

Energy Audit of Humboldt State
University, Science Departments
May 11, 2004

ENVS 410
Prepared by Kyle Lin
Jacques Du Bois

Introduction

As a part of its energy conservation program Humboldt State University has expressed an interest in an energy audit of the refrigeration units used by the various departmental programs in its science faculties. Environmental Sciences 410 has detailed a team of two students, Kyle and Jacques, to prepare an environmental report addressing these problems. A Problem Statement was developed for the report as follows;

Problem Statement

Extra energy costs may result from surplus or inefficient refrigeration units on campus. Those refrigeration units need to be identified

Goals

Within the limits of the course duration, a selective measurement of the consumption demands of some of the units could yield a variety of energy saving proposals.

Objectives

- 1. Develop a selective sample of units by type, size, use and age of units*
- 2. Identify units in the sample that are over or under utilized, duplication or in need of replacement*

Data collection method

We used 3 types of power meters: Digital Power, Kill a Watt and another one we returned to George Wright. We just need to plug in the meter into the outlet, and then plug in the refrigerator. We visited every chair of a department to get permission for putting the meters on refrigerators. Then, we went to talk to the stockman or person who is responsible for the refrigerators and get his help for putting the meters on the refrigerators.

*were they all men?
In the NR building
they are
women.*

Data collection and analysis

As a starting point for this report an Inventory conducted in June of 2001 by the College of Natural Resources & Sciences was obtained. The inventory listed by room number, all of the refrigerators, freezers, incubators, cold rooms and growth rooms used by the individual departments in the science buildings on campus. Two, kilowatt hour meters were obtained from the Schotz energy center and the Plant Maintenance department enabling the completion of a random sample of approximately ten percent of the refrigeration units and some of the freezer units (a total of 26 units were measured out of a grand total of more than 190 units in all categories).

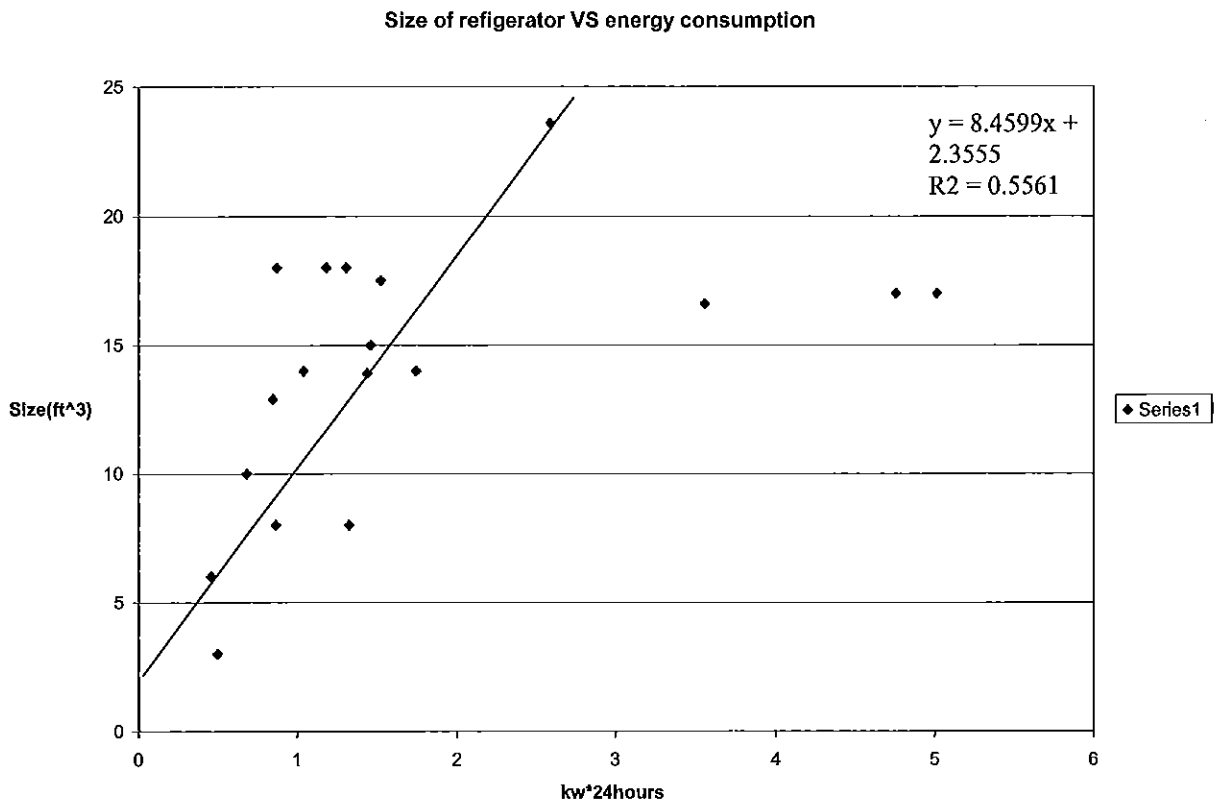


Figure 1. This graph shows the energy use of the refrigerators per day by different sizes of refrigerators. It also shows the steep trend line in terms of rate of change in size of refrigerator per energy use. This trend line has removed the 3 values which significantly change the slope of the trend. Since the slope of the line is steep, there is not significant change in energy use proportional to the size of the refrigerator.

If there were no effect of size on efficiency the line would be a 45 degree one.

Something seems to be off with the line if the three outliers have been removed. The line would be steeper since there are significantly more datapoints above the line if the three have been removed.

Energy Use per Cubic Feet

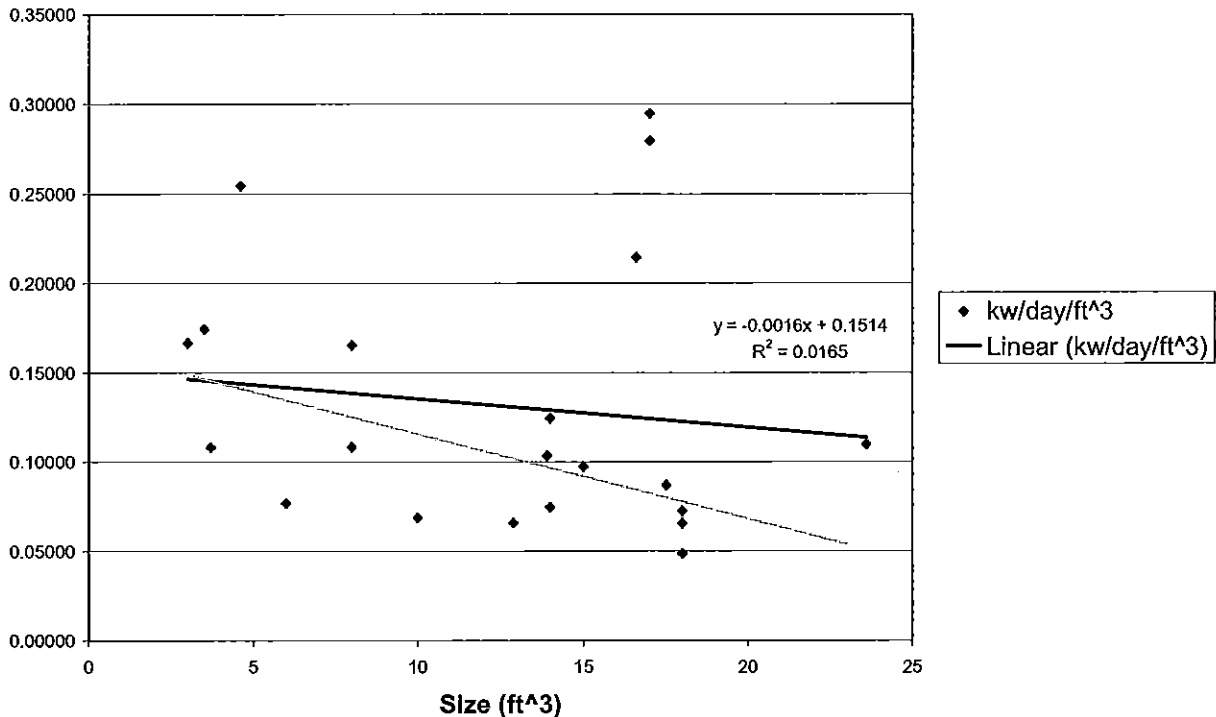


Figure 2. This graph shows the energy use per cubic feet for different sizes of refrigerators. This graph also shows the trend line in black (with 4 refrigerators on the trend) which is $y = -0.0016x + 0.1514$ and has R square value 0.0165. As you can see, the energy use per cubic feet is decreasing as the size of the refrigerator increases. There are 4 refrigerators which have low energy efficiency and don't fit in the trend line. These refrigerators are very old and we proposed to remove them in the implementation strategy. Once we remove the 4 refrigerators, the slope of the trend line become steeper, which is shown in the gray line. The trend line is $y = -0.0035x + 0.1439$ and has R square value 0.3143.

Alternative solutions in order of Priority

1. Extend the audit to the next semester and increase the size of the team to 6 or 8 members.

This will require buying leasing or borrowing at least 6 Kwh meters. Update the inventory since a number of changes in the number of units appears to have occurred since 2001. Conduct as large an audit as possible with each team member conducting 2 or more audits at a time.

2. Review and recommend unused or unplugged units for removal.

3. Examine the possibility of recommending the combining of uses within the refrigerators where two or more are used at the same location, or replace several small units with one larger unit.

This is more of a future recommendation

Obstacles to problem solutions

1. Frequently we found access to the units blocked, due to location in a locked room or pad locks on the unit itself. When this occurred we found the stock rooms, especially in the Biology,

Engineering and Chemistry Departments extremely helpful. They knew the location of the units and had the keys.

2. We also had a hard time finding the person (such as stockman) at the right time. Since they are busy at their regular work, we had a hard time finding the person when we visited. Sometimes, even though we find the person who has the access to classrooms, we had to come back because she or he is busy at work. Therefore, sometimes, we had to come back several times before we could get into the laboratory to collect the data. It turns out that this was the most time consuming part especially at the fishery and wildlife building. We could not access some of the outlets for three weeks. For future investigations, we would like to suggest getting a key from each department.

3. One of the more important items was the date of manufacture of the unit. Efficiency of units was increased by manufacturers over the decades. Finding dates on the units was impossible in some cases. Once again, the Biology and Chemistry stock rooms had that data in most cases. It was suggested that the Purchasing Department should have that data in their records. Some refrigerators are locked and we could not get the information on size

5. The team had only two meters to conduct its audits. Given the number of units and the fact that 24 hour readings were performed on each unit, a random sample of approximately 17.5% of the units was possible.

6. The inventory used contained Refrigerators, Freezers, Incubators, Growth rooms, Warm rooms, Cold rooms and Humidifiers. All of these units use electricity. Due to limitations of team size and the number of meters available, only the first two categories were measured. A future team should consider adding incubators and humidifiers to their audit. The types of rooms listed above are probably all hard wired and would be extremely difficult to audit with the hand held meters. For example, we accidentally measured an incubator and the meter measured 9 Kwh per day. This tells us that there is a possibility that incubators may consume significant amounts of electricity. We strongly suggest that further research on incubators is needed to decrease the electricity use on campus.

7. Space limitations due to unit placement sometimes required the use of an extension cord to hook up the meter. This could permit the meter to be placed out of sight. Another item to consider for the team members tool kit is an expandable tape measure to determine the units inside dimension for cubic footage calculation.

8. I have talked to the stockman in biology department about the criteria for buying new refrigerator. It was surprising to know that there were no certain criteria and what they care about the most is the cheapest refrigerator proportional to the size. Due to the limited budget distributed to the department, they care more about short-term cost rather than long-term benefit. Each department tries to minimize the cost of buying equipment. The biology department also does not have incentives for buying energy efficient refrigerators. The electricity is paid by university when each department buys the refrigerator and uses it. This complex administrative process increases the inefficient energy use and cost.

9. Although the previous inventory shows that there are about 58 refrigerators in the biology department, many of them are broken, retired and/or replaced with new ones. The stockman said since he got his position, more than 7 refrigerators were replaced. The stockman and I did not try to count the number of refrigerators that exist in the biology department and we did not try to measure the new refrigerators. However, we have confidence that we measured most of the old refrigerators existing in the biology department. Since one of our purposes is to identify units in the sample that are over or under utilized or in need of replacement, we decided not to measure the new refrigerators.

Implementation Strategies

1. It became apparent to the team during the conduct of this study that a annual update of the inventory could lead to more efficient energy conservation and accommodate changes in the unit stock. With the use of a computer program, this could be accomplished by entering new acquisitions and deleting removals. Such a program would also yield an annual report for the university administration.
2. Science departments could be asked to re-examine unit uses and the possibility of combining uses that meet federal and state requirements.

This part should describe who did what, when Part of what you write about in the obstacles part is implementation

Monitoring and Evaluations

1. The Plant Operation Department, with the cooperation of the Science Department stockrooms could be responsible for maintaining and updating the inventory based on the computer program.
2. Plant Operation would use its computer program to generate annual reports on the number and power consumption of the units.
3. Succeeding semester students from Environmental Science 410 would be responsible for completing, expanding and correcting the existing inventory.

Tables, Graphs and Related Data

1. Tables of units measured
2. Table: number of refrigerators measured by department
3. Meter specification
4. A sample of Amortization calculation
5. Generalized data collected during the course of the study

Name of Refig	kw/day	size(ft ³)	usage(%)	date	No:	Building and Department
unknown	1.436	13.9	3			Natural Resource
Signature2000	1.458	15	15			Natural Resource
Crosley	1.323	No info (about 8)	15			Biology
Sears coldspot	3.561	16.6	40	1971		Biology
	1.742	14	100	1988	55845	Biology
Sears coldspot	5.012	17	90	1971	44616	Biology
Crosley	0.867	No info (about 8)			36940	Biology
Sears coldspot	4.751	17	50	1971	44640	Biology
Explosion proof	1.042	about 14	50		50107	Biology
	2.589	23.6	100		S02324	Biology
Frigidaire	0.875	18	100		S12036	Wildlife

Frigidaire	1.18	18	90		S12037	Wildlife
Fisher Scientific	1.305	about 18			S12453	Wildlife
unknown	0.5	about 3				Wildlife
Sanyo	0.46	about 6				Wildlife
	0.848	12.9	80	1983(estimate)	48706	Engineering
	0.687	10		1983(estimate)		Engineering
Frigidaire	1.52	17.5	80	1983(estimate)	57203	Engineering
GE	0.4	3.7		1978		Chemistry
	0.61	3.5				Chemistry
	1.17	4.6		2003		Chemistry
Labline	9.05	about 16		1983(estimate)	S03970	Engineering

Table 1. This table shows the data that we collected. Data missing are left blank. The manufactured date is a very important element of this project but we could not get much of this information.

Refrigerators and Freezers			
Department	#measured	#from previous data	Comments
Biology	8	58	measured most of old ones
Chemistry	3	7	only 3 refig are used
Computing Science	0	1	
Engineering	4	5	measured everything
Fish and Wildlife	5	46	very hard to access, Building is new
Forestry	0	2	
Geology	0	1	
INRSEP	0	3	
Marine Lab	0	3	
NRPI	2	2	
Nursing	0	1	
Oceanography	0	3	
Physics	0	1	not existed
RRWS	0	9	
Total	22	126	sample size=17.5%

Table 2. This table shows the number of refrigerators we measured in each department and number of the refrigerators that exists on campus. The data on the existing number of the refrigerators is not accurate since the data was collected in 2001. Since 2001, there are a number of refrigerators retired or replaced with new ones.

Kill a Watt

Specifications	
Operating Voltage	115 VAC
Max. Voltage	125 VAC
Max, Current	15 Amps
Max. Power	1875 VA

during interval)		1850CI)	
Sample Interval	n/a	1 min- 2 hours (21-1850CI)	n/a
RS-232 specs	n/a	8N1, 9600 bps (21-1850CI and 20-1850CI)	n/a
Real time clock/calender Battery backup	n/a	21-1850CI only	n/a
User Recalibration Capability	YES	YES	YES

*VAR, VA, and I rms readings below 20 (0.20 amps) are generally not accurate. See instructions.

NOTE: All models are available for different voltages (220 vac for example) and maximum current/power rating. Call for information and cost.

avg. energy use for existing fridges (Kwh/yr)	1300	kWh/y
average refrigerator size(ft^3)	16.45	
cost per kWh:	\$0.13	
current operating cost:	\$169.00	per fridge per year
yearly energy consumption for high-efficiency 18.4 ft3 model (Kenmore 73754):	479	kWh/yr
yearly kWh savings per fridge:	821	kWh/yr
yearly \$ savings per fridge:	\$106.73	
Replacement cost per fridge (Kenmore 73754):	\$436.88	
Payback:	4.09	years
COST PER KWH PER YR:	\$0.53	
	(Hurdle: \$0.44/kWh/yr)	
Assume replacement of 25 Refrigerators		
TOTAL INVESTMENT =	\$10,922.00	
TOTAL YEARLY SAVINGS =	\$2,668.25	
Note: Payback time may be shorter if utility rebate applies		

— what does this mean?

Comparison of 1991 Refrigerator Models

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need to include the cost of money (the discount rate to the purchase price and to the savings each year)

Normalized Annual energy use Configuration (kWh/ft ³)	Number of refrigerators	Volume (ft ³)	Average	
			Annual energy use (kWh)	
single door, manual defrost	133	5	377	112
single door, automatic defrost	14	13	602	64
side-by-side doors, automatic defrost	434	23	1,251	56
top freezer, partial automatic defrost	36	12	708	62
top freezer, automatic defrost	905	18	885	50
bottom freezer, partial automatic defrost	2	4	544	140
bottom freezer, automatic defrost	14	21	1,145	54
top freezer, manual defrost, superinsulated	3	15	261	18
Total/Average	1,541	18	938	57

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of the 5*

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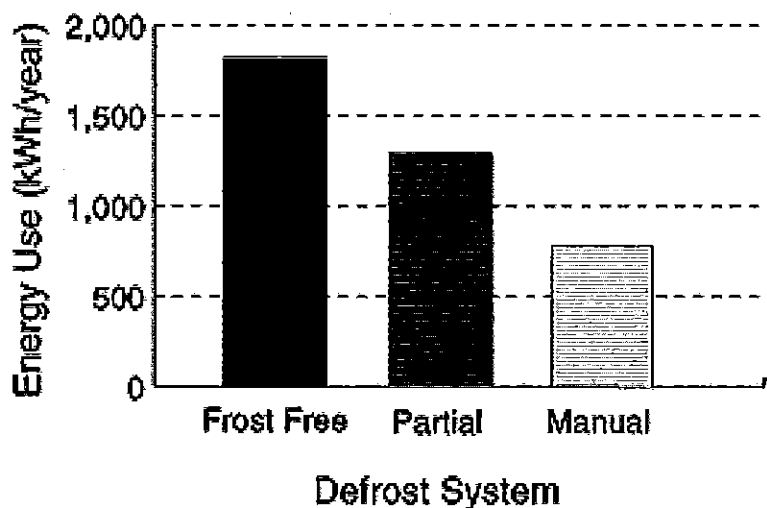


Figure 1. Average energy use of refrigerators by defrost system type

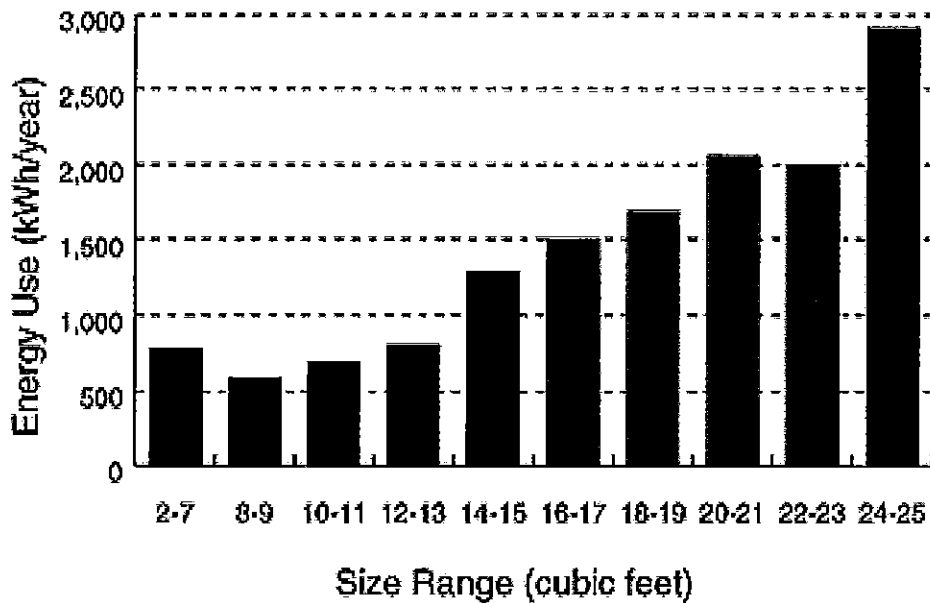


Figure 2. Average energy use of refrigerators by size

Finally, ARCA observed the change in energy use over time (see Figure 3). Refrigerators used much less energy 35 years ago because they were typically smaller and manual defrost. The energy guzzlers appeared in the 1970s (like the cars), and improved with federal energy standards over the last decade, with energy usage for a typical new refrigerator at about 800 kWh per year. When an 11- to 25-year-old refrigerator is replaced with a 1994 unit, expect that the house's electricity use will drop about 600 kWh per year. Even replacing a relatively new unit--five to ten years old--should save a few hundred kWh per year (about \$30 at 10¢ per kWh).

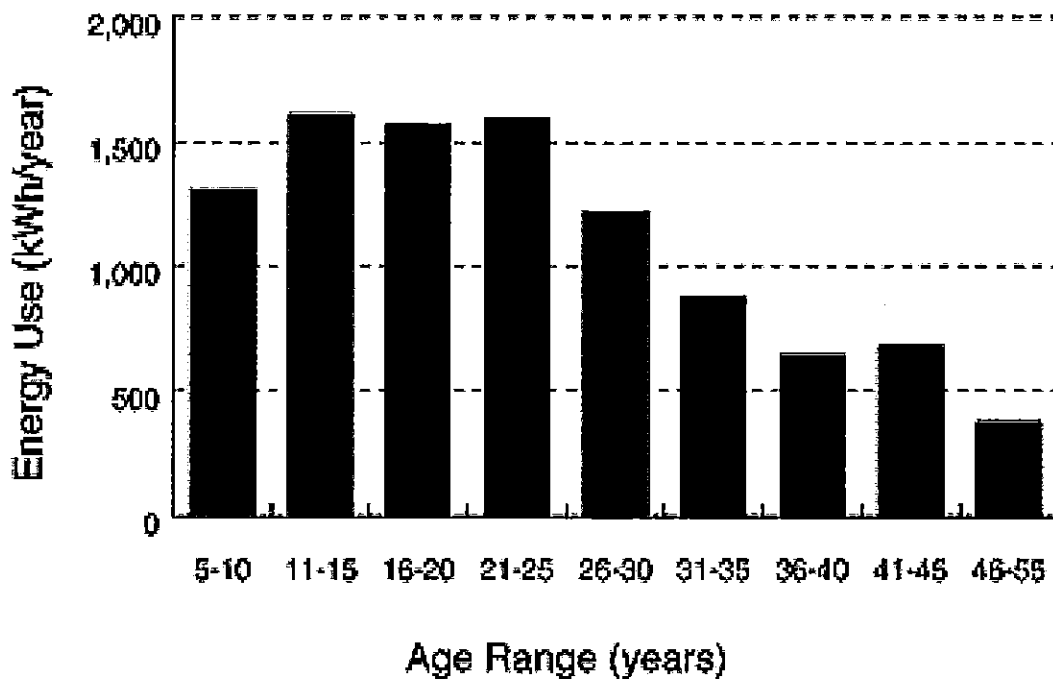


Figure 3. Average energy use of refrigerators by age.

COLLEGE OF NATURAL RESOURCES & SCIENCES
Refrigeration Equipment Inventory
June 2001

Department	Description of Item and What It Is Used For	Location of Item	Do you think this is a Group I or a Group II piece of equipment?	Is preventative maintenance routinely scheduled and performed? If so, how often and by whom?	Has this equipment been repaired in the last 12 months? If so, who repaired it? Was there a cost involved? If so, who paid for it (department, dean's office, Plant Operations)?	Who is responsible for this equipment? (Name of dept.'s equip. technician, Plant Operations or ?)
Biology	Freezer, cultures	SciB 224A	II	No	No	Siering
Biology	Freezer, chemicals	SciB 324	II	No	No	Allen
Biology	Freezer, chemicals, samples	SciB 121	II	No	No	Metz
Biology	Freezer, 44618, cultures	SciB 330	II	No	No	Lu
Biology	Freezer, 47976, chemicals/specimens	SciB 122	II	No	No	Varkey
Biology	Freezer, SO3304, 2/90, cultures	SciB 228	II	No	No	Siering
Biology	Freezer, SO8078, cultures	SciB 224C	II	Yes, Jones, every 6 months	No	Jones
Biology	Ice Machine, S11410, ice	SciB 122	II	No	No	Varkey
Biology	Incubator, specimens	SciB 128	II	No	No	Largent
Biology	Incubator, 44683, cultures	SciB 228	II	No	No	Siering
Biology	Incubator, 44684, cultures	SciB 228	II	No	No	Siering
Biology	Incubator, 44685, cultures	SciB 228	II	No	No	Siering
Biology	Incubator, 44756, 11/93, chemicals	SciB 324D	II	No	No	Allen
Biology	Incubator, 44757, 6/81, cultures	SciB 334	II	No	No	Lu
Biology	Incubator, 46868, cultures	SciB 334	II	No	No	Lu
Biology	Incubator, SO3221, 6/86, cultures	SciB 334	II	No	No	Lu
Biology	Incubator, SO3257, 8/85	SciB 122	II	No	No	Varkey
Biology	Incubator, SO3258, 4/71, specimens	SciB 126	II	No	No	Brueske
Biology	Incubator, SO3272, 6/86, cultures	SciB 324F	II	No	No	Varkey
Biology	Incubator, SO3455, 5/66, specimens	SciB 126	II	No	No	Brueske
Biology	Incubator, SO3480, 3/82, specimens	SciB 128	II	No	No	Largent
Biology	Incubator, SO3532, 8/82, flies	SciB 134	II	No	No	D. Paselk
Biology	Incubator, SO3639, 9/71, specimens	SciD 141	II	No	No	Sillett
Biology	Incubator, SO7927, 4/97, cultures	SciB 324C	II	No	No	Varkey
Biology	Incubator, SO9236, 4/97, cultures	SciB 324C	II	No	No	Varkey
Biology	Refrigerator, specimens	SciB 123	II	No	No	Largent

Biology	Refrigerator, food	SciB 125	II	No	No	BGSA
Biology	Refrigerator, 44623, specimens	SciD 141	II	No	No	Shaugnessy
Biology	Refrigerator, 48731, specimens	SciB 126	II	No	No	Brueske
Biology	Refrigerator, SO3253, 3/79, chemicals	SciB 330	II	No	No	Baker
Biology	Refrigerator, SO3505, 10/79, chemicals	SciB 132	II	No	No	D. Paselk
Biology	Refrigerator, SO3642, 9/82, specimens	SciD 145	II	No	No	Walker
Biology	Refrigerator, SO3643, 9/82, specimens	SciD 151	II	No	No	Walker
Biology	Refrigerator, SO3644, 8/82, specimens	SciD 147	II	No	No	Walker
Biology	Refrigerator, SO4156, 11/93, cultures	SciB 228	II	No	No	Siering
Biology	Refrigerator, SO9221, 3/97, specimens	SciD 153A	II	No	No	Mesler
Biology	Refrigerator, S10930, 4/88, chromatography	SciD 149	II	No	Yes, department, Rocha	Mesler
Biology	Refrigerator/Freezer, specimens	SciA 453	II	No	No	Camann
Biology	Refrigerator/Freezer, specimens	SciC 117B	II	No	No	Herman
Biology	Refrigerator/Freezer, chemicals	SciC 108	II	No	No	Reed
Biology	Refrigerator/Freezer, chemicals, cultures	SciB 324F	II	No	No	Varkey
Biology	Refrigerator/Freezer, chemicals	SciB 328B	II	No	No	Ogara
Biology	Refrigerator/Freezer, cultures	SciD 143A	II	No	No	Wingenbach
Biology	Refrigerator/Freezer, chemicals	SciB 230B	II	No	No	Brueske
Biology	Refrigerator/Freezer, specimens	SciB 123	II	No	No	Largent
Biology	Refrigerator/Freezer, 17277, cultures	SciD 143A	II	No	No	Wingenbach
Biology	Refrigerator/Freezer, 44617, chemicals, cultures	SciB 224D	II	Yes, Jones, every 6 months	No	Jones
Biology	Refrigerator/Freezer, 44624, chemicals	SciC 102	II	No	No	Lu
Biology	Refrigerator/Freezer, 44628, chemicals, cultures	SciD 143A	II	No	No	Wingenbach
Biology	Refrigerator/Freezer, 44630, specimens	SciD 151	II	No	No	Walker
Biology	Refrigerator/Freezer, 44639, chemicals	SciB 330	II	No	No	Baker
Biology	Refrigerator/Freezer, 44640, chemicals	SciB 132	II	No	No	D. Paselk
Biology	Refrigerator/Freezer, SO2324, 9/93, chemicals/specimens	SciB 122	II	No	No	Varkey
Biology	Refrigerator/Freezer, SO3262, 2/90, chemicals/cultures	SciB 334	II	No	No	Lu
Biology	Refrigerator/Freezer, SO3422, 12/88, chemicals/cultures	SciB 224A	II	No	No	Siering
Biology	Refrigerator/Freezer, SO7164, 2/90, chemicals	SciB 324D	II	No	No	Allen
Biology	Refrigerator/Freezer, S11418, chemicals	SciB 121	II	No	No	Metz
Biology	Ultracold Freezer, 3/01, cultures	SciB 224C	II	Yes, Jones, every 6 months	No	Jones
Biology	Ultracold Freezer, SO7928, cultures	SciB 324	II	No	No	Varkey

Biological	Refrigerator, specimens	SciD 153A	I	Yes	No	Rocha
Biology	Freezer, chemicals/samples	SciB 230	II	Yes, Baker, every 6 months	No	Baker
Biology	Freezer, S04157, 11/93, chemicals	SciB 230	II	Yes, Baker, every 6 months	No	Baker
Biology	Refrigerator/Freezer, S03335, 12/88, chemicals/cultures	SciB 230	II	Yes, Baker, every 6 months	No	Baker
Biology	Ultracold Freezer, S12638, 3/00, chemicals/cultures	SciB 230	II	Yes, Baker, every 6 months	No	Baker
Biology	4 Growth Chambers, 1 Cold, 1 Hot, animals and plants	SciB 325	I	Yes, Plant Operations	Yes, Plant Operations	Rocha
Biology	Coldroom, specimens	SciA 367	I	Yes, Plant Operations	Yes, Plant Operations	Rocha
Biology	Coldroom, cultures	SciD 143A	I	Yes, Plant Operations	Yes, Plant Operations	Rocha
Biology	Freezer, specimens	SciC	I	Yes, Plant Operations	Yes, Plant Operations	Rocha
Biology	Refrigerator, cold room	SciB 122	I	Yes, Plant Operations	Yes, Plant Operations	Rocha
Chemistry	Revco Refrigerator, Explosion Proof, S02921, flammable chemical storage	Bldg 3A 5th Floor Hall	II	No; What PMS is required for refrigeration?	Yes, 2-22-2001 Plant Ops Refrigeration Engineer-Charge Back to Chemistry	Chemistry; IST III Fraser
Chemistry	Kelmore Refrigerator, Explosion Proof, 48800, chemical storage	Bldg 3A Room 566	II	No; What PMS is required for refrigeration?	No	Chemistry; IST III Fraser
Chemistry	Kenmore Freezer, S02919, chemical reagent storage	Bldg 3A Room 568	II	No; What PMS is required for refrigeration?	No	Chemistry; IST III Fraser
Chemistry	Kenmore Freezer, S02920, chemical reagent storage	Bldg 3A Room 568	II	No; What PMS is required for refrigeration?	No	Chemistry; IST III Fraser
Chemistry	Frigidaire, chemical reagent storage	Bldg 3A Room 568	II	No; What PMS is required for refrigeration?	No	Chemistry; IST III Fraser
Chemistry	Neslab Cryocooler, 47770, freeze drying	Bldg 3A Room 568	II	No; What PMS is required for refrigeration?	No	Chemistry; IST III Fraser
Chemistry	Kenmore Refrigerator, S02922, biological specimen storage	Bldg 3A 5th Floor Hall	II	No; What PMS is required for refrigeration?	No	Chemistry; IST III Fraser
Chemistry	GE, chemical/biological reagent storage	Bldg 3A Room 568A	II	No; What PMS is required for refrigeration?	No	Chemistry; IST III Fraser

Chemistry	GE, chemical reagent storage	Bldg 3A Room 369D	II	No; What PMS is required for refrigeration?	No	Chemistry; IST III Fraser
Chemistry	Revco Refrigerator, S09805, low temperature chromatography	Bldg 3A Room 568	II	No; What PMS is required for refrigeration?	No	Chemistry; IST III Fraser
Chemistry	Lauda IC6, Cryocooler, 45547, research FTIR	Bldg 3A Room 373	II	No; What PMS is required for refrigeration?	No	Chemistry; Faculty -Golden
Chemistry	GE, chemical/biological reagent storage	Bldg 3A Room 568A	II	No; What PMS is required for refrigeration?	No	Chemistry; IST III Fraser
Chemistry	GE, chemical reagent storage	Bldg 3A Room 369D	II	No; What PMS is required for refrigeration?	No	Chemistry; IST III Fraser
Chemistry	Revco Refrigerator, S09805, low temperature chromatography	Bldg 3A Room 568	II	No; What PMS is required for refrigeration?	No	Chemistry; IST III Fraser
Chemistry	Lauda IC6, Cryocooler, 45547, research FTIR	Bldg 3A Room 373	II	No; What PMS is required for refrigeration?	No	Chemistry; Faculty -Golden
Computing Science	Small Refrigerator, faculty food	NHW 237A	I	No	No	Kuramada
Fisheries	Low Temperature Incubator, cold storage	WFB 120A	II	Yes, every six months	No	R. Thompson
Fisheries	Refrigerator, no frost, cold storage	WFB 120A	II	Yes, every six months	No	R. Thompson
Fisheries	Refrigerator, laboratory, cold storage	WFB 120A	II	Yes, every six months	No	R. Thompson
Fisheries	Frigidaire Refrigerator, cold storage	WFB 110	II	Yes, every six months	No	R. Thompson
Fisheries	Refrigerator, laboratory, cold storage	WFB 112	II	Yes, every six months	No	R. Thompson
Fisheries	Refrigerator, laboratory, cold storage	WFB 112	II	Yes, every six months	No	R. Thompson
Fisheries	Cold Spot Freezer, cold storage	WFB 200	II	Yes, every six months	No	R. Thompson
Fisheries	(Three) Laboratory Refrigerators, cold storage	WFB 214	II	Yes, every six months	No	R. Thompson
Fisheries	(Two) Sub-Zero Freezers, cold storage	WFB 214	II	Yes, every six months	No	R. Thompson
Fisheries	Refrigerator, laboratory, cold storage	WFB 264	II	Yes, every six months	No	R. Thompson
Fisheries	Refrigerator, laboratory, cold storage	WFB 272	II	Yes, every six months	No	R. Thompson
Forestry	Stults Germinators (four), germinate seeds	NR 108	II	Yes, start of every year	It has been maintained, but no repairs were needed. There will be repairs needed Spring 01 semester.	Bigg

Forestry	Incubator, maintain cultures of fungus or plants	NR 119A	II	No, just as needed; machine has sealed compressor	No	Bigg
Forestry	Freezer, seed storage	NR 108	II	No, sealed maintenance-free unit	No	Bigg
Forestry	Refrigerator/Freezer, mostly chemical storage	NR 119A	II	No, sealed maintenance-free unit	No	Bigg
Forestry	Gilson Respirometer, used to measure respiration in plant parts	NR 108	II	Yes, start of every year	Replaced seals on one active channel (used stock parts); re-filled oil reservoirs on all active channels (used stock parts)	Bigg
Forestry	Growth Chambers (three), grow plants	NR 119A	I	Yes, start of every semester; dept does all the non-refrigeration work. Plant Operations helps with motor removal and repair	One chamber was re-lamped Spring 01. Plant Operations provided the bulbs; dept did the work	Bigg
Forestry	Cold Room, storage of tree seedlings and pollen core samples	FR 215	I	Yes, annually, Plant Operations	No; when necessary, Plant Operations covers the cost and makes the repairs	Plant Operations
Geology	Kenmore, 21 cubic ft., Refrigerator/Freezer, cool sample storage	VMH 114	II	No	No	North
Geology	Haskris Water Chiller, cools x-ray tube on XRD	FH 22	II	Yes, dept, every three months	Yes	North
INRSEP	Refrigerators (two)	Hs. 38	II	No	No	INRSEP
INRSEP	Freezer	Hs. 38	II	No	No	INRSEP
NRPI	Explosion-Proof Refrigerator, chemical storage	NR 104	II	Yes, NR Technician	No	NR Stockroom
NRPI/RRWS	Refrigerator, chemical and seed storage	NR 209	II	Yes, NR Technician	No	RRWS and NR Stockroom
Nursing	Refrigerator, samples and medications cold	GH 122	II	No	No	
Physics	Countertop Refrigerator, film storage	ScIA 471	II	No	No	B. Alexander
RRWS	Small Refrigerators (three), storage of perishables	NR 225	II	No	No	Fulgham or NR Stockroom
RRWS	Upright Freezer, storage of perishables	NR 225	II	No	No	Fulgham or NR Stockroom

RRWS	Small Refrigerator, storage of media and chemical solutions	NR 106	II	No	No	S. Marshall or NR Stockroom
RRWS	Water Bath, controlled temperature analyses	NR 122B	II	No	No	Hauxwell or NR Stockroom
RRWS	Refrigerators, student club food service	NR 102 (Student Lounge)	II	No	No	Fulham or NR Stockroom
Wildlife	Refrigerator, drug storage	Bldg 34 Room 11	II	No	No	Golightly
Wildlife	Refrigerator/Freezer, animal food	Bldg 34 Room 1	II	No	No	Golightly
Wildlife	Freezer, animal food	Bldg 34 Room 1	II	No	No	Golightly
Wildlife	Freezer, animal food	Bldg 34 Room 1	II	No	No	Golightly
Wildlife	Freezer, animal food	WFB 3	II	No	No	Golightly
Wildlife	Freezer, animal food	WFB 3	II	No	No	Golightly
Wildlife	Freezer, animal food	WFB 6	II	No	No	Golightly
Wildlife	Freezer, animal food	WFB 6	II	No	No	Golightly
Wildlife	Freezer, walk-in, teaching	WFB 164	I	Yes, Plant Operations	Yes, Plant Operations	Plant Operations
Wildlife	Refrigerator/Freezer, teaching, research	WFB 166A	II	No	No	Golightly
Wildlife	Freezer, teaching, research	WFB 166A	II	No	No	Golightly
Wildlife	Refrigerator, teaching, research	WFB 244	II	No	No	Golightly
Wildlife	Refrigerator/Freezer, teaching/research	Bldg 17 Room 7	II	No	No	Golightly
Wildlife	Refrigerator/Freezer, teaching/research	Bldg 17 Room 9	II	No	No	Golightly
Wildlife	Refrigerator/Freezer, teaching/research	Bldg 17 Room 9	II	No	No	Golightly
Wildlife	Freezer, teaching/research	Bldg 17 Room 9	II	No	No	Golightly
Wildlife	Freezer, teaching/OWON	Bldg 17 Room 9	II	No	No	Golightly
Wildlife	Refrigerator/Freezer, teaching/OWON	Bldg 17 Room 11	II	No	No	Golightly
Wildlife	Freezer, teaching/OWON	Bldg 17 Room 11	II	No	No	Golightly
Wildlife	Freezer, teaching, research	Bldg 17 Room 11	II	No	No	Golightly

Wildlife	Refrigerator, walk-in, dept teaching, research	WFB 136	I	Yes, Plant Operations	No	Plant Operations
Wildlife	Freezer, walk-in, dept teaching, research	WFB 136	I	Yes, Plant Operations	No	Plant Operations
Wildlife	-86°C Freezer, tissue samples, reagent proteins	WFB 134	II	No	No	R. Brown
Wildlife	Frigidaire Refrigerator/Freezer, microbiology	WFB 134	II	No	No	Botzler
Wildlife	Sanyo Refrigerator/Freezer, storage specimens	WFB 248	II	No	No	George
Wildlife	Refrigerator/Freezer, plant/animal samples	WFB 110	ii	No	No	Black
Wildlife	Refrigerator/Freezer, lab materials	Bldg 34 Room 17	II	No	No	Golightly
Wildlife	Refrigerator, walk-in, teaching	Bldg 34 Room 13	I	Yes, Plant Operations	No	Golightly
Wildlife	Freezer, teaching/OWON	Bldg 17 Room 11	II	No	No	Golightly
Wildlife	Freezer, teaching, research	Bldg 17 Room 11	II	No	No	Golightly
Wildlife	Refrigerator, walk-in, dept teaching, research	WFB 136	I	Yes, Plant Operations	No	Plant Operations
Engineering	Freezer, walk-in, dept teaching, research	WFB 136	I	Yes, Plant Operations	No	Plant Operations
Engineering	Refrigerator, food storage	Hs. 18	II	No	No	ERE
Engineering	Refrigerator, food storage	Scid 023	II	No	No	ERE Student Association
Engineering	Incubator	Scid Cage		No	Yes. Repaired two years ago by off campus company - \$750. Paid for by ERE. Needs repair again.	ERE
Engineering	Incubator	Scid 9	II	Broken	Needs repair	ERE
Engineering	Incubator	Scid 11	II	No	No	ERE
Engineering	Incubator	Scid 11	II	No	No	
Engineering	Refrigerator	Scid 11	II	No	No	
Engineering	Refrigerator Lab Station	Scid 1 (will move to JH 214 Summer 01)	II	No	No	ERE



Notes:

For Biology:

Each refrigerator is in an area for which there is a responsible individual. Those individuals report problems to Anthony Baker who:

- 1) assesses the problem,
- 2) sends the request for repair to Marty Reed, and
- 3) arranges for a temporary replacement and evacuation of contents.

different-sized refrigerators or freezers use the same amount of electricity per year, the larger model can be considered more efficient because it keeps more space cold with the same amount of electricity).

These lists represent the best-of-the-best in energy-efficient appliances. The ACEEE publication "*The Consumer Guide to Home Energy Savings*" offers a more extensive list of efficient appliances.

Please note that an asterisk (*) appearing in a model number indicates a digit or letter that varies with features of the appliance not affecting efficiency or capacity (for example, color).

Top-Rated Refrigerators and Freezers

- | | |
|--|---|
| <input type="checkbox"/> <u>Top Freezer: less than 18 cubic feet</u> | <input type="checkbox"/> <u>Single Door Refrigerator: all sizes</u> |
| <input type="checkbox"/> <u>Top Freezer: 18 - 21 cubic feet</u> | <input type="checkbox"/> <u>Compact & small combo: less than 10.5 cubic feet</u> |
| <input type="checkbox"/> <u>Top Freezer: greater than 21 cubic feet</u> | <input type="checkbox"/> <u>Compact & small fridge: less than 10.5 cubic feet</u> |
| <input type="checkbox"/> <u>Bottom Freezer</u> | <input type="checkbox"/> <u>Upright Freezer: all sizes</u> |
| <input type="checkbox"/> <u>Side-by-side: less than 25 cubic feet</u> | <input type="checkbox"/> <u>Chest Freezer: all sizes</u> |
| <input type="checkbox"/> <u>Side-by-side: greater than 25 cubic feet</u> | |

Top Freezer, Automatic Defrost, less than 18 Cubic Feet

Brand	Model	Volume	Energy Use (kWh/yr)	Annual Energy Cost (\$) *
Sun Frost	RF-16	14.31	254	21
Whirlpool	ET5WSE*K*0	14.54	372	31
Magic Chef	CTL1511GEW	14.96	386	32
Magic Chef	CTN1511GEW	14.96	386	32

Top Freezer, Automatic Defrost, 18 - 21 Cubic Feet

Brand	Model	Volume	Energy Use (kWh/yr)	Annual Energy Cost (\$) *
Kenmore	6397*30*	18.79	392	32
Kenmore	6398*30*	18.79	392	32
Kenmore	7397*30*	18.79	392	32
Kenmore	7398*30*	18.79	392	32
Kenmore	7290*20*	18.75	416	34
Kenmore	6199*10*	18.79	416	34
Kenmore	6399*20*	18.79	416	34
Kenmore	7299*20*	18.79	416	34
Whirlpool	GT9SHK*M*O*	18.81	416	34

Top Freezer, Automatic Defrost, greater than 21 Cubic Feet

Brand	Model	Volume	Energy Use (kWh/yr)	Annual Energy Cost (\$) *
Kenmore	7328*30	21.55	437	36
Kenmore	7329*30*	21.55	437	36

Kenmore	6328*30*	21.59	437	36
Kenmore	6329*30*	21.59	437	36
Kenmore	6125*10*	21.59	457	38
Kenmore	7125*10*	21.59	457	38
Kenmore	7120*10*	21.61	457	38
Kenmore	7129*10*	21.61	457	38
Kenmore	7220*20*	21.61	457	38
Kenmore	6128*10*	21.65	457	38
Kenmore	7128*10*	21.65	457	38
Kenmore	7229*20*	21.65	457	38

Bottom Freezer

<i>Brand</i>	<i>Model</i>	<i>Volume</i>	<i>Energy Use (kWh/yr)</i>	<i>Annual Energy Cost (\$)*</i>
Kenmore	7295*	18.52	475	39
Kenmore	7225*	21.92	490	41
Kenmore	7228*	21.92	440	41

Side-by-side, less than 25 Cubic Feet

<i>Brand</i>	<i>Model</i>	<i>Volume</i>	<i>Energy Use (kWh/yr)</i>	<i>Annual Energy Cost (\$)*</i>
Kitchen Aid	KSRA2255**0*	21.70	540	45
Kitchen Aid	KSSS36QM*0*	20.96	566	47
Kenmore	5320*20*	21.91	572	47
Kenmore	5329*20*	21.91	572	47
LG Electronics	LRS*C20###**	19.53	578	48

Side-by-Side, greater than 25 Cubic Feet

<i>Brand</i>	<i>Model</i>	<i>Volume</i>	<i>Energy Use (kWh/yr)</i>	<i>Annual Energy Cost (\$)*</i>
Kenmore	5360*20*	25.57	582	48
Kenmore	5369*20*	25.57	582	48
Kenmore	5468*30*	25.57	582	48
Kenmore	5469*30*	25.57	582	48
General Electric	PSF26NGN**	25.50	613	51
General Electric	PSW26SGN**	25.50	613	51
General Electric	ESS25LGN	25.38	613	51
General Electric	ESS25LSN**	25.38	613	51
General Electric	GSS25SXN**	25.38	613	51
General Electric	ESS25GXN	25.38	613	51
General Electric	PSS25MGN**	25.38	613	51
General Electric	PSS25NGN**	25.27	613	51
General Electric	PSS25SGN**	25.27	613	51

Single-door, refrigerator only, automatic defrost, all sizes

Brand	Model	Volume	Energy Use (kWh/yr)	Annual Energy Cost (\$)*
Sun Frost	R-19	16.14	204	17
Crosley	FFCR17/G	16.80	372	31
Wood's	RFA17NAD**	16.80	372	31
Sub-Zero	601R*	19.94	417	35

Compact & small refrigerator-freezers, less than 10.5 cubic feet

Brand	Model	Volume	Energy Use (kWh/yr)	Annual Energy Cost (\$)*
Absocold	GARD562MG10R/L	5.60	268	22
Avanti	1201W-1	11.00	277	23

Compact & small refrigerators, less than 10.5 cubic feet

Brand	Model	Volume	Energy Use (kWh/yr)	Annual Energy Cost (\$)*
Avanti	RM901W	8.70	230	19
Avanti	BCA902W	8.87	247	20
BSH Home Appliances	RC29	9.98	274	23

Upright freezer, automatic & manual defrost, all sizes

Brand	Model	Volume	Energy Use (kWh/yr)	Annual Energy Cost (\$)*
Avanti	VM799W	7.50	292	24
Wood's	V10NAE*	10.40	353	29
Wood's	V15NAE*	15.00	409	34
Crosley	WCV17/E	16.90	430	36
Wood's	V17NAE	16.90	430	36

Chest freezer, manual defrost, all sizes

Brand	Model	Volume	Energy Use (kWh/yr)	Annual Energy Cost (\$)*
Crosley	WCC10/E	10.0	282	23
Crosley	WCC12/E	12.2	298	25
Crosley	WCC12/G	12.2	298	25
Wood's	C09NAD	9.0	251	21
Wood's	C10NAE	10.0	282	23
Wood's	C12NAD	12.2	298	25

*Annual energy cost based on U.S. national average electricity cost of 8.28 cents per kWh.

Please note that an asterisk (*) appearing in a model number indicates a digit or letter that varies with features of the appliance not affecting efficiency or capacity (for example, color).

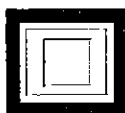
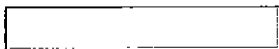
Page last updated October 14, 2003

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Home Energy Magazine Online January/February 1996

TRENDS

United States Leads in Refrigerator

Efficiency

Japan recently adopted the International Standards Organization (ISO) energy test procedure for measuring the energy use of its refrigerators. This is a closed-door, constant temperature test, similar to that used by the U.S. Department of Energy. Now it is easier to compare the energy use of Japanese, European, and U.S. refrigerators. Figure 1 shows the range of energy use for all three groups. Energy efficiency is expressed in kWh per year per liter of refrigerator capacity. (This is how the Europeans calculate efficiency.) For reference, an 18 ft³ refrigerator has a capacity of 510 liters.

While Japanese refrigerator efficiency has stagnated in the last decade, and European refrigerators have made modest gains, the U.S. units have jumped ahead of the pack. Some American units provide twice as much refrigerator capacity for the same amount of energy consumed as the Japanese units. Whirlpool's Golden Carrot refrigerators, and similar models offered by Whirlpool's competitors, ensure that the gap will widen.

This data summarized in Figure 1 should be interpreted with caution. First, Europeans and Japanese use smaller refrigerators than Americans, so the actual difference in energy *use* per refrigerator is much less than these figures indicate. Second, the refrigerators provide slightly different amenities. The European models are more spartan than the Japanese and U.S. models. Third, the U.S. energy test procedure differs slightly from the ISO test procedure. The U.S. test can yield a 2% to 46% higher energy use for the same refrigerator (thus the U.S. models may actually be further ahead than shown).

Most of the U.S. efficiency improvement occurred during the late 1980s, when Europe and Japan lacked efficiency standards. These most recent results demonstrate that the combination of U.S. federal efficiency standards and utility incentives (like the Golden Carrot) have successfully catapulted U.S. manufacturers to the forefront of energy efficiency.

-Alan Meier

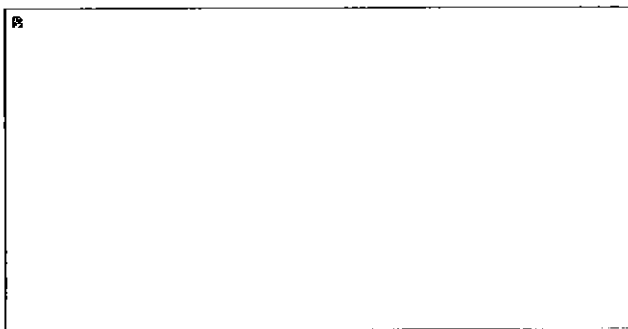


Figure 1. Comparison of energy consumption per liter of frost-free refrigerator-freezers manufactured in the United States, Europe, and Japan in 1995.

COLLEGE OF NATURAL RESOURCES & SCIENCES
Refrigeration Equipment Inventory - Part 2
June 2001

Department	Description of Item and What It Is Used For	Location of Item	Frost Free or Manual Defrost?	Brand/Year (i.e., GE 1998)	Size (i.e., 15 cubic feet or 3'Hx2'x W'D)	Condition Description (i.e., Good, Fair, Poor plus any additional information)	Is refrigerator used/needed on a daily basis? Is current refrigerator used to capacity? The more full, the more energy efficient.	If replacement is possible, would you be satisfied with a smaller unit? If so, what size, type, model?
SAMPLE	Refrigerator, cultures	XXXX	Frost Free	Frigidaire 1989	19 cu ft	Fair; has had to be repaired several times	No, very little. Could be unplugged for extended periods or until needed. Not used from May - Sept.	Will consolidate and put contents in another. Refrigerator could be disposed of.
SAMPLE	Freezer, specimens	XXXX	Manual Defrost	Gibson 1956	21 cu ft	Poor, hole rusted through on inside	Yes, frequent use but not used to capacity	Smaller, 15 cu ft. would be okay.
Biology	Coldroom, specimens	SciA 367	Frost Free		Built-in	Good	Yes, frequent use; not at capacity	
Biology	Refrigerator/Freezer, 44627, specimens	SciA 453	Manual	Sears		Good	Yes, frequent use; not at capacity	
Biology	Freezer, chemicals, samples	SciB 121	Manual	Kenmore		Good	Yes	
Biology	Refrigerator/Freezer, S11418, chemicals	SciB 121	Frost Free	Amana 1995	17.8 cu ft	Good		
Biology	Freezer, 47976, chemicals/specimens	SciB 122	Manual	Sears		DEAD		
Biology	Ice Machine, S11410, ice	SciB 122		Scotsman 1995	140# storage			
Biology	Incubator, SO3257, 8/85	SciB 122		Napco 1985				
Biology	Refrigerator/Freezer, SO2324, 9/93, chemicals/specimens	SciB 122	Frost Free	Kenmore 1993		Good	Yes	
Biology	Refrigerator, cold room	SciB 122	Frost Free		Built in	Good	Yes	Varkey
Biology	Refrigerator, specimens	SciB 123		Absocold				
Biology	Refrigerator/Freezer, specimens	SciB 123		Admiral				
Biology	Refrigerator, food	SciB 125						
Biology	Incubator, SO3258, 4/71, specimens	SciB 126	Manual	GE 1971				
Biology	Incubator, SO3455, 5/66, specimens	SciB 126	Manual	GE 1966				

X	Biology	Refrigerator, 48731, specimens	SciB 126	Manual	Crusley				
	Biology	Incubator, specimens	SciB 128						
	Biology	Incubator, SO3480, 3/82, specimens	SciB 128		Rheem 1982				
X	Biology	Freezer, Chest	SciB 128		Rangaire		Good		
X	Biology	Refrigerator, SO3505, 10/79, chemicals	SciB 134		Lab-line 1979				
X	Biology	Refrigerator/Freezer, 44640, chemicals	SciB 134		Sears				
	Biology	Incubator, SO3532, 8/82, flies	SciB 132		Kenmore 1982		Fair		
X	Biology	Freezer, cultures	SciB 224A	Manual	Sears	31.1 cu ft	Good		
X	Biology	Refrigerator/Freezer, SO3422, 12/88, chemicals/cultures	SciB 224A						
X	Biology	Freezer, SO8078, cultures	SciB 224C	Frost Free	1988 GE 1980	17.2 cu ft	Good	Not at capacity	
X	Biology	Ultracold Freezer, 00278, 3/01, cultures	SciB 224C		Revco 2001		Good		
X	Biology	Refrigerator/Freezer, 44616, chemicals, cultures	SciB 224B	Frost Free	Sears		Good		
X	Biology	Freezer, SO3304, 2/90, cultures	SciB 228	Frost Free	Gibson 1990			Siering	
	Biology	Incubator, 44683, cultures	SciB 228						
	Biology	Incubator, 44684, cultures	SciB 228		Precision				
	Biology	Incubator, 44685, cultures	SciB 228						
X	Biology	Refrigerator, SO4156, 11/93, cultures	SciB 228	Frost Free	Gibson 1993			4	
X	Biology	Freezer, chemicals/samples	SciB 230		Galaxy 2000			baker	
X	Biology	Freezer, SO4157, 11/93, chemicals	SciB 230		GE 1993	21 cu ft			
X	Biology	Refrigerator/Freezer, SO3335, 12/88,	SciB 230		Wards	20 cu ft			

	1988										
Biology	chemicals/cultures Ultracold Freezer, S12638, 3/00, chemicals/cultures	SciB 230			1988						
Biology	Refrigerator/Freezer, chemicals, 44622	SciB 230B	Frost Free		Reyco 2000						
Biology	Freezer, chemicals	SciB 324			Amana				Good		
Biology	Ultracold Freezer, SO7928, cultures	SciB 324	Manual		Reyco				Good		
Biology	Incubator, SO7927, 4/97, cultures	SciB 324C			Precision 1997				Good		
Biology	Incubator, SO9236, 4/97, cultures	SciB 324C			Precision				Good		
Biology	Incubator, 44756, 11/93, chemicals	SciB 324D			GE 1993				Fair	Not at capacity	
Biology	Refrigerator/Freezer, SO7164, 2/90, chemicals	SciB 324D	Manual		Maytag 1990				Good	Full	
Biology	Incubator, SO3272, 6/86, cultures	SciB 324F			Napco 1986				Fair	Not at capacity	
Biology	Refrigerator/Freezer, chemicals, cultures, SO6965	SciB 324F	Frost Free		GE				Good		
Biology	4 Growth Chambers, 1 Cold, 1 Hot, animals and plants	SciB 325									
Biology	Refrigerator/Freezer, chemicals	SciB 328B	Frost Free		Kenmore 2000				Good		
Biology	Freezer, 44618, cultures	SciB 334	Frost Free		Sears				Fair	Not at capacity	lu
Biology	Refrigerator, SO3253, 3/79, chemicals	SciB 330	Manual		Lab-line 1979				Fair		
Biology	Refrigerator/Freezer, 44639, chemicals	SciB 330									
Biology	Incubator, 44757, 6/81, cultures	SciB 334	Manual		GE 1981				Poor	Not at capacity	
Biology	Incubator, 46868, cultures, SO3259	SciB 334	Manual		Freas				DEAD		
Biology	Incubator, SO3221, 6/86, cultures	SciB 334	Frost Free		Napco 1986				Good		
Biology	Refrigerator/Freezer, SO3262, 2/90, chemicals/cultures	SciB 334	Frost Free		Maytag 1990				Good	Yes	

X	Biology	Freezer, specimens, 39065	SciC 203	Manual	Sears		Fair	Yes	
X	Biology	Refrigerator/Freezer, 44624, chemicals	SciC 102	Frost Free	Sears		Fair	Yes	
X	Biology	Refrigerator/Freezer, chemicals	SciC 108						
X	Biology	Refrigerator/Freezer, specimens	SciC 117B						
X	Biology	Incubator, SO3639, 9/71, specimens	SciD 141		Precision 1971				
X	Biology	Refrigerator, 44623, specimens	SciD 141				DEAD		
X	Biology	Refrigerator/Freezer, cultures, Biol 00-011	SciD 143A		2000				
X	Biology	Refrigerator/Freezer, 277, cultures	SciD 143A						
X	Biology	Refrigerator/Freezer, chemicals, cultures	SciD 143A						Replacement in 2001
X	Biology	Coldroom, cultures	SciD 143A			Built in		Wingelbach	
X	Biology	Refrigerator, SO3642, 9/82, specimens	SciD 145		Sears 1982				
X	Biology	Refrigerator, SO3644, 8/82, specimens	SciD 147		Sears 1982				
X	Biology	Refrigerator, S10930, 4/88, chromatography	SciD 149		Fisher 1988		Compressor Probs Recently		
X	Biology	Refrigerator, SO3643, 9/82, specimens	SciD 151		Sears 1982				
X	Biology	Refrigerator/Freezer, 44630, specimens	SciD 151						
X	Biology	Refrigerator, SO9221, 3/97, specimens	SciD 153A		1997			Yes	
X	Biology	Refrigerator, specimens	SciD 153A			Built in			
X	Biology	Refrigerator/Freezer, Biol 00-110	SciB 224A	Frost Free	Kenmore 2001		Good	Yes	
X	Biology	Refrigerator/Freezer, cultures, SO3268	SciB 325	Frost Free	Kenmore		Good	Yes	
X	Biology	Refrigerator/Freezer, SO3406	SciB 325	Frost Free	GCA		Fair	Not used	
X	Biology	Refrigerator/Freezer, chemicals, Biol 00-139	SciB 330	Frost Free	Kenmore 2001		Good	Yes	
X	Biology	Refrigerator/Freezer,	SciC 203	Frost Free	Mont Ward	18.2 cu ft	Good	Yes	

Chemicals/specimens													
Biology	Refrigerator, S03592	SciD 181	Frost Free	Precision									Yes
Biology	Cold Room	SciD 181			Built in								Yes
Biology	Refrigerator, specimens, 44623	SciB 128	Frost Free	Sears									Yes
Biology	Refrigerator/Freezer	SciB 122	Manual	Mont Ward									Yes
Biology	Refrigerator/Freezer	SciB 122	Frost Free	Kenmore									Yes
Chemistry	Revco Refrigerator, Explosion Proof, S02921, flammable chemical storage	Bldg 3A 5th Floor Hall		Revco									
Chemistry	Kelmore Refrigerator, Explosion Proof, 48800, chemical storage	Bldg 3A Room 566		Kelmore									
Chemistry	Kenmore Freezer, S02919, chemical reagent storage	Bldg 3A Room 568		Kenmore									
Chemistry	Kenmore Freezer, S02920, chemical reagent storage	Bldg 3A Room 568		Kenmore									
Chemistry	Frigidaire, chemical reagent storage	Bldg 3A Room 568		Frigidaire									
Chemistry	Neslab Cryocooler, 47770, freeze drying	Bldg 3A Room 568		Neslab									
Chemistry	Kenmore Refrigerator, S02922, biological specimen storage	Bldg 3A 5th Floor Hall		Kenmore									
Chemistry	GE, chemical/biological reagent storage	Bldg 3A Room 568A		GE									
Chemistry	GE, chemical reagent storage	Bldg 3A Room 369D		GE									
Chemistry	Revco Refrigerator, S09805, low temperature chromatography	Bldg 3A Room 568		Revco									
Chemistry	Lauda IG6, Cryocooler, 45547, research FTIR	Bldg 3A Room 373		Lauda									
Chemistry	GE, chemical/biological reagent storage	Bldg 3A Room 568A		GE									
Chemistry	Revco Refrigerator, S09805, low temperature chromatography	Bldg 3A Room 568		Revco									

Chemistry	Lauda IC6, Cryocooler, 45547, research FTIR	Bldg 3A Room 373	Lauda						
Chemistry	GE, chemical reagent storage	Bldg 3A Room 369D	GE						
Computing Science	Small Refrigerator, faculty food	NHW 237A							
ERE	Refrigerator, food storage	Hs. 18							
ERE	Refrigerator, food storage	SciD 023							
ERE	Refrigerator Lab Station	SciD 1 (will move to JH 214 Summer 01)							
ERE	Incubator	SciD 11							
ERE	Incubator	SciD 11							
ERE	Refrigerator	SciD 11							
ERE	Incubator	SciD 9							
ERE	Incubator	SciD Cage							
ERE	Incubator	TML Rm. 113A	Revco	Frost Free	10.8 cu ft	Good	Occasional use	Size is adequate	
ERE	Refrigerator/Freezer; Cultures	TML Rm. 113A	GE 1990	Frost Free	18.2 cu ft	Good	Used daily and usually to capacity	Size is adequate	
ERE	Incubator	TML Rm. 113A	Revco	Frost Free	10.8 cu ft	Good	Occasional Use	Size is adequate	
ERE	Refrigerator/Freezer; Cultures	TML Rm. 113A	GE 1990	Frost Free	18.2 cu ft	Good	Used daily and usually to capacity	Size is adequate	
Fisheries	Refrigerator/Freezer; chemicals, reagents	TML Rm. 111B	White-Westinghouse; 1995	Frost Free	15.0 cu ft	Good	Used daily	Size is adequate	
Fisheries	-85°C Chest Freezer; chemicals, reagents	TML Rm. 111B	Revco 1994	Manual	10.0 cu ft	Good	Used daily to capacity	Adequate size; could be bigger	
Fisheries	Refrigerator/Freezer; reagents, culture media	TML Rm. 111C	Kenmore 1990	Manual	13.0 cu ft	Good	Used daily to capacity	Size is adequate	
Fisheries	Refrigerator/Freezer; chemicals, reagents	TML Rm. 111B	White-Westinghouse; 1995	Frost Free	15 cu ft	Good	Used daily	Size is adequate	
Fisheries	-85°C Chest Freezer;	TML	Revco	Manual	10 cu ft	Good	Used daily to capacity	Adequate size; could be	

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	Specimen tissue sample	Rm. 111B	Manual	1994	13 cu ft	Good			Used daily to capacity	bigger
Fisheries	Refrigerator/Freezer; Reagents, culture media	TML Rm. 111C	Manual	Kenmore 1990	13 cu ft	Good			Used daily to capacity	Size is adequate
Fisheries	Frigidaire Refrigerator, cold storage	WFB 110	Frost Free	Frigidaire	18.0 cu ft	New			Used daily; full	Size is good
Fisheries	Freezer, laboratory, cold storage	WFB 112	Frost	Amana	18.0 cu ft	Fair			Used daily; full	Size is good
Fisheries	Refrigerator, laboratory, cold storage	WFB 112	Frost Free	Fisher	18.0 cu ft	New			Used daily; full	Size is good
Fisheries	Freezer	WFB 112	Frost	Kenmore	12 cu ft chest	New			Used daily; full	Size is good
Fisheries	Low Temperature Incubator, cold storage	WFB 120A	Frost Free	Fisher	18.0 cu ft	New			Used daily; full	Size is good
Fisheries	Refrigerator, no frost, cold storage	WFB 120A	No frost	Fisher	18.0 cu ft	New			Used daily; full	Size is good
Fisheries	Refrigerator, laboratory, cold storage	WFB 120A	Frost	GE	18.0 cu ft	Fair			Used daily; full	Size is good
Fisheries	Cold Spot Freezer, cold storage	WFB 200	Frost Free	Sears	18.0 cu ft	Fair			Used daily; full	Size is good
Fisheries	(Three) Laboratory Refrigerators, cold storage	WFB 214	All Frost Free	Fisher Sears Fisher	18.0 cu ft 12.0 cu ft 18.0 cu ft	New New New			All used daily	Size is good
Fisheries	(Two) Sub-Zero Freezers, cold storage	WFB 214	Frost Free Frost	Jo Ultra Low	20.0 cu ft 18.0 cu ft	New Old			Used daily	Size is good
Fisheries	Refrigerator, laboratory, cold storage	WFB 264	Frost Free	Fisher	18.0 cu ft	New			Used daily	Size is good
Fisheries	Refrigerator, laboratory, cold storage	WFB 272	Frost Free	Gibson	12.0 cu ft	Fair			Yes	Size is ok
Forestry	Coldroom; storage of tree seedlings and pollen core samples	FO215	N/A	Class I Equipment	840.0 cu ft	Good			Used continuously; partial capacity	Retain
Forestry	Cold Room, storage of tree seedlings and pollen core samples	FR 215	Manual	Unknown	840 cu ft	Fair; compressor has failed several times in past decade			Used for long term storage of pollen cores, short term seasonal storage of tree seedlings; not currently being used to capacity	Need at least 24 cu ft of cold storage for pollen cores and 60 cu ft for seedling storage
Forestry	Suits Germinator; germinate seeds	NR 108 HSU S01069 (47089)	N/A	Stults Scientific Engineering	71"Hx 52"Wx 28.5"D	Good; maintained each year before start of fall semester			Used constantly during semester; turned off when not in use	Current model is basically the same; George Pease upgraded the electronics to new control panels a few years ago and that was the only substantial change in current model
Forestry	Suits Germinator; germinate seeds	NR 108 HSU	N/A	Stults Scientific	71"Hx 52"Wx	Good; maintained each year before start of fall			Used constantly during semester; turned off when not	Current model is basically the same; George Pease



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		S01070 (47090)		Engineering	28.5'D	semester	in use	upgraded the electronics on new control panels a few years ago and that was the only substantial change in current model
Forestry	Freezer, upright, seed storage	NR 108 HSU 51841	Manual	Sears Kenmore, Model 21161 ~10 yrs old Gilson	66"Hx 29.5"Wx 26.5"D 16 cu ft	Good; maintained each year before start of fall semester	Used constantly	No; this unit is full of seeds and is as small as is practice
Forestry	Gilson Respirometer, used to measure respiration in plant parts	NR 108 HSU S01068 (46853)	Does not freeze, so never defrosted		59"Hx 25"Wx 16.5"D (including super-structure)	Good; maintained each year before start of fall semester; refrigeration rebuilt a few years ago	Used for two weeks during class experiments; not plugged in when not in use	No; they don't make a smaller unit
Forestry	Incubator (Humidity Chamber), maintain cultures of fungus or plants	NR 119A	N/A	Environator Corp.	75.5"Hx 35.5"Wx 33.5"D 26 cu ft	Good; maintained before it is used	Seldom used and not turned on when not in use	Yes; a smaller incubator would be okay, but since it is not used regularly the cost of replacement would not be justified. George Pease replaced the compressor a few years ago and the machine works well.
Forestry	Refrigerator/Freezer, mostly chemical storage	NR 119A HSU 46015	Frost Free	Sears Coldspot 25+ yrs old	19.2 cu ft	Good; maintained as needed	Used constantly	No; this unit is nearly full and a smaller unit would not be practical
Forestry	Growth Chamber, grow plants	NR 119A HSU S01048 (48034)	N/A	Western Environmental	84"Hx 107"Wx 36"D 70 cu ft	Good maintained constantly; Plant Ops does refrigeration, plumbing and electrical maintenance; George Pease does other maintenance (i.e., electronics) (GROUP I MAINTENANCE)	Used during semester courses	No; these units are barely large enough to be useful. Newer units have better controls, but the compressors are relatively new and are water cooled.
Forestry	Growth Chamber, grow plants	NR 119A HSU S01049 (48035)	N/A	Western Environmental	84"Hx 107"Wx 36"D 70 cu ft	Good maintained constantly; Plant Ops does refrigeration, plumbing and electrical maintenance; George Pease does other maintenance (i.e., electronics) (GROUP I MAINTENANCE)	Used during semester courses	No; these units are barely large enough to be useful. Newer units have better controls, but the compressors are relatively new and are water cooled.
Forestry	Growth Chamber, grow plants	NR 119A HSU	N/A	Western Environmental	84"Hx 107"Wx	Good maintained constantly; Plant Ops	Used during semester courses	No; these units are barely large enough to be useful.

		S01050 (48036)		mental	36"D 70 cu ft	does refrigeration, plumbing and electrical maintenance; George Pease does other maintenance (i.e., electronics) (GROUP I MAINTENANCE)		Newer units have better controls, but the compressors are relatively new and are water cooled.
Forestry	Humidity Chamber; adjust moisture content of samples	NR 222 HSU S01001	N/A	Environator Corp.	75.5"Hx 35.5"Wx 33.5"D	Good	Retain	Retain
Forestry	Humidity Chamber; adjust moisture content of samples	NR 222 HSU S01002	N/A	Environator Corp.	75.5"Hx 35.5"Wx 33.5"D	Good	Retain	Retain
Geology	Haskris Water Chiller, cools x-ray tube on XRD	FH 22		Haskris				
Geology	Kenmore, 21 cubic ft., Refrigerator/Freezer, cool sample storage	VMH 114		Kenmore	21 cu ft			
INRSEP	Refrigerators (two)	Hs. 38						
INRSEP	Freezer	Hs. 38						
Marine Lab	Refrigerator/Freezer; Food storage only	TML Rm. 116	Frost Free	Kenmore 1996	15 cu ft	Good	Used daily and usually to capacity	Size is adequate
Marine Lab	Refrigerator/Freezer; Chemicals, Reagents	TML Rm. 111	Manual	Coldspot 1970	12 cu ft	Very poor, junk	Rarely used	Can be disposed of
Marine Lab	Incubator; algae cultures	TML Rm. 111	Manual	Precision 1985	17 cu ft	Poor; doesn't work, looking for parts	Currently not used, but was used often	Size is adequate
Marine Lab	Incubator; algae cultures	TML Rm. 116	Manual	Precision 2001	18 cu ft	Excellent, New	Used often during the school year	Size is adequate
Marine Lab	Chest Freezer; fish for feeding aquarium animals	TML Rm. 121	Manual	Mont. Ward 1986?	18.5 cu ft	Fair	Used daily	Size is adequate
NRPI	Explosion-Proof Refrigerator, small, chemical storage	NR 104 HSU01014	Frost Free	Marvel	34.5"Hx 24"Wx 24"D	Good	Used continuously; partial capacity	Retain
NRPI/ RRWS	Refrigerator, chemical, specimen, and seed storage; perishables	NR 209 HSU52537	Manual	Hotpoint	61.5"Hx 28"Wx 23"D	Good	Used continuously; partial capacity	Retain
Nursing	Refrigerator, samples and medications cold	GH 122						
Oceano- graphy	Refrigerator/Freezer; chemicals, radioactive isotopes	TML Rm. 111A	Manual	Coldspot 1970	12 cu ft	Very poor, junk	Used occasionally	Should be disposed of and replaced with similar size
Oceano- graphy	Incubator; seawater samples	TML Rm. 111A	Manual	Fisher Scientific	6 cu ft	Good	Used on Research Vessel	Size is adequate

					1998										
Oceanography	Refrigerator/Freezer; reagents	TML Rm. 112	Manual	Coldspot 1970	12 cu ft	Very poor, junk		Used occasionally	Should be disposed of						
Oceanography	Refrigerator/Freezer; reagents	TML Rm. 112	Frost Free	Magic Chef 1992	18 cu ft	Good		Used daily, but not to capacity	Will be used to replace Coldspot above, could be smaller						
Physics	Countertop Refrigerator, film storage	SciA 471	Manual Defrost	Kenmore	7.0 cu ft	Good									
RRWS	Refrigerators, student club food service	NR 102 (Student Lounge)	Frost Free	Signature 2000, Model UAN15314	64"Hx28"Wx25"D, excluding coils; 15 cu ft	Good		Turned on when needed for student club food service	Retain						
RRWS	Small Refrigerator, storage of media and chemical solutions	NR 106	Manual	Marvel	34.5"Hx 24"Wx 24"D	Fair; old, well-used, but works fine		Used continuously; partial capacity	Retain						
RRWS	Water Bath, controlled temperature analyses	NR 122B	N/A	Forma Scientific, Model 2325	35"Hx34.5"Wx22.5"D, excluding control units	Good		Turned on when needed for courses and research	Retain						
RRWS	Small Refrigerators (three), storage of perishables	NR 225													
RRWS	Upright Freezer, storage of specimens	NR 225B/C HSU53402	Manual	Sears Kenmore, Model 25152	64"Hx 28"Wx 24.5"D, 15.1 cu ft	Good		Turned on when needed for courses and research	Retain						
RRWS	Explosion-Proof, Refrigerator, small; storage of chemicals and samples	NR 225B/C HSU54710	Frost Free	No manufacturer's label	34.5"Hx 24"Wx 24"D, excluding coils	Good		Turned on when needed for courses and research	Retain						
RRWS	Refrigerator, small, with freezer compartment; storage of chemicals and samples	NR 225B/C HSU51977	Manual	Marvel	34"Hx 24"Wx 24"D	Fair; old, well-used, but works fine		Not used.	Discard						
RRWS	Refrigerator, small, with freezer compartment; storage of perishables	NR 225B/C	Manual	Dyna-Tone	27.5"Hx 18"Wx 17.5"D, excluding coils	Good		Used continuously; partial capacity	Retain						
Wildlife	Refrigerator/Freezer, teaching/research	Bldg 17 Room 7	Frost Free	Frigidaire 1997	17 cu ft	Good		Yes	No						

Fulgham, NR 225B/C



Wildlife	Refrigerator/Freezer, teaching/research	Bldg 17 Room 9	Frost Free	Gipson 1999	17 cu ft	Good	Yes	No
Wildlife	Refrigerator/Freezer, teaching/research	Bldg 17 Room 9	Frost Free	Maytag 1995	18 cu ft	Good	Yes	No
Wildlife	Freezer, teaching/research	Bldg 17 Room 9	Frost Free	Gipson 1999	23 cu ft	Good	Yes	No
Wildlife	Freezer, teaching/OWCN	Bldg 17 Room 9	Frost Free	Kenmore 1997	21 cu ft	Good	Yes	No
Wildlife	Refrigerator/Freezer, teaching/OWCN	Bldg 17 Room 11	Frost Free	1997	17	Good	Yes	No
Wildlife	Freezer, teaching/OWCN	Bldg 17 Room 11	Frost Free	1999	20 cu ft	Good	Yes	No
Wildlife	Freezer, teaching, research	Bldg 17 Room 11	Manual	1997	23 cu ft	Good	Yes	No
Wildlife	Refrigerator, drug storage	Bldg 34 Room 11	Manual	Kenmore 1988	2'Hx2'Wx 2'D	Good	Yes	No
Wildlife	Refrigerator/Freezer, animal food	Bldg 34 Room 1	Cycle Defrost	Hotpoint	14.6 cu ft	Good	Yes	No
Wildlife	Freezer, animal food	Bldg 34 Room 1	Frost Free	Kenmore 1989	2-1/2'Wx 5'Hx2'D	Good	Yes	No
Wildlife	Freezer, animal food	Bldg 34 Room 1	Frost Free	Kenmore	2'Wx6'Hx 2'D	Good	Yes	No
Wildlife	Refrigerator/Freezer, lab materials	Bldg 34 Room 17	Frost Free	Sears 1994	16 cu ft	Good	Regular	No
Wildlife	Refrigerator, walk-in, teaching	Bldg 34 Room 13	Frost Free	McQuay	Walk In	Good	Experiment Support	No
Wildlife	Freezer, animal food	Bldg. 34	Manual Defrost	Sears	2'Wx 2-1/2'Hx 2-1/2'D	Good	Yes	No
Wildlife	Freezer, animal food	Bldg. 34	Manual Defrost	Tappan	3-1/2'Wx 2-1/2'Hx 2-1/2'D	Good	Yes	No
Wildlife	Refrigerator, animal food	Bldg. 34	Frost Free	Crosley	5'Hx2'Wx 2-1/2'D	Good	Yes	No
Wildlife	Freezer, animal food	Bldg. 34	Frost Free	Frigidaire	5'Wx 2-1/2'Hx 2-1/2'D	Good	Yes	No
Wildlife	Refrigerator/Freezer, plant/animal samples	WFB 110	Frost Free	Frigidaire	18 cu ft	Good	Yes	No
Wildlife	-86°C Freezer, tissue samples, reagent proteins	WFB 134	Manual(?)	Forma Scientific	78"x33"x 7"	Good	Yes	No
Wildlife	Frigidaire Refrigerator/Freezer, microbiology	WFB 134	Frost Free	Frigidaire	18 cu ft	Good	Yes	No

Gallightly

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Wildlife	Refrigerator, walk-in, dept teaching, research	WFB 136	Frost Free	Honeywell 1999	13'x7'x 6-1/2'	Good	Yes	No
Wildlife	Freezer, walk-in, dept teaching, research	WFB 136	Frost Free	Honeywell 1999	15'x10'x 7'	Good	Yes	No
Wildlife	Freezer, walk-in, teaching	WFB 164	Program-med	Custom 1999	Walk in	Good	No - Experimental Chamber	No
Wildlife	Refrigerator/Freezer, teaching, research	WFB 166A	Frost Free	Frigidaire 1999	17 cu ft	Good	Yes	No
Wildlife	Freezer, teaching, research	WFB 166A	Manual	Frigidaire 1997	21 cu ft	Good	Yes	No
Wildlife	Refrigerator, walk-in, dept teaching, research	WFB 242	Frost Free	Frigidaire 1999	18 cu ft	Good	Yes	No
Wildlife	Refrigerator, teaching, research	WFB 244	Manual	Sayor 1999	3 cu ft	Good	Yes	Already small
Wildlife	Sanyo Refrigerator/Freezer, storage specimens	WFB 248	Manual	Sanyo	3 cu ft	Good	No	No