those of Peter Siebach, NEPA Compliance Officer, and Irene Atney, Office of General Law, I have concluded that the proposed action is encompassed within Appendix C to Subpart D of the Department of Energy (DOE) NEPA Regulations, 10 Code of Federal Regulations (CFR) 1021 – class of actions that normally require Environmental Assessments (EAs) but not necessarily Environmental Impact Statements (EISs). Although preparation of an EA is always appropriate when there is some uncertainty as to the level of required NEPA documentation, Category "C12", Siting/Construction/Operation of Energy System Prototypes most closely applies. The approved Environmental Evaluation Notification Form is enclosed for your records.

You are authorized to identify a Document Manager for the proposed action. I encourage your Document Manager to work closely with Peter Siebach and Irene Atney to form a small Management Team to direct and coordinate document scoping, preparation, and review. A meeting of your Team and Princeton Plasma Physics Laboratory staff should be planned as early as convenient to prepare a draft outline leading to cost and schedule projections. Depending on how/whether you apply DOE Order 413.3, all NEPA documentation should be completed prior to Critical Decision-2. Note that certain interim actions may proceed prior to completion of the NEPA process (see 40 CFR 1506.1a) and in those instances, I encourage you to consult with Peter Siebach.

The EA package prepared for my approval should contain the following items:

1. A draft EA, based upon the EA outline and incorporating comments from your Management Team;
2. A draft Finding of No Significant Impact (FONSI) or Notice of Intent (NOI) to prepare an EIS, depending on appropriateness, and;
3. A computer disk of draft documents (EA and FONSI/NOI) in Word 6.0 format.

MAY 21 2002

I am providing copies of this determination to the Office of NEPA Policy and Assistance, and the Office of Science. As required by 10 CFR 1021.309c, Peter Siebach will notify the State of New Jersey. Questions concerning my decision should be directed to him at 630-252-2007.

Signed by
Marvin E. Gunn, Jr.

Marvin E. Gunn, Jr.
Manager

Enclosure:
Approved Environmental Evaluation
Notification Form

cc: C. Borgstrom, HQ, EH-42/FORS, w/encl.
C. Hickey, HQ, SC-83/GTN, w/encl.

bc: OM, w/encl.
A. Wrigley, PAO, w/encl.
I. Atney, BAO-AM, w/encl.
P. Siebach, STS, w/encl.
J. Levine, PPPL, w/encl.

CONCUR	
STS	
Siebach/jp	
05/15/02	
STS	
Zamirowski	
05/ /02	
TS	
Nealy	
05/ /02	
COO	
Kennedy	
05/ /02	
DM	
Vann	
05/ /02	
OM	
Gunn	
05/ /02	

ENVIRONMENTAL EVALUATION NOTIFICATION FORM

Grantee/Contractor Laboratory: Princeton University/Princeton Plasma Physics Laboratory (PPPL)
Project/Activity Title: Construction and Operation of the National Compact Stellerator Experiment (NCSX)
CH NEPA Tracking No.: _____ Type of Funding SC
B&R Code: AT5015020 Total Estimated Cost: $69M

DOE Cognizant Secretarial Officer (CSO): Raymond L. Orbach

Contractor Project Manager: --------- Signature: ---------
Date: ---------

Contractor NEPA Reviewer: Jerry D. Levine Signature: [signature]
Date: 4/17/02

I. **Description of Proposed Action:** The National Compact Stellarator Experiment (NCSX) would be an experimental research facility whose purpose would be to develop the physics of compact stellarators, an innovative fusion confinement concept. NCSX would consist of a plasma confinement device made up of an assembly of several magnet systems and structures that surround a highly shaped plasma (see attached figure). Coils would be provided to produce a magnetic field for plasma shape control, inductive current drive, and field error correction. A vacuum vessel and plasma facing components would produce a high vacuum plasma environment with access for heating, pumping, diagnostics, and maintenance. The device would be enclosed in a cryostat to permit cooling of the magnets at cryogenic temperature using liquid nitrogen.

The NCSX device would be installed in the C-site test cell (formerly occupied by the Princeton Large Torus [PLT] and Princeton Beta Experiment [PBX] facilities) at the Princeton Plasma Physics Laboratory. This test cell would be refurbished and would have been previously cleared of equipment that would not be reused. The former PBX/PLT computer and control rooms, which are contiguous to the test cell, would be refurbished and utilized. Power supplies currently located at D-site would be used by running approximately 500 ft of copper transmission lines from equipment in the D-Site Field Coil Power Conversion (FCPC Building) to the C-Site EF/OH Building, and then to NCSX. Additional existing equipment such as neutral beams, power supplies, and vacuum pumping and gas injection systems would also be used. After completion of assembly and installation, an integrated testing program would be carried out and a plasma ("first plasma") would be produced in the device to make it ready for experimental operations.

Experiments would be carried out using hydrogen, helium and deuterium; no tritium fuel would be used. Radioactivity produced during these experiments (gamma rays, neutrons and tritium) would be very small, comparable to existing experimental fusion devices at PPPL. Construction and fabrication activities would take place mainly in 2004-2006, with operations commencing in 2007.

II. **Description of Affected Environment:** Work would take place in the former PBX-M and PLT test cells and PBX-M/PLT control room at C-Site, the OH/EF Building at C-Site, the TFTR Test Cell at D-Site, and the FCPC Building at D-Site. Also, the power cable run from D-Site to C-Site will pass over some outdoor areas and require digging. See attached map and figures.

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. Yes
	Some digging for footings would be required for the power cable runs between D-Site and C-Site; disturbed area would be about 0.2 acres.	
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. Yes
	The C-Site Test Cell walls are made of asbestos panels. Any wall modifications (e.g., penetrations) could result in asbestos waste, which would be handled using existing PPPL procedures.	
17.	PCBs	17. No
18.	Import, Manufacture or Processing of Toxic Substances	18. No
19.	Chemical Storage/Use	19. Yes
	Examples of chemicals that would be used during this work would include ethanol, acetone, epoxy, RTV sealant and insulating compounds. All chemicals would have accompanying material safety data sheets (MSDSs) reviewed with Industrial Hygiene, and would be used and stored per PPPL policies and procedures. Gases such as hydrogen, deuterium, helium, argon & nitrogen would be used for experiments.	
20.	Pesticide Use	20. No
21.	Hazardous, Toxic, or Criteria Pollutant Air Emissions	21. No
	About 1 Ci/yr maximum of tritium produced during operations would be vented to the atmosphere, well within the site limit of 500 Ci/yr.	
22.	Liquid Effluent	22. No
23.	Underground Injection	23. No
24.	Hazardous Waste	24. Yes
	Wastes may include small amounts of hazardous wastes (i.e., machinist coolant, used vacuum pump oil, epoxy/cements, waste solvents, and solvent soaked rags). These would be disposed of in accordance with approved PPPL procedures.	
25.	Underground Storage Tanks	25. No
26.	Radioactive (AEA) Mixed Waste	26. No

27. Radioactive Waste — 27. Yes

Very small amounts (< 0.001 Ci per year) of tritium contaminated vacuum pump oil may be produced during D-D operations. These would be disposed of in accordance with approved PPPL procedures.

28. Radiation Exposures — 28. Yes

Radiation shielding and administrative controls would limit worker exposures in accordance with PPPL requirements (e.g., ≤ 1,000 mrem/yr, ≤ 600 mrem/qtr). Doses to the public from direct/scattered radiation from the plasma and from air emissions would be < 2 mrem/yr.

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

		Yes/No
29.	A threatened violation of ES&H regulations/permit requirements	29. No

Equipment would require application of proper electrical and/or mechanical safing procedures, including lockout/tagout. All activities would apply safety requirements of the PPPL ES&H Manual and PPPL policies and procedures (e.g., hoisting and rigging). Appropriate personal protective equipment (e.g., fall protection, hard hats, safety shoes, gloves, etc.) would be used. Work preplanning (e.g., job hazard analyses) to mitigate hazards would be conducted, and the area would be posted to limit unauthorized access. Appropriate measures would be taken to protect workers from adverse effects of atmospheric emissions of up to 30,000 gallons/wk of vaporized LN2.

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

Trucking in of liquid nitrogen (estimated to require up to 3 trucks per day during operating periods) would not add significantly to current offsite traffic patterns in the vicinity of PPPL, or to onsite traffic.

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 by the OM under Subpart D of the DOE NEPA Regulations for compliance with NEPA?

Yes

A. **DOE-CH NEPA Coordinator Review:**

DOE-CH NEPA Coordinator Reviewer: Allen Wrigley

Signature: _____ Date: 4/18/02

B. **DOE CH NCO NEPA Review:**

NCO Concurrence with Proposed Class of Action Recommended

CX (EA) EIS

Category

DOE CH NCO Reviewer: P. R. Siebach

Signature: _____ Date: 5/14/02

DOE Recommendation Approvals:

CH PG: Jerry W. Paul Signature: _____ Date: 4/25/02

CH NCO: Peter R. Siebach Signature: _____ Date: 5/14/02

CH GLD: Irene P. Atney Signature: _____ Date: 4/23/02

CH ESHD: Justin T. Zamirowski Signature: _____ Date: 5/16/02

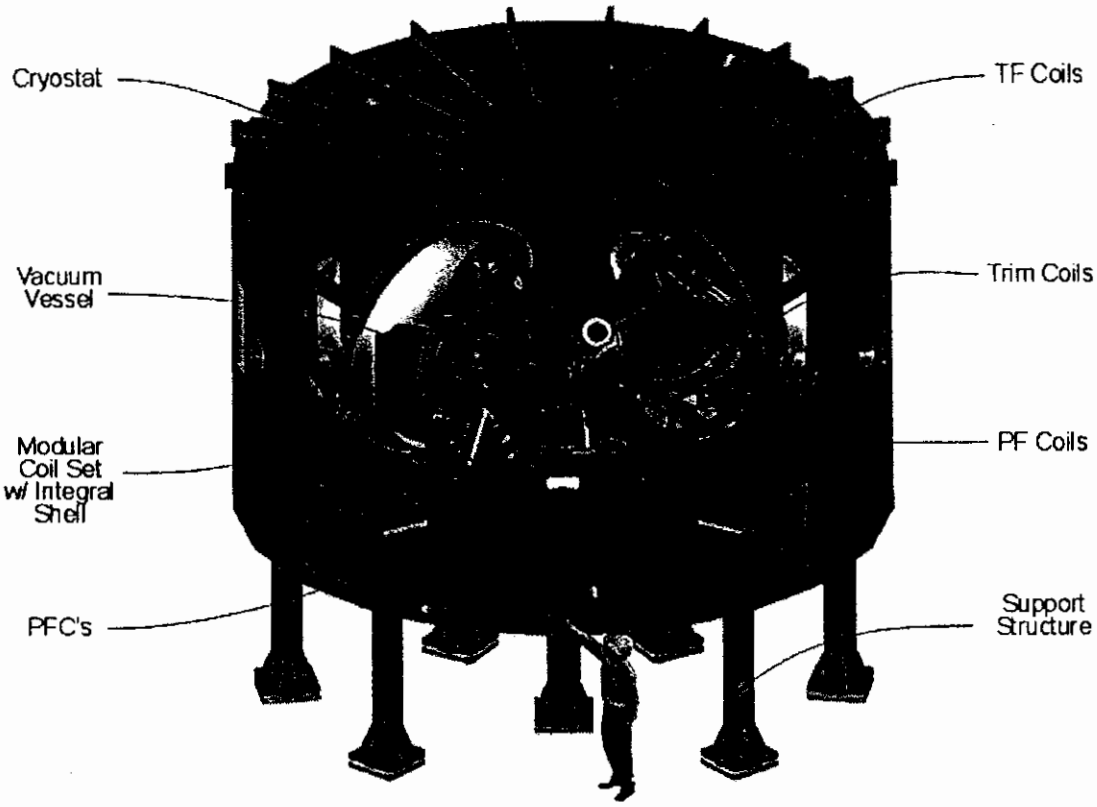
CH AMST: Carson L. Nealy Signature: _____ Date: 5/17/02

Office Manager Subpart D Determination

I HAVE DETERMINED THAT AN EA SHOULD BE PREPARED FOR THE PROPOSED ACTION DESCRIBED IN THE EENF AND BY MY SIGNATURE BELOW, YOU ARE AUTHORIZED TO PROCEED WITH THE PREPARATION OF AN EA. No further action should be taken on the project until the EA is completed, except in accordance with 40 CFR 1506.1(a). I also request that you prepare and submit a schedule to the CH NCO for the activities associated with the completion of the EA.

CH Office Mgr: Marvin E. Gunn Signature: MEGunn

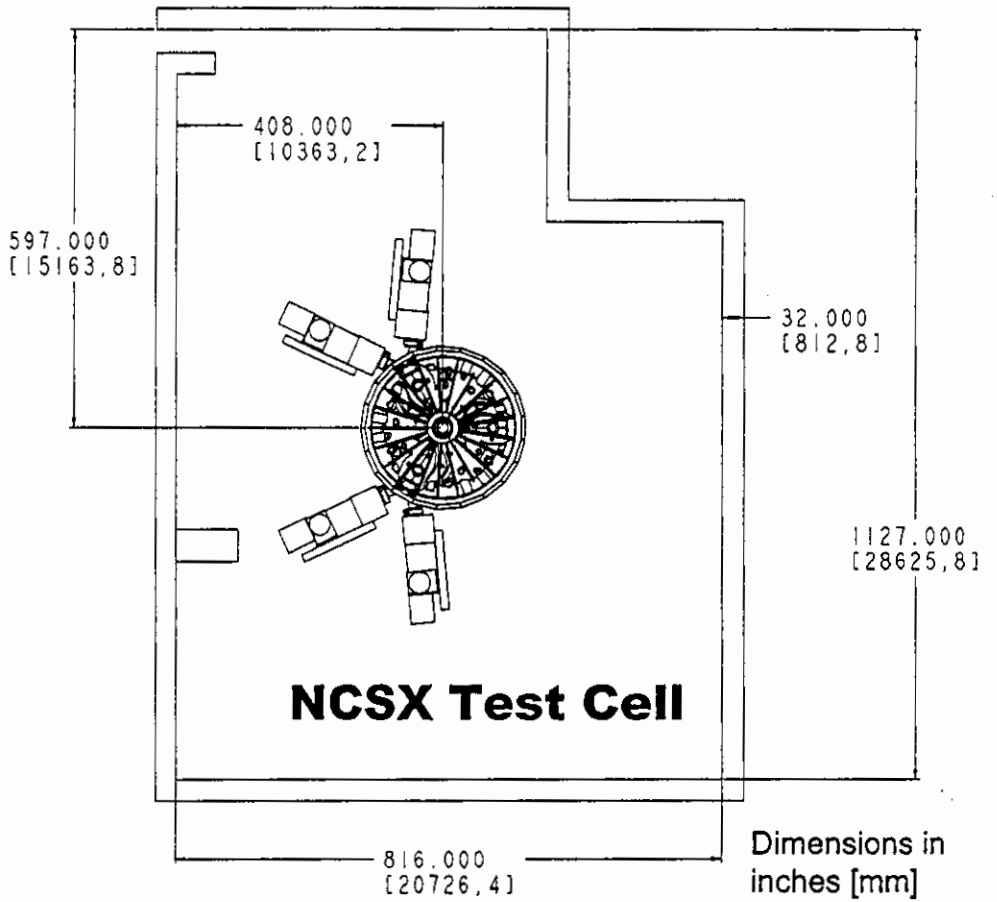
Date: 5/21/02

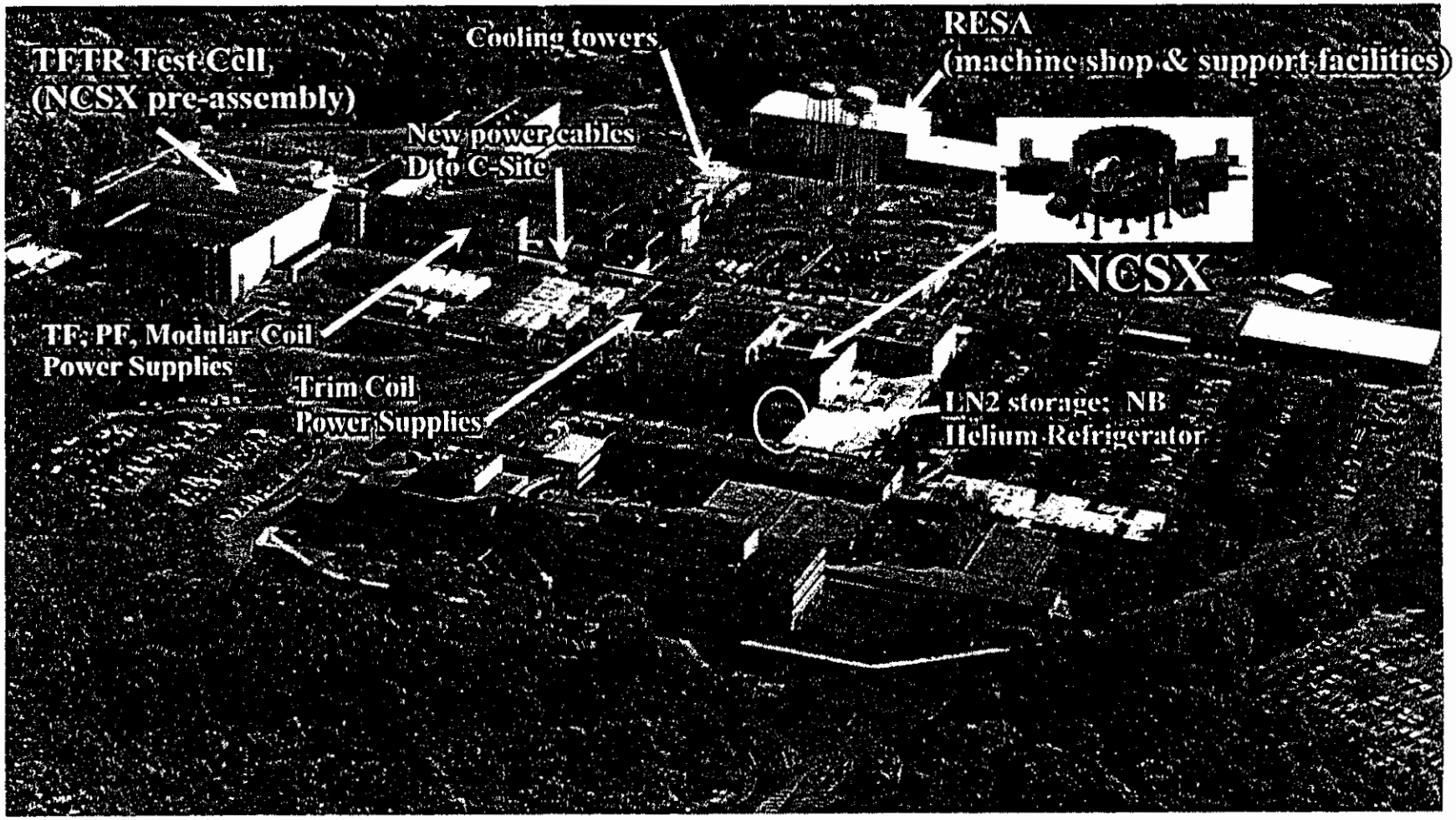

Cryostat
Vacuum Vessel
Modular Coil Set w/ Integral Shell
PFC's
TF Coils
Trim Coils
PF Coils
Support Structure

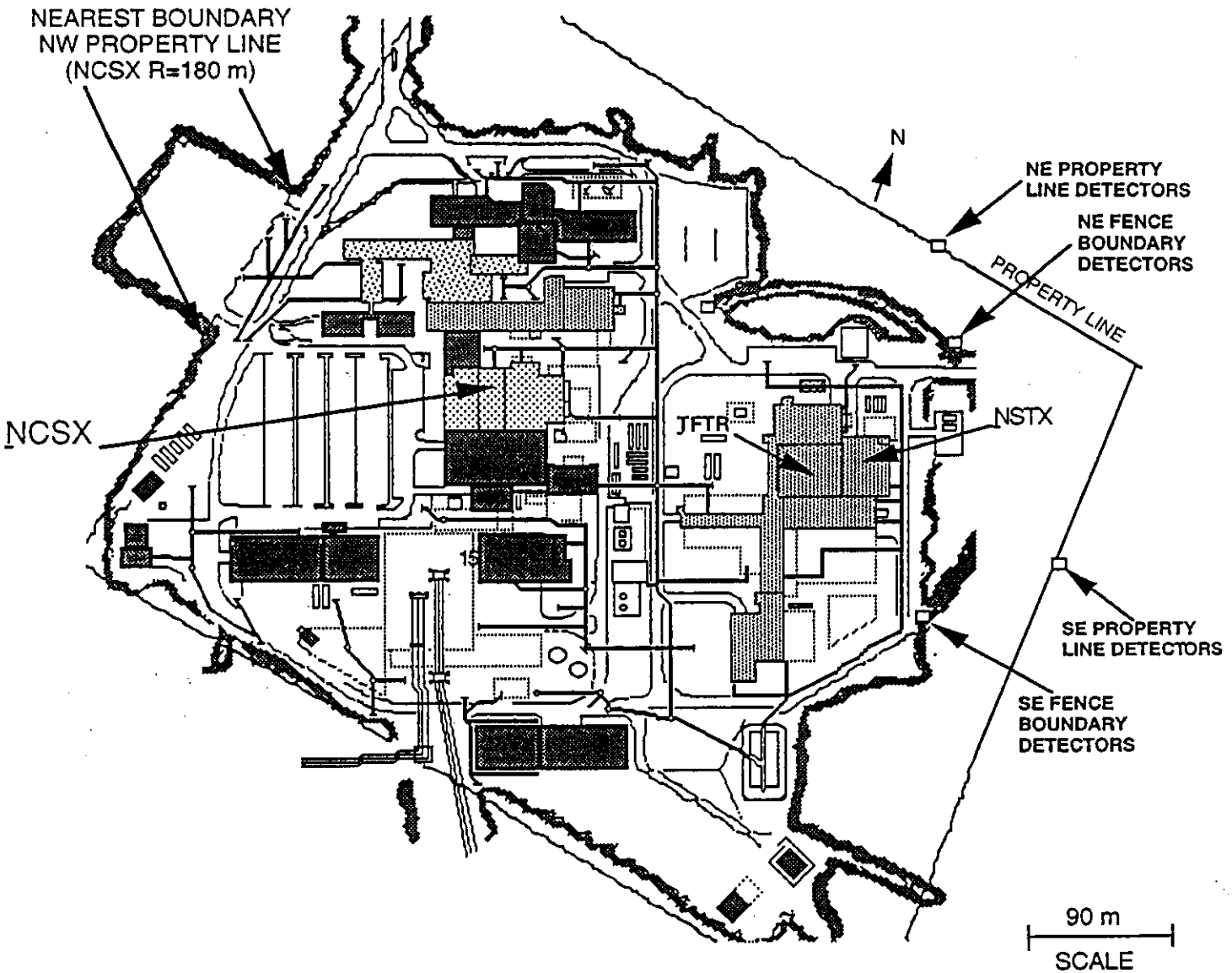
NCSX Device

There is ample room for NCSX in the combined PLT and PBX test cells

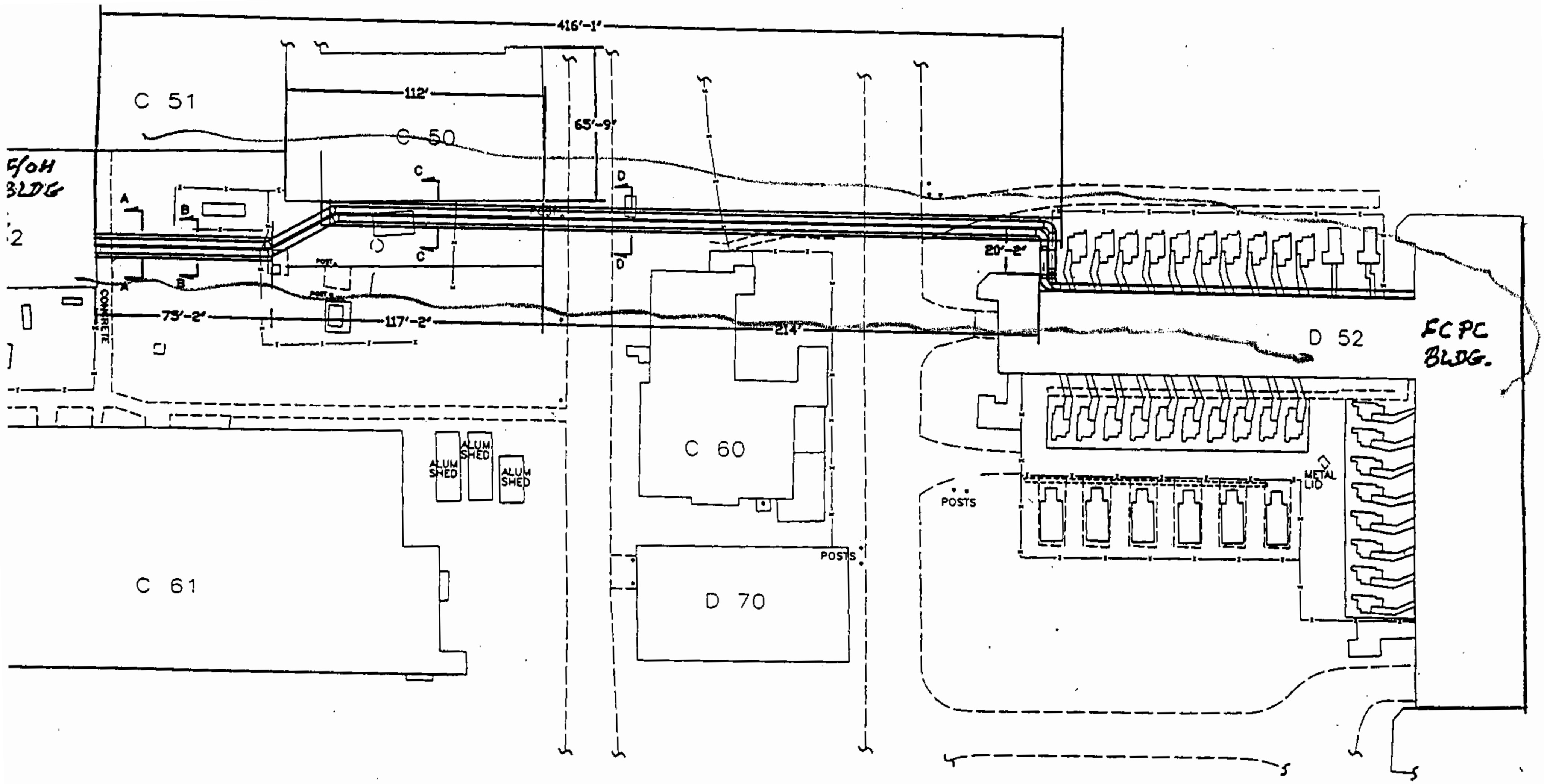
- The combined test cell can easily accommodate four beamlines




TFTR Test Cell
(NCSX pre-assembly)
Cooling towers
RESA
(machine shop & support facilities)
New power cables
D to C-Site
NCSX
TF; PF, Modular Coil
Power Supplies
Trim Coil
Power Supplies
LN2 storage; NB
Helium Refrigerator



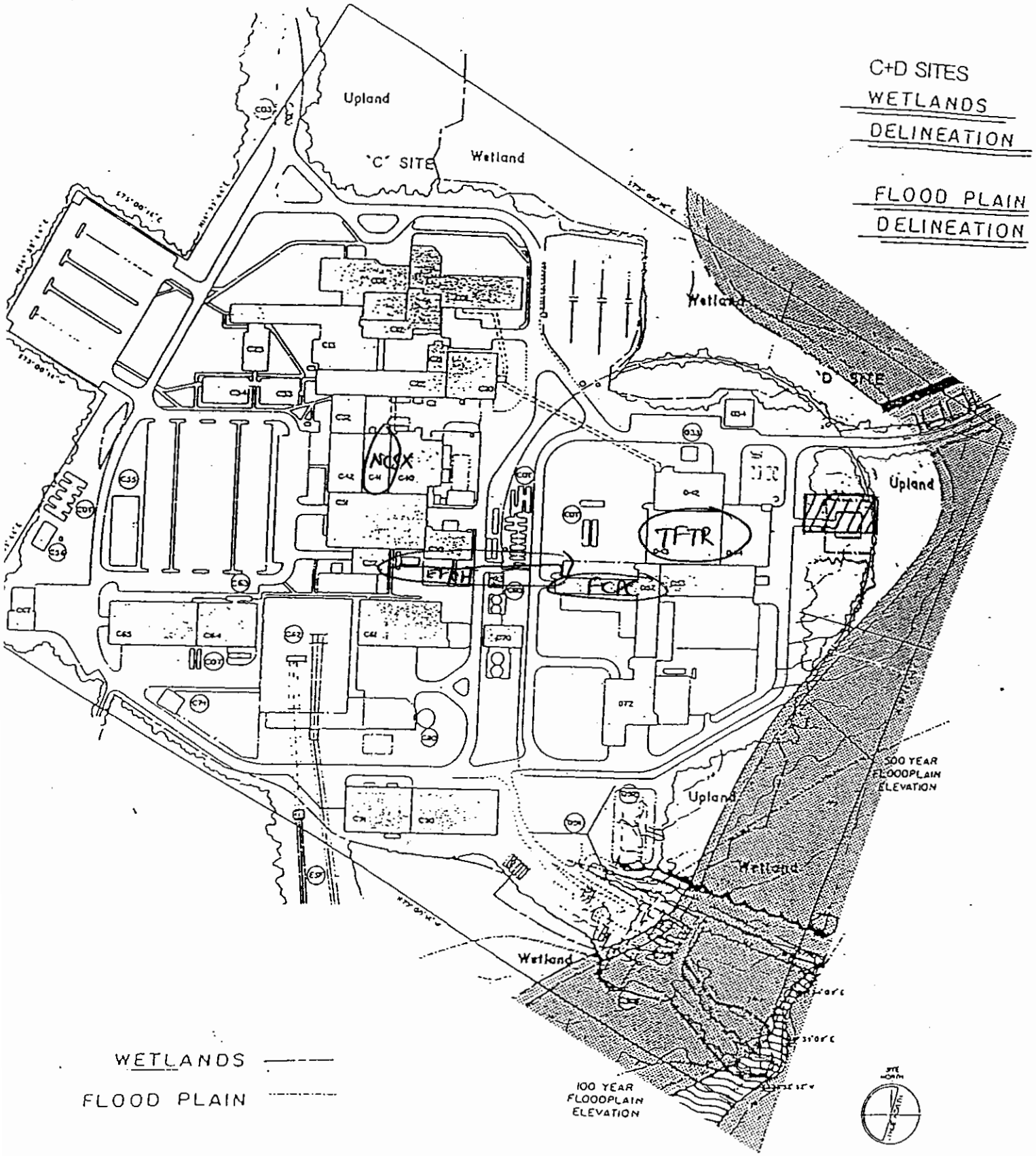
PPPL SITE PLAN SHOWING NCSX
C-SITE TEST CELL LOCATION
RELATIVE TO NEAREST PROPERTY LINES



NCSX
POWER CABLE RUN
FROM D-SITE TO
C-SITE

PRINCETON PLASMA PHYSICS LABORATORY
PRINCETON UNIVERSITY
NCSX
D-SITE TO C-SITE
DC POWER TRANSMISSION
TRAYS AND RACEWAYS

DATE	8/31/01
SCALE	1"=30'-0"
DRAWING NO.	S15 E420-1-001
REV	0



*SHADE INDICATES STREAM PROTECTION CORRIDOR PER PRINCETON FORRESTAL CENTER STORMWATER MANAGEMENT PLAN, 1980

0 100 300 500 FT.

SITE PLAN
PRINCETON UNIVERSITY
PLASMA PHYSICS LABORATORY