

# **FERMILAB'S REFRIGERATION MANAGEMENT PROGRAM**

**Protecting Stratospheric Ozone and Reducing  
GHG Emissions**

# FERMI NATIONAL ACCELERATOR LABORATORY



Fermilab is a High Energy Physics lab, and our scientific priorities are shifting gears. The Tevatron is shut down, and the focus is now on the “intensity frontier” (neutrino experiments).



# REFRIGERANTS AT FNAL



- >600 pieces of equipment
  - Chillers and HVAC
    - used for a/c in office buildings, computing centers, vehicles, experiments, etc.
- Only certified technicians obtain gas from FESS Storeroom
  - In-house
  - Contractors
- Gas issued by Refrigerant Manager



# REFRIGERANTS AT FNAL

<u>GAS</u>	<u>GWP</u>	<u>ODP<sup>4,5</sup></u>
• HCFC-22	➤ 1810 <sup>1</sup>	➤ 0.05
• HCFC-123	➤ 77 <sup>5</sup>	➤ 0.02
• HFC-134A	➤ 1300 <sup>2</sup>	➤ 0
• HFC-407C	➤ 1774 <sup>1</sup>	➤ 0
• R-409A	➤ 1585 <sup>3</sup>	➤ 0
• R-410A	➤ 2088 <sup>1</sup>	➤ 0

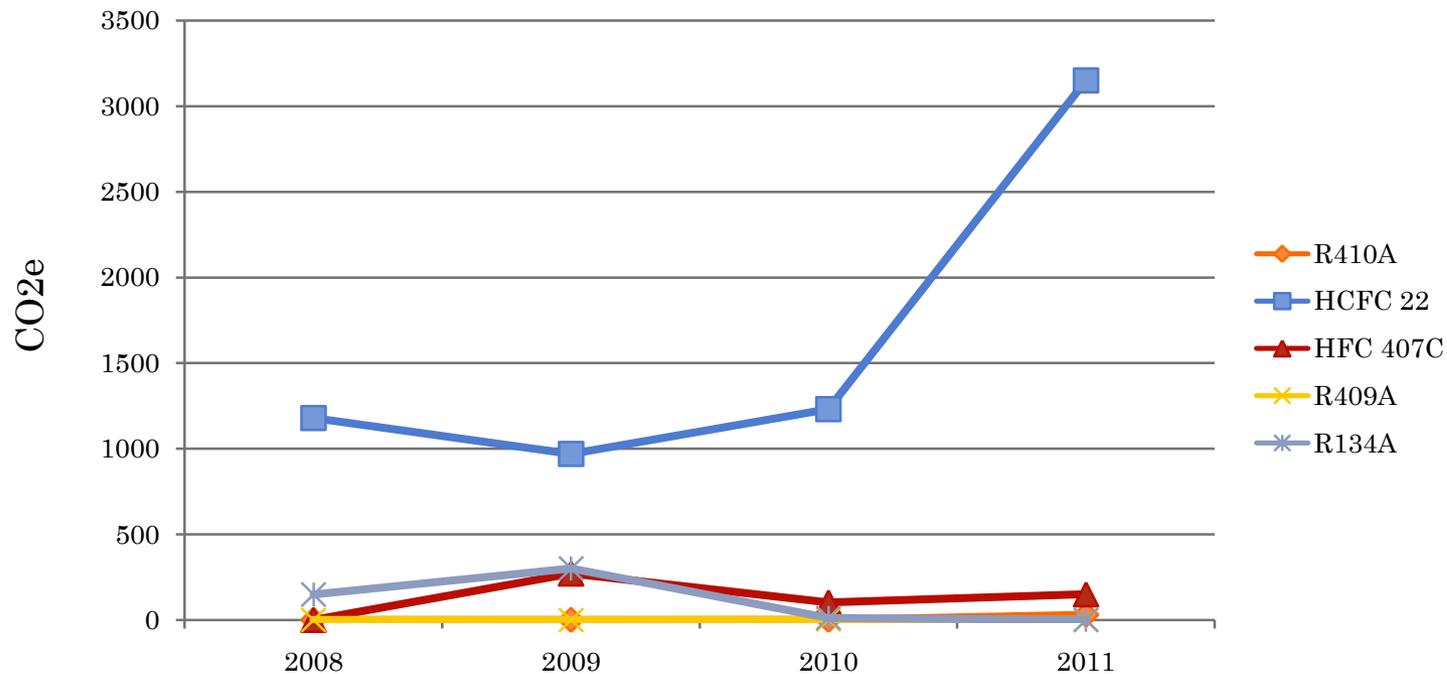


## References

1. GWPs from EPA document "Transitioning to Low GWP Alternatives"
2. Federal Greenhouse Gas Accounting & Reporting Guidance, Technical Support Document
3. <http://www.arkema-inc.com/index.cfm?pag=36>
4. <http://www.epa.gov/ozone/science/ods/classone.html>
5. <http://www.epa.gov/Ozone/science/ods/classtwo.html>

# REFRIGERANT GHG EMISSIONS

- Title IV required phase out of ODS R12
  - ODP = 1
  - GWP = 10890
- Fermilab no longer uses R12, saving ~30k MT CO<sub>2</sub>e emissions since 2008. Currently phasing out HCFC-22 as older equipment is replaced.



# REFRIGERANT MANAGER RESPONSIBILITIES

- Maintain Storeroom inventory
- Maintain database of equipment with charge of  $\geq 50$  lbs
- Ensure certification of technicians
- Maintain refrigerant compliance database
  - Tracks use and releases
- Weigh cylinders at check out and upon return
- Request monitoring plans from D/S for leaky equipment



*Fermilab Refrigerant Manager Pat Marsh weighs a cylinder of refrigerant at the Site 39 Storeroom. Cylinders are accurately weighed at check out and back in to determine how much refrigerant has been used or lost. Photo: Rod Walton*



# RM PROGRAM LIMITS EMISSIONS

- Pick up and return cylinders on same day
  - Techs not allowed to keep cylinders overnight
- Database flags problem equipment (based on 40 CFR 82 leak rates)
- RM notices problems even before the system
- Documentation required for every pound
  - Charging
  - Recovery
  - Leak/Release

Service ID#: _____ Work Order: _____ Date Issued: _____ Completed: _____ Contractor: _____ Technicians: _____	Facility: _____ Location: _____ Appliance ID: _____ Specific Location: _____ Model: _____ Manufacturer: _____ Serial #: _____ Refrigerant Type: _____ Charge: _____																				
<b>Reason for Dispatch</b>																					
<b>Service Description</b> <input type="checkbox"/> Confirmed Charge <input type="checkbox"/> Non-Major Maintenance <input type="checkbox"/> Upgrades Performed <input type="checkbox"/> Major Maintenance <input type="checkbox"/> Isolated Leak <input type="checkbox"/> Refrigerant Conversion Recovery Unit: _____ Vacuum Level: _____ <input type="checkbox"/> 0 <input type="checkbox"/> 10 <input type="checkbox"/> 15 <input type="checkbox"/> 28.2 Inches																					
If disposed unit then complete the following boxes: <input type="checkbox"/> Refrigerant Recovered <input type="checkbox"/> Unit Tagged - "Refrigerant Recovered" <input type="checkbox"/> Recovery Terminated (Air) <input type="checkbox"/> Transferred to Receiver/Condenser, or Pump Out Unit <input type="checkbox"/> Unit Flat at "0" psi Could Not Recover																					
<b>Service Description Notes</b>																					
<b>Refrigerant</b>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">Cylinder ID</th> <th style="width: 25%;">Type</th> <th style="width: 25%;">Condition</th> <th style="width: 25%;">Quantity</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> </tr> <tr> <td colspan="4" style="text-align: right;"><b>Total Recovered:</b></td> </tr> </tbody> </table>	Cylinder ID	Type	Condition	Quantity													<b>Total Recovered:</b>			
Cylinder ID	Type	Condition	Quantity																		
<b>Total Recovered:</b>																					
<b>Added</b>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">Cylinder ID</th> <th style="width: 25%;">Type</th> <th style="width: 25%;">Condition</th> <th style="width: 25%;">Quantity</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> </tr> <tr> <td colspan="4" style="text-align: right;"><b>Total Added:</b></td> </tr> </tbody> </table>	Cylinder ID	Type	Condition	Quantity													<b>Total Added:</b>			
Cylinder ID	Type	Condition	Quantity																		
<b>Total Added:</b>																					
<input type="checkbox"/> Refrigerant Conversion From: _____ To: _____ <input type="checkbox"/> Accidental Release Occurred Estimated Amount Released: _____ Description: _____																					
<b>Leaks</b> <input type="checkbox"/> Leak Found Date: _____ Leak Type: _____ <input type="checkbox"/> Leak Repaired Date: _____ <input type="checkbox"/> Initial Leak Verification Test Date: _____ <i>Test done after repair before charging.</i> Method: _____ <input type="checkbox"/> Follow-up Verification Test Date: _____ <i>Test done with unit running under normal load.</i> Method: _____ <input type="checkbox"/> Leak Audit Date: _____																					
<b>Leak Notes:</b> <i>Exact location of leak and description of how repaired.</i> _____ _____ <input type="checkbox"/> Trace Gas Used Refrigerant: _____ Cylinder ID: _____ Quantity: _____																					
<b>Parts Used</b> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;">Parts #</th> <th style="width: 60%;">Description</th> <th style="width: 30%;">Quantity</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table>		Parts #	Description	Quantity																	
Parts #	Description	Quantity																			
<b>Materials Notes</b> _____ _____ Oil Removed: _____ Oil Type: _____ Drum: _____																					



# MONITORING PLAN EXAMPLE

- D0 chiller
  - Back up chiller used to cool experiment during hot months
- RM noticed frequent requests for R22.
  - Leak rate not exceeded
  - Attempting to “limp along” to the end of the summer
- RM requested a monitoring plan
  - Plan includes
    - logging compressor pressures once per shift
    - Take action if pressure decreases 10 psig
    - Engineer review logs 2x/mo.
    - Leak check 1x/mo.



# RM PROGRAM LIMITS EMISSIONS

- RM Program helps FNAL comply with 40 CFR 82 – Protection of the Stratospheric Ozone
- Coincidentally helps us limit GHG emissions

