
Stationary Source High-Global Warming Potential (GWP) Refrigerant Management Program

Public Workshops
California Air Resources Board

Fresno, CA, September 8, 2008
El Monte, CA, September 12, 2008
Sacramento, CA, September 15, 2008

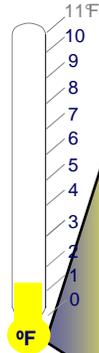
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Agenda

- Background Information
 - Climate Change
 - California Global Solutions Act of 2006 (AB 32)
 - Stationary Source High-GWP GHG Sector Overview
 - Stationary Source High-GWP Refrigerant Management Program
 - Preliminary emissions estimates
 - Affected equipment and facilities
 - Proposed Requirements
 - Technical and policy issues
 - Timeline
 - Q & A
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California Climate Impacts (over the past 100 years)



1.3 °F higher temperatures

~7 inch sea level rise

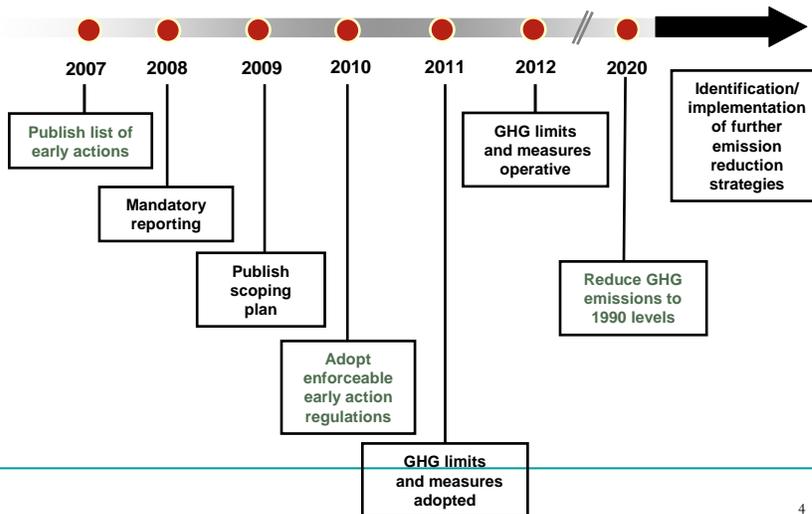
12% decrease in fraction of runoff between April and July

Snowmelt and spring blooms advanced 2 days/decade since 1955

4-fold increase in wildfire frequency (over 34 years)

Cal/EPA-OEHHA, "Environmental Protection Indicators for California" (2002), www.oehha.ca.gov/multimedia/epic/Epicreport.html
 Westerling et al., "Warming and Earlier Spring Increase Western U.S. Forest Wildfire Activity", *Science* (2006)³

California Global Warming Solutions Act of 2006 (AB 32)



Reductions Required by AB32

- ~170 MMTCO₂E emission reductions by 2020
- 1 MMTCO₂E = Annual emissions from 216,000 passenger cars or electricity used by 193,000 average CA households
- 44 Early Action Measures approved by Air Resource Board

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Stationary Source High-GWP GHG Sector Overview

- **What Are High-Global Warming Potential (GWP) Greenhouse Gases (GHGs)?**
 - Gases that may cause many times more global warming than equivalent weight of carbon dioxide (CO₂)
 - Kyoto Protocol Gases
 - Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), Sulfur hexafluoride (SF₆)
 - Montreal Protocol Gases -
 - Class I and II Ozone Depleting Substances (ODSs): Chlorofluorocarbons (CFCs), Hydrochlorofluorocarbons (HCFCs), Halons, *et al.*
 - Other High-GWP GHGs - controlled neither by Kyoto nor Montreal Protocols
 - Nitrogen trifluoride (NF₃), Hydrofluoroethers (HFEs), Perfluoropolyethers (PFPEs)

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GWP of Kyoto and Non-Kyoto* Gases

GHG/Class	Global Warming Potential
Carbon Dioxide (CO ₂)	1
Methane (CH ₄)	21
Nitrous Oxide (N ₂ O)	310
Hydrofluorocarbons (HFCs)	140 to 11,700
Perfluorocarbons (PFCs)	6,500 to 9,200
Sulfur hexafluoride (SF ₆)	23,900
Chlorofluorocarbons (CFCs)*	3,800 to 8,100
Hydrochlorofluorocarbons (HCFCs)*	90 to 1,800
Halons*	5,400
Ammonia	Not Applicable

HFCs, CFCs, and HCFCs are commonly used as refrigerants and the gases most applicable to the Refrigerant Management Program.

Source: 100-year global warming potentials (relative to CO₂) from IPCC 2nd Assessment Report (1996)

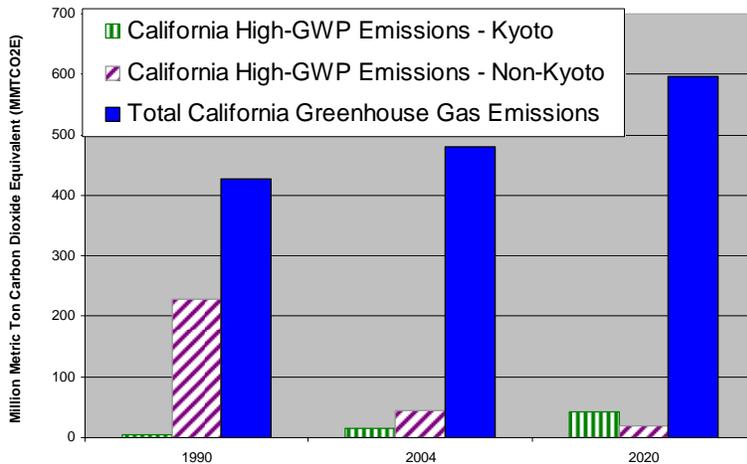
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How Are High-GWP GHGs Accounted For Under AB 32?

- Kyoto Gases are Directly Included in 1990 Baseline and 2020 Target
- Several Non-Kyoto Gases With Climate Impacts Are Not In The Baseline
 - Are being evaluated for mitigation

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California High-GWP GHG Emissions



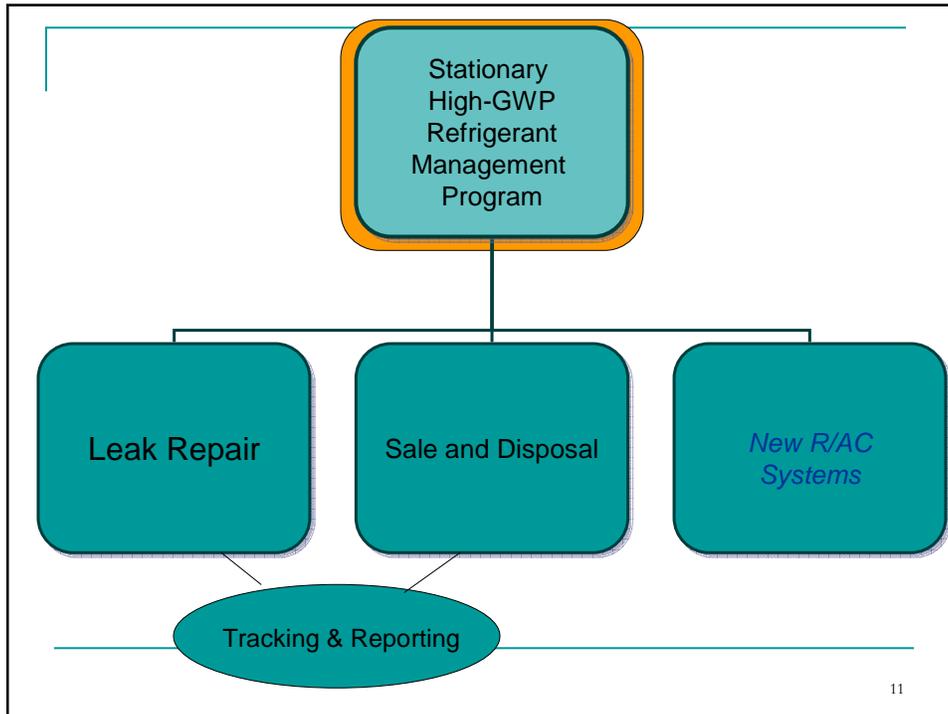
Source: US EPA Vintaging Model

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Refrigerant Management Program Rulemaking Process

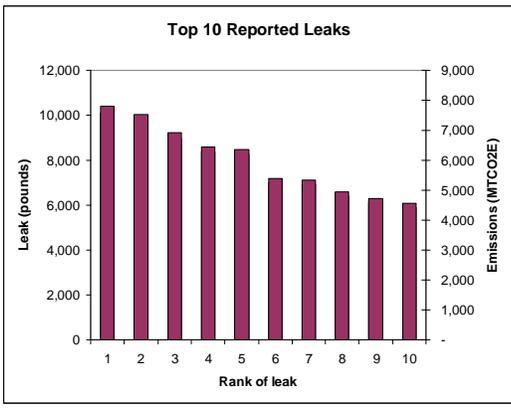
Items in Progress or Completed to Date	
Identified Major Stakeholders & Established Working Group	February 2008
Held Two Technical Working Group Meetings	April – July 2008
Held Stakeholder Consultation Meetings	April – August 2008
Developed and Updated Draft Proposal	July – Sept. 2008
Currently Conducting Public Workshops	September 2008
Items Remaining to be Completed	
Release Staff Report	December 2008
Hearing Notice	December 2008
Board Hearing and Adoption	January 2009
Post Board Adoption Effort	Throughout 2009

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Summary of Need and Benefit of Refrigerant Management Program

- Total California emissions from stationary refrigeration and air conditioning expected to grow to over 35 MMTCO₂E by 2020
- Refrigerant leak rates can exceed 100% percent annually (2.7%)
- A single significant leaking system can contribute over 7,000 MTCO₂E annually
- Reduction in direct refrigerant emissions.
- Reduced refrigerant expenditures resulting from repaired leaks



Data source: South Coast Air Quality Management District, Rule 1415 reporting.

Preliminary Emissions Estimates BAU Projections for California

	2007 (MMTCO ₂ E)	2020 (MMTCO ₂ E)
High GWP emissions	57	61
Stationary refrigeration/AC emissions (ODS + HFCs)	30	35

Based on US EPA Vintaging Model

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Existing Controls

- Refrigerants have some restrictions under U.S. Clean Air Act and SCAQMD Rule 1415
 - No intentional venting during service and disposal
 - Leak repair
 - Technician certification
 - Recycling/recovery
 - *difficult to enforce*
 - *market disincentives*

* *Current restrictions apply to ozone depleting substances only; they do not apply to HFCs*

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International Models

- EU F-gas Regulations
 - HFCs, PFCs, SF₆
 - Containment, recovery, technician certification, labeling, reporting
 - Ban of non-refillable (one-way) refrigerant cylinders

- Japan
 - ODS recovery/disposal from R/AC systems
 - Technician certification

- Australia/Canada
 - Ban of non-refillable (one-way) refrigerant cylinders

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International Models Refrigerant Fee Programs

COUNTRY	AUSTRALIA	NEW ZEALAND	CANADA	NORWAY	SWEDEN
Refrigerants accepted	CFCs, HCFCs, HFCs, PFCs	CFCs and HCFCs	CFCs and HCFCs	CFCs and HCFCs	CFCs, HCFCs, HFCs
Fate of refrigerant	Destroyed	Destroyed	Destroyed	Destroyed or reclaimed	Destroyed or reclaimed
Fee structure	Importers and wholesalers pay fee on import and sale	Wholesalers pay fee on import	Importers, reclaimers, producers pay sales and reclaim fee	Importers, reclaimers, producers pay sales fee	Importers, reclaimers pay sales fee

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Goal: Minimize emissions of high GWP refrigerants* from stationary refrigeration and air conditioning equipment through:

- Leak test and repair
- Best practices for installation and servicing
- Sale restrictions
- Safe disposal
- Reporting by facilities and refrigerant reclaimers, distributors, and wholesalers

Builds on Federal 608 program and SCAQMD Rule 1415

****CFCs, HCFCs, HFCs, PFCs***

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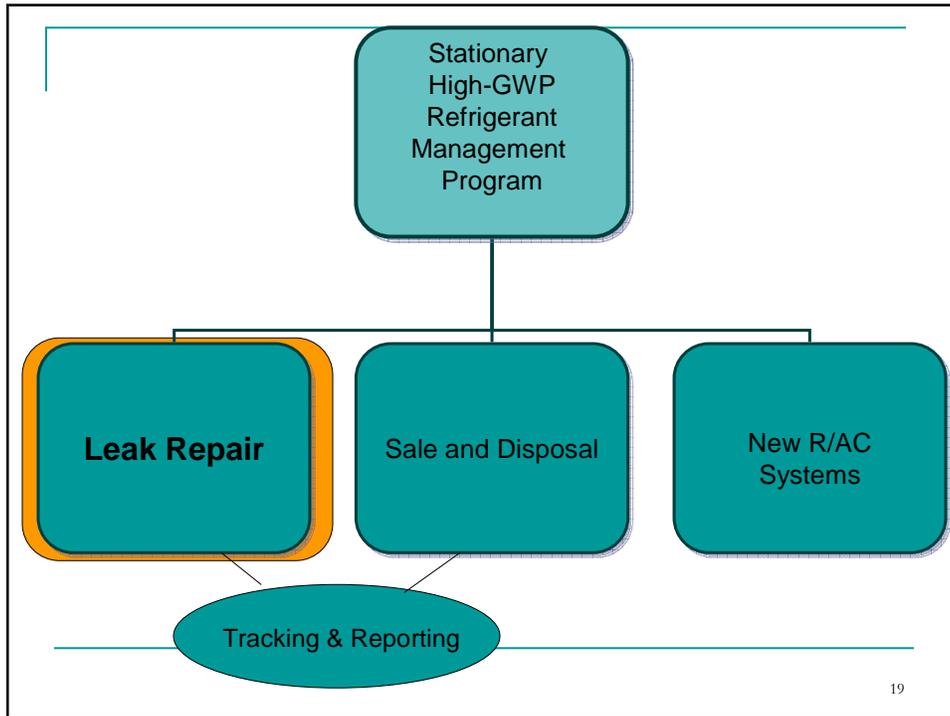
Estimated CO₂ Equivalent Emissions from Facilities

Estimated CO₂E emissions from Refrigeration and A/C Equipment in CA

Equipment size	Estimated emissions (MMTCO₂E)	Est. facility #
50 - 200 lbs	~ 6	~ 108,000
200 - 2,000 lbs	~ 15	~ 63,000
≥ 2,000 lbs	~ 10	~ 9,000

Preliminary emissions estimates obtained from data provided by the South Coast Air Quality Management District

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Leak Repair: focus on large equipment, e.g.,

- Commercial building chillers & rooftop units
- Supermarket systems
- Industrial process refrigeration

A photograph of a large, teal-colored industrial chiller unit with various pipes and a control panel.

A photograph of a large, grey rooftop HVAC unit with vertical louvers.

A photograph of a refrigerated display case in a supermarket, filled with various packaged goods.

A photograph of an industrial refrigeration system with blue panels and various pipes in a facility.

A photograph of industrial process refrigeration equipment in a large, open industrial space.

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Facility Types Potentially Required to Register (Approx # CA)

- Cold storage warehouses (n ~ 5,300)
- Food preparation/processing/service (n ~ 5,200)
- Grocery stores/supermarkets (n ~ 3,400)
- Office, commercial, and industrial buildings
- Hospitals and other medical facilities
- Military bases
- Institutions (schools, universities, laboratories, etc) (n ~ 10,000)
- Hotels, recreational facilities, etc (n ~ 10,000)
- Process cooling (n ~ 16,000)

*Facilities using ammonia based refrigeration systems are not impacted
Agricultural facilities are included in cold storage warehouses and food
preparation/processing/service categories*

Facilities without an estimated number are still under review

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Facilities Types Not Required to Register

- Any facility using a refrigerant that is not a high-GWP GHG (Ammonia, CO₂)
- Smaller sized office, commercial, industrial, and institutional buildings, and hotels with centralized air-conditioning (~ less than 5,000 square feet)
- Small bars and restaurants with no walk-in refrigeration
- Small stores, restaurants, or bars using only stand-alone refrigerated cases and vending machines
- Residences

Facility types and characteristics listed are broad examples only. Contact the system manufacturer to determine if the refrigerant charge is 50 pounds or greater.

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Facilities with Large Refrigeration or Air-Conditioning Systems - 2000 Pounds Refrigerant or Greater

Example Facilities:

- Processes cooling/manufacturing
- Cold storage warehouses
- Food preparation/processing/service
- Grocery stores/supermarkets
- Large office, commercial, industrial, and institutional buildings, and hotels with centralized air-conditioning

Proposed Requirements:

□ Facility Registration

- Registration providing facility and equipment information by January 2010
- Payment of any required enforcement agency fees

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Facilities with Large Refrigeration or Air-Conditioning Systems - 2000 Pounds Refrigerant or Greater

Proposed Requirements (Continued):

■ Leak Detection and Monitoring

- Automatic leak detection with annual audit/calibration

■ Leak Repair

- Repair leaks within 14 days of detection
- Greater than 14 days if certified technician or parts not available, or retrofit plan approved by enforcing agency
- Initial repair verification test upon completion of repair
- Follow-up verification test within 30 days
- System retirement or retrofit required if verification test fails after three successive attempts of leak repair

Leak repair requirements become effective for all refrigeration and air-conditioning systems with a refrigerant charge of 50 pounds or greater upon effective date of the regulation.

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Facilities with Large Refrigeration or Air-Conditioning Systems - 2000 Pounds Refrigerant or Greater

Proposed Requirements (Continued):

- **System Retirement and Retrofit**
 - Plan required for leaking system (failure of verification tests); plan describes proposed replacement/retrofit
 - Plan must be approved by enforcing agency
 - Retirement/retrofit required within 6-months
 - Approved in 30 days if no response from enforcing agency

System retirement and retrofit requirements become effective for all refrigeration and air-conditioning systems with a refrigerant charge of 50 pounds or greater upon effective date of the regulation.

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Facilities with Large Refrigeration or Air-Conditioning Systems - 2000 Pounds Refrigerant or Greater

Proposed Requirements (Continued):

- **Reporting and Recordkeeping**
 - Annual reports due 60 days after the end of the calendar year, starting after 2010
 - Service and refrigerant leak repairs requiring additional refrigerant charge greater than 1% of the system's full charge;
 - Report annually all refrigerant purchases and shipments for refrigerant reclamation or destruction; and
 - Keep records for at least 5 years of system reports, service, leaks, and repairs.

Recordkeeping requirements become effective for all refrigeration and air-conditioning systems with a refrigerant charge of 50 pounds or greater upon effective date of the regulation.

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Facilities with Refrigeration or Air-Conditioning Systems – between 200 and 2000 Pounds Refrigerant

Example Facilities:

- Medium sized office, commercial, industrial, and institutional buildings, and hotels with centralized air-conditioning (~ Greater than 20,000 square feet)

Proposed Requirements:

- **Facility Registration**
 - Registration providing facility and equipment information by January 2012
 - Payment of any required enforcement agency fees
 - **Leak Detection and Monitoring**
 - Quarterly leak inspection
-

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Facilities with Refrigeration or Air-Conditioning Systems – between 200 and 2000 Pounds Refrigerant

Proposed Requirements: (Continued)

- **Reporting**
 - Annual reports due 60 days after the end of the calendar year, starting after 2012
 - Information reported is same as reported for systems 2000 pounds or greater
 - **Leak Repair, System Retirement and Retrofit, and Recordkeeping**
 - Same requirements as systems 2000 pounds or greater
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Facilities with Refrigeration or Air-Conditioning Systems – between 50 and 200 Pounds Refrigerant

Example Facilities:

- Smaller sized office, commercial, industrial, and institutional buildings, and hotels with centralized air-conditioning (~ less than 20,000 square feet)
- Facilities with large walk-in refrigerators
- Medium sized food retail establishments (pharmacies, minimarts, convenience stores, etc.)

Proposed Requirements:

- **Facility Registration**
 - Registration providing facility and equipment information by January 2014
 - Payment of any required enforcement agency fees
- **Leak Detection and Monitoring**
 - Annual leak inspection

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Facilities with Refrigeration or Air-Conditioning Systems – between 50 and 200 Pounds Refrigerant

Proposed Requirements: (Continued)

- **Reporting**
 - Annual reports due 60 days after the end of the calendar year, starting after 2014
 - Information reported is same as reported for systems 2000 pounds or greater
- **Leak Repair, System Retirement and Retrofit, and Recordkeeping**
 - Same requirements as systems 2000 pounds or greater

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Facilities with Refrigeration and Air-Conditioning Systems – All Systems 50 Pounds Refrigerant or Greater

- **Proposed Required Service Practices:**
 - Must not intentionally disrupt refrigeration circuit.
 - Must make refrigerant recovery attempt prior to opening system to atmosphere.
 - Must recover refrigerant using approved equipment and procedures.
 - Must evacuate and dispose of refrigerants in accordance with Federal regulations.
 - Must use EPA-approved refrigerant.
 - Must not add refrigerant without repair attempt (topping off).

Proposed service practices requirements become effective for all refrigeration and air-conditioning systems with a refrigerant charge of 50 pounds or greater upon effective date of the regulation

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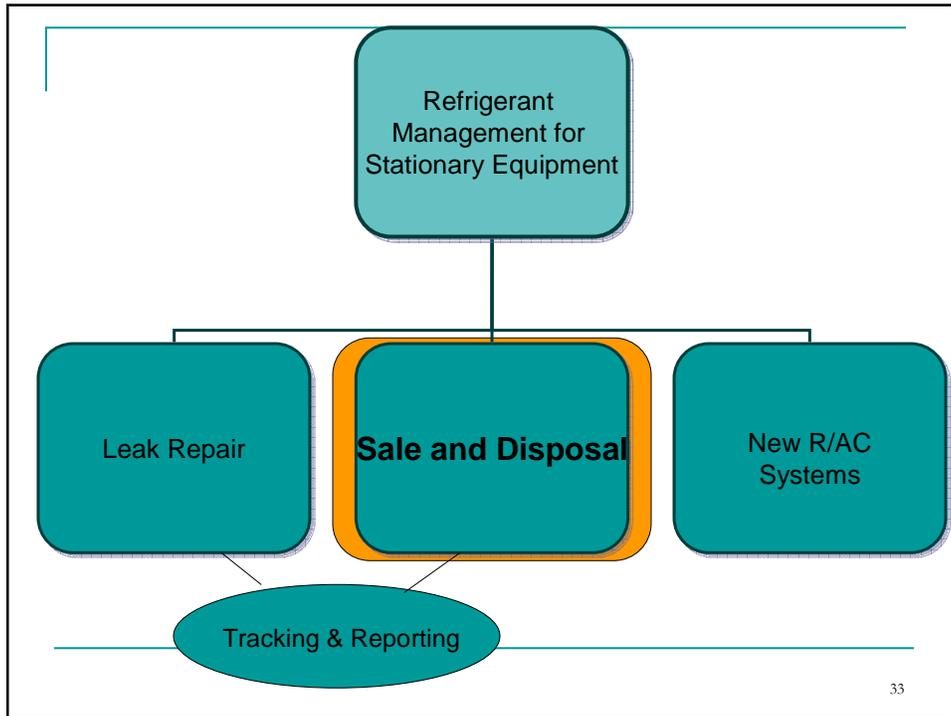
Example Leak Repair Cost

- Average Refrigeration Charge Size -- 200 to 2000 Pounds.
- Example Leak Rate Prior to Repair -- 30%
- Refrigerant Cost -- \$7/lbs.

	Small	Large
Refrigeration System Charge Size (lbs.)	200	2,000
Refrigerant Leak Rate	30%	30%
Total Annual Refrigerant Lost (lbs.)	60	600
Total Annual Refrigerant Cost (\$7/lbs.)	\$420	\$4,200
Estimated Repair Costs	\$1,500	\$3,000
Estimated Payback Period (years)	3.6	0.7

Analysis includes cost of common repairs and refrigerant only. Administrative, registration, or other costs associated with proposed rule are not included.

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Refrigerant Sale & Disposal

End-of-Life Emissions

- HCFC-22 refrigerant reclaimed in the U.S. is ~<3%
- “Empty” cylinders are not empty
- Lack of economic incentive to recover and return gas

Facilities & Certified Technicians

■ Required Services Practices

- Refrigerant recovery using approved recovery/ recycling equipment.
 - Refrigerant recycling to same equipment or to other equipment owned by same person.
- Service of refrigeration or air-conditioning systems consistent with US EPA certification.

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Refrigerant Wholesalers & Distributors

■ Required Services Practices

- Sell of refrigerant cylinder only if:
 - Refrigerant is in refillable cylinder, or
 - Refrigerant is in a non-refillable cylinder and a deposit of \$35 is collected
 - Receipt provided with deposit separately identified
- Must accept empty cylinders provided with receipt and return deposit
- Refrigerant recovery from returned cylinders using approved recovery/recycling equipment

Sale of refrigerant is not for specifically for stationary or motor vehicle air-conditioning service, so required service practices applies to all sales of refrigerant.

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Refrigerant Wholesalers & Distributors, and Reclaimers

■ Prohibitions

- No sale or distribution in a container greater than 2 pounds to a person unless:
 - The buyer is certified by US EPA
 - Refrigerant is sold only for:
 - Resale to certified technicians
 - Resale to refrigeration or air-conditioning appliance manufacturers
 - Reclamation
 - Refrigerant is contained in a refrigeration or air-conditioning system or other appliance.
- No sale of refrigerant unless it is approved by US EPA under SNAP Program
- No cylinder disposal unless facility evacuates under vacuum
- No refill or modification to allow refill of non-refillable cylinder

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Refrigerant Wholesalers & Distributors, and Certified Technicians

■ Prohibitions - continued

- No re-sale of refrigerant to a new owner unless reclaimed
- No sales unless US EPA approved refrigerant under SNAP program
- No sales of recovery or recycling equipment not meeting AHRI Standard 740 requirements
- No intentional disruption of refrigerant circuit unless an attempt to recover refrigerant
- No disposal of a cylinder unless disposal or recycling facility evacuates the cylinder

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Refrigerant Wholesalers & Distributors

■ Reporting & Recordkeeping

- Report total refrigerant shipped to service technicians/contractors
- Report total refrigerant shipped to service reclaimer
- Report total cylinders accepted for deposit and total deposit paid
- Recordkeeping – 5 years

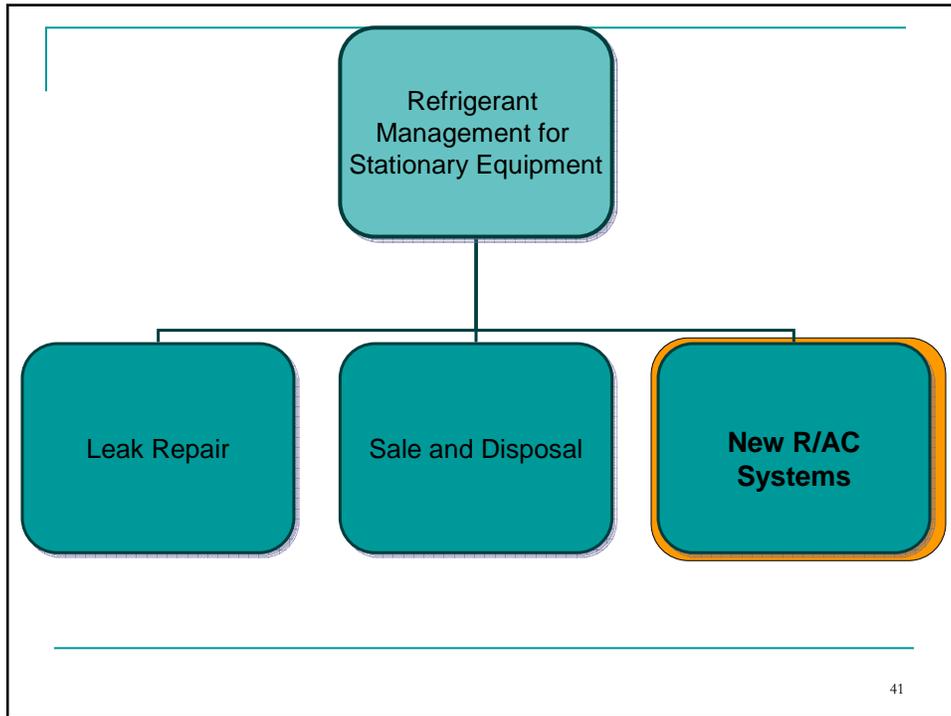
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Refrigerant Reclaimers

■ Reporting & Recordkeeping

- Report total refrigerant collected for reclamation
- Report total refrigerant collected for destruction
- Report total refrigerant reclaimed
- Report total refrigerant destroyed
- Report refrigerant received by a certified technician/contractor
- Report total cylinders accepted for deposit and total deposit paid
- Recordkeeping – 5 years

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Specifications for New Commercial/Industrial Refrigeration Systems

- New systems specifications will be coordinated with the California Energy Commission's anticipated 2011 Update of Building Standards Code (Title 24).

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Refrigerant Management Program Requirements Comparison

	US EPA Rule 608	SCAQMD Rule 1415	Refrigerant Management Program
Facility Rule Applicability	50 pounds or greater of ODS	51 pounds or greater of ODS	50 pounds or greater of high-GWP refrigerant (ODS, HFCs, PFCs)
Facility Registration	Not Applicable	Biennial registration - \$109	Registration fee - amount not yet determined
Leak Detection & Monitoring	Annual Monitoring	Class I ODS – Annual Audit by certified Technician Class II ODS Maintenance by certified technician	Based on refrigerant charge size – <ul style="list-style-type: none"> • Automatic leak detection • Quarterly • Annually Upon use for non-continuous use systems

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Refrigerant Management Program Requirements Comparison (Continued)

	US EPA Rule 608	SCAQMD Rule 1415	Refrigerant Management Program
Leak Repair	Repair within 30 days if: <ul style="list-style-type: none"> • 35% leak rate commercial/industrial refrigeration • 20% leak rate comfort cooling Requires certified technician Time extension for repairs – parts not available or delay due to local laws	Repair within 14 days for any leak No time extension for repairs Requires certified technician	Repair within 14 days for any leak Time extension for repairs - parts or certified technician not available Requires certified technician

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Refrigerant Management Program

Requirements Comparison (Continued)

	US EPA Rule 608	SCAQMD Rule 1415	Refrigerant Management Program
Retrofit & Retirement Plan	Required within 30 days of exceeding specified leak rate – completed within 12 months	Not Applicable	Required after three unsuccessful repair attempts – completed within 6 months Approved by enforcing agency
Required Service Practices	No intentional venting No disruption of refrigerant circuit without refrigerant recovery with approved equipment	No intentional venting No disruption of refrigerant circuit without refrigerant recovery with approved equipment	No intentional venting No disruption of refrigerant circuit without refrigerant recovery with approved equipment No "topping off" without repair attempt

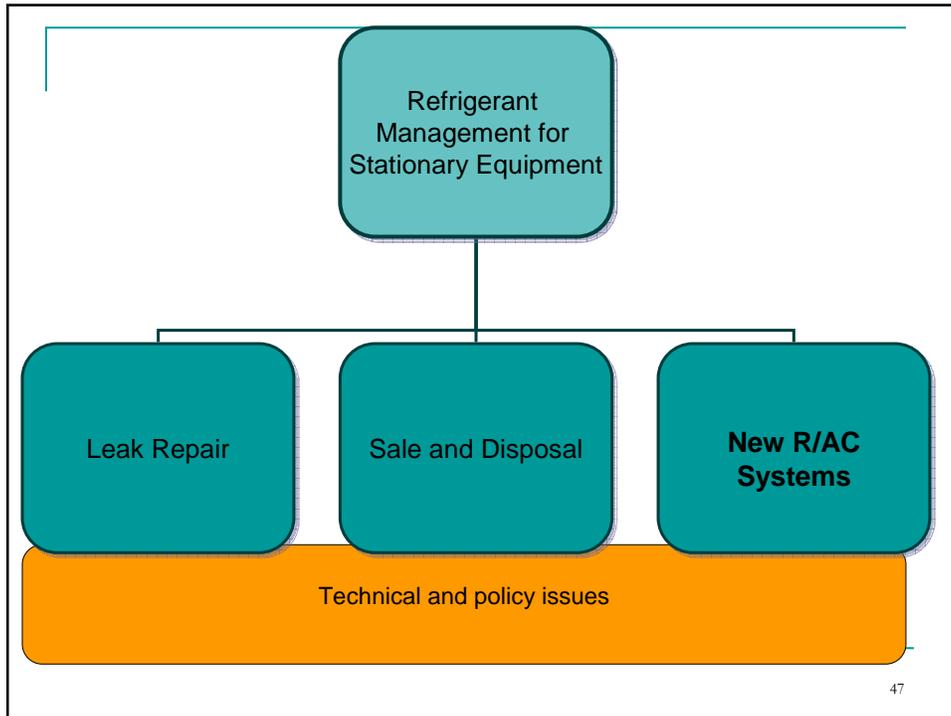
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Refrigerant Management Program

Requirements Comparison (Continued)

	US EPA Rule 608	SCAQMD Rule 1415	Refrigerant Management Program
Facility Reporting and Recordkeeping	Recordkeeping only	Biennial reporting Recordkeeping for 3 years	Annual reporting Recordkeeping for 5 years
Refrigerant Use, Sale & Disposal	ODS sales restricted to certified technicians Reclamation required for sale to new owner	ODS sales restricted to certified technicians Reclamation required for sale to new owner	High-GWP refrigerant sales restricted to certified technicians Refrigerant must be sold in a refillable cylinder or a non-refillable cylinder with deposit Reclamation required for sale to new owner
Wholesalers, Distributors, and Reclaimers Reporting	Recordkeeping only	Recordkeeping only	Annual reporting

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- ## Rule Implementation Options Considered
- **Statewide Rule –**
 - ARB registration and fee collection with district enforcement
 - ARB enforcement in non-adopting districts
 - **Statewide Rule –**
 - Districts adopt rule – registration, fee collection, and enforcement
 - ARB registration, fee collection, and enforcement in non-adopting districts
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Rule Development – Next Steps

<i>ARB Receives Stakeholder & Public Comments</i>	<i>September 22, 2008</i>
Release Staff Report	December 2008
Hearing Notice	December 2008
Board Hearing and Adoption	January 2009
Post Board Adoption Effort	Throughout 2009

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Outstanding Policy Issues

- Mitigation Fee
 - Consideration of high-GWP mitigation fee to encourage market change
- Integration with refrigerant sales for motor vehicle air conditioning
- Available data to improve facility inventory
- Available data for to improve cost estimates for leak monitoring and detection, leak repair, and reporting
- Methods to outreach to inform all potentially impacted industries or individuals

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Contact Info

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