

1. Work requester fills out this section.  Standing Work Permit

Requester: Don Lynch	Date: 2/15/2006	Ext.: 2253	Dept/Div/Group: PO/PHENIX
Other Contact person (if different from requester): Carter Biggs			Ext.: 7515
Work Control Coordinator: Don Lynch		Start Date: 2/15/2006	Est. End Date: 3/15/2006
Brief Description of Work: Receive, and Install a 6000 gallon LN2 Dewar and integrate it into the PHENIX experimental gas system			
Building: 1008F	Room: Gas Pad & Mixing House	Equipment: Mobile Crane(>20 ton)	Service Provider: PHENIX, Riggers, ACME Cryogenics

WCC, Requester/Designee, Service Provider, and ES&H (as necessary) fill out this section or attach analysis

<b>ES&amp;H ANALYSIS</b>					
<b>Radiation Concerns</b>	<input checked="" type="checkbox"/> None	<input type="checkbox"/> Activation	<input type="checkbox"/> Airborne	<input type="checkbox"/> Contamination	<input type="checkbox"/> Radiation
Radiation Generating Devices:	<input type="checkbox"/> Radiography	<input type="checkbox"/> Moisture Density Gauges	<input type="checkbox"/> Soil Density Gauges	<input type="checkbox"/> X-ray Equipment	
<input type="checkbox"/> Special nuclear materials involved, notify Isotope Special Materials Group			<input type="checkbox"/> Fissionable materials involved, notify Laboratory Criticality Officer		
<b>Safety Concerns</b>	<input type="checkbox"/> None	<input type="checkbox"/> Ergonomics	<input type="checkbox"/> Transport of Haz/Rad Material		
<input type="checkbox"/> Adding/Removing Walls or Roofs	<input type="checkbox"/> Confined Space*	<input type="checkbox"/> Explosives	<input type="checkbox"/> Lead*	<input type="checkbox"/> Penetrating Fire Walls	
	<input type="checkbox"/> Corrosive	<input type="checkbox"/> Flammable	<input type="checkbox"/> Magnetic Field*	<input type="checkbox"/> Pressurized Systems	
<input type="checkbox"/> Asbestos*	<input type="checkbox"/> Cryogenic	<input type="checkbox"/> Fumes/Mist/Dust*	<input type="checkbox"/> Material Handling	<input checked="" type="checkbox"/> Rigging/Critical Lift	
<input type="checkbox"/> Beryllium*	<input type="checkbox"/> Electrical	<input type="checkbox"/> Heat/Cold Stress	<input type="checkbox"/> Noise*	<input type="checkbox"/> Toxic Materials*	
<input type="checkbox"/> Biohazard*	<input type="checkbox"/> Elevated Work*	<input type="checkbox"/> Hydraulic	<input type="checkbox"/> Non-ionizing Radiation*	<input type="checkbox"/> Vacuum	
<input type="checkbox"/> Chemicals*	<input type="checkbox"/> Excavation	<input type="checkbox"/> Lasers*	<input type="checkbox"/> Oxygen Deficiency*	<input type="checkbox"/> Other	
* Does this work require medical clearance or surveillance from the Occupational Medicine Clinic? <input type="checkbox"/> Yes <input type="checkbox"/> No					
<b>Environmental Concerns</b>			<input checked="" type="checkbox"/> None	<input type="checkbox"/> Work impacts Environmental Permit No.	
<input type="checkbox"/> Atmospheric Discharges (rad/non-rad)	<input type="checkbox"/> Land Use		<input type="checkbox"/> Soil Activation/contamination	<input type="checkbox"/> Waste-Mixed	
<input type="checkbox"/> Chemical or Rad Material Storage or Use	<input type="checkbox"/> Liquid Discharges		<input type="checkbox"/> Waste-Clean	<input type="checkbox"/> Waste-Radioactive	
<input type="checkbox"/> Cesspools (UIC)	<input type="checkbox"/> Oil/PCB Management		<input type="checkbox"/> Waste-Hazardous	<input type="checkbox"/> Waste-Regulated Medical	
<input type="checkbox"/> High water/power consumption	<input type="checkbox"/> Spill potential		<input type="checkbox"/> Waste-Industrial	<input type="checkbox"/> Underground Duct/Piping	
Waste disposition by:					
<b>Pollution Prevention (P2)/Waste Minimization Opportunity:</b>			<input checked="" type="checkbox"/> None	<input type="checkbox"/> Yes	
<b>FACILITY CONCERNS</b>					
<input checked="" type="checkbox"/> None					
<input type="checkbox"/> Access/Egress Limitations	<input type="checkbox"/> Electrical Noise	<input type="checkbox"/> Potential to Cause a False Alarm		<input type="checkbox"/> Vibrations	
	<input type="checkbox"/> Impacts Facility Use Agreement			<input type="checkbox"/> Temperature Change	
<input type="checkbox"/> Configuration Control	<input type="checkbox"/> Maintenance Work on Ventilation Systems		<input type="checkbox"/> Utility Interruptions		
<b>WORK CONTROLS</b>					
<b>Work Practices</b>					
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Exhaust Ventilation	<input type="checkbox"/> Lockout/Tagout	<input type="checkbox"/> Spill Containment	<input type="checkbox"/> Security (see Instruction Sheet)	
<input type="checkbox"/> Back-up Person/Watch	<input type="checkbox"/> HP Coverage	<input type="checkbox"/> Posting/Warning Signs	<input type="checkbox"/> Time Limitation	<input type="checkbox"/> Other	
<input type="checkbox"/> Barricades	<input type="checkbox"/> IH Survey	<input type="checkbox"/> Scaffolding-requires inspection	<input type="checkbox"/> Warning Alarm (i.e. "high level")		
<b>Protective Equipment</b>					
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Ear Plugs	<input type="checkbox"/> Gloves	<input type="checkbox"/> Lab Coat	<input type="checkbox"/> Safety Glasses	
<input type="checkbox"/> Coveralls	<input type="checkbox"/> Ear Muffs	<input type="checkbox"/> Goggles	<input type="checkbox"/> Respirator	<input type="checkbox"/> Safety Harness	
<input type="checkbox"/> Disposable Clothing	<input type="checkbox"/> Face Shield	<input type="checkbox"/> Hard Hat	<input type="checkbox"/> Shoe Covers	<input type="checkbox"/> Safety Shoes	<input type="checkbox"/> Other
<b>Permits Required (Permits must be valid when job is scheduled.)</b>					
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Cutting/Welding	<input type="checkbox"/> Impair Fire Protection Systems			
<input type="checkbox"/> Concrete/Masonry Penetration	<input type="checkbox"/> Digging/Core Drilling	<input type="checkbox"/> Rad Work Permit-RWP No			
<input type="checkbox"/> Confined Space Entry	<input type="checkbox"/> Electrical Working Hot	<input type="checkbox"/> Other			
<b>Dosimetry/Monitoring</b>					
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Heat Stress Monitor	<input type="checkbox"/> Real Time Monitor	<input type="checkbox"/> TLD		
<input type="checkbox"/> Air Effluent	<input type="checkbox"/> Noise Survey/Dosimeter	<input type="checkbox"/> Self-reading Pencil Dosimeter	<input type="checkbox"/> Waste Characterization		
<input type="checkbox"/> Ground Water	<input type="checkbox"/> O <sub>2</sub> /Combustible Gas	<input type="checkbox"/> Self-reading Digital Dosimeter	<input type="checkbox"/> Other		
<input type="checkbox"/> Liquid Effluent	<input type="checkbox"/> Passive Vapor Monitor	<input type="checkbox"/> Sorbent Tube/Filter Pump			
<b>Training Requirements (List below specific training requirements)</b>					
PHENIX Awareness, RHIC Access. ACME Cryogenics installer to Read this work permit and attached work plan procedure, to be briefed on all work hazards as outlined in the workplan, shall be escorted at all times by a trained PHENIX technician, and shall sign a training waiver form per SBMS document. FS-SOP-4027					
Based on analysis above, the Walkdown Team determines the risk, complexity, and coordination ratings below:			If using the permit when all hazard ratings are low, only the following need to sign: ( Although allowed, there is no need to use back of form)		
<b>ES&amp;H Risk Level:</b>	<input checked="" type="checkbox"/> Low	<input type="checkbox"/> Moderate	<input type="checkbox"/> High	WCC:	Date:
<b>Complexity Level:</b>	<input checked="" type="checkbox"/> Low	<input type="checkbox"/> Moderate	<input type="checkbox"/> High	Service Provider:	Date:
<b>Work Coordination:</b>	<input type="checkbox"/> Low	<input checked="" type="checkbox"/> Moderate	<input type="checkbox"/> High	Authorization to start	Date:
(Departmental Sup/WCC/Designee)					

**3. Both work requester and service provider contribute to work plan (use attachments for detailed plans)**

<b>Work Plan</b> (procedures, timing, equipment, and personnel availability need to be addressed): See attached				
Special Working Conditions Required: No				
Operational Limits Imposed: None				
Post Work Testing Required: No				
Job Safety Analysis Required: <input type="checkbox"/> Yes <input type="checkbox"/> No			Walkdown Required: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
<b>Reviewed by:</b> Primary Reviewer will determine the size of the review team and the other signatures required based on hazards and job complexity. Primary Reviewer signature means that the hazards and risks that could impact ES&H have been identified and will be controlled according to BNL requirements.				
Title	Name (print)	Signature	Life #	Date
Primary Reviewer				
ES&H Professional				
Other	Ali Javidfar			
Other	Charlie Pearson			
Work Control Coordinator	Don Lynch		20146	2/17/2006
Service Provider				
Review Done: <input type="checkbox"/> in series <input type="checkbox"/> team				

**4. Job site personnel fill out this section.**

Note: Signature indicates personnel performing work have read and understand the hazards and permit requirements (including any attachments).			
Job Supervisor:		Contractor Supervisor:	
Workers:	Life#:	Workers :	Life#:
Workers are encouraged to provide feedback on ES&H concerns or on ideas for improved job work flow. Use feedback form or space below.			

**5. Departmental Job Supervisor, Work Control Coordinator/Designee**

Conditions are appropriate to start work: (Permit has been reviewed, work controls are in place and site is ready for job.)			
Name:	Signature:	Life#:	Date:

**6. Departmental Job Supervisor, Work Requester/Designee determines if Post Job Review is required.  Yes  No**

Post Job Review (Fill in names of reviewers)			
Name:	Signature:	Life#:	Date:
Name:	Signature:	Life#:	Date:

**7. Worker provides feedback.**

Worker Feedback (use attached sheets as necessary)	
a) WCM/WCC: Is any feedback required? <input type="checkbox"/> Yes <input type="checkbox"/> No	
b) Workers: Are there better methods or safer ways to perform this job in the future? <input type="checkbox"/> Yes <input type="checkbox"/> No	

**8. Closeout: Work Control Coordinator (authorizing dept.) checks quality of completed permit and ensures the work site is left in an acceptable condition. (WCC can delegate clean up of work area to work supervisor)**

Name:	Signature:	Life#:	Date:
Comments:			

## **PHENIX LN2 Dewar Installation Plan**

### **Background**

Until recently, the Beam-Beam Counter (BBC) subsystem of the PHENIX detector in the RHIC accelerator has utilized dry air provided by a RHIC complex wide compressed air system. This system had worked adequately for 5 years but during the recent maintenance shutdown, the system unexpectedly overwhelmed the PHENIX distribution controls with a large quantity of water which nearly damaged the BBC. Fortunately, the BBC system was not energized at that time, and the water flow was stopped quickly. PHENIX technicians and BBC expert scientists then systematically disassembled, cleaned and dried, reassembled and tested the BBC system immediately and prevented any permanent damage to the BBC.

The BBC system is critical to the PHENIX detector; without it detector measurements are not properly triggered and such measurements are rendered useless. In addition, there is no remedy available in the event of total damage to the detector modules, which could conceivably happen should the compressors deliver water to the subsystem while it is operating. Furthermore, even if permanent damage were not to occur, a significant loss of run time, on the order of 1 month, would certainly be experienced if this problem were to recur.

PHENIX management and technical staff have evaluated the alternatives and decided that the best solution is to remove the BBC from the dry air system and provide cooling instead with dry nitrogen. The supply system thus designed is an open loop system providing N<sub>2</sub> via boiloff from a liquid nitrogen dewar to be located on the existing PHENIX gas pad. The dewar so designed was sized at 6000 gallons. This work plan describes the installation of the system and integration into the existing BBC supply system.

### **Equipment**

6000 gallon re-manufactured liquid nitrogen tank, National Board # 6363, serial # 206 (ACME Cryogenics), LN<sub>2</sub> fill valve, pressure regulation and indication, and supply ports are pre-installed

Vaporizer (5000 cfh) (ACME Cryogenics)

1-1/2 Copper pipe and associated fittings

Existing BBC gas distribution system

## Procedure

The vendor (ACME Cryogenics) will provide shipment to BNL and an installation technician. PHENIX gas system technicians will escort the vendor personnel (driver and technician) at all times while vendor personnel are on site at BNL and assist vendor technician as necessary with the installation. (Note: technician and delivery personnel may arrive and depart separately and or at different times. PHENIX will provide as many appropriately trained escorts as necessary so that all vendor personnel are properly escorted at all times while on site.)

1. PHENIX technicians will receive and position the vaporizer on the gas pad prior to delivery of the LN<sub>2</sub> Vessel.
2. BNL riggers shall review the offloading requirements for the LN<sub>2</sub> vessel prior to receipt of the vessel and shall pre-position an adequate crane (20 ton minimum) by the end of the work day immediately preceding the scheduled delivery of the vessel. Receipt of shipment of the vessel at BNL shall be scheduled for 8:30 AM on the date of delivery.
3. Vendor personnel will be briefed on lab safety procedures prior to entering the radiologically controlled section of the RHIC complex (briefing document attached). Vendor personnel shall sign the document indicating their understanding and concurrence with BNL safety regulations.
4. Vendor shall proceed under escort to the PHENIX complex and be met by BNL riggers at the PHENIX gas pad. Riggers shall offload the LN<sub>2</sub> and position the dewar as described in the attached sketch and diagrams.
5. When delivery is completed, driver shall be escorted off site, while the vendor technician and PHENIX technicians connect the LN<sub>2</sub> vessel to the vaporizer.
6. Upon completion of installation and integration of the LN<sub>2</sub> vessel and vaporizer, the vessel shall be filled with LN<sub>2</sub> (existing BNL supplier), checked for leaks, (adjusted as necessary) and the system tested for delivery as far as the gas pad supply connection.
7. The vendor technician shall then be escorted off site. (Vendor personnel shall be escorted at all times while on site, including breaks and meals. Should vendor leave site prior to completion of installation, the same procedure as described above shall be enforced to ensure that vendor personnel are continually escorted.)
8. PHENIX technicians shall complete integration of the N<sub>2</sub> gas system in accordance with the attached block diagram, connecting to the existing BBC gas distribution inside the PHENIX gas mixing house. Only mechanical pipe connections are allowed within the PHENIX gas mixing house, as flammable gas is currently in use therein. Any sweating of pipes or other open flames used for cutting and/or joining pipes shall be accomplished outside of the PHENIX gas mixing house (skill of the craft work).

9. PHENIX gas system technicians shall test and adjust the N<sub>2</sub> gas supply system for the BBC as necessary to achieve required flows and pressures (skill of the craft work).

# Environment, Safety, Health, and Security Briefing Checklist

Initial or indicate NA  
(Not Applicable) for  
each item or section

## I. Emergency Information

1. **Emergency number is ext. 2222** (fire, medical emergency, serious injury, ambulance, leaks, and spills). You must dial 344-2222 from a cellular phone. \_\_\_\_\_
2. BNL Laboratory Site-wide and Building alarms: \_\_\_\_\_
  - a. Alert siren: continuous sounding of site siren for five (5) minutes. Proceed to assembly area and wait for further instructions.
  - b. Evacuation siren: Intermittent sounding of the site siren for five (5) minutes. Evacuate the site immediately.
  - c. Sirens are tested at noon every Monday.
  - d. Building Alarms: Evacuate the building immediately.
3. Report injuries immediately to your BNL Contact. \_\_\_\_\_  
(Or if an emergency, dial 2222.)
4. Note the locations of Fire Alarm Pull Boxes, phones, fire extinguishers, escape routes, and Material Safety Data Sheets (MSDS) in your work locations. \_\_\_\_\_

## II. Compliance with Procedures and Regulations

1. Obey all environmental, safety and health requirements that apply to your work. If you have questions about requirements that may affect your specific work, ask your BNL Contact. \_\_\_\_\_
2. Comply with all warning signs posted at the Laboratory. \_\_\_\_\_  
Access to certain areas at the Laboratory is limited to individuals who are trained and qualified to be there. Do not enter any areas that are posted with warning signs. For example Radiological Areas are posted with yellow and magenta or yellow and black signs and there are special requirements that need to be fulfilled to access these areas. If you have any doubt about whether or not you may enter an area, ask your BNL Contact.
3. All unauthorized disposal or release of oil or hazardous materials is strictly forbidden. Report spills to your BNL Contact. \_\_\_\_\_  
If you witness a spill of material onto soil or into a water stream (gasoline, oil, chemicals), you must call 2222 to report the spill immediately.
4. Potentially hazardous operations require special training and permits before individuals are authorized to perform such work. Forklift operation, overhead crane operation, electrical work, handling of compressed gas cylinders, cutting and welding activities, confined space entry, disposal of hazardous materials, operations that may impair fire protection systems and any task performed in a radiological area are examples of activities that require proper authorization prior to task performance. \_\_\_\_\_

Initial or indicate NA  
(Not Applicable) for  
each item or section.

- 5. Do not use a computer, or any BNL equipment unless you are authorized for its use and handling. Inappropriate use of equipment may constitute fraud, waste, or abuse of government property. \_\_\_\_\_
- 6. Report any unsafe conditions or activities to your BNL Contact. \_\_\_\_\_
- 7. If you are being escorted while onsite and performing a potentially hazardous task under escort, your escort must be in your constant sight during task performance. \_\_\_\_\_

**III. Traffic Rules** \_\_\_\_\_

- 1. Speed Limit on site is 30 m.p.h. and is radar enforced.
- 2. Pedestrians have right-of-way in marked areas. Cross in marked zones.
- 3. Vehicles are subject to police inspection.
- 4. Bicycles must observe all Laboratory traffic rules.
- 5. Park in designated parking areas. Yellow-painted curbs indicate no parking areas.
- 6. On-site deer population presents driving hazard.

**IV. Individual Responsibility** \_\_\_\_\_

- 1. Carry BNL ID at all times. When your BNL work assignment is over, you must return your badge to your BNL Contact or the Badging Office.
- 2. You may access the BNL site for the performance of your BNL work assignment only. Accessing the site for any other purpose is prohibited.
- 3. Professional conduct and ethical behavior are expected and required at all times.
- 4. Prohibited activities include: alcohol consumption, illegal drug use, sexual harassment or any other discrimination. No smoking in any building on-site.

**V. Reviewed or issued the following documents:**

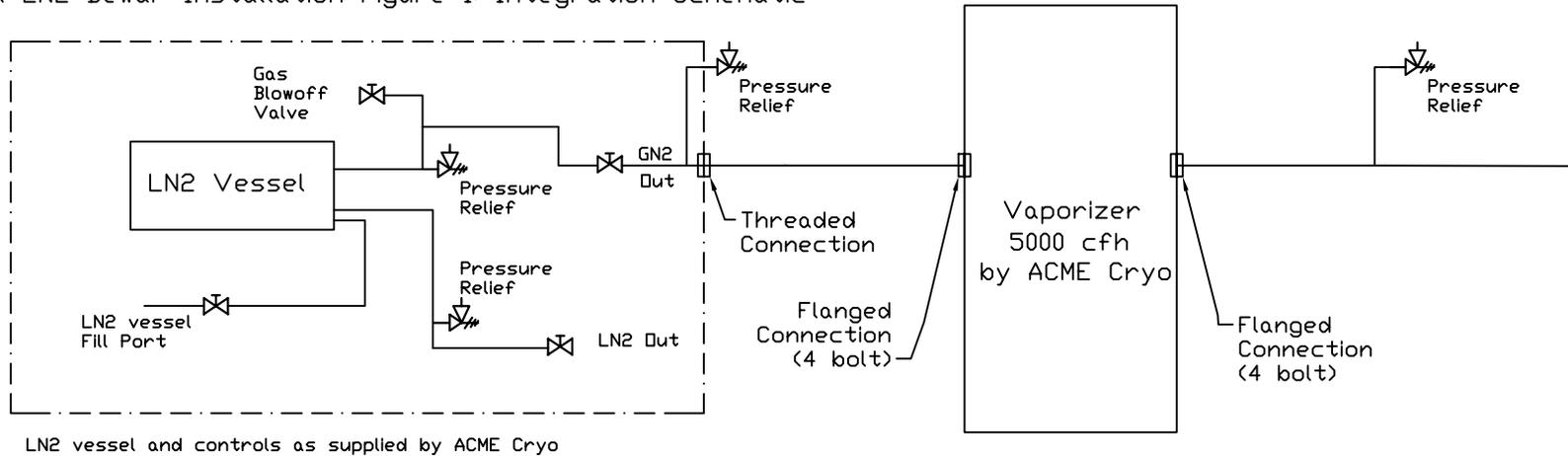
The above information was reviewed with me by: \_\_\_\_\_  
BNL Contact Name

\_\_\_\_\_  
BNL Contact Signature Date

\_\_\_\_\_  
Contractor ID Number Contractor/Vendor Name

\_\_\_\_\_  
Contractor/Vendor Signature

PHENIX LN2 Dewar Installation Figure 1: Integration Schematic



LN2 vessel and controls as supplied by ACME Cryo

BBC distribution rack  
in PHENIX Gas mixing house  
(existing)

PHENIX technician  
installed piping from  
gas pad to Gas mixing  
house. 1-1/2" copper  
pipe (sweat fittings  
outside mixing house,  
compression fittings  
inside mixing house).

Vendor technician  
connection from  
vaporizer to  
gas pad 1-1/2" cu pipe  
sweat connection

Gate  
Valve

Note: System pressure relief factory preset at 175psi. All piping, joints and vaporizer to be tested to 200 psi (110 % of operating pressure prior to connection to LN2 vessel.)

DRL-2006-15 B  
PHENIX LN2 Supply Schematic  
D. Lynch  
3/17/2006

# LN<sub>2</sub> Storage Dewar for BBC

Acme Cryogenics 6000 Gallon vessel



23' long x 10'4" high, 7' wide  
footprint 219psig MAWP, we would  
set MOP to 125psig.

Original Mfr.:

Linde, NB #6363 ser.#206

Remanufactured by Chart

# LN<sub>2</sub> Supply

- Acquire ASME NB certified 6000 gal LN<sub>2</sub> Dewar
- CA internal cryo and mechanical safety review
- Modify gas pad layout to accommodate dewar
- Install dewar on pad



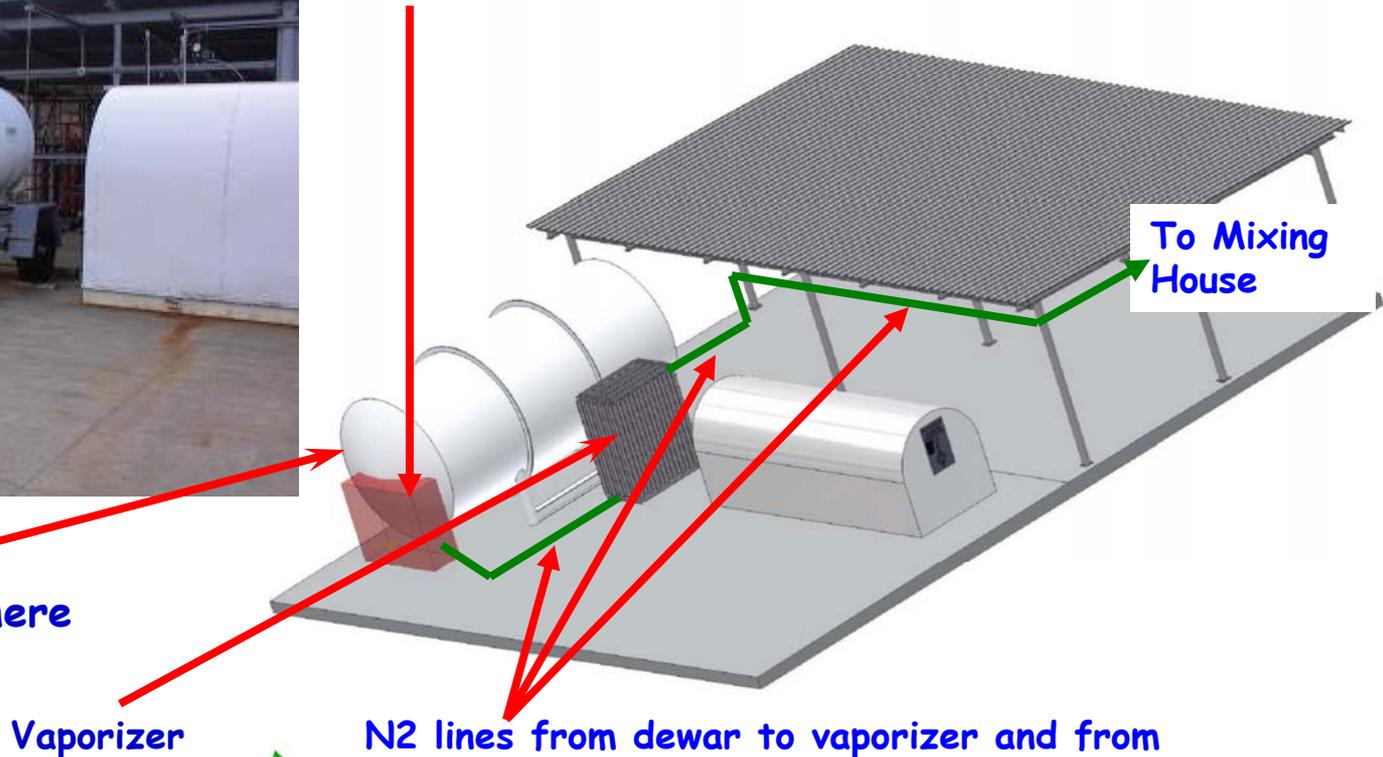
LN<sub>2</sub> dewar to be located on south side of pad beyond CO<sub>2</sub> unit shown here

# LN<sub>2</sub> Storage Dewar for BBC



LN<sub>2</sub> Vessel to go here

Instrumentation Envelope



Vaporizer

N<sub>2</sub> lines from dewar to vaporizer and from vaporizer to supply manifold to be installed by vendor. Lines from manifold to to mixing house and routing in mixing house to BBC supply to be modified from existing lines by PHENIX gas technicians.

# LN<sub>2</sub> Storage Dewar for BBC

New Gas Pad Design.  
 Dimensions and access  
 to be added.  
 Estimated weight of  
 6000 gallon tank 30  
 tons when full, 10 tons  
 when empty.

Work Permit required.

