

# **Helium Recovery at Iowa State University**

**Special Thanks to**

**Sarah Cady and Marc McGinn**

**by**

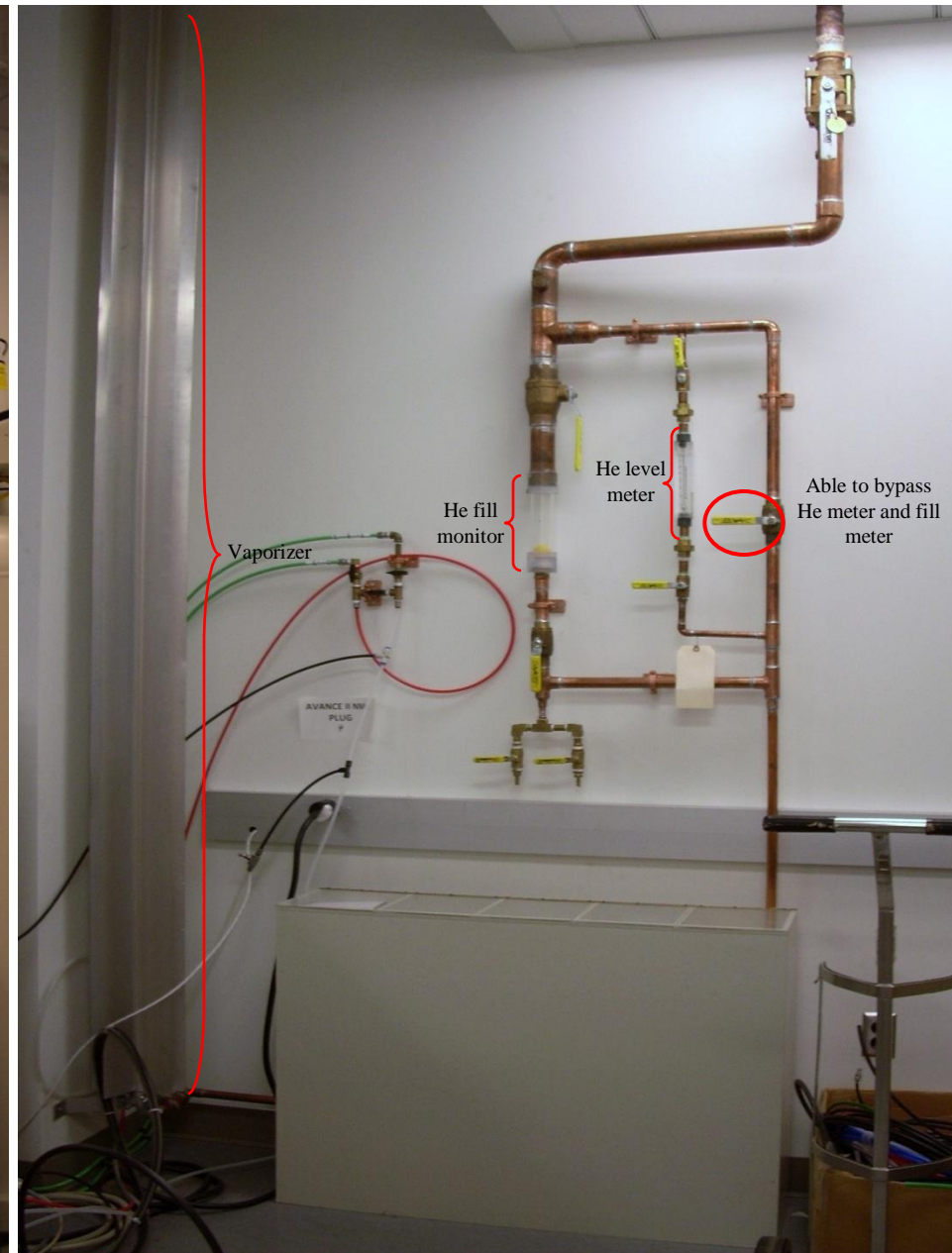
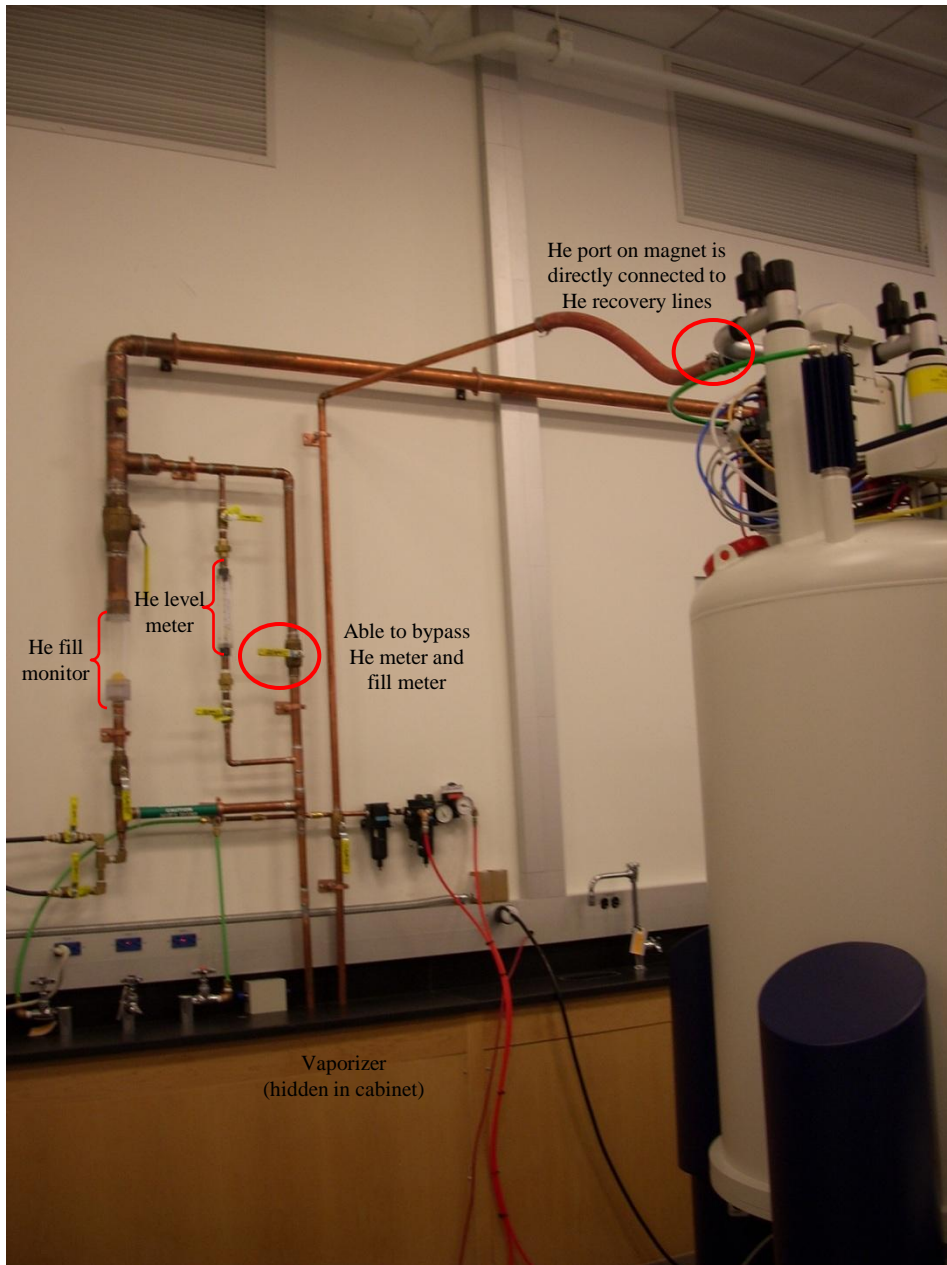
**Jennifer Rapp, Ph.D., Spectroscopist**

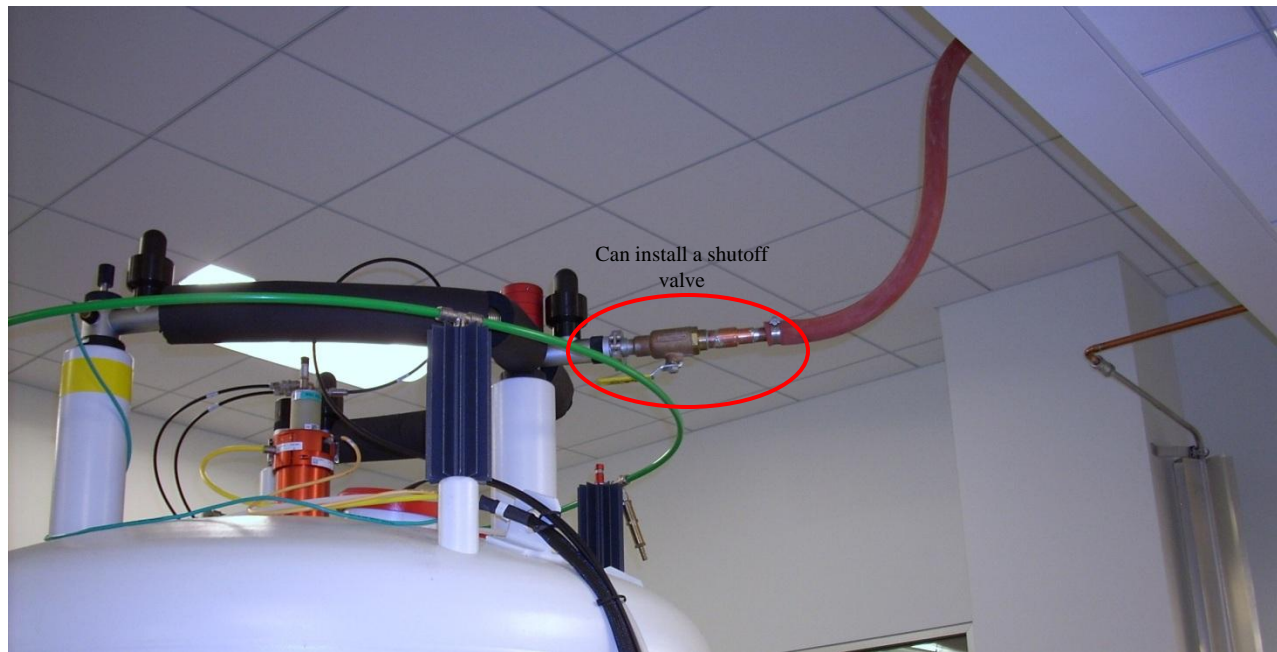
**Dean Olson, Ph.D., Director**

**U. of Illinois NMR Lab**

**<http://scs.illinois.edu/nmr/>**

# Helium Recovery Set-Up at Magnet





# Basement – Helium Gas Bag



Helium Gas Collection Bag



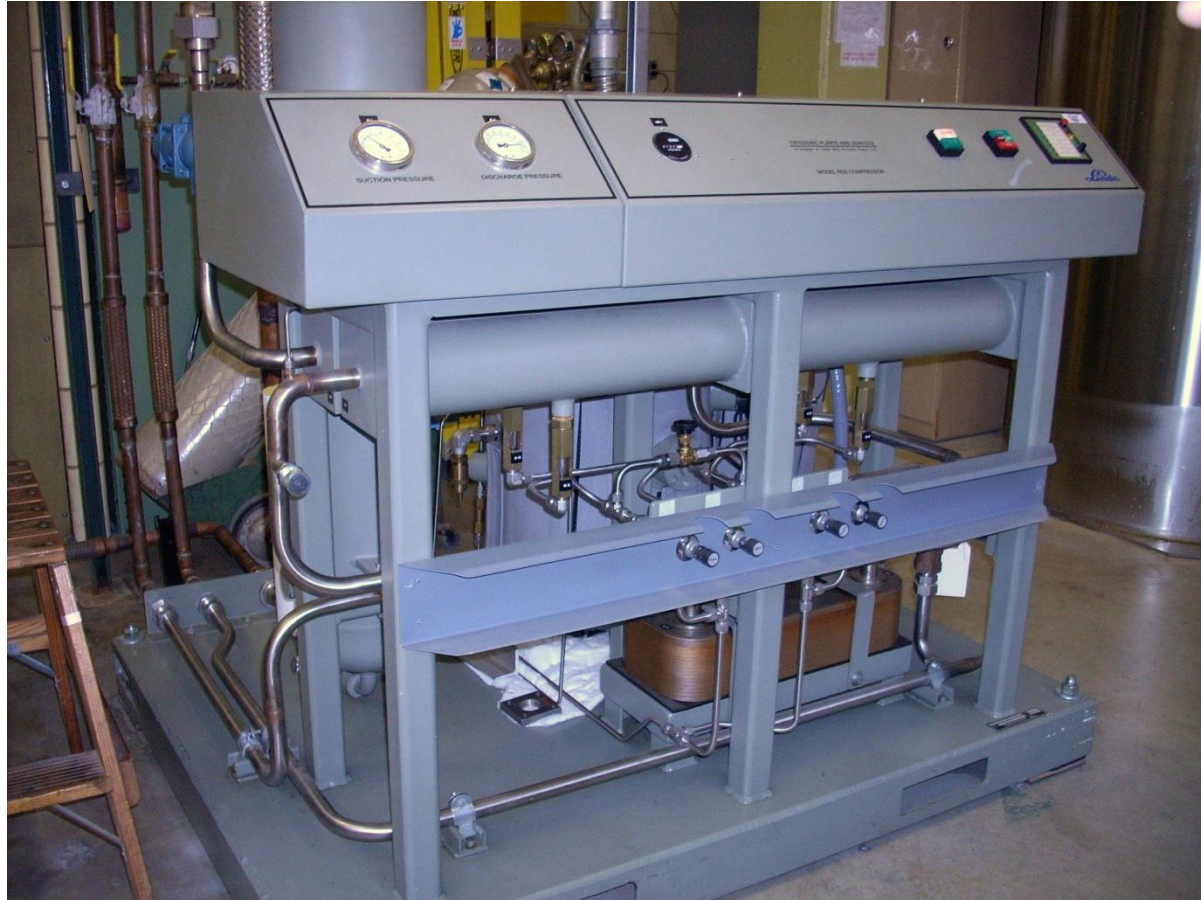
# Recovery Compressor



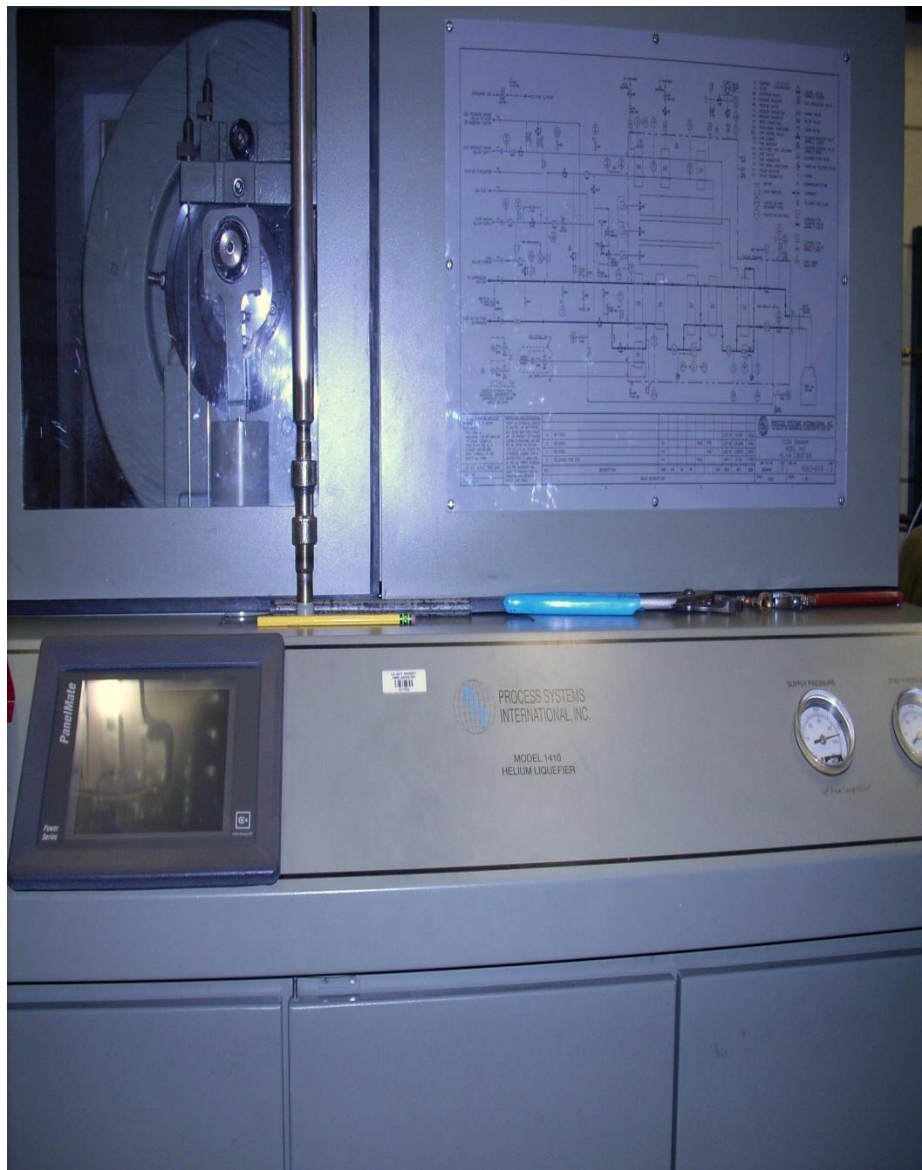
# Holding Tanks – Clean and Dirty He Gas



# RSS Compressor for Liquefier



# Liquefier

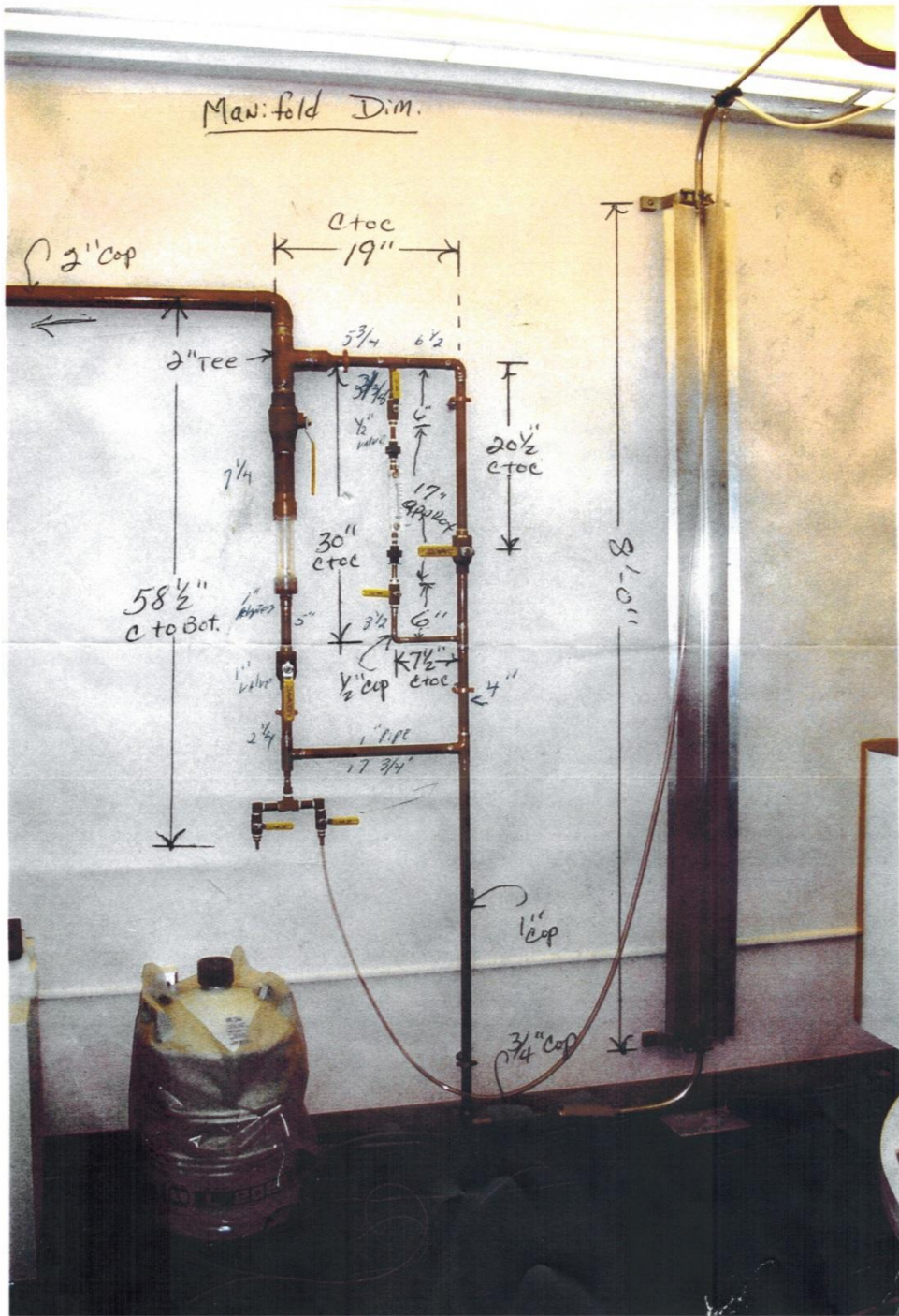




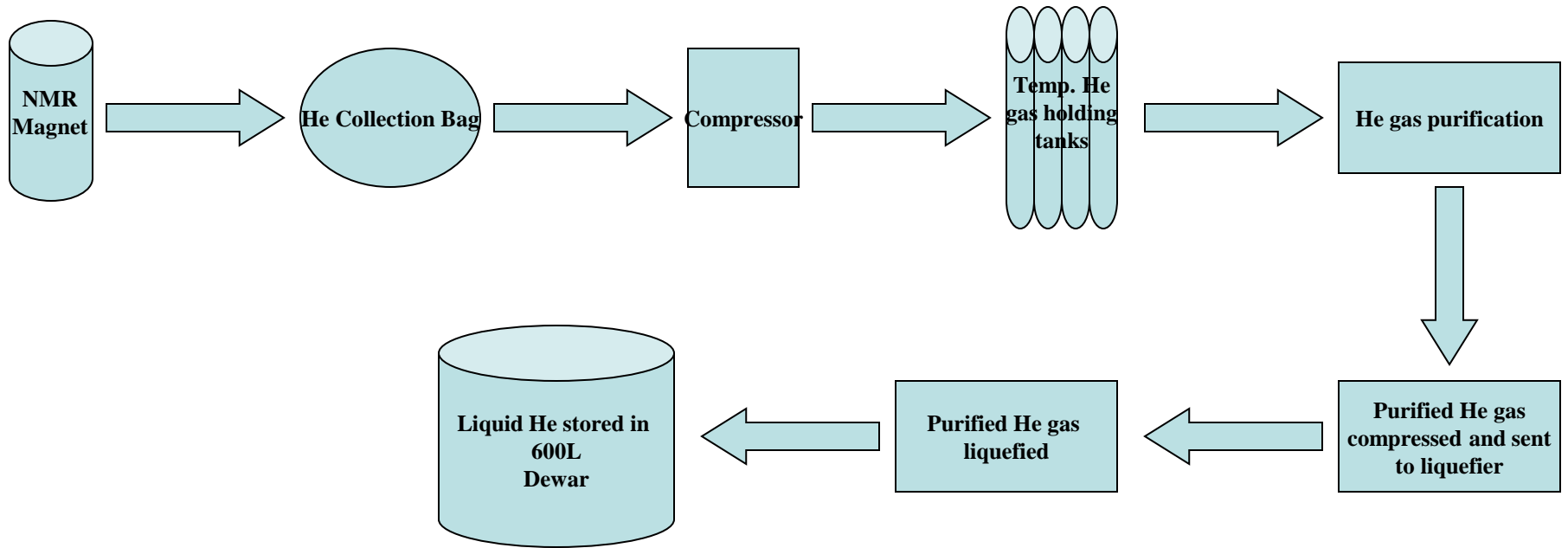
# Final Holding Tank (600L)



# Dimensions of Helium Recovery System at Magnet

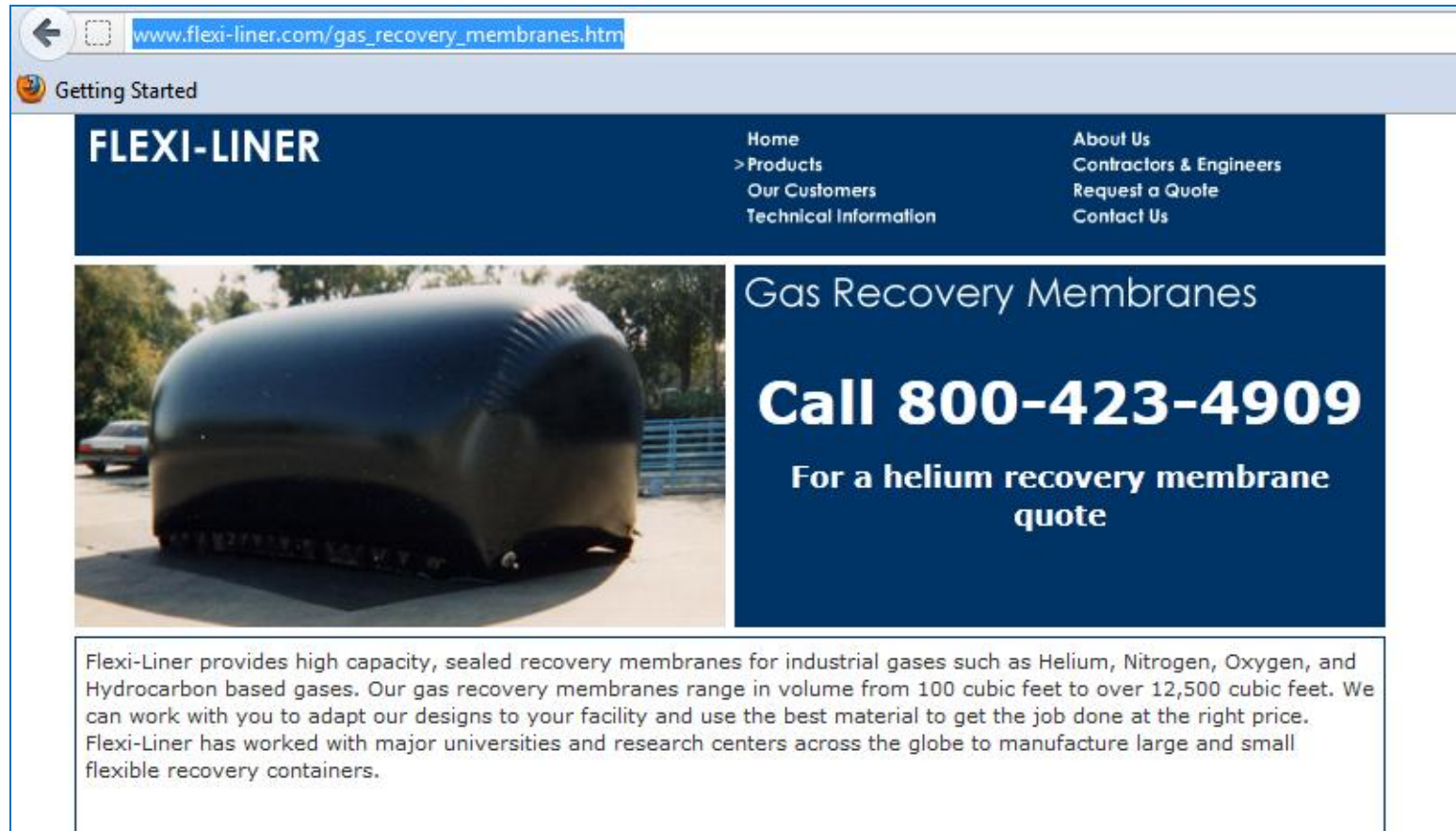


# Total Helium Recovery Pathway



# Helium Storage Bag

- Serves as a volume buffer between a magnet (especially during a fill) and a liquification system
- [http://www.flexi-liner.com/gas\\_recovery\\_membranes.htm](http://www.flexi-liner.com/gas_recovery_membranes.htm)




The screenshot shows a web browser window with the URL [www.flexi-liner.com/gas\\_recovery\\_membranes.htm](http://www.flexi-liner.com/gas_recovery_membranes.htm). The page features a dark blue header with the Flexi-Liner logo and navigation links. Below the header is a large image of a black, flexible gas recovery membrane bag. To the right of the image is a call-to-action box with the text "Gas Recovery Membranes" and "Call 800-423-4909 For a helium recovery membrane quote". Below the image and call-to-action is a paragraph of text describing the company's services.

Getting Started

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Gas Recovery Membranes

**Call 800-423-4909**

For a helium recovery membrane quote

Flexi-Liner provides high capacity, sealed recovery membranes for industrial gases such as Helium, Nitrogen, Oxygen, and Hydrocarbon based gases. Our gas recovery membranes range in volume from 100 cubic feet to over 12,500 cubic feet. We can work with you to adapt our designs to your facility and use the best material to get the job done at the right price. Flexi-Liner has worked with major universities and research centers across the globe to manufacture large and small flexible recovery containers.

# Helium Fun Facts

- A bag of about 12,000 cubic feet is about \$12K
  - The cost is non-linear. A bag twice as big costs less than twice as much. Shapes are customized.
- 1 liter of LHe expands to 26.63 SCF
  - SCF = standard cubic feet ( $P = 1$  atm and 70 degrees F)
- Our new 800 MHz magnet holds about 1000 L, but takes 4500 L to cool down at installation.
- When working with non-scientists, it is good to mention that helium is:
  - Non-toxic, non-flammable, and non-corrosive
  - A lot like nitrogen except lighter
- A purification and liquification system could cost \$300-500K.
  - The facility in our nearby Physics Department is staffed by one full-time employee and runs 24/7 and is down just 2 weeks per year.

# **Substitute for Plume Observation During Helium Fills**

- **A special flow component serves as:**
  - **A check valve to gently allow the one-way exit of helium gas from the magnet on a continuous basis without affecting NMR data**
  - **A flow indicator that shows plainly when the helium Dewar of the magnet is full**
- **Note:**
  - **On earlier slides, this was labeled as a “helium fill monitor”**
  - **It is really a “ping pong ball check valve”**
  - **This is entirely an Iowa State idea!**

# Ping Pong Ball Check Valve

## How It Works



**Beginning of LHe Fill**



**Middle of LHe Fill:  
The ball rises somewhat**

# Ping Pong Ball Check Valve

## How It Works



**End of LHe Fill:**

**The ball rises nearly to the top over a short period of about 2 min**

**What really makes it work:**

**The inner profile of the cylinder is slightly V-shaped; the higher the ball, the faster the flow!**