Responsible Appliance Disposal Program

RAD

EPA

2009 Annual Report

Recover

Recycle

Reclaim

Recover Recycle Reclaim

EPA's Responsible Appliance Disposal (RAD) Program is a voluntary partnership program that began in October 2006 to help protect the ozone layer and reduce emissions of greenhouse gases. The RAD Program recognizes partners that ensure the disposal of refrigerant-containing appliances using the best environmental practices available. The RAD Program invites utilities, retailers, manufacturers, state and local governments, universities, and other qualifying organizations to become partners.

Overview

Through the RAD Program, partners reduce emissions of ozone-depleting substances (ODS) and greenhouse gases (GHGs) by recovering appliance foam and refrigerant. They also prevent the release of hazardous materials, as well as save landfill space and energy by recycling durable materials (eliminating the need to produce virgin materials). RAD partners achieve these benefits by using best practices to dispose of appliances; namely, they ensure that:

- Refrigerant is recovered and reclaimed or destroyed;
- Insulation foam is recovered and destroyed, or the blowing agent is recovered and reclaimed;
- Metals, plastic, and glass are recycled; and
- Polychlorinated biphenyls (PCBs), mercury, and used oil are recovered and properly disposed of.

In addition, certain RAD partners also reduce energy consumption by encouraging appliance owners to permanently retire old, inefficient units. For example, many utility partners offer a monetary reward for the pick-up of old, working refrigerators.

This annual report presents the RAD Program environmental benefits for 2009.

The Need for the RAD Program

EPA estimates that 9 million refrigerators and freezers, 4.5 million window air-conditioning units, and 800 thousand dehumidifiers were disposed of in the United States in 2009.

Because these appliances contain ozone-depleting substances (ODS), greenhouse gases (GHGs), hazardous substances, and recyclable materials, their proper disposal is critical for environmental and human health. Prior to disposal or recycling of appliances, federal law requires that (1) all refrigerant be recovered, and (2) universal waste (e.g., mercury), used oil, and PCBs be properly managed and stored. However, the laws do not require the recovery of appliance foam, which represents a significant source of ODS and GHG emissions.

Characteristics of Gases Used as Refrigerants and Foam-Blowing Agents in Appliances Reaching End-of-Life

Compound	Global Warming Potential (GWP)*	Ozone Depletion Potential (ODP)	Predominant Use in Appliances
CFC-11	4,750	1	Foam
CFC-12	10,900	1	Refrigerant
HCFC-22	1,810	0.055	Refrigerant
HCFC-141b	725	0.11	Foam
HFC-134a	1,430	0	Refrigerant

* GWP calculations are based on the 100-year direct GWPs provided in the Intergovernmental Panel on Climate Change Fourth Assessment Report (2007). GWP values are relative to CO_2, which has a GWP of 1.

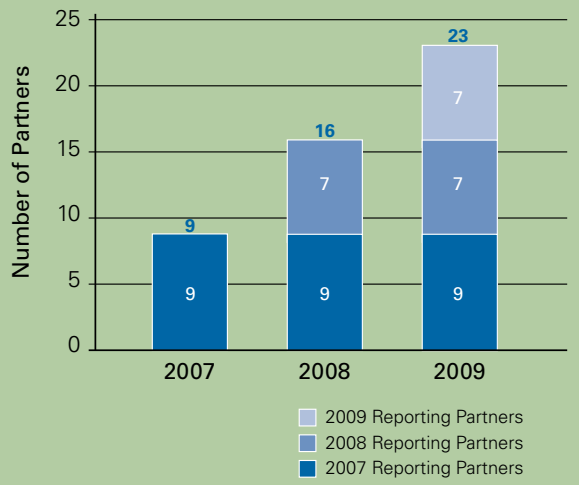
RAD Partners

Twenty-three partners reported their accomplishments for the RAD Program from January 1, 2009 through December 31, 2009:

- American Electric Power (OH)
- Austin Energy (TX)
- Baltimore Gas and Electric Company (MD)
- City of Burbank Water & Power (CA)
- City of Palo Alto Utilities (CA)
- Commonwealth Edison (IL)
- Dayton Power & Light Company (OH)
- City of Fort Collins Utilities (CO)
- Energy Trust of Oregon (OR)
- Georgia Power (GA)
- Nebraska Public Power District (NE)
- NV Energy (NV)
- Pacific Gas & Electric Company (CA)
- PacifiCorp (ID, UT, WA)
- PNM (NM)
- Sacramento Municipal Utility District (CA)
- Salt River Project (AZ)
- San Diego Gas & Electric (CA)
- Sears Home Services (Nationwide)
- Snohomish County Public Utility District No. 1 (WA)
- Southern California Edison (CA)
- Wisconsin Public Service (WI)
- WPPI Energy (WI)

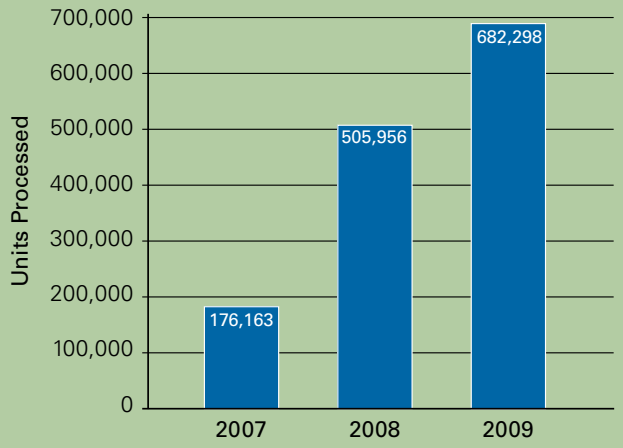
Program Growth

In the RAD Program's first three years, it has grown from having nine to 23 partners.



> *Sears Holdings' participation in EPA's RAD Program is a demonstration of our commitment to the environment and our customers. Sears Home Services has long been a champion of energy-efficient appliances and we're proud to be a RAD partner and promote both responsible appliance use and disposal.*
>
> - Stu Reed, SVP & President, Sears Home Services

Total Number of Refrigerant-Containing Appliances Processed by RAD Partners, 2007–2009



Results

In 2009, the RAD Program's 23 partners collected and processed a total of 682,298 refrigerant-containing appliances, including:

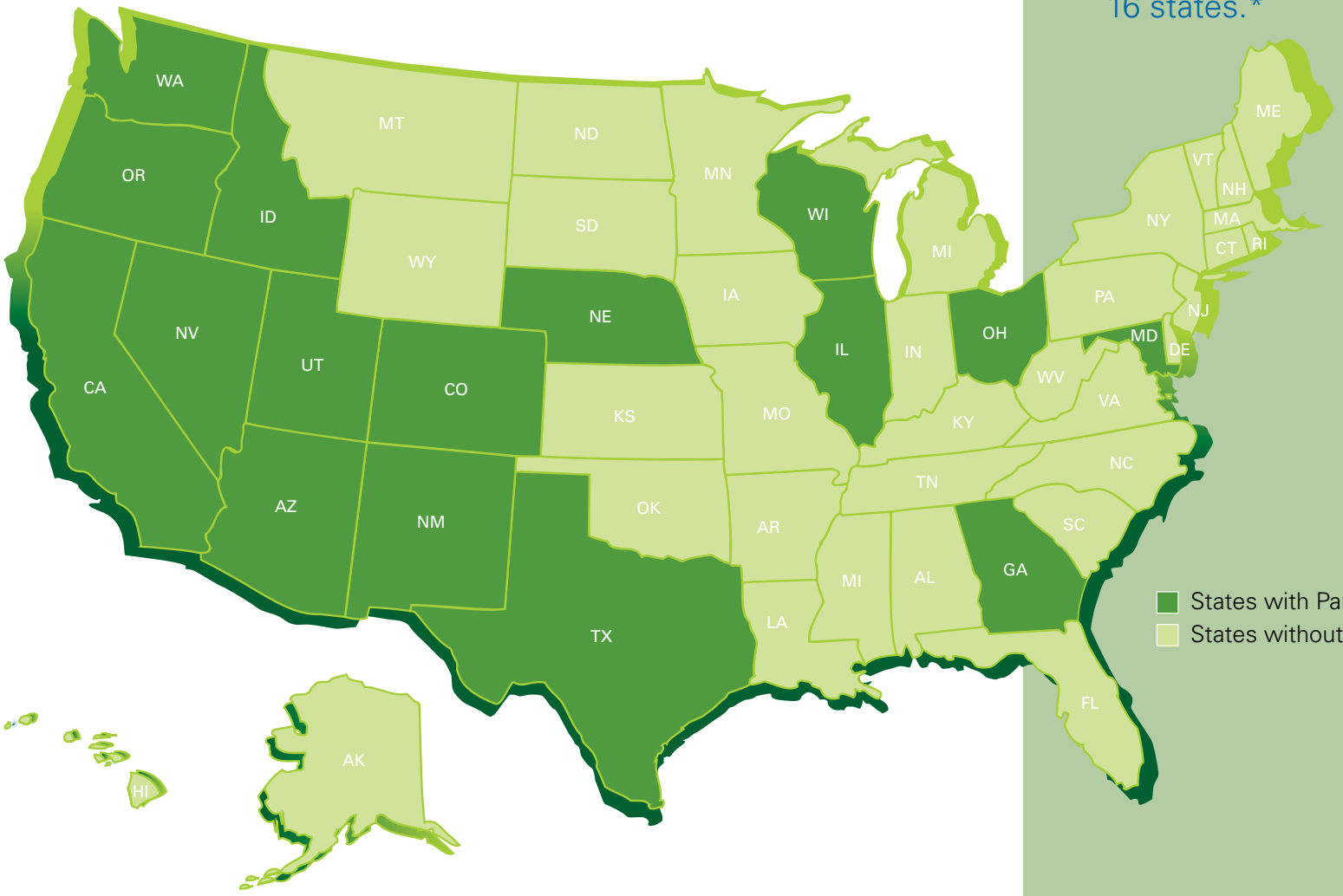
- 644,751 refrigerators
- 35,356 stand-alone freezers
- 2,136 window air-conditioning units
- 55 dehumidifiers

By disposing of these units using the best available practices, RAD partners have helped protect the ozone layer, reduce GHG emissions, reduce energy use, and increase recycling. The benefits of these practices are described in the following pages.

> *"SCE has been a proud RAD partner since 2007. With each passing year, we've expanded our appliance recycling program to help our customers save even more energy and money, while protecting the environment."*
>
> -Tom Schober,
> Southern California Edison ARP Program Manager

Savings Around the Nation

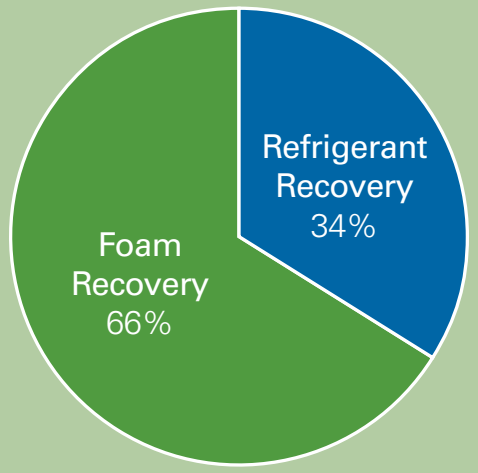
In 2009, the RAD Program's 22 utility partners offered responsible appliance disposal services to households across 16 states.*



* In 2009, appliance recycling programs operated by the 22 RAD utility partners covered a territory of 26 million households, representing approximately 23% of U.S. households.

Typical Emissions of ODS Avoided by Proper Disposal of Older Refrigerators*

Significant ozone benefits are realized through the recovery of foam, as more than twice as much ODS foam-blowing agent is recoverable as ODS refrigerant.



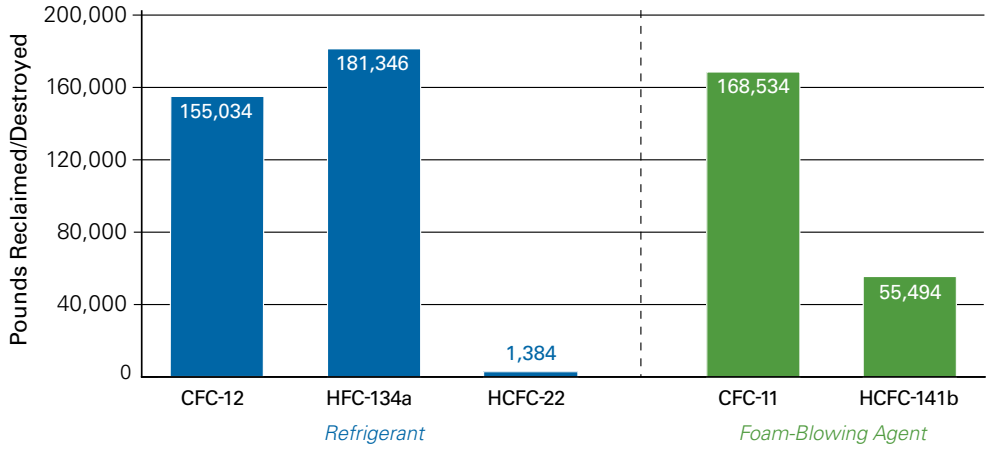
* Older refrigerators are assumed to be those manufactured prior to 1995, which contain CFC refrigerant and blowing agent.

Stratospheric Ozone Benefits

RAD partners not only reduce emissions of ODS by recovering and reclaiming or destroying refrigerant, but they recover and reclaim or destroy foam-blowing agents, which also deplete the ozone layer.

Partners recover foam from appliances manually or by using an automated system, and then reclaim or destroy the blowing agent. Foam destruction is typically performed using municipal solid waste incinerators (e.g., waste-to-energy facilities) or rotary kiln incinerators. On average, utility partners recovered 0.46 lb. of refrigerant and 1.0 lb. of foam-blowing agent from each refrigerator/freezer. Across all equipment types, RAD partners recovered a total of 156,418 lbs. of CFC and HCFC refrigerant, and 224,029 lbs. of CFC and HCFC foam-blowing agent. By avoiding the release of this refrigerant and foam-blowing agent into the environment, an estimated 4,034 pounds of ODS (148 ODP-weighted metric tons) were avoided during 2009.

Refrigerants and Foam-Blowing Agents Reclaimed or Destroyed by RAD Partners in 2009

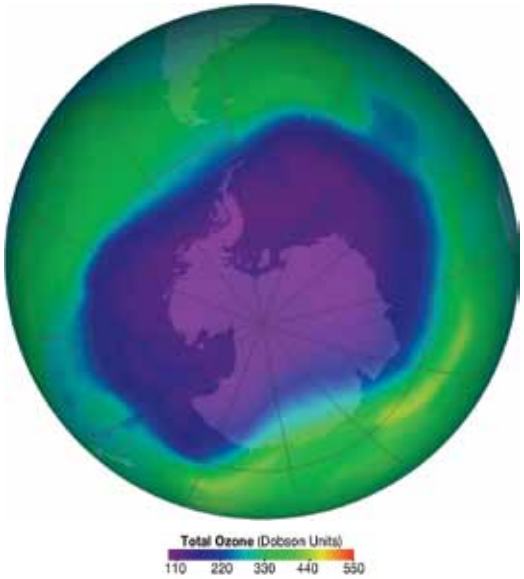


The Importance of Stratospheric Ozone Protection

Since the appearance of an ozone hole over the Antarctic in the early 1980s, Americans have become more aware of the health threats posed by ozone depletion, which decreases our atmosphere's natural protection from the sun's harmful ultraviolet (UV) rays.

The depletion of stratospheric ozone, caused by the release of man-made ODS—such as CFCs and HCFCs—has led to significant increases in UV reaching the Earth's surface, which in turn has been linked to several major human health problems, including:

- **Skin cancer**: melanoma, basal cell carcinoma, squamous cell carcinoma
- **Eye damage**: cataracts, pterygium, degeneration of the macula, squamous cell cancer of the cornea, conjunctiva
- **Other skin problems**: sunburn, premature aging, actinic keratoses
- **Immune suppression**: reduced resistance to infectious diseases and skin tumors, diminished effectiveness of vaccines



The largest ozone hole observed. September 24, 2006. Photo Credit: National Aeronautics and Space Administration, 2006. Available at http://ozonewatch.gsfc.nasa.gov/index.html

To reverse stratospheric ozone depletion and its associated health effects, the *Montreal Protocol on Substances that Deplete the Ozone Layer* was signed in 1987 to phase out production of ODS. The Protocol has been ratified by 196 states and will result in significant ozone recovery in the 21st century, assuming that countries comply with its provisions. The most recent scientific projections (from 2006) estimate that the Antarctic ozone concentrations will return to pre-1980 levels around 2060–2075, which is 10–25 years later than previous recovery estimates. The delayed recovery is mostly due to larger than predicted use of ODS in developing countries and changing wind patterns.

By responsibly recovering refrigerant and foam-blowing agents from appliances, RAD partners are doing their part to help restore the stratospheric ozone layer and prevent unwanted human health effects.

RAD partners disposed of 682,298 appliances in 2009; this resulted in 1.41 $MMTCO_2e$* GHG emission reductions, equivalent to approximately:

Source: EPA's Greenhouse Gas Equivalency Calculator. Available at www.epa.gov/cleanenergy/energy-resources/calculator.html.

* This does not include GHG emission reductions associated with early appliance retirement.

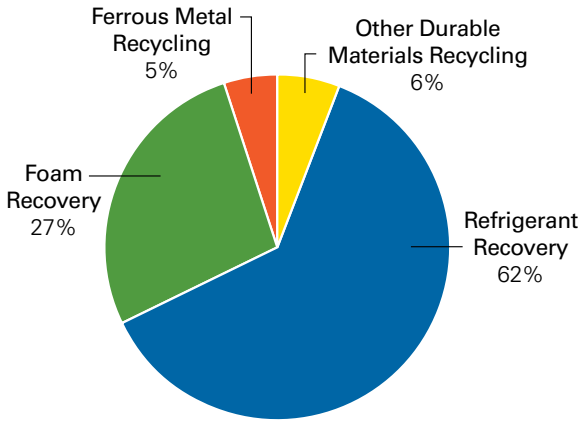
Climate Benefits

CFCs, HCFCs, and HFCs contained in appliances are all potent GHGs.

In fact, these refrigerants and blowing agents have direct global warming potentials (GWPs) up to 10,900—meaning that they are up to 10,900 times more effective at damaging the climate system than carbon dioxide (CO_2) on an equal mass basis. Therefore, recovering these compounds, even in small quantities, can result in significant climate benefits. In addition, the recycling of durable materials from appliances prevents indirect GHG emissions associated with the generation of electricity, which would have otherwise been needed to produce virgin materials.

During 2009, RAD partners achieved the reduction of 1.41 million metric tons of carbon dioxide equivalent ($MMTCO_2e$), which is equivalent to approximately 269,165 passenger car emissions for one year. Of this, 62% can be attributed to reclaiming or destroying refrigerant, 27% to reclaiming or destroying foam-blowing agents, and 11% to recycling durable materials. Additional climate benefits are realized through energy savings detailed on the next page.

GHG Emissions Avoided by Responsible Appliance Disposal



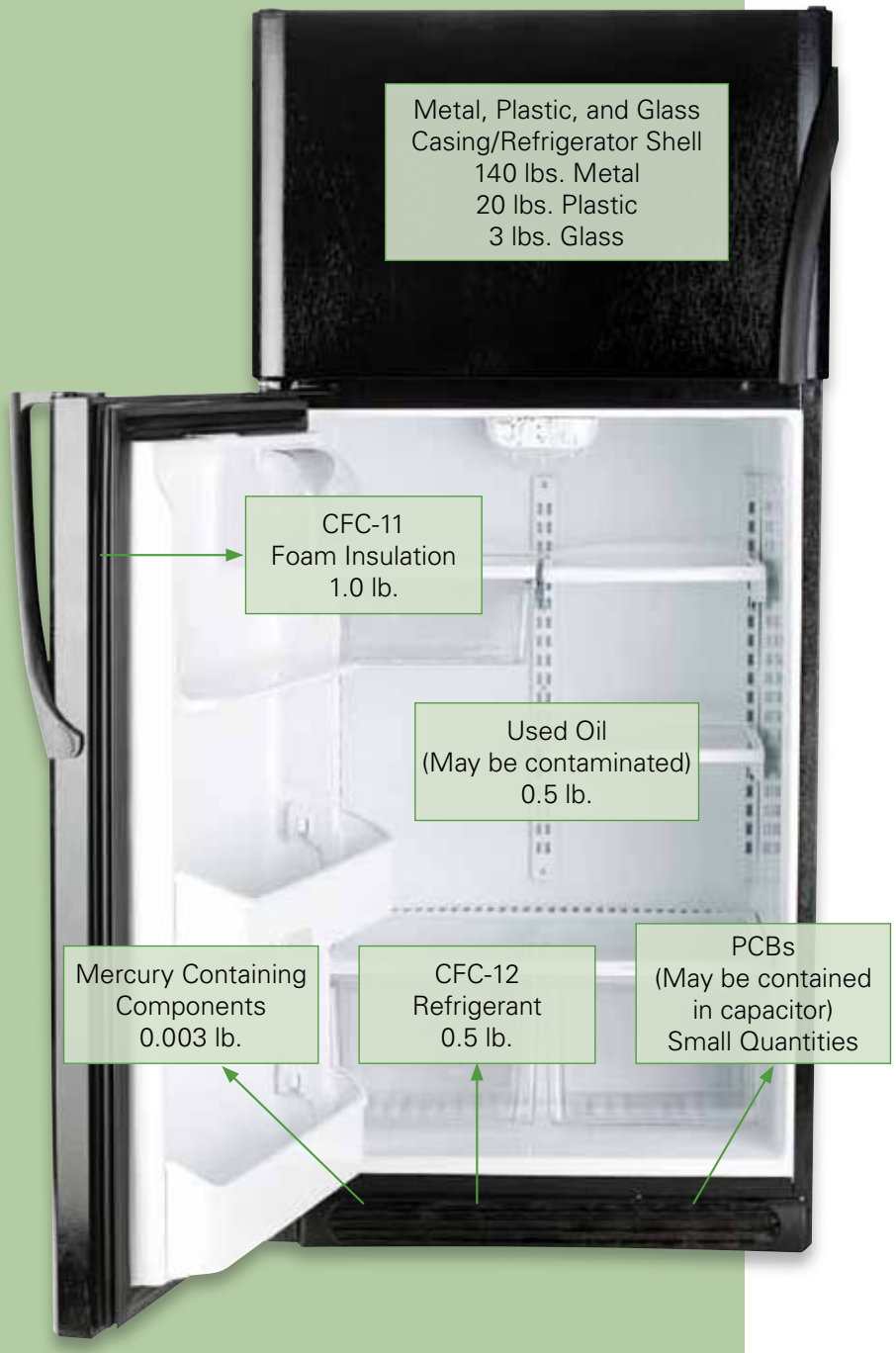
Energy Savings

For utilities, appliance recycling programs can be an important component of a successful Demand Side Management program.

Replacing old, inefficient refrigerated appliances reduces the amount of electricity needed to power them and, therefore, the amount of indirect GHG emissions released. In 2009, appliance recycling programs operated by the 22 RAD utility partners covered a territory of 26.4 million households, representing approximately 23% of U.S. households. In total, RAD utility partners reduced energy use by more than 2.7 billion kilowatt hours (kWh) by removing old refrigerators, freezers, air conditioners, and dehumidifiers from the grid. These energy savings translate to climate benefits of approximately 1.94 $MMTCO_2e$, and are estimated to have saved consumers $320 million.

- *Replacing an inefficient, approximately 20-year-old refrigerator with one that has earned the government's ENERGY STAR® label will save a household roughly 500 kWh/year or more—or about $50/year.**
- *If a secondary refrigerator (e.g., in a basement or garage) is removed and not replaced, households can save over 1,000 kWh/year, or roughly $100/year.**

* Actual energy and costs savings will vary by equipment model and region. These estimates are conservative and are based on national averages (Energy Star 2010 Databook).



Other Environmental Benefits

In 2009, RAD partners further protected the environment by keeping recyclable materials out of landfills and ensuring the proper handling of hazardous waste, as shown below.

Materials prevented from going to a landfill:

- 77.7 million pounds of ferrous metals
- 16.1 million pounds of non-ferrous metals
- 13.6 million pounds of plastic
- 1.8 million pounds of glass

Toxic or hazardous materials properly handled:

- 0.05 million gallons of used oil
- 0.2 million pounds of PCB-containing capacitors
- 1,636 pounds of mercury-containing components

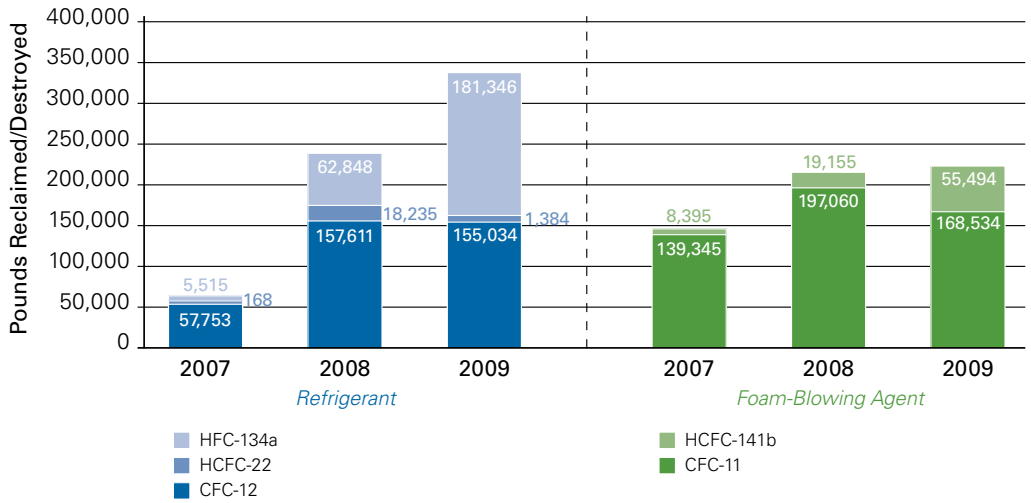
If released into the environment, used oil can leak into groundwater and major waterways and pollute drinking water sources. In addition to used oil, appliances may contain toxic chemicals and heavy metals—namely PCBs from capacitors and mercury from thermostatic switches. PCBs are regulated by EPA as toxic substances; they may cause cancer and liver damage, and can have negative impacts on the neurological development of children, the human reproductive system, the immune system, and the endocrine system. Mercury is toxic and causes a variety of adverse health effects, including tremors, headaches, respiratory failure, reproductive and developmental abnormalities, and potentially, cancers.

Increasing Program Benefits Over Time

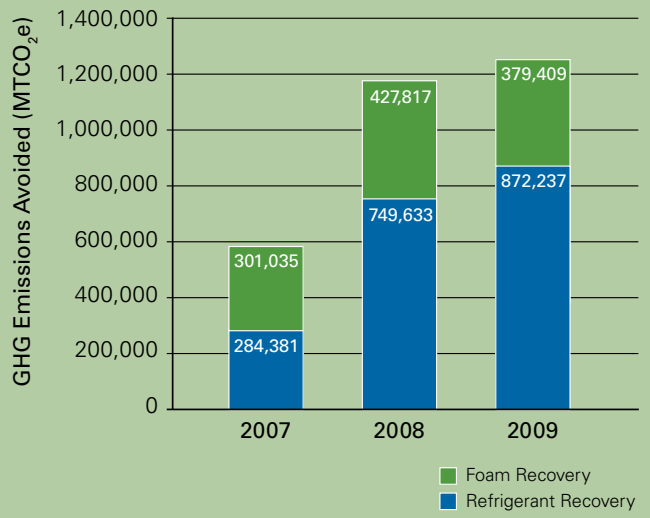
In 2007, nine RAD partners recovered 63,436 pounds of refrigerant and 147,740 pounds of foam-blowing agent. Since then, the program has expanded to 23 partners, who recovered 337,764 pounds of refrigerant and 224,029 pounds of foam-blowing agent.

As the program matures, the relative number of units collected with CFC-based refrigerant and foam is decreasing, while the number with HFC refrigerant and HCFC-based foam is increasing; this trend will continue into the future, until the full fleet of older CFC units reaches retirement.

Refrigerant and Foam-Blowing Agent Reclaimed or Destroyed by RAD Partners, 2007–2009



GHG Emissions Avoided through Proper Appliance Disposal by RAD Partners



Partner Recognition

In return for their efforts, RAD partners receive public recognition and technical support from the U.S. EPA.

For example, EPA has issued several press releases publicly recognizing new partners. All partners are listed on the RAD website. Partners are also given the opportunity to provide case studies of their programs to showcase on the RAD website. In addition, partners may use the RAD logo on their websites and other outreach materials.

Maximizing RAD Benefits: The Opportunity Is Now!

Of all refrigerant-containing appliances, those that contain CFC refrigerant and/or foam pose the greatest threats to the stratospheric ozone layer and climate system.

Therefore, it is critical that efforts to properly dispose of appliances be undertaken today, before the full stock of CFC appliances is retired, and this opportunity to avoid harmful emissions is lost.

Ensuring the proper disposal of older appliances through the RAD Program is a priority, but the importance of the program will continue for years to come. Even new units being produced today contain high-GWP refrigerants and foam-blowing agents that will lead to increased concentrations of GHGs if they are not properly handled at end-of-life.

To learn more, contact:

U.S. Environmental Protection Agency
Stratospheric Protection Division
U.S. EPA (6205J)
1200 Pennsylvania Avenue, NW
Washington, DC 20460
Tel: 1-800-296-1996
www.epa.gov/Ozone/partnerships/rad/

Printed on 100% recycled/recyclable paper
with a minimum 50% post-consumer waste
using vegetable-based inks.

U.S. Environmental Protection Agency
Stratospheric Protection Division (6205J)
EPA-430-K-10-002
www.epa.gov/Ozone/partnerships/rad/
August 2010