



September 24, 2010

The Honorable Gina McCarthy  
Assistant Administrator for Air and Radiation  
U.S. Environmental Protection Agency  
Ariel Rios Federal Building  
Washington D.C. 20460

Dear Ms. McCarthy:

Thank you for meeting with us on September 7, 2010 to discuss the EPA's regulation regarding uncharged HCFC-22 air conditioning condensing units.

As you requested, attached please find our analysis of the potential scope of this issue, including the additional HCFC demand that could be created. Our analysis provides estimates of HCFC-22 consumption and greenhouse gas emissions for ten different scenarios. In order to provide a broader picture of the residential air conditioning market, I have also attached historical shipment data information for residential central air conditioners and heat pumps.

I hope that the enclosed information will be helpful to EPA in assessing the potential environmental impact resulting from the domestic sale of uncharged HCFC-22 air conditioning condensing units. If you need further information or have questions about the analysis, please do not hesitate to contact me.

Thank you for your consideration and attention to this matter.

Sincerely,

A handwritten signature in black ink, appearing to read 'K Amrane'.

Karim Amrane  
Vice President, Regulatory and Research  
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Enclosure: As stated

cc: Drusilla Hufford, EPA

## R-22 Condensing Units Analysis

### Assumptions

- Annual shipment increase – 1%
- 80% of annual shipment of split air conditioners and heat pumps is for the replacement market
- No servicing
- Average refrigerant charge - 2 lbs/ton
- Average condensing unit cooling capacity - 3 tons
- Average SEER of replacement unit (AC & HP) – 10 SEER
- Average HSPF of replacement HP – 6.8 HSPF

### **Scenario 1 – 10% of Units Replaced Use R-22**

year	Shipment Split A/C)	Shipment Split HPs	Shipment Replacement Market (AC+HP)	Shipment - R-22 Units (AC+HP)	Amount of R-22 Used (MT)	Total Allocation (MT)	% of Total Allocation	Cumulative Energy Increase (kWh)	Cumulative Operating Cost Increase (\$)	Cumulative Primary Energy Increase (quads)	Cumulative Emission Increase (MT CO2E)
2010	2,915,642	1,402,785	3,454,741	345,474	940	50,000	2%	349,916,865	39,645,581	0.0036183	209,950
2011	2,944,798	1,416,813	3,489,289	348,929	950	45,400	2%	703,332,899	79,687,617	0.0072727	422,000
2012	2,974,246	1,430,981	3,524,182	352,418	959	40,700	2%	1,060,283,093	120,130,074	0.0109637	636,170
2013	3,003,989	1,445,291	3,559,423	355,942	969	35,900	3%	1,420,802,790	160,976,956	0.0146916	852,482
2014	3,034,028	1,459,744	3,595,018	359,502	978	31,100	3%	1,784,927,683	202,232,306	0.0184568	1,070,957
2015	3,064,369	1,474,341	3,630,968	363,097	988	27,709	4%	2,152,693,825	243,900,210	0.0222597	1,291,616

### Scenario 2 – 20% of Units Replaced Use R-22

year	Shipment Split A/C)	Shipment Split HPs	Shipment Replacement Market (AC+HP)	Shipment - R-22 Units (AC+HP)	Amount of R-22 Used (MT)	Total Allocation (MT)	% of Total Allocation	Cumulative Energy Increase (kWh)	Cumulative Operating Cost Increase (\$)	Cumulative Primary Energy Increase (quads)	Cumulative Emission Increase (MT CO2E)
2010	2,915,642	1,402,785	3,454,741	690,948	1,880	50,000	4%	699,833,731	79,291,162	0.0072365	419,900
2011	2,944,798	1,416,813	3,489,289	697,858	1,899	45,400	4%	1,406,665,798	159,375,235	0.0145454	843,999
2012	2,974,246	1,430,981	3,524,182	704,836	1,918	40,700	5%	2,120,566,187	240,260,149	0.0219274	1,272,340
2013	3,003,989	1,445,291	3,559,423	711,885	1,937	35,900	5%	2,841,605,579	321,953,912	0.0293833	1,704,963
2014	3,034,028	1,459,744	3,595,018	719,004	1,957	31,100	6%	3,569,855,366	404,464,613	0.0369136	2,141,913
2015	3,064,369	1,474,341	3,630,968	726,194	1,976	27,709	7%	4,305,387,650	487,800,421	0.0445193	2,583,233

### Scenario 3 – 30% of Units Replaced Use R-22

year	Shipment Split A/C)	Shipment Split HPs	Shipment Replacement Market (AC+HP)	Shipment - R-22 Units (AC+HP)	Amount of R-22 Used (MT)	Total Allocation (MT)	% of Total Allocation	Cumulative Energy Increase (kWh)	Cumulative Operating Cost Increase (\$)	Cumulative Primary Energy Increase (quads)	Cumulative Emission Increase (MT CO2E)
2010	2,915,642	1,402,785	3,454,741	1,036,422	2,821	50,000	6%	1,049,750,596	118,936,743	0.0108548	629,850
2011	2,944,798	1,416,813	3,489,289	1,046,787	2,849	45,400	6%	2,109,998,698	239,062,852	0.0218182	1,265,999
2012	2,974,246	1,430,981	3,524,182	1,057,254	2,877	40,700	7%	3,180,849,280	360,390,223	0.0328912	1,908,510
2013	3,003,989	1,445,291	3,559,423	1,067,827	2,906	35,900	8%	4,262,408,369	482,930,868	0.0440749	2,557,445
2014	3,034,028	1,459,744	3,595,018	1,078,505	2,935	31,100	9%	5,354,783,049	606,696,919	0.0553704	3,212,870
2015	3,064,369	1,474,341	3,630,968	1,089,290	2,965	27,709	11%	6,458,081,475	731,700,631	0.066779	3,874,849

### Scenario 4 – 40% of Units Replaced Use R-22

year	Shipment Split A/C)	Shipment Split HPs	Shipment Replacement Market (AC+HP)	Shipment - R-22 Units (AC+HP)	Amount of R-22 Used (MT)	Total Allocation (MT)	% of Total Allocation	Cumulative Energy Increase (kWh)	Cumulative Operating Cost Increase (\$)	Cumulative Primary Energy Increase (quads)	Cumulative Emission Increase (MT CO2E)
2010	2,915,642	1,402,785	3,454,741	1,381,897	3,761	50,000	8%	1,399,667,461	158,582,323	0.0144731	839,800
2011	2,944,798	1,416,813	3,489,289	1,395,716	3,799	45,400	8%	2,813,331,597	318,750,470	0.0290909	1,687,999
2012	2,974,246	1,430,981	3,524,182	1,409,673	3,837	40,700	9%	4,241,132,374	480,520,298	0.0438549	2,544,679
2013	3,003,989	1,445,291	3,559,423	1,423,769	3,875	35,900	11%	5,683,211,159	643,907,824	0.0587665	3,409,927
2014	3,034,028	1,459,744	3,595,018	1,438,007	3,914	31,100	13%	7,139,710,732	808,929,226	0.0738273	4,283,826
2015	3,064,369	1,474,341	3,630,968	1,452,387	3,953	27,709	14%	8,610,775,300	975,600,841	0.0890386	5,166,465

### Scenario 5 – 50% of Units Replaced Use R-22

Year	Shipment Split A/C)	Shipment Split HPs	Shipment Replacement Market (AC+HP)	Shipment - R-22 Units (AC+HP)	Amount of R-22 Used (MT)	Total Allocation (MT)	% of Total Allocation	Cumulative Energy Increase (kWh)	Cumulative Operating Cost Increase (\$)	Cumulative Primary Energy Increase (quads)	Cumulative Emission Increase (MT CO2E)
2010	2,915,642	1,402,785	3,454,741	1,727,371	4,701	50,000	9%	1,749,584,326	198,227,904	0.0180914	1,049,751
2011	2,944,798	1,416,813	3,489,289	1,744,644	4,748	45,400	10%	3,516,664,496	398,438,087	0.0363636	2,109,999
2012	2,974,246	1,430,981	3,524,182	1,762,091	4,796	40,700	12%	5,301,415,467	600,650,372	0.0548186	3,180,849
2013	3,003,989	1,445,291	3,559,423	1,779,712	4,844	35,900	13%	7,104,013,949	804,884,780	0.0734581	4,262,408
2014	3,034,028	1,459,744	3,595,018	1,797,509	4,892	31,100	16%	8,924,638,414	1,011,161,532	0.0922841	5,354,783
2015	3,064,369	1,474,341	3,630,968	1,815,484	4,941	27,709	18%	10,763,469,125	1,219,501,052	0.1112983	6,458,081

### Scenario 6 – 60% of Units Replaced Use R-22

year	Shipment Split A/C)	Shipment Split HPs	Shipment Replacement Market (AC+HP)	Shipment - R-22 Units (AC+HP)	Amount of R-22 Used (MT)	Total Allocation (MT)	% of Total Allocation	Cumulative Energy Increase (kWh)	Cumulative Operating Cost Increase (\$)	Cumulative Primary Energy Increase (quads)	Cumulative Emission Increase (MT CO2E)
2010	2,915,642	1,402,785	3,454,741	2,072,845	5,641	50,000	11%	2,099,501,192	237,873,485	0.0217096	1,259,701
2011	2,944,798	1,416,813	3,489,289	2,093,573	5,698	45,400	13%	4,219,997,395	478,125,705	0.0436363	2,531,998
2012	2,974,246	1,430,981	3,524,182	2,114,509	5,755	40,700	14%	6,361,698,561	720,780,447	0.0657823	3,817,019
2013	3,003,989	1,445,291	3,559,423	2,135,654	5,812	35,900	16%	8,524,816,738	965,861,736	0.0881498	5,114,890
2014	3,034,028	1,459,744	3,595,018	2,157,011	5,871	31,100	19%	10,709,566,097	1,213,393,839	0.1107409	6,425,740
2015	3,064,369	1,474,341	3,630,968	2,178,581	5,929	27,709	21%	12,916,162,950	1,463,401,262	0.1335579	7,749,698

### Scenario 7 – 70% of Units Replaced Use R-22

year	Shipment Split A/C)	Shipment Split HPs	Shipment Replacement Market (AC+HP)	Shipment - R-22 Units (AC+HP)	Amount of R-22 Used (MT)	Total Allocation (MT)	% of Total Allocation	Cumulative Energy Increase (kWh)	Cumulative Operating Cost Increase (\$)	Cumulative Primary Energy Increase (quads)	Cumulative Emission Increase (MT CO2E)
2010	2,915,642	1,402,785	3,454,741	2,418,319	6,582	50,000	13%	2,449,418,057	277,519,066	0.0253279	1,469,651
2011	2,944,798	1,416,813	3,489,289	2,442,502	6,648	45,400	15%	4,923,330,295	557,813,322	0.0509091	2,953,998
2012	2,974,246	1,430,981	3,524,182	2,466,927	6,714	40,700	16%	7,421,981,654	840,910,521	0.076746	4,453,189
2013	3,003,989	1,445,291	3,559,423	2,491,596	6,781	35,900	19%	9,945,619,528	1,126,838,693	0.1028414	5,967,372
2014	3,034,028	1,459,744	3,595,018	2,516,512	6,849	31,100	22%	12,494,493,780	1,415,626,145	0.1291977	7,496,696
2015	3,064,369	1,474,341	3,630,968	2,541,678	6,917	27,709	25%	15,068,856,775	1,707,301,473	0.1558176	9,041,314

### Scenario 8 – 80% of Units Replaced Use R-22

Year	Shipment Split A/C)	Shipment Split HPs	Shipment Replacement Market (AC+HP)	Shipment - R-22 Units (AC+HP)	Amount of R-22 Used (MT)	Total Allocation (MT)	% of Total Allocation	Cumulative Energy Increase (kWh)	Cumulative Operating Cost Increase (\$)	Cumulative Primary Energy Increase (quads)	Cumulative Emission Increase (MT CO2E)
2010	2,915,642	1,402,785	3,454,741	2,763,793	7,522	50,000	15%	2,799,334,922	317,164,647	0.0289462	1,679,601
2011	2,944,798	1,416,813	3,489,289	2,791,431	7,597	45,400	17%	5,626,663,194	637,500,940	0.0581818	3,375,998
2012	2,974,246	1,430,981	3,524,182	2,819,345	7,673	40,700	19%	8,482,264,748	961,040,596	0.0877098	5,089,359
2013	3,003,989	1,445,291	3,559,423	2,847,539	7,750	35,900	22%	11,366,422,318	1,287,815,649	0.117533	6,819,853
2014	3,034,028	1,459,744	3,595,018	2,876,014	7,827	31,100	25%	14,279,421,463	1,617,858,452	0.1476545	8,567,653
2015	3,064,369	1,474,341	3,630,968	2,904,774	7,906	27,709	29%	17,221,550,600	1,951,201,683	0.1780772	10,332,930

### Scenario 9 – 90% of Units Replaced Use R-22

year	Shipment Split A/C)	Shipment Split HPs	Shipment Replacement Market (AC+HP)	Shipment - R-22 Units (AC+HP)	Amount of R-22 Used (MT)	Total Allocation (MT)	% of Total Allocation	Cumulative Energy Increase (kWh)	Cumulative Operating Cost Increase (\$)	Cumulative Primary Energy Increase (quads)	Cumulative Emission Increase (MT CO2E)
2010	2,915,642	1,402,785	3,454,741	3,109,267	8,462	50,000	17%	3,149,251,788	356,810,228	0.0325644	1,889,551
2011	2,944,798	1,416,813	3,489,289	3,140,360	8,547	45,400	19%	6,329,996,093	717,188,557	0.0654545	3,797,998
2012	2,974,246	1,430,981	3,524,182	3,171,763	8,632	40,700	21%	9,542,547,841	1,081,170,670	0.0986735	5,725,529
2013	3,003,989	1,445,291	3,559,423	3,203,481	8,719	35,900	24%	12,787,225,107	1,448,792,605	0.1322246	7,672,335
2014	3,034,028	1,459,744	3,595,018	3,235,516	8,806	31,100	28%	16,064,349,146	1,820,090,758	0.1661113	9,638,609
2015	3,064,369	1,474,341	3,630,968	3,267,871	8,894	27,709	32%	19,374,244,425	2,195,101,893	0.2003369	11,624,547

**Scenario 10 – 100% of Units Replaced Use R-22**

Year	Shipment Split A/C)	Shipment Split HPs	Shipment Replacement Market (AC+HP)	Shipment - R-22 Units (AC+HP)	Amount of R-22 Used (MT)	Total Allocation (MT)	% of Total Allocation	Cumulative Energy Increase (kWh)	Cumulative Operating Cost Increase (\$)	Cumulative Primary Energy Increase (quads)	Cumulative Emission Increase (MT CO2E)
2010	2,915,642	1,402,785	3,454,741	3,454,741	9,402	50,000	19%	3,499,168,653	396,455,808	0.0361827	2,099,501
2011	2,944,798	1,416,813	3,489,289	3,489,289	9,496	45,400	21%	7,033,328,992	796,876,175	0.0727272	4,219,997
2012	2,974,246	1,430,981	3,524,182	3,524,182	9,591	40,700	24%	10,602,830,935	1,201,300,745	0.1096372	6,361,699
2013	3,003,989	1,445,291	3,559,423	3,559,423	9,687	35,900	27%	14,208,027,897	1,609,769,561	0.1469163	8,524,817
2014	3,034,028	1,459,744	3,595,018	3,595,018	9,784	31,100	31%	17,849,276,829	2,022,323,065	0.1845681	10,709,566
2015	3,064,369	1,474,341	3,630,968	3,630,968	9,882	27,709	36%	21,526,938,250	2,439,002,104	0.2225965	12,916,163

# Historical Shipment Data for Residential Central Air Conditioners and Heat Pumps

<b>Year</b>	<b>Shipment A/C + HPs</b>
1990	3,320,960
1991	3,404,836
1992	3,331,673
1993	3,644,539
1994	4,416,864
1995	4,558,610
1996	5,128,259
1997	4,818,281
1998	5,582,492
1999	5,936,711
2000	5,948,954
2001	5,636,247
2002	6,154,920
2003	6,194,924
2004	6,748,563
2005	7,939,397
2006	6,365,782
2007	5,688,759
2008	5,199,995
2009	4,672,025