Residential Refrigerator Recycling
Ninth Year Retention Study

Study ID Nos. 546B, 563

Prepared for

Southern California Edison Company
Rosemead, California

Prepared by

KEMA Inc.
Madison, Wisconsin

July 22, 2004

FINAL

NINTH-YEAR PERSISTENCE STUDY OF SOUTHERN CALIFORNIA EDISON'S 1994 THROUGH 1997 APPLIANCE RECYCLING PROGRAMS

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E

EXECUTIVE SUMMARY

This report provides the results of a ninth-year persistence study of Southern California Edison's (SCE) 1994 through 1997 Appliance Recycling Programs, as required by the Measurement and Evaluation Protocols (M&E Protocols) of the California DSM Measurement Advisory Committee (CADMAC).[1]

As given in the M&E Protocols, the goal of this measure persistence study is to determine "the length of time the measure(s) installed during the program year are maintained in operating condition." This issue is addressed by estimating a measure's effective useful life (EUL). A measure's EUL is defined as its median survival time. For each of the program years 1994–1997, the EULs will reflect

- the time at which half the recycled appliances are from participating premises that have added an appliance and
- the time at which half the recycled appliances would have met their ultimate death anyway.

For each of the program years 1994 through 1997, both refrigerators and freezers have an *ex ante* estimate of the EUL of six years, which has been used in the earnings claims to date. A measure's *ex post* EUL is the EUL estimated by a persistence study. If a measure's *ex ante* EUL is outside the 80 percent confidence interval, the measure's *ex post* EUL may be used for future earnings claims. Otherwise, the measure's *ex ante* EUL will continue to be used in earnings claims.

For each of the program years 1994 through 1997, this study recommends SCE adopt an *ex post* EUL of eight years for both refrigerators and freezers.

E.1 SUMMARY OF RESULTS

The results of this study are summarized in Table E-1.

[1] California Public Utilities Commission, *Protocols and Procedures for the Verification of Costs, Benefits, and Shareholder Earnings from Demand-side Management Programs*, Decision 93-05-063. Revised June 1999, pursuant to Decisions 94-05-063, 94-10-059, 94-12-021, 95-12-054, 96-12-079, 98-03-063, and 99-06-052.

Table E-1
1994–1997 Appliance Recycling Program
Summary of Effective Useful Life Estimates

Program Year	Measure	End Use	EUL (years)					EUL Realization Rate (adopted *ex post/ex ante*)
						80% Confidence Interval		
			ex ante	*ex post* (estimated from study)	Adopted *ex post* (to be used in claim)	Lower Bound	Upper Bound	
1994	Freezer	Refrigeration	6.0	8.0	8.0	8.0	11.0	1.33
	Refrigerator		6.0	8.0	8.0	8.0	11.0	1.33
1995	Freezer	Refrigeration	6.0	8.0	8.0	8.0	11.0	1.33
	Refrigerator		6.0	8.0	8.0	8.0	11.0	1.33
1996	Freezer	Refrigeration	6.0	8.0	8.0	8.0	8.0	1.33
	Refrigerator		6.0	8.0	8.0	8.0	8.0	1.33
1997	Freezer	Refrigeration	6.0	8.0	8.0	8.0	8.0	1.33
	Refrigerator		6.0	8.0	8.0	8.0	8.0	1.33

For program years 1994 through 1997, Table E-1 presents the *ex ante* EULs, the selected results of the persistence analysis, the adopted *ex post* EULs, and the EUL realization rates by appliance type. For both refrigerators and freezers in each of these program years, the adopted *ex post* EUL equals the *ex post* EUL estimated from this study and the EUL realization rate is greater than one. In each case, the *ex ante* EUL is outside the 80 percent confidence interval and the *ex post* EUL estimated from this study seems reasonable.

E.2 ANALYSIS OVERVIEW

This study estimates the length of time the savings estimated by the first-year impact evaluation will last or persist. In particular, per the M& E Protocols, this study estimates the EUL or median survival time of these savings; that is, the time at which half these savings are no longer being realized. The first-year impact evaluations of the 1994–1997 Appliance Recycling Programs identified two sources of net savings:

- savings resulting from removing appliances from participating premises that otherwise would have kept the appliance (direct savings); and
- savings resulting from preventing the transfer of older, inefficient appliances to premises within the SCE territory (indirect savings).

In light of these two sources of net savings, we considered three definitions of survival. A recycled appliance fails:

1. when a participating premises adds an appliance;
2. when it would have met its ultimate death anyway; or

3. when a participating premise adds an appliance or when the recycled appliance would have met its ultimate death anyway, whichever comes first.

Direct savings may be considered to fail for any of these reasons, although we focused on the latter two. Indirect savings were considered to fail when the recycled appliance would have met its ultimate death anyway.

For each program year 1994 through 1997, the estimate of the EUL was obtained from a single survival curve for direct and indirect savings combined. For each of these program years, the steps we took to estimate a single survival curve for direct and indirect savings were as follows.

1. Estimate the survival curve where failure is defined as when a participating premise adds an appliance.
2. Estimate the survival curve where failure is defined as when a recycled appliance would have met its ultimate death anyway.
3. Combine these two survival curves, which produces the survival curve where failure is defined as when a participating premise adds an appliance or when a recycled appliance would have met its ultimate death anyway, whichever comes first.
4. Combine the survival curve for direct savings with the survival curve for indirect savings.

E.2.1 Data Sources

The data used in this study were obtained from a variety of sources:

- Program tracking data for program years 1994 through 1997,
- First-year impact evaluation conducted for the 1994 and 1996 programs,
- 2003 California Statewide Residential Appliance Saturation Survey,
- Survey of recent appliance discarders, and
- Survey of participating premises conducted for the fourth-year persistence study and this current persistence study.

1 INTRODUCTION

This report provides the results of the ninth-year persistence study of Southern California Edison's (SCE) 1994 through 1997 Appliance Recycling Programs. The Measurement and Evaluation Protocols (M&E Protocols) of the California DSM (demand-side management) Measurement Advisory Committee (CADMAC) require periodic persistence studies.[1] In this section, a brief description of the program is given, the protocol requirements are discussed, and the organization of the report is described.

1.1 PROGRAM DESCRIPTION

The 1994 through 1997 Appliance Recycling Programs offered incentives to customers to turn in their old appliances for destruction by means of ecologically responsible recycling of components and materials. The goals were

- to eliminate the use of a second appliance at participating premises; and
- to prevent the transfer of older, inefficient appliances into the used (secondary) appliance market.

1.2 PROTOCOL REQUIREMENTS

For most utility DSM programs, the M&E Protocols require that persistence studies be performed periodically with an explicit schedule covering the majority of programs. However, there is no Protocol specifically covering the Appliance Recycling Programs. SCE obtained a waiver to conduct one fourth-year and one ninth-year persistence study to cover program years 1994 through 1997 (Appendix D).

As given in the M&E Protocols (page A-9), the goals of a measure persistence study are to determine:

> (a) the length of time the measure(s) installed during the program year are maintained in operating condition and (b) the extent to which there has been a significant reduction in the effectiveness of the measures.

Only the first issue (a) is addressed by this study. As agreed within the CADMAC Persistence Subcommittee, the first issue (a) is addressed by estimating each measure's effective useful life (EUL). A measure's EUL is defined as its median survival time.

[1] California Public Utilities Commission, *Protocols and Procedures for the Verification of Costs, Benefits, and Shareholder Earnings from Demand-side Management Programs*, Decision 93-05-063. Revised June 1999, pursuant to Decisions 94-05-063, 94-10-059, 94-12-021, 95-12-054, 96-12-079, 98-03-063, and 99-06-052.

For a "traditional" measure—that is, units of the measure are literally installed during a program year—the median survival time is the time at which half the installed units are no longer in place and operable. The 1994–1997 Appliance Recycling Programs, on the other hand, rather than installing units of a measure to save energy, removed units. Specifically, the programs removed refrigerators and freezers. Given the goals of the programs, the EULs or median survival times of these two measures will reflect

- the time at which half the recycled appliances are from participating premises that have added an appliance, and/or
- the time at which half the recycled appliances would have met their ultimate death anyway.

For each of the program years 1994 through 1997, both refrigerators and freezers have an *ex ante* estimate of the EUL of 6 years, which has been used in the earnings claims to date. A measure's *ex post* EUL is the EUL estimated by a persistence study. If a measure's *ex ante* EUL is outside the 80 percent confidence interval, the measure's *ex post* EUL may be used for future earnings claims. Otherwise, the measure's *ex ante* EUL will continue to be used in earnings claims.

1.3 REPORT ORGANIZATION

An overview of the analysis is provided in the next section. Following the overview, the results are presented. The report concludes with four appendixes:

A. Questionnaires,

B. M&E Protocols Table 6B,

C. M&E Protocols Table 7B, and

D. Approved Waiver for Study Methods.

2 ANALYSIS OVERVIEW

The objective of this study is to estimate the EULs or median survival times of appliances removed by the 1994–1997 Appliance Recycling Programs. This section of the report discusses the definitions of survival for these programs, describes the methodology used to estimate the EULs, and the data used by the analysis. The results of the analysis are presented in the next section.

2.1 BACKGROUND

A persistence study estimates the length of time the savings estimated by the first-year impact evaluation will last or persist. A first-year impact evaluation was conducted for the 1994 and the 1996 Appliance Recycling Programs (XENERGY Inc. [now KEMA] 1997 and 1998, respectively). The impact evaluations were based on the idea that, in the absence of the programs, an appliance may have been:

- kept at the participating premise,
- transferred to a premise within SCE territory,
- transferred to a premise outside SCE territory, or
- destroyed.

Only appliances that would have been kept at participating premises and appliances that would have been transferred to premises within the SCE territory in the absence of the programs result in non-zero net impacts.

For appliances that otherwise would have been kept at participating premises, the gross savings is defined as the full-year unit energy consumption (UEC) of recycled appliances based on an analysis of metering data conducted by SCE. For appliances that otherwise would have been transferred to a premise within SCE territory, the gross savings is the UEC of the recycled appliance as just described minus the UEC of the appliance obtained by the premise that would otherwise have obtained the recycled appliance.

For each group of appliances (otherwise kept and otherwise transferred within SCE territory), to obtain net savings, gross savings are adjusted by the attribution factor and the part-use factor. The attribution factor accounts for what the disposition of a recycled appliance would have been in the absence of the program. The part-use factor is the fraction of the year the appliance would have been used if it had not been recycled.

2.2 DEFINITIONS OF SURVIVAL

This section discusses the definitions of survival for the 1994–1997 Appliance Recycling Programs. Different definitions of survival are considered for the two sources of net savings estimated by the first-year impact evaluations of these programs:

- savings resulting from removing appliances from participating premises that otherwise would have kept the appliance (direct savings), and
- savings resulting from preventing the transfer of older, inefficient appliances to premises within the SCE territory (indirect savings).

2.2.1 Direct Savings

We considered three definitions of survival for recycled appliances that otherwise would have been kept at participating premises. A recycled appliance fails:

1. when a participating premise adds an appliance;
2. when it would have met its ultimate death anyway; or
3. when a participating premise adds an appliance or when the recycled appliance would have met its ultimate death anyway, whichever comes first.

The first definition was used in the fourth-year persistence study (XENERGY Consulting Inc., 1999). The reasons for considering the second definition are outlined below. The third definition simply reflects both the first and second definitions. The study collected data and conducted the analysis to support all three of these definitions.

Consistent Unit Definition

The second definition of failure, where failure is defined as the ultimate death of an appliance, may be a reasonable approach because it is challenging to meaningfully determine whether an appliance has been added. Because appliances may or may not leave a premise at the time the premise changes hands, there is no unambiguous way to say where the absence of an additional unit should be tracked. Because households can move, break into multiple households, and combine, tracking the absence of an appliance in households over time is virtually impossible. This leaves us with tracking the absence at the premise level.

The ambiguity of tracking the absence of an additional appliance at the premise level increases with each passing year since the impact evaluations. With each passing year since the impact evaluations, there will be fewer participating households (nonmover) and more new households (mover) at the participating premise. Also, the connection between a participating household and a new household is likely to be less and less with each new household that moves into the participating premise. The number and percentage of participating and new households at the time of this current persistence study are provided in Table 2-1. Almost half of participating households have moved.

Table 2–1
1994 and 1996 Program Years: Nonmover/Mover Status as of the Ninth Year

Household	# Recycled Appliances	
	Number	Percentage
Participant (nonmover)	37,782	53%
New (mover)	34,003	47%
Total recycled appliances	71,785	100%

Measure "Removal" Less of an Issue at Year Nine

Soon after recycling an appliance, it makes sense to consider the addition of an appliance as effectively undoing the effect of the program. This situation is analogous to, for example, compact fluorescent lamps (CFLs) installed by a program being replaced with incandescent lamps due to dissatisfaction with the measure. This type of situation is most likely to occur soon after participating in a program. This suggests the third definition of failure, which reflects both the first and second definitions, may be a reasonable approach. Specifically, a recycled appliance fails when the participating premise adds an appliance "soon" after participating in the program or when the recycled appliance would have met its ultimate death anyway, whichever comes first.

Persistence Defined By Original, Not Equivalent, Units

To the extent a recycled appliance would have met its ultimate death by now anyway, to define its survival as the continued absence of an additional appliance at the participating premise is defining survival in terms of equivalent, not original, units of a measure. This is analogous to defining, for example, the survival of a CFL installed by a program as the continued presence of a CFL, regardless of whether it is the exact same CFL installed by the program or an equivalent measure. In other persistence studies, SCE has defined survival in terms of the presence of the specific physical units installed by the program, not the continued presence of equivalent units. This suggests the third definition of failure, which reflects both the first and second definitions, may be a reasonable approach. That is, a recycled appliance fails when the participating premise adds an appliance or when the recycled appliance would have met its ultimate death anyway, whichever comes first.

2.2.2 Indirect Savings

We considered only one definition of the failure for recycled appliances that otherwise would have been transferred to premises within SCE territory: when the recycled appliance would have met its ultimate death anyway.

2.3 ESTIMATING THE EULS

Generally speaking, a measure's EUL or median survival time is the time at which half the units of the measure have failed. The relationship between time and the proportion of surviving units is given by a measure's survival curve. For each program year 1994 through 1997, the estimate of the EUL was obtained from a single survival curve for direct and indirect savings combined. As discussed, we considered three definitions of survival for direct savings and one definition of survival for indirect savings. The only definition of failure for indirect savings, the ultimate death of an appliance, is also one of the definitions of failure for direct savings.

For each program year 1994 through 1997, the steps we took to estimate a single survival curve for direct and indirect savings were as follows.

1. Estimate the survival curve where failure is defined as when a participating premise adds an appliance.
2. Estimate the survival curve where failure is defined as when a recycled appliance would have met its ultimate death anyway.
3. Combine these two survival curves, which produces the survival curve where failure is defined as when a participating premise adds an appliance or when a recycled appliance would have met its ultimate death anyway, whichever comes first.
4. Combine the survival curve for direct savings with the survival curve for indirect savings.

Each of these steps is discussed in turn.

2.4 FAILURE: PARTICIPATING PREMISE ADDS AN APPLIANCE

2.4.1 The Basics

In order to estimate the survival curve where failure is defined as when a participating premise adds an appliance, this study assumed the number of years at which an appliance is added follows some general path. Technically, this path is referred to as a distribution. The specific path or parameters of the distribution were estimated using the data collected from participating premises. It was necessary to make a distributional assumption about the number of years at which an appliance is added because, often in the data collected, when an appliance was added is not an exact year, but a range of years.

Participating premises were surveyed to determine if they had added an appliance and if so, when.[1] If an exact year was provided, the analysis employed the exact number of years since participating that an appliance was added. If a range of years was provided, the analysis

[1] A participating premise was determined to have added a refrigerator if, since the impact evaluation, the number of refrigerators plugged in and running (at the same time for at least three months in a year) ever exceeded the number plugged in and running at the time of the impact evaluation. The determination of whether or not a participating premise added a freezer was analogous.

employed a lower bound and an upper bound number of years since participating that an appliance was added per the range provided. If an appliance had not been added, the lower bound number of years was the number of years between program participation and the date of the latest survey (either the fourth-year or the current persistence study) and the upper bound was set equal to infinity.

The parameters of the distribution of the number of years at which a participating premise adds an appliance were estimated by fitting a general linear regression model to the log (natural) of these times observed in the data. This model can be written as

$$\log(T_j) = \mu + \sigma\varepsilon_j ,$$

where

T_j = observed number of years at which the premise that recycled appliance *j* added an appliance,

μ = location parameter or intercept,

σ = scale parameter, and

ε_j = random error term.

The exponential of the error term of this model (e^{ε_j}) was assumed to follow the standardized form of the distribution of the number of years at which a participating premise adds an appliance. The general linear regression model was fitted by maximizing the log-likelihood function for the assumed distribution. The estimated parameters of this distribution were then employed in the survival function.

2.4.2 Weights

When fitting the general linear regression model, weights are employed that ensure the following proportions are the same in the sample as they are in the population (i.e., program tracking data).

- 1994 recycled appliances from a participating premise at which the participant still resides (participating households or nonmovers),
- 1994 recycled appliances from a participating premise from which the participant has moved (new households or movers),
- 1996 nonmovers, and
- 1996 movers.[2]

[2] Typically, if the net savings per unit of a measure varies across units, weights that reflect these net savings are used when fitting the general linear regression. In this case, however, because the results were based on two program years (1994 and 1996) and were used for these two program years as well as two additional program years (1995 and 1997), it seemed more appropriate to employ weights that reflect the number of recycled appliances.

This weighting scheme ensured that any systematic differences in the number of years at which a participating premise adds an appliance across these two program years and nonmover/mover combinations was appropriately reflected in the results.

The weight w_{yg} for a recycled appliance in program year y (1994 or 1996) in group g (nonmover, mover) was calculated as the ratio of the population proportion to the sample proportion:

$$w_{yg} = (N_{yg}/N_y)/(n_{yg}/n_y),$$

where

N_{yg} = number of recycled appliances in program year y in group g in the population,
N_y = number of recycled appliances in program year y in the population,
n_{yg} = number of recycled appliances in program year y in group g in the sample, and
n_y = number of recycled appliances in program year y in the sample.

In order to obtain the correct standard errors, the sum of the weights must equal the number of observations (recycled appliances) included in the analysis. The sum of w_{yg} meets this condition. Table 2-2 gives the four different weights w_{yg}.

Table 2–2
Weights w_{yg}

Nonmover/ Mover	Recycled Appliances				Weight
	Population		Sample		
	Number[a]	Percent	Number	Percent	
Program Year 1994					
Nonmover	22,726	50%	177	78%	0.64
Mover	22,426	50%	49	22%	2.29
Total	45,152	100%	226	100%	226
Program Year 1996					
Nonmover	15,056	57%	201	79%	0.72
Mover	11,577	43%	54	21%	2.05
Total	26,633	100%	255	100%	255

[a] The population totals in this table reflect the recycled appliances in the program tracking data for which we were able to determine whether or not it was from a participating premise at which the participant still resides (nonmover) or from which the participant has moved (mover). We had the necessary information to determine this for more than 99 percent of the recycled appliances in the program tracking data. For program year 1994, the population totals in this table also exclude the very small number of recycled appliances for which age was missing (less than 0.2 percent).

2.4.3 Distribution Options

This study considered a variety of distributional assumptions for the number of years at which a participating premise adds an appliance:

- Gamma,
- Weibull,
- Exponential,
- Log-normal, and
- Log-logistic.

These are common distributional assumptions made when conducting Survival Analysis.

The Gamma distribution is the most general of the distributions listed above. It has three free parameters, location (μ), scale (σ), and shape, whereas the other distributions have only one or two free parameters. The Weibull, Log-normal, and Log-logistic distributions have two free parameters, location and scale; and the Exponential distribution has one free parameter, location. The Gamma distribution includes the Weibull, Exponential, and Log-normal distributions as special cases. The Weibull distribution includes the Exponential distribution as a special case.

2.4.4 Distribution Adopted

As will be discussed in the next section, it was possible to fit the general linear regression model when the number of years at which a participating premise adds an appliance was assumed to follow all but a Gamma distribution. The selection of the most appropriate distribution was based on several criteria:

- implications for the failure rate over time,
- likelihood ratio test,
- analysis of residuals, and
- maximum of the log-likelihood function.

Failure Rate Over Time

The distributional assumption has implications for the failure rate over time. If a Weibull distribution is assumed, the failure rate may be always decreasing, always increasing, or constant over time. If the scale parameter is greater than one then it is decreasing over time, whereas if the scale parameter is less than one then it is increasing over time. Recall, a Weibull distribution with scale parameter equal to one corresponds to the Exponential distribution. The Exponential distribution results in a failure rate that is constant over time.

If the Weibull distribution results in an increasing failure rate over time (the scale parameter is less than one), the rate of increase depends on the value of the scale parameter. If the scale parameter is between 0.5 and 1, the failure rate is increasing at a decreasing rate over time; if the scale parameter equals 0.5, the failure rate is increasing at a constant rate over time; and if the scale parameter is between 0 and 0.5, the failure rate is increasing at an increasing rate over time.

The Log-normal distribution produces a failure rate that increases to a peak, then decreases over time. The larger the scale parameter, the sooner the failure rate reaches its peak and begins to decrease.

If a Log-logistic distribution is assumed, the failure rate may increase to a peak, then decrease, or it may be always decreasing over time. If the scale parameter is less than one, then the failure rate is increasing then decreasing over time, whereas if the scale parameter is greater than or equal to one, then the failure rate is always decreasing over time.

Likelihood Ratio Test

If a distribution is a special case of another distribution, the appropriateness of the former versus the latter can be formally tested using the likelihood ratio test. Therefore, a likelihood ratio test comparing the appropriateness of the Exponential distribution versus the Weibull distribution was conducted.

Analysis of Residuals

If the distribution assumed for the number of years at which a participating premise adds an appliance is appropriate, the Cox-Snell residuals have an approximate exponential distribution with location parameter zero. To determine whether or not this is the case, for each distributional assumption, a second general linear regression model was fitted to the log of the Cox-Snell residuals assuming the exponential of the error term follows the standardized form of the exponential distribution. An estimated location parameter not statistically different from zero at a 10 percent level of significance or better suggests the distributional assumption may be appropriate.

Maximum of the Log-Likelihood Function

Recall, under each assumed distribution, the general linear regression model is fitted by maximizing the log-likelihood function. A larger maximum value of the log-likelihood function suggests a better model fit.

2.4.5 Survey of Participating Premises

The recycled appliances eligible for inclusion in this analysis of failure were the recycled appliances identified by the first-year impact evaluation of either program year 1994 or 1996 as ones that otherwise would have been kept at the participating premises. Of these eligible

recycled appliances, in order to be included in the analysis, the participating premise had to have completed a survey at the time of the fourth-year persistence study or for this current persistence study. Hence, of the 578 eligible recycled appliances, 481, or 83 percent, were included in this analysis of failure. By program year and refrigerator/freezer, Table 2-3 presents the number of these appliances per the first-year impact evaluations and the number included in this analysis of failure.

Table 2–3
Recycled Appliances That Otherwise Would Have Been Kept

Refrigerator/ Freezer	Recycled Appliances Would-be Keepers		
	# Impact Evaluation Sample	Participating Premises Survey Complete (4th or 9th-year)	
		Number	% Impact Evaluation Sample
Program Year 1994			
Freezer	47	35	74%
Refrigerator	236	191	81%
Total	283	226	80%
Program Year 1996			
Freezer	46	43	93%
Refrigerator	249	212	85%
Total	295	255	86%
Total			
Freezer	93	78	84%
Refrigerator	485	403	83%
Total	578	481	83%

Ninth-year Sample Disposition

For this current persistence study, we attempted to contact all but 14 of the 572 participating premises associated with a recycled appliance that otherwise would have been kept at the participating premises, as identified by the first-year impact evaluations.[3] The 14 participating premises that we did not attempt to contact had added an appliance by the time of the fourth-year persistence study and had a different occupant than at the time of the fourth-year persistence study.

[3] These 572 participating premises account for the total number of recycled appliances that otherwise would have been kept in the impact evaluation samples shown in Table 2-3 (578). A participating premise that recycled both a refrigerator and a freezer is included twice in this total. A participating premise that recycled more than one refrigerator or more than one freezer is included only once in this total.

As Table 2-4 shows, a survey was completed for 354 of the 558 participating premises, or 63 percent. The final status of the incompletes does not contain any surprises, with the possible exception of several incorrect addresses. Telephone numbers with a final status of not available/answering machine, call back, or busy, were called at least ten times.

Table 2–4
Participating Premises Sample Disposition

Final Status	Number	Percentage
Completed	354	63%
Incomplete	204	37%
Total sample	558	100%
Incomplete detail		
Not available/answering machine	44	22%
Call back	16	8%
Busy	2	1%
Language problem	15	7%
Incorrect address	4	2%
Refusal	53	26%
Disconnected telephone #	51	25%
Blocked incoming telephone #	16	8%
Computer tone	3	1%
Total incompletes	204	100%

2.5 FAILURE: ULTIMATE DEATH

The survival curve where failure is defined as when a recycled appliance would have met its ultimate death anyway was estimated in two steps:

1. Using data collected from households that recently discarded an appliance, estimate the survival curve where failure is defined as the ultimate death of the appliance.
2. Apply the results of this survival curve to the program tracking data for each of the years 1994 through 1997.

Each of these steps is discussed in turn.

2.5.1 Survival Curve Based on Recently Discarded Appliances

In order to estimate a survival curve where failure is defined as when an appliance meets its ultimate death, it was not necessary to make a distributional assumption. It was not necessary because the ages of the appliances employed in the analysis were exact (although imperfect) and not specified as ranges. We considered two methods of estimating this survival curve: Kaplan-Meier and life-table.

Kaplan-Meier Method

The Kaplan-Meier method employs each of the appliance ages observed in the data. At each appliance age observed in the data, the proportion of appliances expected to survive at least to this age is the product of the proportions of appliances expected to survive at least to this age and each earlier observed age, given they survived to the age just previous. That is, the estimate of the probability of an appliance surviving to at least age t is

$$\hat{S}(t) = \prod_{j:t_j \le t} \left[1 - \frac{d_j}{n_j} \right],$$

where

d_j = number of appliances that met their ultimate death at age t_j, and
n_j = number of appliances that survive to age t_j (includes d_j).

Life-table Method

The life-table method allowed us to associate the same probability of survival with more than one appliance age by creating groups of appliance ages. Consider three appliance age groups or intervals: 0 to 8 years, 8 to 13 years, and 13 to 18 years. Each appliance group includes the age up to but not including the end of the interval. So, interval 0 to 8 years includes ages 0 through 7, interval 8 to 13 years includes ages 8 to 12, etc. These three appliance age groups are denoted by $i = 1$, 2, and 3, respectively. The life-table method estimates the probability of an appliance surviving to at least the start of an interval t_i ($t_1 = 0$, $t_2 = 8$, $t_3 = 13$) as

$$\hat{S}(t_i) = \prod_{j=1}^{i-1} \left(1 - \frac{f_j}{e_j} \right),$$

where

f_j = the number of appliances that met their ultimate death in interval j and

e_j = the effective sample size for interval j

= (number of appliances censored within interval j)/2
+ (all remaining appliances that survived to the start of interval j [includes appliances that failed in interval j]).

The number of appliances censored within an interval is simply the number of appliances for which its age is included in the interval and that are still alive.

A comparison of the equations used by the life-table and Kaplan-Meier methods to estimate the survival probabilities reveals that they are similar. The primary differences are:

- The life-table method allows us to define the intervals for which probabilities are calculated, whereas the Kaplan-Meier method takes the intervals as defined by the appliance ages observed in the data.
- The life-table method includes only half the censored appliances in the calculation of sample size.

If appliance ages are not grouped, the Life-table method produces results similar to that of the Kaplan-Meier Method.

We considered grouping appliance ages to estimate the survival curve where failure is defined as when an appliance meets its ultimate death due to the appliance age groupings observed in the data collected from recent appliance discarders as well as in the program tracking data. Figures 2-1 and 2-2 show the distribution of appliance ages in the data collected from recent appliance discarders and in the program tracking data, respectively. The appliance age data are not "smoothly" distributed in either of these sources. That is, there is a preference for ages that end in "0" or "5" as opposed to "1," "2," "3," or "4." In the data collected from appliance discarders, the ages of 60 percent of the appliances are one of six values. These six values are "5," "10," "15," "20," "25," and "30." In the tracking data for each of the program years, the ages of between 62 and 69 percent of appliances are one of these six values (or these values excluding "5").

Figure 2-1
Distribution of Ages in the Data Collected from Recent Appliance Discarders

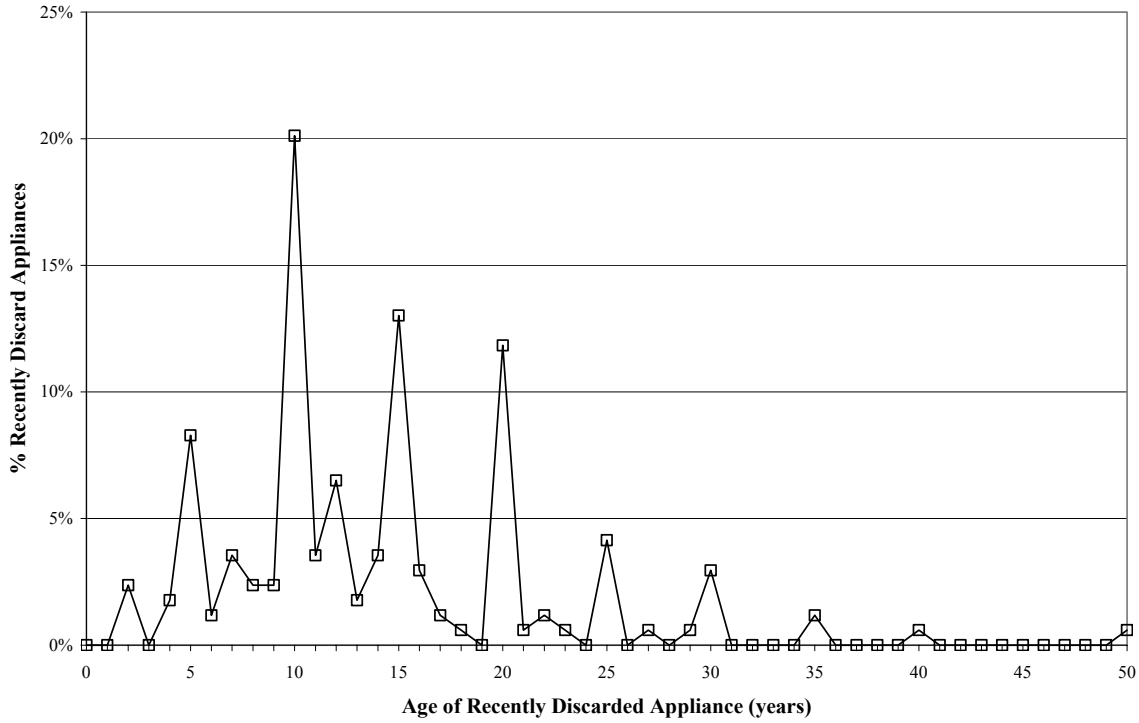
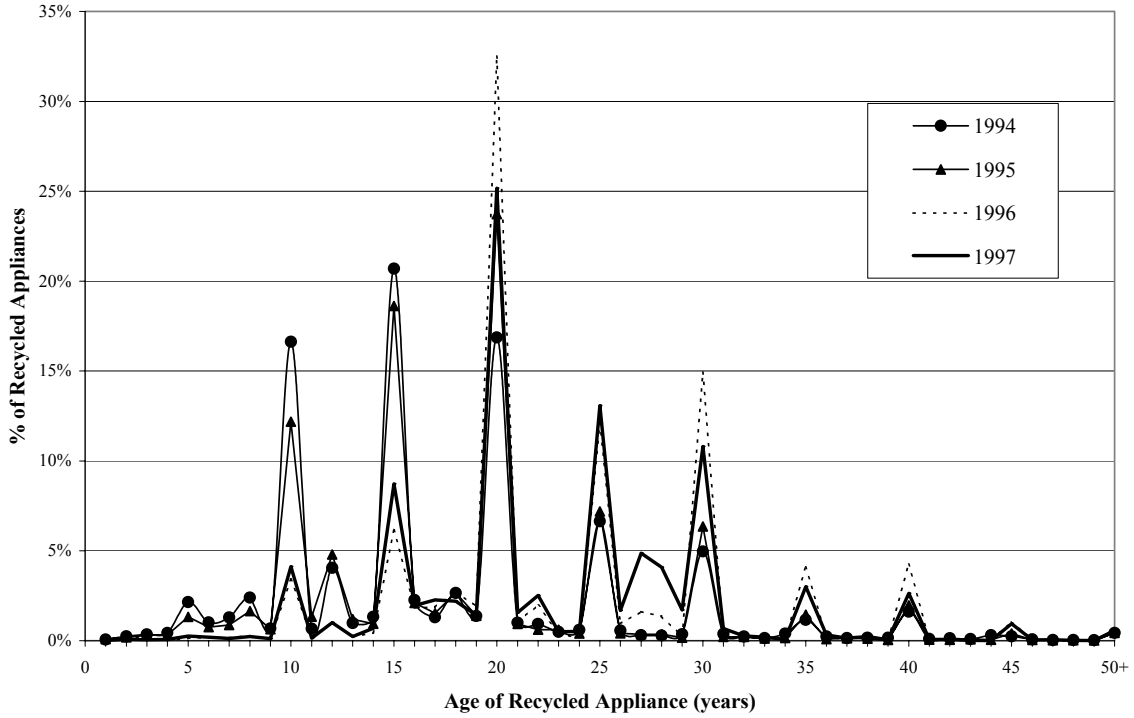


Figure 2-2
Distribution of Ages in the Program Tracking Data, 1994–1997



Based on the groups of appliance ages observed in the data collected from recent appliance discarders as well as in the program tracking data, we employed the Life-table method to estimate the probability of survival for the following groups of ages:

- 0 to 8 years,
- 8 to 13 years,
- 13 to 18 years,
- 18 to 23 years,
- 23 to 28 years,
- 28 to 32 years,
- and so on.

Survey of Recent Appliance Discarders

Data were collected from recent appliance discarders to estimate the survival curve where failure is defined as when an appliance meets its ultimate death. Recent appliance discarders in SCE territory were identified via the 2003 California Statewide Residential Appliance Saturation

Survey (RASS). We attempted to contact respondents to this survey who resided in SCE territory, answered any of the refrigerator discarded questions (G2) or any of the freezer discarded questions (H2), and who hadn't moved since responding to the RASS (to facilitate obtaining a telephone number).

The survey of recent appliance discarders collected the following data:

- Whether or not the appliance was in working condition when it was discarded.
  - If it was in working condition, whether or not it was in need of repair.
  - If it was not in working condition, whether or not it was worth repairing.
- Also, if it was not in working condition, the age of the appliance when it broke.
- The age of the appliance when it was discarded. (We attempted to obtain more precise age data than were collected by the 2003 California Statewide RASS. Also, these data were sometimes missing in the 2003 California Statewide RASS data.)
- How the appliance was discarded.
- If recently discarded more than one appliance or the data were missing in the 2003 California Statewide RASS data, various appliance characteristics.

The sample disposition is provided in Table 2-5. A survey was completed with 160 of the 516 eligible discarders, or 31 percent. Telephone numbers with a final status of not available/answering machine, call back, or busy were called at least ten times. Still, a response rate of 31 percent was somewhat disappointing. Almost one-third of the incompletes said they did not get rid of an appliance recently. In an attempt to increase the number of affirmative answers to this question, we added two questions. If a person said they had not gotten rid of an appliance since January 2002, we followed up with "What about in the last five years?" If they still said no, we asked, "Is there anyone else that might know about appliances gotten rid of from this address?"

Table 2–5
Recent Appliance Discarders Sample Disposition

Final Status	Number	Percentage
Completed	160	31%
Incomplete	356	69%
Total	516	100%
Incomplete detail		
Not available/answering machine	59	17%
Call back	8	2%
Busy	6	2%
Language problem	25	7%
Did not get rid of an appliance since Jan 2002	81	23%
Did not get rid of an appliance in last 5 years	25	7%
No such person	10	3%
Business telephone #	9	3%
Refusal	78	22%
Disconnected telephone #	40	11%
Blocked incoming telephone #	10	3%
Computer tone	5	1%
Total incompletes	356	100%

2.5.2 Application of the Survival Curve

After estimating the survival curve where failure is defined as when an appliance meets its ultimate death, we applied it to the age distribution in the program tracking data for each of the years 1994 through 1997. For each of these program years, this application provides the relationship between the time since program participation and the proportion of recycled appliances that would still be alive had they not been recycled. We refer to these survival curves, one for each of the program years 1994 through 1997, as distributions of remaining useful life or remaining useful life curves *R(t)*.

R(t) is the probability that an appliance would still be alive (i.e., not met its ultimate death) at least *t* years since program participation had it not been recycled. For program years 1994 through 1997, these probabilities were developed by "applying" the estimated survival curve, where failure is defined as when an appliance meets its ultimate death to the age distribution in the program tracking data as follows:

- For each recycled appliance age *a* observed in the program tracking data, obtain from the estimated survival curve, for each year *t* since participating, the probability an appliance of that age would have survived at least an additional *t* years had it not been recycled $R(t \mid a)$.
- Combine these separate remaining useful life curves for each recycled appliance age *a*:

  weight the curve for a given recycled appliance age by the fraction of recycled appliances in the program tracking data of that age.

Suppose, according to the estimated survival curve:

- the probability of an appliance surviving to age 15 is 30 percent and
- the probability of an appliance surviving to age 20 is 10 percent.

Then the probability an appliance of age 15 would have survived five years from the time it was recycled $R(t=5 \mid a=15)$ (that is, would have reached an age of 20) is 10 percent divided by 30 percent, or 33 percent. This perhaps intuitive result can be expressed mathematically as

$$R(t=5 \mid a=15) = \hat{S}(20 \mid 15) = \hat{S}(20) / \hat{S}(15)$$

$$R(t \mid a) = \hat{S}(a+t \mid a) = \hat{S}(a+t) / \hat{S}(a).$$[4]

For a given program year, combining the separate remaining useful life curves for each recycled appliance age *a* can be mathematically expressed as

$$R(t) = \sum_a R(t \mid a) \frac{N_a}{N},$$

where

N_a = number of appliances in the program tracking data recycled at age *a* and
N = total number of recycled appliances in the program tracking data.[5]

Confidence Intervals

In the current persistence study, for each of the program years 1994 through 1997, we develop the 80 percent confidence interval around the remaining useful life curve, where failure is defined as when an appliance meets its ultimate death, by borrowing the distances between the survival curve t_S and the lower and upper bounds of its confidence interval $\left(t_S^-, t_S^+\right)$. For each recycled appliance age *a*, the lower and upper bounds of the confidence interval for the remaining useful life $\left(t_R^-, t_R^+\right)$ at time t_R are calculated as

$$t_R^- = t_R - (t_S - t_S^-)$$

$$t_R^+ = t_R + (t_S^+ - t_S),$$

[4] By the laws of probability, $\hat{S}(a+t \mid a) = \hat{S}(a+\text{t } and\ a) / \hat{S}(a)$. Furthermore, in order for *a*+*t* to occur, *a* must have occurred, $\hat{S}(a+t\ and\ a) = \hat{S}(a+t)$.

[5] With the exception of program year 1994, the age at which an appliance was recycled was available from the program tracking data for all appliances. These data were missing for a very small percentage (less than 0.2 percent) of appliances in the program tracking data for program year 1994. These appliances were not included in any N_a or in *N*. Implicitly, these appliances were assumed to have the same age distribution as those whose ages were available from the program tracking.

where t_R and t_S are simply related by $t_S = a + t_R$.

For a given program year, we combined the separate lower (or upper) bounds of the confidence interval for the remaining useful life curve of each recycled appliance age *a* the same way we combined the separate remaining useful life curves for each recycled appliance age *a*. We weighted the lower (or upper) bounds of the confidence interval for each recycled appliance age *a* by the fraction of recycled appliances in the program tracking data of that age.

This procedure attributes all the uncertainty in the estimated remaining life distribution to the uncertainty in the estimated survival curve *S(t)*. For each year since participation, the distribution of ages at which appliances were recycled is assumed known. This assumption is close to correct, because all but a handful of appliances in the program tracking data have ages reported. While there are likely to be reporting errors in these ages, the effect of such errors cannot be reflected in the confidence interval calculation unless some explicit assumption is made about their distribution. Lacking any information on these errors, they are assumed to be negligible in terms of the final estimate of the EUL.

Direct Versus Indirect Savings

When a recycled appliance would have met its ultimate death anyway is a definition of failure considered for both direct and indirect savings. The possibility was considered that the age distribution of recycled appliances that otherwise would have been kept (direct savings) may be different from that for recycled appliances that otherwise would have been transferred (indirect savings). The hypothetical disposition of recycled appliances in the absence of the program is known only for the participants surveyed for the first-year impact evaluations. The would-be keeper and would-be transferee age distributions were compared for the combined survey samples from the first-year impact evaluations and found to be almost identical. Consequently, it was determined unnecessary to apply the estimated survival curve where failure is defined as when an appliance meets its ultimate death separately to an age distribution for would-be keepers and an age distribution for would-be transferees. This meant that instead of having to develop these age distributions based on samples, the ages of all recycled appliances in the program tracking data could be used. In addition, this means the remaining useful life curves developed for each program year 1994 through 1997 by applying the estimated survival curve to the age distribution in the program tracking data are applicable to both direct and indirect savings.

2.6 FAILURE: WHICHEVER COMES FIRST

Only for direct savings do we consider as a definition of failure when a participating premise adds an appliance or when a recycled appliance would have met its ultimate death anyway, whichever comes first. The survival curve for this combined definition of failure is simply the product of the survival curves for each of the components, $\hat{S}(t)$ and *R(t)*. The lower and upper bounds of the 80 percent confidence interval around this product $S_k(t)$ are approximated by:

$$S_k^-(t) = S_k(t) - S_k(t)\sqrt{\left(\frac{\hat{S}(t)-\hat{S}^-(t)}{\hat{S}(t)}\right)^2 + \left(\frac{R(t)-R^-(t)}{R(t)}\right)^2} \quad \text{and}$$

$$S_k^+(t) = S_k(t) + S_k(t)\sqrt{\left(\frac{\hat{S}^+(t)-\hat{S}(t)}{\hat{S}(t)}\right)^2 + \left(\frac{R^+(t)-R(t)}{R(t)}\right)^2},$$

where

$S_k^-(t), \hat{S}^-(t), R^-(t)$ = lower bound of the 80 percent confidence interval around $S_k(t), \hat{S}(t), R(t)$;

$S_k^+(t), \hat{S}^+(t), R^+(t)$ = upper bound of the 80 percent confidence interval around $S_k(t), \hat{S}(t), R(t)$.

2.7 COMBINED SURVIVAL CURVE

For each program year 1994 through 1997, the survival curve for direct savings was combined with the survival curve for indirect savings by calculating a weighted sum of the two probabilities each year. The weights employed were the fraction of first-year net savings associated with each of type of savings (direct and indirect). These fractions are given in Table 2-6.[6]

[6] For program years 1994 and 1995, these fractions are based on the first-year impact evaluation of the 1994 program. For program years 1996 and 1997, these fractions are based on the first-year impact evaluation of the 1996 program. Total net savings for each program year were calculated using:

- counts by appliance type from the program tracking,
- the overall full-year UECs by appliance type from the impact evaluations, and
- the overall net-to-gross factors by appliance type from the impact evaluations.

Net savings accounted for by would-be keepers were calculated using:

- counts by appliance type from the program tracking,
- the fractions of would-be keepers in the impact evaluation samples by appliance type,
- the overall full-year UECs by appliance type from the impact evaluations, and
- the net-to-gross factors for would-be keepers by appliance type from the impact evaluations.

For program year 1995, the fractions of would-be keepers by appliance type were changed from those employed for program year 1994. The net-to-gross ratios best judgment for program year 1995 included the same two assumptions made for 1994 as well as an additional assumption (XENERGY Inc. 1997, 4-7).

Table 2–6
Fraction of Net Savings: Direct Savings vs. Indirect Savings

Program Year	Fraction of Net Savings		Total
	Direct Savings (Would-be Keepers)	Indirect Savings (Would-be Transferees)	
1994	83%	17%	100%
1995	85%	15%	100%
1996	77%	23%	100%
1997	77%	23%	100%

For each program year 1994 through 1997, the EUL or median survival time is the time at which half the recycled appliances have failed per the combined survival curve $S_c(t)$. That is, the EUL is the time t_c^* such that

$$S_c(t_c^*) = 0.5.$$

At each time t on the combined survival curve, the approximate upper and lower bounds of an 80 percent confidence interval were calculated using the upper and lower bounds of the 80 percent confidence intervals for the two survival curves on which the combined survival curve is based (t^-, t^+). Specifically, at each time t:

$$t_c^- = t - \sqrt{p_k^2(t_k^- - t)^2 + p_D^2(t_D^- - t)^2}$$

$$t_c^+ = t + \sqrt{p_k^2(t_k^+ - t)^2 + p_D^2(t_D^+ - t)^2}\ ,$$

where

t_c^-, t_k^-, t_D^- = lower bound of the 80 percent confidence interval for the combined, direct savings, and indirect savings survival curves, respectively;

t_c^+, t_k^+, t_D^+ = upper bound of the 80 percent confidence interval for the combined, direct savings, and indirect savings survival curves, respectively; and

p_k, p_D = fraction of first-year net savings associated with direct and indirect savings, respectively (as defined above).

2.8 DATA SOURCES

The data used in this study were obtained from a variety of sources:

- Program tracking data for program years 1994 through 1997.
- First-year impact evaluation conducted for the 1994 and 1996 programs.
- 2003 California Statewide RASS.

- Survey of participating premises conducted for the fourth-year persistence study and this current persistence study.
- Survey of recent appliance discarders.

Several of these data sources have already been discussed, namely the 2003 California Statewide RASS, the survey of participating premises, and the survey of recent appliance discarders. The remaining data sources are discussed here.

2.8.1 Program Tracking Data

For each appliance, the program tracking data provided:

- a unique premise identification number for the premise that recycled it,
- a unique customer identification number for the customer living at the premise at the time, and
- age when it was recycled.

2.8.2 First-year Impact Evaluations

The first-year impact evaluations conducted for the 1994 and 1996 programs provided the following data on each sampled participating premise:

- a unique premise identification number;
- complete address of the premise;
- name of the customer who recycled it;
- date of the impact evaluation survey;
- if recycled a refrigerator, number of refrigerators plugged in and running at the time of the impact evaluation; and
- if recycled a freezer, number of freezers plugged in and running at the time of the impact evaluation.

2.9 REFERENCES

XENERGY (now KEMA) Consulting Inc. 1999. *Persistence Study of Southern California Edison's 1994 through 1997 Appliance Recycling Programs*. Prepared for Southern California Edison, Study ID #525B.

XENERGY Inc. 1998. *Impact Evaluation of the Spare Refrigerator Recycling Program*. Prepared for California Energy Commission, Study ID #537.

XENERGY Inc. 1997. *Extended Impact Evaluation of the Spare Refrigerator Recycling Program Final Report*. Prepared for California Energy Commission, Study ID #515.

3 PERSISTENCE RESULTS

This section presents the persistence results for the 1994–1997 Appliance Recycling Programs. The focus of these results is the EUL or median survival time of recycled appliances. For each of the program years 1994 through 1997, both refrigerators and freezers have an *ex ante* estimate of the EUL of six years. Table 3–1 offers a brief preview of the EUL estimates discussed in this section.

Table 3–1
Results in Brief

Definition of Failure		Estimated EUL by Program Year (# years)							
		Life-table Method				Kaplan-Meier Method			
Direct Savings	Indirect Savings	1994	1995	1996	1997	1994	1995	1996	1997
Add appliance, Log-logistic	Ultimate death	102.6	114.7	71.0	70.5	102.6	114.7	70.5	69.9
Add appliance, Weibull	Ultimate death	80.1	87.7	61.0	61.0	80.1	87.7	58.6	58.2
Ultimate death	Ultimate death	13.0	12.0	8.0	8.0	10.0	10.0	10.0	10.0
Whichever comes first (add--Log-logistic=Weibull, death)	Ultimate death	8.0	8.0	8.0	8.0	10.0	10.0	10.0	9.0

Before discussing the combined survival curve EUL estimates shown in Table 3–1, the results for the three definitions of failure are provided. A recycled appliance may be considered to fail when

- the participating premise adds an appliance;
- the recycled appliance would have met its ultimate death anyway; and
- the participating premise adds an appliance, or the recycled appliance would have met its ultimate death anyway, whichever comes first.

3.1 FAILURE: PARTICIPATING PREMISE ADDS AN APPLIANCE

Table 3–2 presents the results of the survival analysis where failure is defined as when a participating premise adds an appliance. It was possible to fit a model when the number of years at which a participating premise adds an appliance was assumed to follow all but a Gamma

distribution.[1] Refrigerators and freezers were analyzed together because appliance type did not appear to affect the number of years at which an appliance is added.[2]

Table 3–2
Survival Curve Results: Participating Premise Adds an Appliance
(number of appliances = 481)[3]

Distribution	EUL (# years) Estimate	80% Confidence Interval	Standard Error of Estimate	Selected Parameter Estimate: Scale	Maximum of Log Likelihood
Exponential	30	(25 , 35)	3.7	1.00 [a]	-284.6
Log-logistic	213	(102 , 448)	123.2	1.92	-268.5
Log-normal	407	(173 , 957)	271.1	3.84	-267.6
Weibull	143	(73 , 278)	74.1	2.02	-268.8

[a] The value of the scale parameter for the Exponential distribution is always 1, it is not estimated.

If a recycled appliance fails when a participating premise adds an appliance, the estimated time at which half the recycled appliance will have failed (i.e., estimated or *ex post* EUL) ranges between 30 and 407 years.[4] Based on the available statistics, it is most appropriate to assume the number of years at which a participating premise adds an appliance follows either a Log-logistic or Weibull distribution. These distributions result in an *ex post* EUL of 213 and 143 years.

The available statistics support the assumption of a Log-logistic or Weibull distribution for the following reasons:

- A likelihood ratio test rules out the Exponential distribution. Based on the likelihood ratio test, the Weibull distribution is more appropriate than the Exponential distribution at a 1 percent level of significance.

[1] The more parameters a distribution has, the more difficult it is to fit a model. The Gamma distribution has more parameters (three) than any of the other distributions considered.

[2] The null hypothesis that the coefficient on appliance type is zero was not rejected at the 10 percent level of significance.

[3] The sample size is the number of appliances because if a participating premise recycled both a refrigerator and a freezer, two observations were included in the analysis: number of years at which a refrigerator was added and number of years at which a freezer was added.

[4] In contrast, the EULs estimated by the fourth-year persistence study for this aspect of failure ranged between 6 and 10 years. In part, the difference between the results of the current persistence study and the fourth-year persistence study is due to a different determination of failure. In the current persistence study, a participating premise was determined to have added a refrigerator if since the impact evaluation, the number of refrigerators plugged in and running (at the same time for at least three months in a year) ever exceeded the number plugged in and running at the time of the impact evaluation. The determination of whether or not a participating premise added a freezer was analogous. If the original participant still resided at the premise (nonmover), the fourth-year persistence study determined whether or not the participating premise added an appliance in a manner similar to this study. However if a new occupant now resided at the participating premise (mover), the fourth-year persistence study assessed the participating premises as having added an appliance if the new occupant brought an appliance into their home either when they moved in or at some point after they moved in. We now think it makes more sense to determine whether or not a new occupant at a participating premises added an appliance in the same way this assessment is made for an original participant at the premises.

- All three remaining distributions (Log-logistic, Log-normal, and Weibull) have very similar values for the maximum of the log-likelihood function.
- The Log-normal distribution produces a failure rate that increases to a peak, then decreases over time. The Log-logistic distribution may produce a similar result (if the scale parameter is less than 1), but it did not. Rather, when the Log-logistic distribution is assumed, the failure rate is always decreasing over time (scale parameter greater than 1). When the Weibull distribution is assumed, the result is similar.
- The residual analysis suggests the Weibull distribution may be slightly more appropriate than the Log-logistic distribution (as well as the other distributions).

In Section 2, it was suggested that it makes most sense to consider the addition of an appliance as effectively undoing the effect of the program if the appliance is added soon after program participation. Although it is not possible to operationalize this approach in this analysis, the estimated EUL is already more than 100 years if the addition of an appliance anytime since program participation is considered a failure.

3.2 FAILURE: ULTIMATE DEATH

The survival curve where failure is defined as when a recycled appliance would have met its ultimate death anyway was estimated in two steps:

1. Using data collected from households that recently discarded an appliance, estimate the survival curve where failure is defined as the ultimate death of the appliance.
2. Apply the results of this survival curve to the program tracking data for each of the years 1994 through 1997.

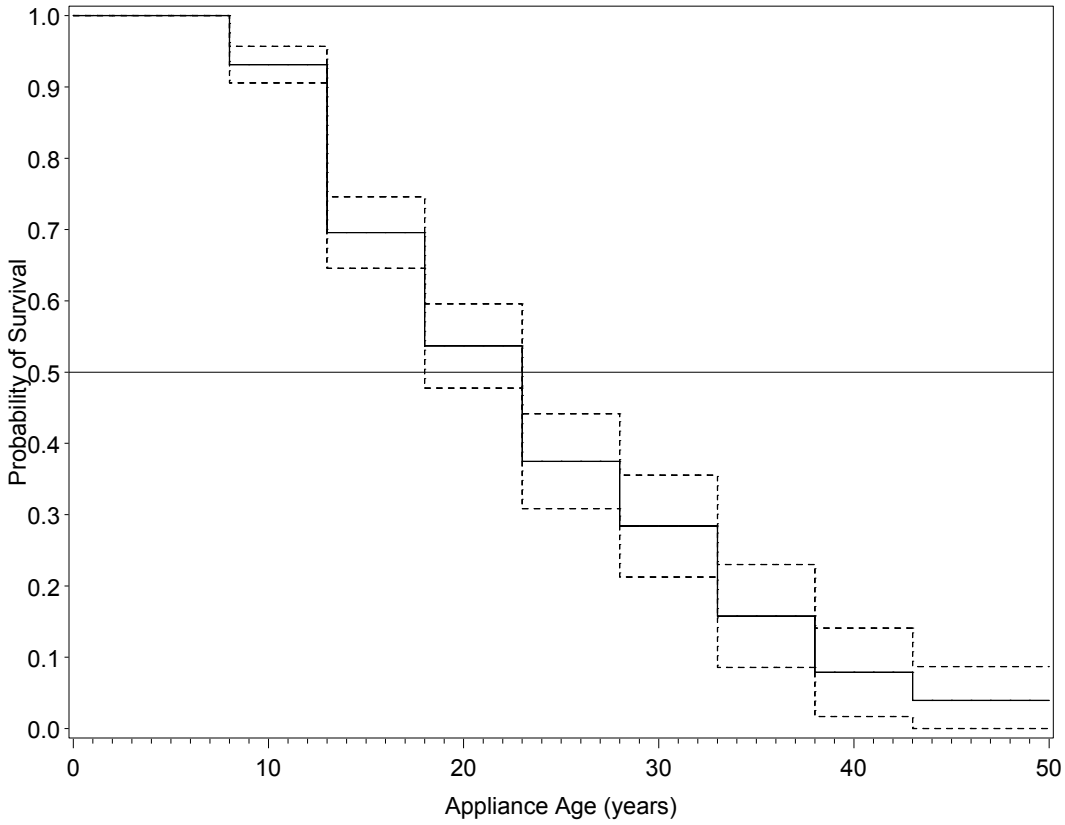
The results of each of these steps are discussed in turn.

3.2.1 Survival Curve Based on Recently Discarded Appliances

Figure 3–1 shows the estimated survival curve of appliances (solid curve) using the Life-table method based on data collected from households that recently discarded an appliance. Refrigerators and freezers were analyzed together using either the Life-table or Kaplan-Meier method because appliance type did not appear to affect the number of years at which an appliance ultimately dies.[5] The figure also shows the lower and upper bounds of the 80 percent confidence interval around the survival curve (dashed curves).

[5] The null hypothesis that the coefficient on appliance type is zero was not rejected at the 10 percent level of significance.

Figure 3–1
Estimated Survival Curve Based on Recently Discarded Appliances, Life-table Method
(number of appliances = 169)



The estimated survival curve gives the probability an appliance will survive to a specified age or longer. For example, according to Figure 3–1, there is a 50 percent probability an appliance will survive to at least age 23. This age is found by following the horizontal line that starts at a survival probability of 0.5 (or 50 percent) on the y-axis, until it hits the survival curve (the solid curve). The confidence interval around age 23 at a survival probability of 50 percent is (18 years, 23 years). These confidence interval bounds are found by following the horizontal line that starts at a survival probability of 50 percent until it hits the confidence interval lower bound (dashed curve to the left of survival curve) and the confidence interval upper bound (dashed curve to the right of the survival curve). In this example, the upper bound of the confidence interval around age 23 at a survival probability of 50 percent coincides with (i.e., lies directly on top of) the survival curve.

The Kaplan-Meier method produces results similar to the Life-table method. Using the Kaplan-Meier method, there is a 50 percent probability an appliance will survive to at least age 20. The confidence interval around this age at a survival probability of 50 percent is (17 years, 20 years).

In this analysis, we considered an appliance to have met its ultimate death if the recipient of the appliance was any of the following:

- a utility recycling program,
- a scrap dealer or recycler,
- a landfill,
- or it was picked up by someone the household hired to take it away.

It was almost as clear that an appliance was still alive if any of the following were true:

- the household took it to someone's home;
- the household took it to an appliance dealer;
- it was picked up by a dealer, but not one the household had just bought an appliance from; or
- it was picked up by a private citizen.

We also considered an appliance to still be alive if the respondent could not tell us where they took it or who picked it up.

This left one discard category in particular that probably contained both appliances that met their ultimate death and appliances that did not: it was picked up by the dealer from whom the household bought a new appliance. In the cases of appliances discarded in this manner, we determined an appliance met its ultimate death if any of the following were true:

- The household paid the dealer.
- No money exchanged hands and either:
  (a) the appliance did not work or
  (b) the appliance worked but was in need of repair. (The primary reason we determined (b) to be ultimate death was because it was never the case that a dealer other than the dealer from whom a household bought a new appliance picked up an appliance that was in need of repair, which worked or otherwise.)

Of appliances picked up by a dealer from whom the household purchased a new appliance, this leaves the following conditions under which an appliance was determined to still be alive:

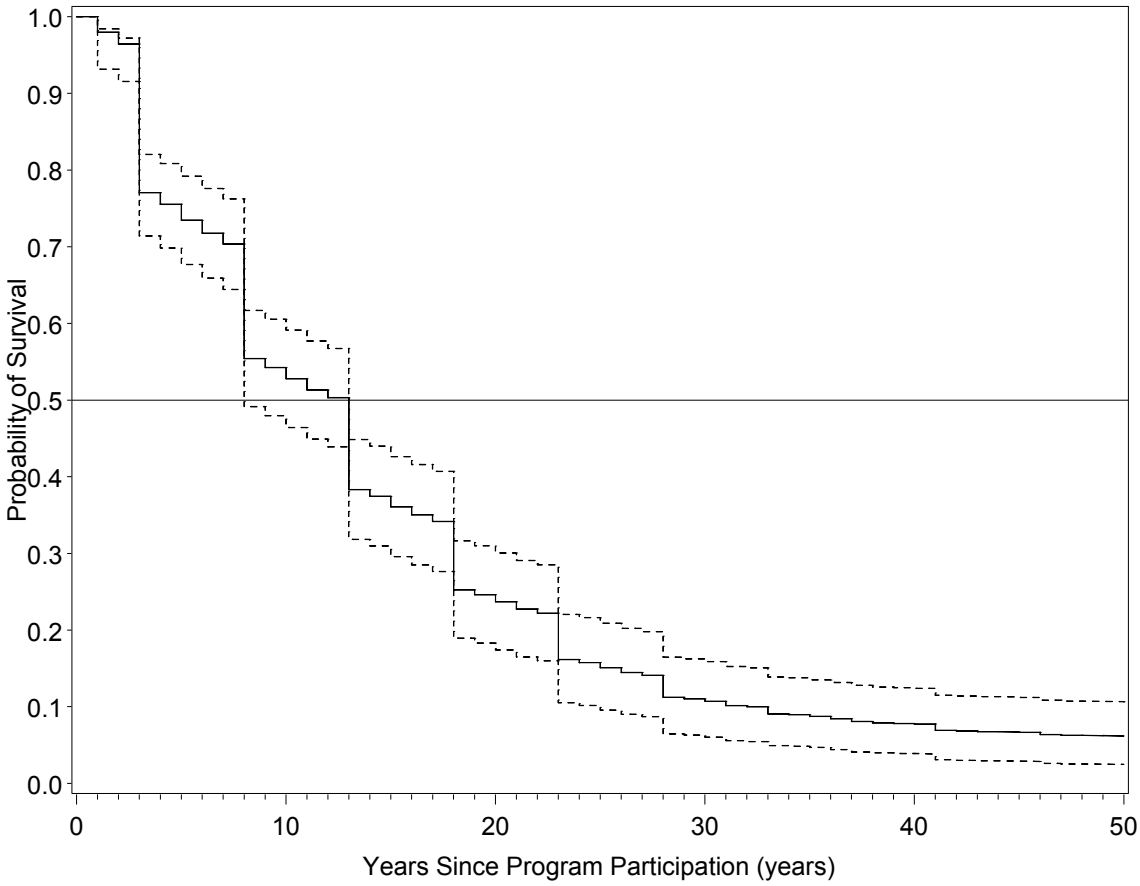
- The dealer paid the household.
- No money exchanged hands with the exception of the two scenarios (a) and (b) noted above, or whether or not money exchanged hands is unknown.

3.2.2 Application of the Survival Curve

Figure 3–2 shows the application of the estimated survival curve in Figure 3–1 to the age distribution in the program tracking data for program year 1994. We refer to the curve shown in Figure 3–2 as a remaining useful life curve (solid curve). Figure 3–2 also shows the lower and

upper bounds of the 80 percent confidence interval around the remaining useful life curve (dashed curves).

Figure 3–2
Remaining Useful Life Curve (Life-table Method), Program Year 1994



The remaining useful life curve gives the probability a recycled appliance would have survived (i.e., not met its ultimate death) to a specified time since it was recycled or longer. For example, according to Figure 3–2, the probability a recycled appliance would have survived at least an additional 13 years had it not been recycled is 50 percent. For program year 1994 then, 13 years is the estimated median remaining useful life. That is, at 13 years since program participation (which would be 2004), half the appliances recycled during program year 1994 would have met their ultimate death if they had not been recycled. The confidence interval around this age at a survival probability of 50 percent is (8years, 13 years).

The application of the estimated survival curve to the age distributions in the program tracking data for the years 1995 through 1997 produces remaining useful life curves similar to that shown in Figure 3–2. The application of the estimated survival curve developed using the Kaplan-Meier method to the age distributions in the program tracking data produces similar results as well. For each of the program years 1994 through 1997, Table 3–3 gives the estimated median remaining useful life based on the estimated survival curves developed using the Life-table and

Kaplan-Meier methods. Table 3-3 also gives the 80 percent confidence interval around these medians and the median age of a recycled appliance in the program tracking data. (The median age of a recycled appliance in the program tracking data are of course unaffected by the method used, but are repeated for convenience).

Table 3–3
Estimated Median Remaining Useful Life (RUL), Program Years 1994-1997

Program Year	# Years		
	Estimated Median RUL	80% Confidence Interval (median RUL)	Median Age in Program Tracking Data
Life-table Method			
1994	13.0	(8.0 , 13.0)	15.0
1995	12.0	(8.0 , 13.0)	18.0
1996	8.0	(8.0 , 13.0)	20.0
1997	8.0	(8.0 , 13.0)	21.0
Kaplan-Meier Method			
1994	10.0	(10.0 , 13.0)	15.0
1995	10.0	(10.0 , 12.0)	18.0
1996	10.0	(10.0 , 10.0)	20.0
1997	10.0	(9.0 , 10.0)	21.0

The estimated median remaining useful life based on the estimated survival curve developed using the Life-table method varies across program years. It ranges between 8 and 13 years and is higher for program years that recycled younger appliances, which makes sense. In contrast, although the median age of appliances in the program tracking data ranges between 15 and 21 years, the estimated median remaining useful life based on the estimated survival curve developed using the Kaplan-Meier method is the same (10 years) for all program years.

These results suggest the remaining useful life curves based on the estimated survival curve developed using the Life-table method may be more appropriate than those based on the estimated survival curve developed using the Kaplan-Meier method. It appears grouping appliance ages to develop the estimated survival curve may produce more meaningful results when the age data employed at each stage of the analysis are imperfect as indicated by the preferences for ages that end in "0" or "5."

3.3 FAILURE: WHICHEVER COMES FIRST

The survival curve where failure is defined as when a participating premise adds an appliance or when a recycled appliance would have met its ultimate death anyway, whichever comes first, is simply the product of the survival curves for each of the components. For each of the program years 1994 through 1997, the results for this survival curve are presented in Table 3–4. For the component of failure defined as when a participating premise adds an appliance, the results assuming a Log-logistic or a Weibull distribution were very similar. Hence, only the results

assuming the number of years at which a participating premise adds an appliance follows a Weibull distribution are presented in Table 3–4. For the component of failure defined as when a recycled appliance would have met its ultimate death anyway, results are presented for both the Life-table and Kaplan-Meier methods.

Table 3–4
Survival Curve Results: Whichever Comes First, Program Years 1994–1997

Whichever Comes First		Program Year	EUL (# years)	
Add an Appliance	Ultimate Death		Estimate	80% Confidence Interval
Weibull distribution	Life-table method	1994	8.0	(8.0 , 11.0)
		1995	8.0	(8.0 , 10.0)
		1996	8.0	(6.0 , 8.0)
		1997	8.0	(6.0 , 8.0)
Weibull distribution	Kaplan-Meier method	1994	10.0	(7.0 , 10.0)
		1995	10.0	(7.0 , 10.0)
		1996	10.0	(6.0 , 10.0)
		1997	8.0	(5.4 , 10.0)

For this definition of failure, the estimated EUL is eight years for all program years if when a recycled appliance would have met its ultimate death anyway is based on the estimated survival curve using the life-table method. The estimated EUL ranges between 8 and 10 years across program years if the Kaplan-Meier method is used instead.

Figure 3–3 illustrates the following whichever comes first scenario (thin curve on bottom First_bot) for program year 1994.

- The number of years at which a participating premise adds an appliance is assumed to follow a Weibull distribution (dashed curve on top Add_top).
- The Life-table results for when a recycled appliance would have met its ultimate death anyway (thicker curve in the middle Death_mid).

You can see how the product of the Add_top and Death_mid curves results in the First_bot curve. The product of the Add_top survival curve with an estimated EUL of 143 years and the Death_mid remaining useful life curve with an estimated median remaining useful life of 13 years results in a First_bot survival curve with an estimated EUL of eight years.

Figure 3–3
Whichever Comes First: Add—Weibull or Ultimate Death—Life-table, 1994

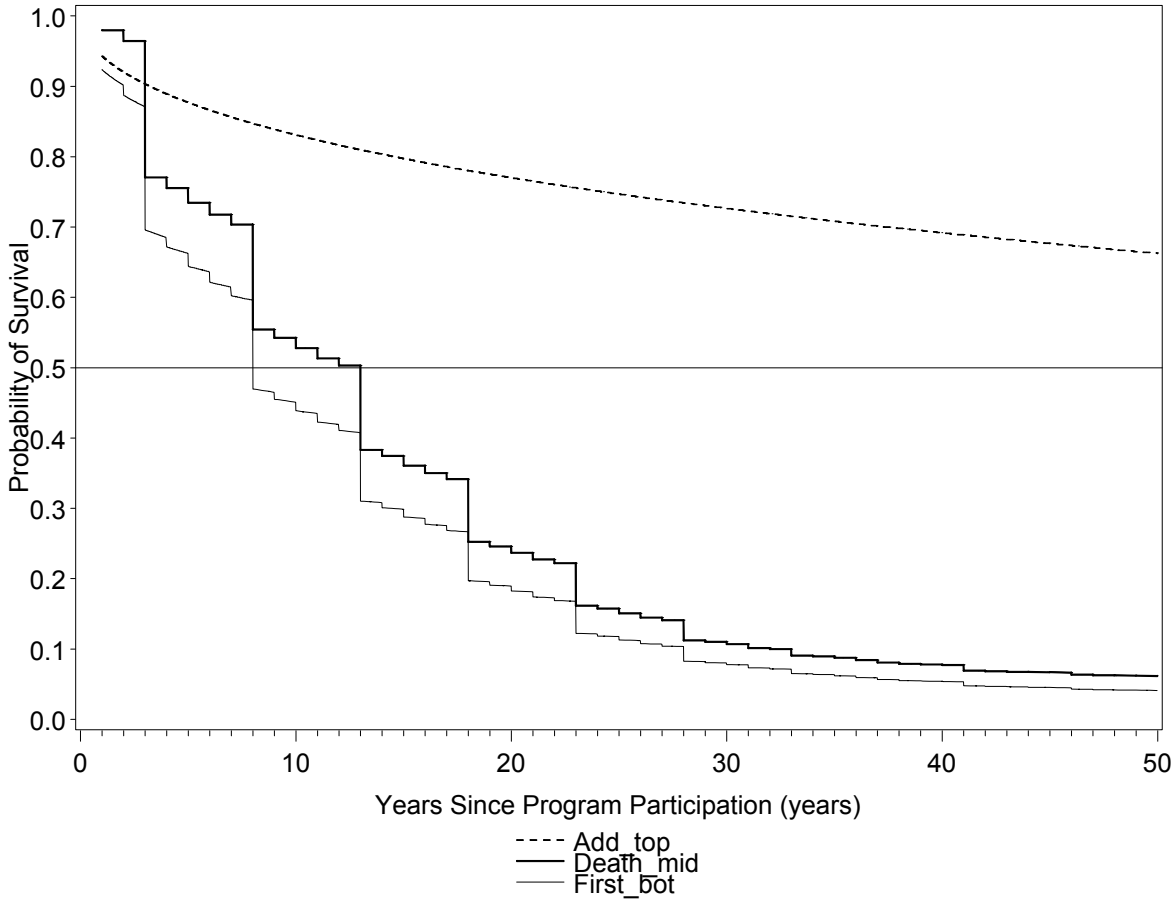
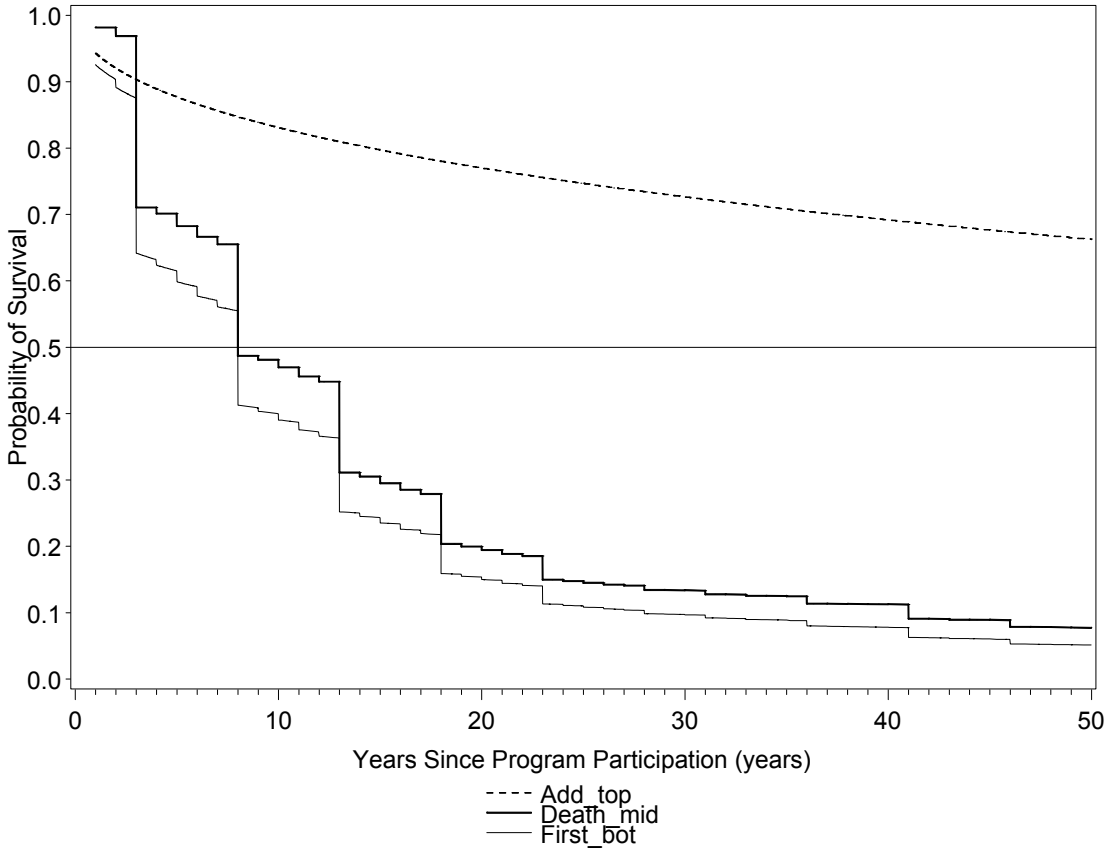


Figure 3–4 illustrates the same whichever comes first scenario for program year 1996. In this example, the product of the Add_top survival curve with an estimated EUL of 143 years and the Death_mid remaining useful life curve with an estimated median remaining useful life of eight years results in a First_bot survival curve with an estimated EUL of eight years.

Figure 3-4
Whichever Comes First: Add—Weibull or Ultimate Death—Life-table, 1996



3.4 COMBINED SURVIVAL CURVE

As discussed in the Analysis Overview section of this report, there are two sources of net savings estimated by the first-year impact evaluations of the 1994–1997 Appliance Recycling Programs:

- savings resulting from removing appliances from participating premises that otherwise would have kept the appliance (direct savings), and
- savings resulting from preventing the transfer of older, inefficient appliances to premises within the SCE territory (indirect savings).

For each program year 1994 through 1997, the estimate of the EUL was obtained from a single survival curve for both direct and indirect savings combined. One definition of failure was considered for indirect savings and three definitions of failure were considered for direct savings. Furthermore, for the definitions of failure involving when a recycled appliance would have met its ultimate death anyway, we considered two methods of estimating the survival curve on which these results are based: Life-table and Kaplan-Meier. The results of combining the various survival curves for direct savings with the survival curve for indirect savings are presented in Table 3–5. The results are sensitive to whether the Life-table or Kaplan-Meier method is used,

but they are much more sensitive to the definition of failure employed for direct savings. Depending on the definition of failure employed for direct savings, the estimated EULs range between 8 and 115 years.

Table 3–5
Combined Survival Curve Results, Program Years 1994–1997

Definition of Failure		Program Year	EUL (# years)			
			Life-table Method		Kaplan-Meier Method	
Direct Savings	Indirect Savings		Estimate	80% Confidence Interval	Estimate	80% Confidence Interval
Add appliance, Log-logistic	Ultimate death	1994	102.6	(29.4 , 365.9)	102.6	(26.3 , 365.9)
		1995	114.7	(36.5 , 388.7)	114.7	(31.5 , 388.7)
		1996	71.0	(18.0 , 313.9)	70.5	(16.7 , 313.9)
		1997	70.5	(18.0 , 313.9)	69.9	(16.5 , 313.9)
Add appliance, Weibull	Ultimate death	1994	80.1	(27.0 , 251.0)	80.1	(25.0 , 251.0)
		1995	87.7	(30.6 , 267.2)	87.7	(28.2 , 267.2)
		1996	61.0	(18.0 , 214.7)	58.6	(15.5 , 214.7)
		1997	61.0	(18.0 , 214.7)	58.2	(15.3 , 214.7)
Ultimate death	Ultimate death	1994	13.0	(8.0 , 13.0)	10.0	(10.0 , 13.0)
		1995	12.0	(8.0 , 13.0)	10.0	(10.0 , 12.0)
		1996	8.0	(8.0 , 13.0)	10.0	(10.0 , 10.0)
		1997	8.0	(8.0 , 13.0)	10.0	(9.0 , 10.0)
Whichever comes first (add--Log-logistic=Weibull; death)	Ultimate death	1994	8.0	(8.0 , 11.0)	10.0	(8.0 , 10.0)
		1995	8.0	(8.0 , 11.0)	10.0	(8.0 , 10.0)
		1996	8.0	(8.0 , 8.0)	10.0	(8.0 , 10.0)
		1997	8.0	(8.0 , 8.0)	9.0	(7.0 , 10.0)

If failure for direct savings is defined as when a participating premise adds an appliance, the combined survival curve results are different depending on whether the number of years at which an appliance is added is assumed to follow a Log-logistic or Weibull distribution. Hence, the results under both distributional assumptions are presented in Table 3–5. On the other hand, if failure for direct savings is defined as when a participating premise adds an appliance or when a recycled appliance would have met its ultimate death anyway, whichever comes first, the combined survival curve results are very similar under both distributional assumptions.

Both the fourth-year persistence study and the current persistence study define failure for indirect savings (recycled appliances that otherwise would have been transferred to premises within SCE territory) as when the recycled appliance would have met its ultimate death anyway. However, the fourth-year persistence study considered only one definition of failure for direct savings (recycled appliances that otherwise would have been kept at participating premises): a recycled appliance fails when a participating premise adds an appliance. With the benefit of five additional years experience conducting persistence studies since then, the current persistence study suggests a more appropriate definition of failure for direct savings may be when the recycled appliance would have met its ultimate death anyway. Even if the latter definition of failure does not replace the former, a definition of failure for direct savings that recognizes the possibility of both types of failure would be more appropriate than a definition of failure that recognizes only when a participating premise adds an appliance.

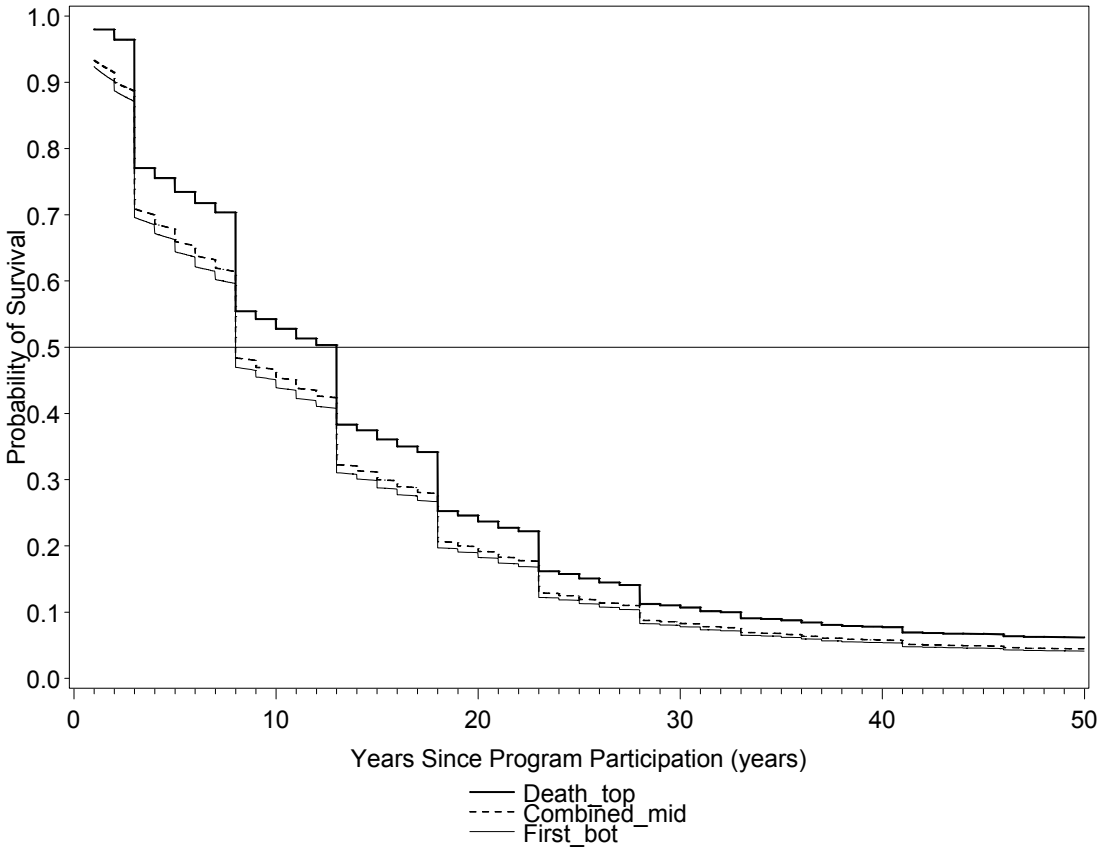
If the definition of failure for direct savings is either ultimate death or whichever comes first (addition of an appliance or ultimate death), the estimated EULs for program years 1994 through 1997 range between 8 and 13 years. Furthermore, the common *ex ante* EUL of six years is always outside the 80 percent confidence interval and smaller than the estimated or *ex post* EUL. For each of the program years 1994 through 1997, this study recommends SCE adopt an *ex post* EUL of eight years. These are the estimated EULs obtained if the Life-table method is employed and the definition of failure for direct savings is whichever comes first. As discussed earlier in this section, it appears the appliance age data employed in this analysis may be better suited for the Life-table method than the Kaplan-Meier method.

Adopting *ex pos*t EULs of eight years would result in EUL realization rates of 1.33 for all program years. The EUL realization rate is the adopted EUL divided by its *ex ante* EUL. For program year 1994, Figure 3–5 shows how the combined survival curve (dashed curve in the middle Combined_mid) is the result of a weighted sum of:

- the whichever comes first (add—Weibull, ultimate death—life-table) survival curve (thin curve on bottom First_bot) with
- the Life-table results for when a recycled appliance would have met its ultimate death anyway (thicker curve on top Death_top).

The weighted sum of the First_bot survival curve with an estimated EUL of eight years and the Death_top remaining useful life curve with an estimated median remaining useful life of 13 years results in the Combined_mid survival curve with an estimated EUL of eight years. The First_bot survival curve has a weight of 83 percent leaving the Death_top remaining useful life curve with a weight of 17 percent.

Figure 3–5
Combined Survival Curve: Whichever Comes First
(Add—Weibull, Ultimate Death—Life-table) and Ultimate Death—Life-table



The survival curve results for the ultimate death of an appliance combined with the age distributions in the program tracking data (that is, the remaining useful life curves) are primarily responsible for the EUL estimates ranging between 8 and 13 years. Consequently, future persistence studies of the Appliance Recycling Program may want to consider the following issues.

- The survival curve where failure is defined as the ultimate death of an appliance was estimated using data collected from a random sample of households that recently discarded an appliance. Are there alternatives to these data that should be considered? How can the accuracy of the appliance ages employed in the analysis be improved?
- Can the approach be modified to better address age data in the program tracking that may be only generally accurate; say, within five years? In the tracking data for each of the program years 1994 through 1997, the ages of more than 60 percent of the appliances are one of the following: "10," "15," "20," "25," and "30."
- The confidence intervals around the remaining useful life curves are approximations. Can these approximations be improved?
- What are the consequences of the following changes for the analysis?

- Changes in how appliances are manufactured.
- Changes in appliance standards.
- Changes in appliance technology.

A QUESTIONNAIRES

A.1 PARTICIPANT SURVEY

Sample Data

pname: participant name
paddy: participating premises full address
porig: occupant expected to be participant or household surveyed by fourth-year persistence study (1), else 0
imoyr: fielding of impact evaluation survey, month year
cmoyr: if fourth-year retention study respondent, when the survey was fielded = January 1999; otherwise imoyr
cyear = year only from cmoyr
OPR: number of refrigerators plugged in and running at time of impact evaluation
OPF: number of freezers plugged in and running at time of impact evaluation
<DSC>: refrigerator, stand-alone freezer, refrigerator and a stand-alone freezer
<DSCNUM>: =1 if refrigerator only, 2= if stand-alone freezer only, 3= if both
<DSCS>: refrigerators, stand-alone freezers, refrigerators and stand-alone freezers

Section 1: Lead In

- Identify original participant vs. movers (original participant no longer resides at premise).

b1. Hello, may I speak with <PNAME>?
Yes ..... [SKIP TO b3] 1
No 2
Don't know ..... –97
Refused ..... [THANK AND TERMINATE] –98

b2. [IF AN ADULT ANSWERED OR YOU CAN GET AN ADULT ON THE LINE.] Perhaps you can help me.

b3. My name is _____ and I'm with Research America. I'm calling on behalf of Southern California Edison. We're conducting a brief survey to learn about refrigerators and freezers in Southern California Edison territory. This is not a marketing call. We're collecting data to help Southern California Edison improve its residential programs and services and help its customers save energy. Southern California Edison is required by the California Public Utility Commission to conduct this type of research. Your responses will be kept entirely confidential.

b4. First, I'd like to confirm your current address. Is it <PADDY>?
Yes 1
No..... [THANK AND TERMINATE] 2
Don't know ..... [THANK AND TERMINATE] –97
Refused ..... [THANK AND TERMINATE] –98

b5. [[IF <PORIG>=0 SKIP TO mr1] According to our records, while living at this address you recycled a <DSC> through a Southern California Edison program in the mid 1990s. Is this correct?
Yes .....[SKIP TO pr1] 1
No.....2
Don't know .....–97
Refused .....–98

b6. Perhaps you moved to this address since that time. Did you move to this address after <IMOYR>?
Yes 1
No.....[SKIP TO b7b] 2
Don't know .....[SKIP TO b7b] –97
Refused .....[SKIP TO b7b] –98

b7a. I would like to ask you some questions about the number of <DSCS> you have had in recent years. [SKIP TO mr1]

b7b. I would still like to ask you some questions about the number of <DSCS> you have had in recent years. Please, answer the questions as best you can.

Section 2: Original Participants Refrigerator Questions

Subsection 2.1 Refrigerators acquired

pr1. [IF <DSCNUM>=2 SKIP TO pf1] According to our records, in <IMOYR>, there were <OPR> refrigerator(s) plugged in and running at this address. Since then, have you brought any refrigerators into your home? [IF RESPONDENT DISAGREES WITH NUMBER OF FRIDGES, SAY "I'll note that" AND GET RESPONSE TO QUESTION.]
Yes 1
No.....[SKIP TO pr11] 2
Don't know .....[SKIP TO pr4] –97
Refused .....[SKIP TO pr4] –98

pr2. How many?
[RECORD NUMBER >0] .....
Don't know .....[SKIP TO pr4] –97
Refused .....[SKIP TO pr4] –98

pr3a. [IF pr2=1] Was this refrigerator plugged in and running for 3 months or more in a year?
Yes 1
No.....2
Don't know .....–97
Refused .....–98

pr3b. [IF pr2>1] How many of these refrigerators were plugged in and running for 3 months or more in a year?
[RECORD NUMBER <= pr2].....
Don't know .....–97
Refused .....–98

Subsection 2.2 Refrigerators discarded

[IF pr3a=2 OR pr3b=0 SKIP TO pr11
IF (pr3a=1 OR pr3b=1) AND <OPR>=0 SKIP TO pr8a
IF pr3b>1 AND <OPR>=0 SKIP TO pr9a]

pr4. Since <IMOYR>, have you gotten rid of any refrigerators?
Yes 1
No.....[SKIP TO pr7] 2
Don't know .....[SKIP TO pr7] –97
Refused .....[SKIP TO pr7] –98

pr5. How many?
[RECORD NUMBER >0] .....
Don't know .....[SKIP TO pr7] –97
Refused .....[SKIP TO pr7] –98

pr6a. [IF pr5=1] Was this refrigerator plugged in and running for 3 months or more in a year after < IMOYR>?
Yes 1
No.....2
Don't know .....–97
Refused .....–98

pr6b. [IF pr5>1] How many of these refrigerators were plugged in and running for 3 months or more in a year after < IMOYR>?
[RECORD NUMBER <= pr5].....
Don't know .....–97
Refused .....–98

Subsection 2.3 Exceed # refrigerators at time of impact evaluation? If so, when

pr7. Since <CMOYR>, have you ever had more than <OPR> refrigerator(s) plugged in and running **at the same time** for at least 3 months in a year?

Yes 1
No.....[SKIP TO pr11] 2
Don't know .....[SKIP TO pr11] –97
Refused .....[SKIP TO pr11] –98

pr8a. [IF CYEAR=1999] About what year did this first happen? [WE'RE LOOKING FOR THE EXACT YEAR. IF CAN'T SPECIFY EXACT YEAR, RECORD RESPONSE IN 'Other.']

1999.....1
2000.....2
2001.....3
2002.....4
2003.....5
2004.....6
Other [SPECIFY].....[SKIP TO pr11] 96
Don't know .....[SKIP TO pr11] –97
Refused .....[SKIP TO pr11] –98

pr8b. [IF CYEAR=1995] About what year did this first happen? [WE'RE LOOKING FOR THE EXACT YEAR. IF CAN'T SPECIFY EXACT YEAR, RECORD RESPONSE IN 'Other.']

1995.....1
1996.....2
1997.....3
1998.....4
1999.....5
2000.....6
2001.....7
2002.....8
2003.....9
2004.....10
Other [SPECIFY].....[SKIP TO pr11] 96
Don't know .....[SKIP TO pr11] –97
Refused .....[SKIP TO pr11] –98

pr8c. [IF CYEAR=1998] About what year did this first happen? [WE'RE LOOKING FOR THE EXACT YEAR. IF CAN'T SPECIFY EXACT YEAR, RECORD RESPONSE IN 'Other.']

1998.....1
1999.....2
2000.....3
2001.....4
2002.....5
2003.....6
2004.....7
Other [SPECIFY].....[SKIP TO pr11] 96
Don't know .....[SKIP TO pr11] –97
Refused .....[SKIP TO pr11] –98

pr9a. [IF pr3b>1 AND <OPR>=0 AND CYEAR=1999] Since January 1999, about what year did you first have one or more of these refrigerators plugged in and running for at least 3 months? [WE'RE LOOKING FOR THE EXACT YEAR. IF CAN'T SPECIFY EXACT YEAR, RECORD RESPONSE IN 'Other.']1999 1
2000.....2
2001.....3
2002.....4
2003.....5
2004.....6
Other [SPECIFY].....[SKIP TO pr11] 96
Don't know .....[SKIP TO pr11] –97
Refused .....[SKIP TO pr11] –98

pr9b. [IF pr3b>1 AND <OPR>=0 AND CYEAR=1995] Since November 1995, about what year did you first have one or more of these refrigerators plugged in and running for at least 3 months? [WE'RE LOOKING FOR THE EXACT YEAR. IF CAN'T SPECIFY EXACT YEAR, RECORD RESPONSE IN 'Other.']

1995.....1
1996.....2
1997.....3
1998.....4
1999.....5
2000.....6
2001.....7
2002.....8
2003.....9
2004.....10
Other [SPECIFY].....[SKIP TO pr11] 96
Don't know .....[SKIP TO pr11] –97
Refused .....[SKIP TO pr11] –98

pr9c. [IF pr3b>1 AND <OPR>=0 AND CYEAR=1998] Since January 1998, about what year did you first have one or more of these refrigerators plugged in and running for at least 3 months? [WE'RE LOOKING FOR THE EXACT YEAR. IF CAN'T SPECIFY EXACT YEAR, RECORD RESPONSE IN 'Other.']

1998.....1
1999.....2
2000.....3
2001.....4
2002.....5
2003.....6
2004.....7
Other [SPECIFY].....[SKIP TO pr11] 96
Don't know .....[SKIP TO pr11] –97
Refused .....[SKIP TO pr11] –98

pr10. Can you tell me about what month during this year it first happen? [WE'RE LOOKING FOR THE EXACT MONTH. IF CAN'T SPECIFY EXACT MONTH, RECORD RESPONSE IN 'Other.']

January 1
February 2
March 3
April 4
May 5
June 6
July.....7
August.....8
September 9
October.....10
November.....11
December 12
Other [SPECIFY].....96
Don't know .....–97
Refused .....–98

pr11. How many refrigerators do you now have at this address that are plugged in and running? [RECORD NUMBER].....
Don't know .....–97
Refused .....–98

Section 3: Original Participants Freezer Questions

[IF <DSCNUM>=1 THANK AND TERMINATE]

Subsection 3.1 Freezers acquired[VG6]

pf1. According to our records, in <IMOYR>, there were <OPF> stand-alone freezer(s) plugged in and running at this address. Since then, have you brought [VG7]any stand-alone freezers into your home? [IF RESPONDENT DISAGREES WITH NUMBER OF FREEZERS, SAY "I'll note that" AND GET RESPONSE TO QUESTION.]
Yes 1
No..... [SKIP TO PF11] 2
Don't know .....[SKIP TO pf4] –97
Refused .....[SKIP TO pf4] –98

pf2. How many?
[RECORD NUMBER>0] .....
Don't know .....[SKIP TO pf4] –97
Refused .....[SKIP TO pf4] –98

pf3a. [IF pf2=1] Was this freezer plugged in and running for 3 months or more in a year[VG8]?
Yes 1
No.....2
Don't know .....–97
Refused .....–98

pf3b. [IF pf2>1] How many of these freezers were plugged in and running for 3 months or more in a year[VG9]?
[RECORD NUMBER <= pf2].....
Don't know .....–97
Refused .....–98

Subsection 3.2 Freezers discarded

[IF pf3a=2 OR pf3b=0 SKIP TO PF11
IF (pf3a=1 OR pf3b=1) AND <OPF>=0 SKIP TO pf8a
IF pf3b>1 AND <OPF>=0 SKIP TO pf9a]]

pf4. Since <IMOYR>, have you gotten rid of any stand-alone freezers?
Yes 1
No.....[SKIP TO pf7] 2
Don't know .....[SKIP TO pf7] –97
Refused .....[SKIP TO pf7] –98

pf5. How many?
[RECORD NUMBER>0] .....
Don't know .....[SKIP TO pf7] –97
Refused .....[SKIP TO pf7] –98

pf6a. [IF pf5=1] Was this freezer plugged in and running for 3 months or more in a year after < IMOYR>?
Yes 1
No.....2
Don't know .....–97
Refused .....–98

pf6b. [IF pf5>1] How many of these freezers were plugged in and running for 3 months or more in a year after < IMOYR>?
[RECORD NUMBER <= pf5].....
Don't know .....–97
Refused .....–98

Subsection 3.3 Exceed # freezers at time of impact evaluation? If so, when

pf7. Since <CMOYR>, have you ever had more than <OPF> stand-alone freezer(s) plugged in and running at the same time for at least 3 months in a year?
Yes 1
No..... [SKIP TO PF11] 2
Don't know ..... [SKIP TO PF11] –97
Refused ..... [SKIP TO PF11] –98

pf8a. [IF CYEAR=1999] About what year did this first happen? [WE'RE LOOKING FOR THE EXACT YEAR. IF CAN'T SPECIFY EXACT YEAR, RECORD RESPONSE IN 'Other.'] 19991
2000.....2
2001.....3
2002.....4
2003.....5
2004.....6
Other [SPECIFY]..... [SKIP TO PF11] 96
Don't know ..... [SKIP TO PF11] –97
Refused ..... [SKIP TO PF11] –98

pf8b. [IF CYEAR=1995] About what year did this first happen? [WE'RE LOOKING FOR THE EXACT YEAR. IF CAN'T SPECIFY EXACT YEAR, RECORD RESPONSE IN 'Other.']

1995.....1
1996.....2
1997.....3
1998.....4
1999.....5
2000.....6
2001.....7
2002.....8
2003.....9
2004.....10
Other [SPECIFY]..... [SKIP TO PF11] 96
Don't know ..... [SKIP TO PF11] –97
Refused ..... [SKIP TO PF11] –98

pf8c. [IF CYEAR=1998] About what year did this first happen? [WE'RE LOOKING FOR THE EXACT YEAR. IF CAN'T SPECIFY EXACT YEAR, RECORD RESPONSE IN 'Other.']

1998.....1
1999.....2
2000.....3
2001.....4
2002.....5
2003.....6
2004.....7
Other [SPECIFY]..... [SKIP TO PF11] 96
Don't know ..... [SKIP TO PF11] –97
Refused ..... [SKIP TO PF11] –98

pf9a. [IF pf3b>1 AND <OPF>=0 AND CYEAR=1999] Since January 1999, about what year did you first have one or more of these freezers plugged in and running for at least 3 months? [WE'RE LOOKING FOR THE EXACT YEAR. IF CAN'T SPECIFY EXACT YEAR, RECORD RESPONSE IN 'Other.']1999.....1
2000.....2
2001.....3
2002.....4
2003.....5
2004.....6
Other [SPECIFY]..... [SKIP TO PF11] 96
Don't know ..... [SKIP TO PF11] –97
Refused ..... [SKIP TO PF11] –98

pf9b. [IF pf3b>1 AND <OPF>=0 AND CYEAR=1995] Since November 1995, about what year did you first have one or more of these freezers plugged in and running for at least 3 months? [WE'RE LOOKING FOR THE EXACT YEAR. IF CAN'T SPECIFY EXACT YEAR, RECORD RESPONSE IN 'Other.']

1995.....1
1996.....2
1997.....3
1998.....4
1999.....5
2000.....6
2001.....7
2002.....8
2003.....9
2004.....10
Other [SPECIFY]..... [SKIP TO PF11] 96
Don't know ..... [SKIP TO PF11] –97
Refused ..... [SKIP TO PF11] –98

pf9c. [IF pf3b>1 AND <OPF>=0 AND CYEAR=1998] Since January 1998, about what year did you first have one or more of these freezers plugged in and running for at least 3 months? [WE'RE LOOKING FOR THE EXACT YEAR. IF CAN'T SPECIFY EXACT YEAR, RECORD RESPONSE IN 'Other.']1998 1
1999.....2
2000.....3
2001.....4
2002.....5
2003.....6
2004.....7
Other [SPECIFY]..... [SKIP TO PF11] 96
Don't know ..... [SKIP TO PF11] –97
Refused ..... [SKIP TO PF11] –98

pf10. Can you tell me about what month during this year it first happen? [WE'RE LOOKING FOR THE EXACT MONTH. IF CAN'T SPECIFY EXACT MONTH, RECORD RESPONSE IN 'Other.']
January 1
February 2
March 3
April 4
May 5
June 6
July 7
August 8
September 9
October 10
November 11
December 12
Other [SPECIFY] 96
Don't know .....–97
Refused .....–98

pf11. How many stand-alone freezers do you now have at this address that are plugged in and running?
[RECORD NUMBER] .....
Don't know .....–97
Refused .....–98

Section 4: Mover Refrigerator Questions

Subsection 4.1 Mover's starting point and refrigerators acquired[VG10]

[IF b5=1 OR b6^=1 THANK AND TERMINATE]

mr1. [IF <DSCNUM>=2 SKIP TO mf1] When you first moved to this address, how many refrigerators did you have? Either that you brought with you or that were there when you moved in.
[RECORD NUMBER] .....
Don't know .....–97
Refused .....–98

mr2. After moving here, have you brought any refrigerators into your home?
Yes 1
No .....[SKIP TO mr6a] 2
Don't know ..... [SKIP TO mr7b] –97
Refused ..... [SKIP TO mr7b] –98

mr3. How many?
[RECORD NUMBER>0] .....
Don't know ..... [SKIP TO mr7b] –97
Refused ..... [SKIP TO mr7b] –98

//when first moved=0, after moving>0//
mr4a. [IF mr1=0 AND mr3=1] Was this refrigerator plugged in and running for 3 months or more in a year?
Yes 1
No..... [SKIP TO mr13] 2
Don't know ..... [SKIP TO mr7b] –97
Refused ..... [SKIP TO mr7b] –98

mr4b. [IF mr1=0 AND mr3>1] How many of these refrigerators were plugged in and running for 3 months or more in a year?
[RECORD NUMBER <=mr3].....
Don't know ..... [SKIP TO mr7b] –97
Refused ..... [SKIP TO mr7b] –98

//when first moved>0, after moving>0//
mr5. [IF mr1>0] Consider the <mr1> refrigerator(s) you had when you first moved here as well as the <mr3> refrigerator(s) you've brought into your home since moving here. Since moving here, how many of these refrigerators were plugged in and running for 3 months or more in a year?
[RECORD NUMBER <= (mr1+mr3)] .....
Don't know ..... [SKIP TO mr7b] –97
Refused ..... [SKIP TO mr7b] –98

//when first moved>0, after moving=0//
mr6a. [IF mr1=1 AND mr2=2] Consider the refrigerator you had when you first moved here. Since moving here, was this refrigerator plugged in and running for 3 months or more in a year?
Yes 1
No..... [SKIP TO mr13] 2
Don't know ..... [SKIP TO mr7b] –97
Refused ..... [SKIP TO mr7b] –98

mr6b. [IF mr1>1 AND mr2=2] Consider the <mr1> refrigerators you had when you first moved here. Since moving here, how many of these refrigerators were plugged in and running for 3 months or more in a year?
[RECORD NUMBER <= mr1].....
Don't know ..... [SKIP TO mr7b] –97
Refused ..... [SKIP TO mr7b] –98

Subsection 4.2 Refrigerators discarded

[IF mr1=0 and mr2=2 GO TO mr13
IF mr1=–97 or –98 SKIP TO mr7b
IF (mr4a<=<OPR> OR mr4b<=<OPR> OR mr5<=<OPR> OR mr6a<=<OPR> OR mr6b<=<OPR>) GO TO mr13
IF (mr4a=1 OR mr4b=1 OR mr5=1 OR mr6a=1 OR mr6b=1) AND <OPR>=0 GO TO mr10a
IF (mr4b>1 OR mr5>1 OR mr6b>1) AND <OPR>=0 GO TO mr11a]

mr7a[VG11]. Since moving here, have you gotten rid of any of these refrigerators?
Yes ..... [SKIP TO mr8] 1
No..... [SKIP TO mr9] 2
Don't know ..... [SKIP TO mr9] –97
Refused ..... [SKIP TO mr9] –98

mr7b. Since moving here, have you gotten rid of any refrigerators?
Yes 1
No..... [SKIP TO mr9] 2
Don't know ..... [SKIP TO mr9] –97
Refused ..... [SKIP TO mr9] –98

mr8. How many?
[RECORD NUMBER].....
Don't know .....–97
Refused .....–98

Subsection 4.3 Exceed # refrigerators at time of impact evaluation? If so, when

mr9. Since moving here, have you ever had more than <OPR> refrigerator(s) plugged in and running at the same time for at least 3 months in a year?
Yes 1
No..... [SKIP TO mr13] 2
Don't know ..... [SKIP TO mr13] –97
Refused ..... [SKIP TO mr13] –98

mr10a. [IF CYEAR=1999] About what year did this first happen? [WE'RE LOOKING FOR THE EXACT YEAR. IF CAN'T SPECIFY EXACT YEAR, RECORD RESPONSE IN 'Other.']
1999.....1
2000.....2
2001.....3
2002.....4
2003.....5
2004.....6
Other [SPECIFY]..... [SKIP TO mr13] 96
Don't know ..... [SKIP TO mr13] –97
Refused ..... [SKIP TO mr13] –98

mr10b. [IF CYEAR=1995] About what year did this first happen? [WE'RE LOOKING FOR THE EXACT YEAR. IF CAN'T SPECIFY EXACT YEAR, RECORD RESPONSE IN 'Other.']1995 1
1996.....2
1997.....3
1998.....4
1999.....5
2000.....6
2001.....7
2002.....8
2003.....9
2004.....10
Other [SPECIFY]..... [SKIP TO mr13] 96
Don't know ..... [SKIP TO mr13] –97
Refused ..... [SKIP TO mr13] –98

mr10c. [IF CYEAR=1998] About what year did this first happen [WE'RE LOOKING FOR THE EXACT YEAR. IF CAN'T SPECIFY EXACT YEAR, RECORD RESPONSE IN 'Other.']
1998.....1
1999.....2
2000.....3
2001.....4
2002.....5
2003.....6
2004.....7
Other [SPECIFY]..... [SKIP TO mr13] 96
Don't know ..... [SKIP TO mr13] –97
Refused ..... [SKIP TO mr13] –98

mr11a. [IF (mr4b>1 OR mr5>1 OR mr6b>1) AND <OPR>=0 AND CYEAR=1999] Since moving here, about what year did you first have one or more of these refrigerators plugged in and running for at least 3 months[WE'RE LOOKING FOR THE EXACT YEAR. IF CAN'T SPECIFY EXACT YEAR, RECORD RESPONSE IN 'Other.']

1999.....1
2000.....2
2001.....3
2002.....4
2003.....5
2004.....6
Other [SPECIFY]..... [SKIP TO mr13] 96
Don't know ..... [SKIP TO mr13] –97
Refused ..... [SKIP TO mr13] –98

mr11b. [IF (mr4b>1 OR mr5>1 OR mr6b>1) AND <OPR>=0 AND CYEAR=1995] Since moving here, about what year did you first have one or more of these refrigerators plugged in and running for at least 3 months? [WE'RE LOOKING FOR THE EXACT YEAR. IF CAN'T SPECIFY EXACT YEAR, RECORD RESPONSE IN 'Other.']

1995.....1
1996.....2
1997.....3
1998.....4
1999.....5
2000.....6
2001.....7
2002.....8
2003.....9
2004.....10
Other [SPECIFY]..... [SKIP TO mr13] 96
Don't know ..... [SKIP TO mr13] –97
Refused ..... [SKIP TO mr13] –98

mr11c. [IF (mr4b>1 OR mr5>1 OR mr6b>1) AND <OPR>=0 AND CYEAR=1998] Since moving here, about what year did you first have one or more of these refrigerators plugged in and running for at least 3 months? [WE'RE LOOKING FOR THE EXACT YEAR. IF CAN'T SPECIFY EXACT YEAR, RECORD RESPONSE IN 'Other.']

1998.....1
1999.....2
2000.....3
2001.....4
2002.....5
2003.....6
2004.....7
Other [SPECIFY]..... [SKIP TO mr13] 96
Don't know ..... [SKIP TO mr13] –97
Refused ..... [SKIP TO mr13] –98

mr12. Can you tell me about what month during this year it first happen? [WE'RE LOOKING FOR THE EXACT MONTH. IF CAN'T SPECIFY EXACT MONTH, RECORD RESPONSE IN 'Other.']

January 1
February 2
March 3
April 4
May 5
June 6
July.....7
August.....8
September 9
October.....10
November.....11
December 12
Other [SPECIFY].....96
Don't know .....–97
Refused .....–98

mr13. How many refrigerators do you now have at this address that are plugged in and running? [RECORD NUMBER].....
Don't know .....–97
Refused .....–98

Section 5: Mover Freezer Questions

// //

mf0. [IF <DSCNUM>=1 THANK AND TERMINATE]

Subsection 5.1 Mover's starting point and freezers acquired[VG13]

mf1. When you first moved to this address, how many stand-alone freezers did you have? Either that you brought with you or that were there when you moved in.
[RECORD NUMBER].....
Don't know .....–97
Refused .....–98

mf2. After moving here, have you brought any stand-alone freezers into your home?
Yes 1
No.....[SKIP TO mf6a] 2
Don't know ..... [SKIP TO mf7b] –97
Refused ..... [SKIP TO mf7b] –98

mf3. How many?
[RECORD NUMBER>0] .....
Don't know ..... [SKIP TO mf7b] –97
Refused ..... [SKIP TO mf7b] –98

//when first moved=0, after moving>0//
mf4a. [IF mf1=0 AND mf3=1] Was this freezer plugged in and running for 3 months or more in a year?
Yes 1
No.....[SKIP TO MF13] 2
Don't know ..... [SKIP TO mf7b] –97
Refused ..... [SKIP TO mf7b] –98

mf4b. [IF mf1=0 AND mf3>1] How many of these freezers were plugged in and running for 3 months or more in a year?
[RECORD NUMBER <=mf3].....
Don't know ..... [SKIP TO mf7b] –97
Refused ..... [SKIP TO mf7b] –98

//when first moved>0, after moving>0//
mf5. [IF mf1>0] Consider the <mf1> stand-alone freezer(s) you had when you first moved here as well as the <mf3> stand-alone freezer(s) you've brought into your home since moving here. Since moving here, how many of these freezers were plugged in and running for 3 months or more in a year?
[RECORD NUMBER <= (mf1+mf3)] .....
Don't know ..... [SKIP TO mf7b] –97
Refused ..... [SKIP TO mf7b] –98

//when first moved>0, after moving=0//
mf6a. [IF mf1=1 AND mf2=2] Consider the stand-alone freezer you had when you first moved here. Since moving here, was this freezer plugged in and running for 3 months or more in a year?
Yes 1
No..... [SKIP TO MF13] 2
Don't know ..... [SKIP TO mf7b] –97
Refused ..... [SKIP TO mf7b] –98

mf6b. [IF mf1>1 AND mf2=2] Consider the <mf1> stand-alone freezers you had when you first moved here. Since moving here, how many of these freezers were plugged in and running for 3 months or more in a year?
[RECORD NUMBER <= mf1].....
Don't know ..... [SKIP TO mf7b] –97
Refused ..... [SKIP TO mf7b] –98

Subsection 5.2 Freezers discarded

[IF mf1=0 and mf2=2 SKIP TO MF13
IF mf1=–97 or –98 SKIP TO mf7b
IF (mf4a<=<OPF> OR mf4b<=<OPF> OR mf5<=<OPF> OR mf6a<=<OPF> OR mf6b<=<OPF>) SKIP TO MF13
IF (mf4a=1 OR mf4b=1 OR mf5=1 OR mf6a=1 OR mf6b=1) AND <OPF>=0 GO TO mf10a
IF (mf4b>1 OR mf5>1 OR mf6b>1) AND <OPF>=0 GO TO mf11a]

mf7a[VG14]. Since moving here, have you gotten rid of any of these freezers?
Yes ..... [SKIP TO mf8] 1
No..... [SKIP TO mf9] 2
Don't know ..... [SKIP TO mf9] –97
Refused ..... [SKIP TO mf9] –98

mf7b. Since moving here, have you gotten rid of any stand-alone freezers?
Yes 1
No..... [SKIP TO mf9] 2
Don't know ..... [SKIP TO mf9] –97
Refused ..... [SKIP TO mf9] –98

mf8. How many?
[RECORD NUMBER].....
Don't know .....–97
Refused .....–98

Subsection 5.3 Exceed # freezers at time of impact evaluation? If so, when

mf9. Since moving here, have you ever had more than <OPF> stand-alone freezer(s) plugged in and running at the same time for at least 3 months in a year?
Yes 1
No..... [SKIP TO MF13] 2
Don't know ..... [SKIP TO MF13] –97
Refused ..... [SKIP TO MF13] –98

mf10a. [IF CYEAR=1999] About what year did this first happen? [WE'RE LOOKING FOR THE EXACT YEAR. IF CAN'T SPECIFY EXACT YEAR, RECORD RESPONSE IN 'Other.']
1999.....1
2000.....2
2001.....3
2002.....4
2003.....5
2004.....6
Other [SPECIFY]..... [SKIP TO MF13] 96
Don't know ..... [SKIP TO MF13] –97
Refused ..... [SKIP TO MF13] –98

mf10b. [IF CYEAR=1995] About what year did this first happen? [WE'RE LOOKING FOR THE EXACT YEAR. IF CAN'T SPECIFY EXACT YEAR, RECORD RESPONSE IN 'Other.']

1995.....1
1996.....2
1997.....3
1998.....4
1999.....5
2000.....6
2001.....7
2002.....8
2003.....9
2004.....10
Other [SPECIFY].....[SKIP TO MF13] 96
Don't know .....[SKIP TO MF13] –97
Refused .....[SKIP TO MF13] –98

mf10c. [IF CYEAR=1998] About what year did this first happen [WE'RE LOOKING FOR THE EXACT YEAR. IF CAN'T SPECIFY EXACT YEAR, RECORD RESPONSE IN 'Other.']

1998.....1
1999.....2
2000.....3
2001.....4
2002.....5
2003.....6
2004.....7
Other [SPECIFY].....[SKIP TO MF13] 96
Don't know .....[SKIP TO MF13] –97
Refused .....[SKIP TO MF13] –98

mf11a. [IF (mf4b>1 OR mf5>1 OR mf6b>1) AND <OPF>=0 AND CYEAR=1999] Since moving here, about what year did you first have one or more of these freezers plugged in and running for at least 3 months? [WE'RE LOOKING FOR THE EXACT YEAR. IF CAN'T SPECIFY EXACT YEAR, RECORD RESPONSE IN 'Other.']

1999.....1
2000.....2
2001.....3
2002.....4
2003.....5
2004.....6
Other [SPECIFY].....[SKIP TO MF13] 96
Don't know .....[SKIP TO MF13] –97
Refused .....[SKIP TO MF13] –98

mf11b. [IF (mf4b>1 OR mf5>1 OR mf6b>1) AND <OPF>=0 AND CYEAR=1995] Since moving here, about what year did you first have one or more of these freezers plugged in and running for at least 3 months? [WE'RE LOOKING FOR THE EXACT YEAR. IF CAN'T SPECIFY EXACT YEAR, RECORD RESPONSE IN 'Other.']

1995.....1
1996.....2
1997.....3
1998.....4
1999.....5
2000.....6
2001.....7
2002.....8
2003.....9
2004.....10
Other [SPECIFY].....[SKIP TO MF13] 96
Don't know .....[SKIP TO MF13] –97
Refused .....[SKIP TO MF13] –98

mf11c. [IF (mf4b>1 OR mf5>1 OR mf6b>1) AND <OPF>=0 AND CYEAR=1998] Since moving here, about what year did you first have one or more of these freezers plugged in and running for at least 3 months? [WE'RE LOOKING FOR THE EXACT YEAR. IF CAN'T SPECIFY EXACT YEAR, RECORD RESPONSE IN 'Other.']

1998.....1
1999.....2
2000.....3
2001.....4
2002.....5
2003.....6
2004.....7
Other [SPECIFY].....[SKIP TO MF13] 96
Don't know .....[SKIP TO MF13] –97
Refused .....[SKIP TO MF13] –98

mf12. Can you tell me about what month during this year it first happen? [WE'RE LOOKING FOR THE EXACT MONTH. IF CAN'T SPECIFY EXACT MONTH, TRY TO GET TO SPECIFY A RANGE OF MONTHS AND RECORD ALL, BEFORE MONTH, OR AFTER MONTH.]

January 1
February 2
March 3
April 4
May 5
June 6
July 7
August 8
September 9
October 10
November 11
December 12
Other [SPECIFY] 96
Don't know .....–97
Refused .....–98

mf13. How many stand-alone freezers do you now have at this address that are plugged in and running?

[RECORD NUMBER] .....
Don't know .....–97
Refused .....–98

Those are all the questions I have for you. Thank you very much for your help.

A.2 RECENT APPLIANCE DISCARDERS

Sample Data

<NPNAME>: nonparticipant name
<RFDSCSTY>: RASS fielded in 2003, door style of old refrigerator discarded in last 12 months
<RFDSCDEF>: RASS fielded in 2003, old refrigerator discarded in last 12 months frost-free or manual defrost
<RFDSCSZ>: RASS fielded in 2003, size of old refrigerator discarded in last 12 months
<FZDSCSTY>: RASS fielded in 2003, style of old freezer discarded in last 12 months
<FZDSCSZ>: RASS fielded in 2003, size of old freezer discarded in last 12 months

FYI, RASS data = 98 means missing

Discuss with survey house:

- Not all contact names are persons or master metered w/person as contact. Wing it or revise/add questions to handle. Seems could simply start with b2. Reference to household is somewhat awkward. However, expected survey to be completed for a home.
- Collecting age data: note follow up question
- If range, need a range before\after is not sufficient

Section 1: Lead In

b1. Hello, may I speak with <NPNAME>?
Yes ..... [SKIP TO b3] 1
No 2
Don't know ..... –97
Refused ..... [THANK AND TERMINATE] –98

b2. [IF AN ADULT ANSWERED OR YOU CAN GET AN ADULT ON THE LINE.] Perhaps you can help me.

b3. My name is _____ and I'm with Research America. I'm calling on behalf of Southern California Edison. We're conducting a brief survey to learn about refrigerators and freezers in Southern California Edison territory. This is not a marketing call. We're collecting data to help Southern California Edison improve its residential programs and services and help its customers save energy. Southern California Edison is required by the California Public Utility Commission to conduct this type of research. Your responses will be kept entirely confidential.

b4. Did you get rid of a refrigerator or a stand-alone freezer sometime in the last couple of years; say, sometime since January 2002?

Yes 1
No.....2
Don't know .....–97
Refused .....–98

b5. What about in the last 5 years?
Yes 1
No.....2
Don't know .....–97
Refused .....–98

b6. Is there anyone else that might know about refrigerators or freezers gotten rid of from this address?
Yes ..... [BACK TO BEGINNING WITH NEW PERSON] 1
No..... [THANK AND TERMINATE] 2
Don't know ..... [THANK AND TERMINATE] –97
Refused ..... [THANK AND TERMINATE] –98

Section 2: Refrigerator Questions

Subsection 2.1 Intro

r0. How many refrigerators [VG16]have you gotten rid of since then?
[RECORD NUMBER > 0] .....
Don't know .....–97
Refused .....–98

[IF r0=0 THEN GO TO f0
ELSE GO TO r1]

r1. [IF r0^=1] Please answer my questions for the refrigerator you got rid of most recently.

Subsection 2.2 When got rid of worked? If not, age broke + age at discard

r2a. [VG17]. When you got rid of the refrigerator, was it still in working condition?
Yes .....[SKIP TO r2b] 1
No.....[SKIP TO r2c] 2
Don't know .....[SKIP TO rd1] –97
Refused .....[SKIP TO rd1] –98

r2b. [IF r2a=1] Was it in need of any repair?
Yes .....[SKIP TO rd1] 1
No.....[SKIP TO rd1] 2
Don't know .....[SKIP TO rd1] –97
Refused .....[SKIP TO rd1] –98

r2c. [IF r2a=2] Was it worth repairing?
Yes 1
No.....2
Don't know .....–97
Refused .....–98

r3[VG18]. About how many years ago was the refrigerator no longer in working condition? [RECORD A RANGE IN 'Other[VG19].']
[RECORD EXACT NUMBER OF YEARS] .....
Other [SPECIFY].....96
Don't know .....–97
Refused .....–98

r4a[VG20]. About how many years old was the refrigerator then? Thinking about what else happened around the same time you bought the refrigerator may help you remember the age of the refrigerator. Also, if you did not buy the refrigerator new, be sure to factor in the age of the refrigerator when you bought it. [WE'RE LOOKING FOR AN EXACT NUMBER OF YEARS. RECORD A RANGE IN 'Other.']
[RECORD EXACT NUMBER OF YEARS] .....
Other [SPECIFY].....96
Don't know .....[SKIP TO r5a] –97
Refused .....[SKIP TO r5a] –98

r4b. Just to confirm: This is the age of the refrigerator when it was no longer in working condition and not necessarily its age when you got rid of it?
Yes .....[SKIP TO r6] 1
No.....2
Don't know .....–97
Refused .....–98

r4c[VG21]. About how many years old was the refrigerator when it was no longer in working condition? [WE'RE LOOKING FOR AN EXACT NUMBER OF YEARS. RECORD A RANGE IN 'Other.']
[RECORD EXACT NUMBER OF YEARS] .....[SKIP TO r6]
Other [SPECIFY].....[SKIP TO r6] 96
Don't know .....–97
Refused .....–98

r5a. Can you tell me within five years how old the refrigerator was when it was no longer in working condition? That is, would you say it was closest to 5 years old, 10 years old, 15 years old, etc.?

Closest to 5 years old 1
Closest to 10 years old 2
Closest to 15 years old 3
Closest to 20 years old 4
Closest to 25 years old 5
Closest to 30 years old 6
Closest to 35 years old 7
Closest to 40 years old 8
Closest to 45 years old 9
Closest to 50 years old 10
Other [SPECIFY] 96
Don't know ..... [SKIP TO rd1] –97
Refused ..... [SKIP TO rd1] –98

r5b. Just to confirm: This is the age of the refrigerator when it was no longer in working condition and not necessarily its age when you got rid of it?

Yes ..... [SKIP TO r6] 1
No 2
Don't know ..... –97
Refused ..... –98

r5c. Can you tell me within five years how old the refrigerator was when it was no longer in working condition? That is, would you say it was closest to 5 years old, 10 years old, 15 years old, etc.?

Closest to 5 years old 1
Closest to 10 years old 2
Closest to 15 years old 3
Closest to 20 years old 4
Closest to 25 years old 5
Closest to 30 years old 6
Closest to 35 years old 7
Closest to 40 years old 8
Closest to 45 years old 9
Closest to 50 years old 10
Other [SPECIFY] 96
Don't know ..... [SKIP TO rd1] –97
Refused ..... [SKIP TO rd1] –98

r6. About how long after the refrigerator was no longer in working condition did you get rid of it: less than 6 months, 1 year, 2 years, etc.?

Less than 6 months.....[SKIP TO rs1] 1
1 year.....[SKIP TO rs1] 2
2 years.....[SKIP TO rs1] 3
3 years.....[SKIP TO rs1] 4
4 years.....[SKIP TO rs1] 5
5 years.....[SKIP TO rs1] 6
Other [SPECIFY].....[SKIP TO rs1] 96
Don't know.....[SKIP TO rs1] –97
Refused.....[SKIP TO rs1] –98

Subsection 2.3 Discard age [VG22]

rd1. My next questions concern the age of the refrigerator when you got rid of it. Thinking about what else happened around the same time you bought the refrigerator may help you remember the age of the refrigerator. Also, if you did not buy the refrigerator new, be sure to factor in the age of the refrigerator when you bought it.

rd7a. About how many years old was the refrigerator when you got rid of it? [WE'RE LOOKING FOR AN EXACT NUMBER OF YEARS. RECORD A RANGE IN 'Other.']

[RECORD NUMBER OF YEARS].....[SKIP TO rs1]
Other [SPECIFY].....[SKIP TO rs1] 96
Don't know.....–97
Refused.....–98

rd7b. Can you tell me within five years how old it was? That is, would you say it was closest to 1 year old, 5 years old, 10 years old, 15 years old, etc.?

Closest to 1 year old.....1
Closest to 5 years old.....2
Closest to 10 years old.....3
Closest to 15 years old.....4
Closest to 20 years old.....5
Closest to 25 years old.....6
Closest to 30 years old.....7
Closest to 35 years old.....8
Closest to 40 years old.....9
Closest to 45 years old.....10
Closest to 50 years old.....11
Other [SPECIFY].....96
Don't know.....[SKIP TO f0] –97
Refused.....[SKIP TO f0] –98

Subsection 2.4 Discard status

rs1. To get rid of the refrigerator, did you pay someone, did someone pay you, or did you give it away?
You paid someone....1
Someone paid you....2
Gave it away....3
Don't know....–97
Refused....–98

rs2. To get rid of the refrigerator, did you take it somewhere or was it picked up?
You took it somewhere....1
It was picked it up....[SKIP TO rs3b] 2
Don't know....[SKIP TO rc1] –97
Refused....[SKIP TO rc1] –98

rs3a. Which of the following best describes where you took it? [READ LIST. DON'T RECORD RESPONSE UNTIL FINISHED READING LIST]
To a utility recycling program....[SKIP TO rc1] 1
To a scrap dealer or recycler....[SKIP TO rc1] 2
To a landfill....[SKIP TO rc1] 3
To an appliance dealer....[SKIP TO rc1] 4
Or to someone's home....[SKIP TO rc1] 5
[DO NOT READ]Other [SPECIFY]....[SKIP TO rc1] 96
Don't know....[SKIP TO rc1] –97
Refused....[SKIP TO rc1] –98

rs3b. Which of the following best describes who picked it up? [READ LIST. DON'T RECORD RESPONSE UNTIL FINISHED READING LIST]
The dealer you bought a new refrigerator from....1
A dealer, but not one you just bought a refrigerator from....2
A utility recycling program....3
A scrap dealer or recycler....4
Someone you hired to take it away....5
Or a private citizen....6
[DO NOT READ]Other [SPECIFY]....96
Don't know....–97
Refused....–98

Subsection 2.5 Refrigerator characteristics

rc1[VG23]. [IF r2a=2] During the year prior to the refrigerator no longer being in working condition, about how many months did you use it?
[RECORD NUMBER OF MONTHS 0–12]
Don't know .....–97
Refused .....–98

rc2. During the year prior to getting rid of the refrigerator, about how many months did you use it? [IF RESPOND "all the time," CONFIRM "that would be 12 months?"]
[RECORD NUMBER OF MONTHS 0–12]
Don't know .....–97
Refused .....–98

rc3. [IF r0^=1 OR <RFDSCSTY>=98] Which of the following best describes the refrigerator you got rid of? [READ LIST. DON'T RECORD RESPONSE UNTIL FINISHED READING LIST.]
Single-door.....1
Top freezer, bottom refrigerator 2
Bottom freezer, top refrigerator 3
Or side-by-side.....4
[DON'T READ] Don't know .....–97
[DON'T READ] Refused .....–98

rc4. [IF r0^=1 OR <RFDSCDEF>=98] Was the refrigerator frost-free or manual defrost?
Frost-free.....1
Manual defrost 2
Don't know .....–97
Refused .....–98

rc5. [IF r0^=1 OR <RFDSCSZ>=98] In terms of size, was the refrigerator mini, which would be less than 13 cubic feet?
Yes 1
No.....2
Don't know .....–97
Refused .....–98

Section 3: Freezer Questions

Subsection 3.1 Intro

f0. How many stand-alone freezers have you gotten rid of since January 2002?
[RECORD NUMBER>0] .....
Don't know .....–97
Refused .....–98

[IF f0=0 THEN THANK AND TERMINATE
ELSE GO TO f1]

f1 [IFf0^=1] Please answer my questions for the freezer you got rid of most recently.

Subsection 3.2 When got rid of worked? If not, age broke + age at discard

f2a. [VG25]. When you got rid of the freezer, was it still in working condition?
Yes .....[SKIP TO f2b] 1
No.....[SKIP TO f2c] 2
Don't know .....[SKIP TO fd1] –97
Refused .....[SKIP TO fd1] –98

f2b. [IF f2a=1] Was it in need of any repair?
Yes .....[SKIP TO fd1] 1
No.....[SKIP TO fd1] 2
Don't know .....[SKIP TO fd1] –97
Refused .....[SKIP TO fd1] –98

f2c. [IF f2a=2] Was it worth repairing?
Yes 1
No.....2
Don't know .....–97
Refused .....–98

f3[VG26]. About how many years ago was the freezer no longer in working condition?
[RECORD A RANGE IN 'Other.']
[RECORD EXACT NUMBER OF YEARS] .....
Other [SPECIFY].....96
Don't know .....–97
Refused .....–98

f4a[VG27]. About how many years old was the freezer then? Thinking about what else happened around the same time you bought the freezer may help you remember the age of the freezer. Also, if you did not buy the freezer new, be sure to factor in the age of the freezer when you bought it. [WE'RE LOOKING FOR AN EXACT NUMBER OF YEARS. RECORD A RANGE IN 'Other.']

[RECORD EXACT NUMBER OF YEARS] .....
Other [SPECIFY] 96
Don't know .....[SKIP TO f5a] –97
Refused .....[SKIP TO f5a] –98

f4b. Just to confirm: This is the age of the freezer when it was no longer in working condition and not necessarily its age when you got rid of it?

Yes .....[SKIP TO f6] 1
No 2
Don't know .....–97
Refused .....–98

f4c[VG28]. About how many years old was the freezer when it was no longer in working condition? [WE'RE LOOKING FOR AN EXACT NUMBER OF YEARS. RECORD A RANGE IN 'Other.']

[RECORD EXACT NUMBER OF YEARS] .....[SKIP TO f6]
Other [SPECIFY] .....[SKIP TO f6] 96
Don't know .....–97
Refused .....–98

f5a. Can you tell me within five years how old the freezer was when it was no longer in working condition? That is, would you say it was closest to 5 years old, 10 years old, 15 years old, etc.?

Closest to 5 years old 1
Closest to 10 years old 2
Closest to 15 years old 3
Closest to 20 years old 4
Closest to 25 years old 5
Closest to 30 years old 6
Closest to 35 years old 7
Closest to 40 years old 8
Closest to 45 years old 9
Closest to 50 years old 10
Other [SPECIFY] 96
Don't know .....[SKIP TO fd1] –97
Refused .....[SKIP TO fd1] –98

f5b. Just to confirm: This is the age of the freezer when it was no longer in working condition and not necessarily its age when you got rid of it?

Yes .....[SKIP TO f6] 1
No.....2
Don't know .....–97
Refused .....–98

f5c. Can you tell me within five years how old the freezer was when it was no longer in working condition? That is, would you say it was closest to 5 years old, 10 years old, 15 years old, etc.?

Closest to 5 years old 1
Closest to 10 years old 2
Closest to 15 years old 3
Closest to 20 years old 4
Closest to 25 years old 5
Closest to 30 years old 6
Closest to 35 years old 7
Closest to 40 years old 8
Closest to 45 years old 9
Closest to 50 years old 10
Other [SPECIFY].....96
Don't know .....[SKIP TO fd1] –97
Refused .....[SKIP TO fd1] –98

f6. About how long after the freezer was no longer in working condition did you get rid of it: less than 6 months, 1 year, 2 years, etc.?

Less than 6 months.....[SKIP TO fs1] 1
1 year.....[SKIP TO fs1] 2
2 years .....[SKIP TO fs1] 3
3 years .....[SKIP TO fs1] 4
4 years .....[SKIP TO fs1] 5
5 years .....[SKIP TO fs1] 6
Other [SPECIFY].....[SKIP TO fs1] 96
Don't know .....[SKIP TO fs1] –97
Refused .....[SKIP TO fs1] –98

Subsection 3.3 Discard age [VG29]

fd1. My next questions concern the age of the freezer when you got rid of it. Thinking about what else happened around the same time you bought the freezer may help you remember the age of the freezer. Also, if you did not buy the freezer new, be sure to factor in the age of the freezer when you bought it.

fd7a. About how many years old was the freezer when you got rid of it? [WE'RE LOOKING FOR AN EXACT NUMBER OF YEARS. RECORD A RANGE IN 'Other.'] [RECORD NUMBER OF YEARS] ..... [SKIP TO fs1]
Other [SPECIFY] ..... [SKIP TO fs1] 96
Don't know ..... –97
Refused ..... –98

fd7b. Can you tell me within five years how old it was? That is, would you say it was closest to 1 year old, 5 years old, 10 years old, 15 years old, etc.?
Closest to 1 year old 1
Closest to 5 years old 2
Closest to 10 years old 3
Closest to 15 years old 4
Closest to 20 years old 5
Closest to 25 years old 6
Closest to 30 years old 7
Closest to 35 years old 8
Closest to 40 years old 9
Closest to 45 years old 10
Closest to 50 years old 11
Other [SPECIFY] 96
Don't know ..... [THANK AND TERMINATE] –97
Refused ..... [THANK AND TERMINATE] –98

Subsection 3.4 Discard status

fs1. To get rid of the freezer, did you pay someone, did someone pay you, or did you give it away?
You paid someone 1
Someone paid you 2
Gave it away 3
Don't know ..... –97
Refused ..... –98

fs2. To get rid of the freezer, did you take it somewhere or was it picked up?
You took it somewhere 1
It was picked it up ..... [SKIP TO fs3b] 2
Don't know ..... [SKIP TO fc1] –97
Refused ..... [SKIP TO fc1] –98

fs3a. Which of the following best describes where you took it? [READ LIST. DON'T RECORD RESPONSE UNTIL FINISHED READING LIST]

To a utility recycling program ..... [SKIP TO fc1] 1
To a scrap dealer or recycler ..... [SKIP TO fc1] 2
To a landfill ..... [SKIP TO fc1] 3
To an appliance dealer ..... [SKIP TO fc1] 4
Or to someone's home ..... [SKIP TO fc1] 5
[DO NOT READ]Other [SPECIFY] ..... [SKIP TO fc1] 96
Don't know ..... [SKIP TO fc1] –97
Refused ..... [SKIP TO fc1] –98

fs3b. Which of the following best describes who picked it up? [READ LIST. DON'T RECORD RESPONSE UNTIL FINISHED READING LIST]

The dealer you bought a new freezer from 1
A dealer, but not one you just bought a freezer from 2
A utility recycling program 3
A scrap dealer or recycler 4
Someone you hired to take it away 5
Or a private citizen 6
[DO NOT READ]Other [SPECIFY] 96
Don't know ..... –97
Refused ..... –98

Subsection 3.5 Freezer characteristics

fc1[VG30]. [IF f2a=2] During the year prior to the freezer no longer being in working condition, about how many months did you use it?
[RECORD NUMBER OF MONTHS 0–12]
Don't know ..... –97
Refused ..... –98

fc2. During the year prior to getting rid of the freezer, about how many months did you use it? ?
[IF RESPOND "all the time," CONFIRM "that would be 12 months?"]
[RECORD NUMBER OF MONTHS 0–12]
Don't know ..... –97
Refused ..... –98

fc3. [IF f0^=1 OR <FZDSCSTY>=98] Which of the following best describes the freezer you got rid of? [READ LIST. DON'T RECORD RESPONSE UNTIL FINISHED READING LIST.]
Upright, frost free.....1
Upright, manual defrost 2
Chest, frost free.....3
Chest, manual defrost.....4
Don't know .....–97
Refused .....–98

fc4. [IF f0^=1 OR <FZDSCSZ>=98] What was the approximate size of the freezer? [READ LIST. DON'T RECORD RESPONSE UNTIL FINISHED READING LIST.]
Small (under 13 cubic feet).....1
Medium (13 – 16 cubic feet).....2
Or large (over 16 cubic feet) 3
Don't know .....–97
Refused .....–98

Those are all the questions I have for you. Thank you very much for your help.

A.3 CALIFORNIA STATEWIDE RASS 2003

A full copy of the California Statewide RASS 2003 follows.

HOME ENERGY SURVEY

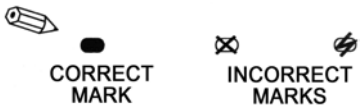
Thank you for your help! Your participation is very important to us. The information you provide helps us plan for the electric and natural gas needs for you and all Californians. Please complete the survey for the service address listed below:

(SFCODE)

Please fill out the survey for the home at the address to the left.

YOUR PARTICIPATION IS VERY IMPORTANT

Please fill out this survey with a **PENCIL**, filling in the oval completely as illustrated to the right. Information in **red** helps to clarify questions. Information in **blue** directs you to skip to another question based on your response.



Do your best to answer all of the questions. If you do not know the answer to one of the questions, please move on to the next one. If you would like help in completing the survey, you can call our toll free survey line at 1-800-331-8786 from 8:30 a.m. to 7 p.m. Monday through Friday. You may leave a message at all other times and we will call you back with a response.

When you are done, please return the survey in the enclosed postage-paid envelope to the address below:

CEC Survey Processing Center
492 Ninth Street, Suite 220
Oakland, CA 94607-4048

Thank you for participating!

Sponsored by:

California Energy Commission
Pacific Gas and Electric
San Diego Gas and Electric
Southern California Edison
Southern California Gas Company
Los Angeles Dept. of Water and Power

Your Home & Lifestyle

A1 What type of building exists at the service address on the front cover of this survey? (DWLTYPE) (RES – Cleaned dwltype)

1⊂⊃ Single-family detached house ➡ Number of stories: 1⊂⊃ 1 1⊂⊃ 2 1⊂⊃ 3 or more (STORIES)

2⊂⊃ Townhouse, duplex, or row house *(Shares exterior walls with neighboring unit, but not roof or floor)*

3⊂⊃ Apartment or condominium (2 – 4 units)

4⊂⊃ Apartment or condominium (5 or more units)

5⊂⊃ Mobile home

6⊂⊃ Other *(Describe:* (DWLOTRD)_____*)*

A2 Do you own or rent this home? (OWNRENT)

1⊂⊃ Own / buying 2⊂⊃ Rent / lease

A3 How long have you lived at this address? (YRS_RES)

1⊂⊃ 1 yr or less	6⊂⊃ 6 years	11⊂⊃ 11 years	16⊂⊃ 16 – 20 years
2⊂⊃ 2 years	7⊂⊃ 7 years	12⊂⊃ 12 years	17⊂⊃ 21 – 30 years
3⊂⊃ 3 years	8⊂⊃ 8 years	13⊂⊃ 13 years	18⊂⊃ More than 30 years
4⊂⊃ 4 years	9⊂⊃ 9 years	14⊂⊃ 14 years	
5⊂⊃ 5 years	10⊂⊃ 10 years	15⊂⊃ 15 years	

A4 What best describes this residence? (SEASOCC)

1⊂⊃ This is my permanent year-round residence. (Go to *A6.*)

2⊂⊃ This is my partial-year or seasonal residence.

3⊂⊃ This is my vacation home and is generally used only by my family.

4⊂⊃ This is a vacation rental home.

A5 If this is a partial-year or vacation home, please indicate the months this home is typically occupied? *(Mark all months that apply.)*

1⊂⊃ Jan (SEASJAN)	1⊂⊃ Mar (SEASMAR)	1⊂⊃ May (SEASMAY)	1⊂⊃ Jul (SEASJUL)	1⊂⊃ Sept (SEASSEP)	1⊂⊃ Nov (SEASNOV)
1⊂⊃ Feb (SEASFEB)	1⊂⊃ Apr (SEASAPR)	1⊂⊃ Jun (SEASJUN)	1⊂⊃ Aug (SEASAUG)	1⊂⊃ Oct (SEASOCT)	1⊂⊃ Dec (SEASDEC)

A6 Approximately what year was this residence built? (BUILTYR)
(HOMEAGE – cleaned Builtyr, not including Master Metered (MM))

1⊂⊃ Before 1940	8⊂⊃ 1973	15⊂⊃ 1980	22⊂⊃ 1987	29⊂⊃ 1994	36⊂⊃ 2001
2⊂⊃ 1940-1949	9⊂⊃ 1974	16⊂⊃ 1981	23⊂⊃ 1988	30⊂⊃ 1995	37⊂⊃ 2002
3⊂⊃ 1950-1959	10⊂⊃ 1975	17⊂⊃ 1982	24⊂⊃ 1989	31⊂⊃ 1996	38⊂⊃ 2003
4⊂⊃ 1960-1969	11⊂⊃ 1976	18⊂⊃ 1983	25⊂⊃ 1990	32⊂⊃ 1997	
5⊂⊃ 1970	12⊂⊃ 1977	19⊂⊃ 1984	26⊂⊃ 1991	33⊂⊃ 1998	
6⊂⊃ 1971	13⊂⊃ 1978	20⊂⊃ 1985	27⊂⊃ 1992	34⊂⊃ 1999	
7⊂⊃ 1972	14⊂⊃ 1979	21⊂⊃ 1986	28⊂⊃ 1993	35⊂⊃ 2000	

A7 How many bedrooms are in your home? (NUMROOM)

1⊂⊃ No bedrooms (studio apartment)	4⊂⊃ 3	7⊂⊃ 6	10⊂⊃ 9
2⊂⊃ 1 bedroom	5⊂⊃ 4	8⊂⊃ 7	11⊂⊃ 10
3⊂⊃ 2 bedrooms	6⊂⊃ 5	9⊂⊃ 8	12⊂⊃ More than 10

A8 How many square feet of **living space** are there in your residence, including bathrooms, foyers and hallways? *(Exclude garages, basements and unheated porches.)* (SQFT) (SQFT_A – cleaned continuous sqft, not including MM)

1⊂⊃ Less than 250	5⊂⊃ 1001 – 1250	9⊂⊃ 2501 – 3000
2⊂⊃ 250 – 500	6⊂⊃ 1251 – 1500	10⊂⊃ 3001 – 4000
3⊂⊃ 501 – 750	7⊂⊃ 1501 – 2000	11⊂⊃ 4001 – 5000
4⊂⊃ 751 –1000	8⊂⊃ 2001 – 2500	12⊂⊃ Greater than 5000

A9 Are your home's **exterior walls** insulated? (EXTWLINS)

1⊂⊃ Yes, all walls 1⊂⊃ Yes, some walls 1⊂⊃ No

A10 Is your home's **attic/ceiling** insulated? (ACEILINS)

1⊂⊃ Yes ➡ **A11** If yes, estimate the number of inches of **attic/ceiling** insulation. (CEILINCH)

2⊂⊃ No

1⊂⊃ 0 – 3 inches *(R-value less than R-10)*
2⊂⊃ 4 – 6 inches *(R-11 to R-19)*
3⊂⊃ 7 – 10 inches *(R-20 to R-30)*
4⊂⊃ More than 10 inches *(R-31 or higher)*

A12 Choose the statement that best describes your **windows**. (WINDTYPE)

1⊂⊃ All or most are double pane windows
2⊂⊃ All or most are single pane windows
3⊂⊃ My home has a mixture of single pane and double pane windows

A13 Choose the statement that best describes the frames on your **windows**. (WINFRAME)

1⊂⊃ All or most have vinyl window frames
2⊂⊃ All or most have wood window frames
3⊂⊃ All or most have metal window frames

A14 Has your home been remodeled in the past 12 months? (REMOD)

1⊂⊃ **No *(Go to A16.)***

2⊂⊃ Yes➡**A15** If yes, what type of remodel did you do? *(Choose all that apply.)*

1⊂⊃ Room addition, added square footage to home (RMDROOM)
1⊂⊃ Kitchen or bath re-model (RMDKTBTH)
1⊂⊃ Re-built most of the home (RMDREBLT)
1⊂⊃ Other (RMDOTHR)

A16 For each of the following age groups, how many people, including yourself, usually live in this home? (NUMI – plugged continuous number in household, not including MM)

	Number of People Usually Living In This Home								
Age	**None**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**Over 7**
5 and under (NR0_5)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
6 – 18 (NR6_18)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
19 – 34 (NR19_34)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
35 – 54 (NR35_54)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
55 – 64 (NR55_64)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
65 and over (NR65_99)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃

A17 Generally speaking, how often does a member of this household use major **electrical** appliances or equipment (e.g., clothes washer, electric range, dishwasher, air conditioner, etc.) on **weekdays from 12 noon to 6 pm**? (ONPKUSE)

1⊂⊃ Frequently *(3 – 5 weekdays per week)*
2⊂⊃ Occasionally *(1 – 2 weekdays per week)*
3⊂⊃ Rarely or Never *(Less than 1 weekday per week)*

A18 Is natural gas service from underground pipes from the gas utility available in your neighborhood? (NGSERV)

1⊂⊃ Yes 1⊂⊃ No *(Go to B1.)*

A19 Do you have a natural gas line or hook-up to any part of your home? (NGLINE)

1⊂⊃ Yes 1⊂⊃ No

A20 What utility do you pay for **natural gas** service to your home? (NGUTIL)

1⊂⊃ Pacific Gas & Electric (PG&E)
2⊂⊃ San Diego Gas & Electric
3⊂⊃ Southern California Gas Company ("The Gas Company")
4⊂⊃ Southwest Gas Corporation
5⊂⊃ City of Coalinga
6⊂⊃ City of Long Beach Gas Department
7⊂⊃ Not sure

Space Heating

B1 Do you pay to heat your home? (PAYHEAT)

1⊂⊃ Yes 2⊂⊃ No, it is part of my rent/condo fee *(Go to B8.)*
3⊂⊃ No, do not have a heating system *(Go to B8.)*

B2 What type of heating system do you use to heat this home?
(If you use more than one heating system, mark the system that you use the most as "Main Heating" and mark all other systems as "Additional Heating.")
(PHTFUEL3 – Plugged heating fuel)

	Main Heating *(Mark only ONE BOX below)*	**Additional Heating** *(Mark ALL BOXES that apply)*
NATURAL GAS (from gas utility)		
Central forced-air furnace *(fan circulates hot air through air ducts)*	1⊂⊃ (PHTNGCNT)	1⊂⊃ (AHTNGCNT)
Floor or wall heater/furnace	1⊂⊃ (PHTNGFWL)	1⊂⊃ (AHTNGFWL)
Hot water radiator	1⊂⊃ (PHTNGRAD)	1⊂⊃ (AHTNGRAD)
Other system type	1⊂⊃ (PHTNGOTH)	1⊂⊃ (AHTNGOTH)
ELECTRIC		
Resistance (baseboard/ceiling/floor/wall)	1⊂⊃ (PHTELBSB)	1⊂⊃ (AHTELBSB)
Central forced air furnace *(fan circulates hot air through air ducts)*	1⊂⊃ (PHTELCRH)	1⊂⊃ (AHTELCRH)
Central heat pump *(heats and cools)*	1⊂⊃ (PHTELCHP)	1⊂⊃ (AHTELCHP)
Through-the-wall heat pump *(looks like a window/wall air conditioner, but also provides heat)*	1⊂⊃ (PHTELWHP)	1⊂⊃ (AHTELWHP)
Portable heaters	1⊂⊃ (PHTELPOR)	1⊂⊃ (AHTELPOR)
Other system type	1⊂⊃ (PHTELOTH)	1⊂⊃ (AHTELOTH)
BOTTLED GAS (propane, LP)		
Central forced air furnace *(fan circulates hot air through air ducts)*	1⊂⊃ (PHTBGCNT)	1⊂⊃ (AHTBGCNT)
Floor or wall heater/furnace	1⊂⊃ (PHTBGFWL)	1⊂⊃ (AHTBGFWL)
Hot water radiator	1⊂⊃ (PHTBGRAD)	1⊂⊃ (AHTBGRAD)
Other system type	1⊂⊃ (PHTBGOTH)	1⊂⊃ (AHTBGOTH)
WOOD		
Woodstove/fireplace insert	1⊂⊃ (PHTWDWS)	1⊂⊃ (AHTWDWS)
Fireplace	1⊂⊃ (PHTWDFP)	1⊂⊃ (AHTWDFP)
SOLAR		
Solar – no backup	1⊂⊃ (PHTSLRN)	1⊂⊃ (AHTSLRN)
Solar – natural gas backup	1⊂⊃ (PHTSLRG)	1⊂⊃ (AHTSLRG)
Solar – propane backup	1⊂⊃ (PHTSLRP)	1⊂⊃ (AHTSLRP)
Solar – electric backup	1⊂⊃ (PHTSLRE)	1⊂⊃ (AHTSLRE)
OTHER *(Describe):* (HTOTSYSD)_____	1⊂⊃ (PHTOTSYS)	1⊂⊃ (AHTOTSYS)

B3 If your heating system(s) use natural gas for fuel, indicate whether it has a pilot light(s).

Main gas heating (MAINPILT)	1⊂⊃ Yes, pilot light	2⊂⊃ No pilot light
Secondary gas heating (SECPILT)	1⊂⊃ Yes, pilot light(s)	2⊂⊃ No pilot light(s)

B4 How old is your main heating system? (HTSYSAGE)

1⊂⊃ Less than one year
2⊂⊃ 1 – 3 years
3⊂⊃ 4 – 8 years
4⊂⊃ 9 – 13 years
5⊂⊃ 14 – 30 years
6⊂⊃ Over 30 years

B5 What type of thermostat does your main heating system(s) use? (HTCTLTYP)

1⊂⊃ Programmable thermostat *(Digital units usually have a digital readout and buttons. Mechanical units usually have a clock or rotary timer and tabs, pins or levers.)*
2⊂⊃ Standard thermostat *(Allows you to set the temperature and turn the heater on or off. You cannot set on/off times.)*
3⊂⊃ No thermostat *(Simple on/off control or steam valve)* *(Go to B7.)*

B6 If your main heating system is controlled by a thermostat, what is the average thermostat temperature usually set for each time period during the heating season? *(Choose one answer for each time period. Provide the average setting if it varies.)*

	Off	Below 55°F	55 – 60°F	61 – 65°F	66 – 70°F	71 – 75°F	Over 75°F
Morning *(6am-9am)* (HMRNSET)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Day *(9am-5pm)* (HDAYSET)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Evening *(5pm-9pm)* (HEVNSET)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Night *(9pm-6am)* (HNITESET)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃

B7 Has maintenance been performed on your main heating system in the past 12 months? (HTMAINTN)

1⊂⊃ Yes
2⊂⊃ No

B8 How many electric portable heaters do you use? (NPORHTRS)

1⊂⊃ I don't use portable heaters
2⊂⊃ 1 portable heater
3⊂⊃ 2 portable heaters
4⊂⊃ 3 or more portable heaters

B9 How often do you use any additional heating system(s), including portable heaters, during the heating season? (USEADDHT)

1⊂⊃ No additional heating
2⊂⊃ Rarely *(once per month)*
3⊂⊃ Sometimes *(once per week)*
4⊂⊃ Often *(2 to 4 days per week)*
5⊂⊃ Always *(5 to 7 days per week)*

Space Cooling

CENTRAL AIR CONDITIONING/COOLING

C1 Do you pay for central air conditioning/cooling for your home? (PAYCOOL)

1⊂⊃ Yes
2⊂⊃ No, it is part of my rent/condo fee *(Go to C7.)*
3⊂⊃ No, do not have central air conditioning *(Go to C7.)*

C2 What type and how many central air conditioning/cooling system(s) do you have in your home?

(COOLING – Plugged combo of CAC/RAC)

	Number of Central Cooling Systems 1	2	3 or more
Central air conditioning (CTLACAGE)	1⊂⊃	2⊂⊃	3⊂⊃
Central evaporative cooler *(swamp cooler)* (CTEVPAGE)	1⊂⊃	2⊂⊃	3⊂⊃
Heat pump *(heats and cools)* (HPAGE)	1⊂⊃	2⊂⊃	3⊂⊃

C3 How old is your main central air conditioning/cooling unit? (CLCNTAGE)

1⊂⊃ Less than one year
2⊂⊃ 1 – 3 years
3⊂⊃ 4 – 8 years
4⊂⊃ 9 – 13 years
5⊂⊃ 14 – 30 years
6⊂⊃ Over 30 years

C4 What type of thermostat does your main cooling system(s) use? (CLCTLTYP)

1⊂⊃ Programmable thermostat *(Digital units usually have a digital readout and buttons. Mechanical units usually have a clock or rotary timer and tabs, pins or levers.)*
2⊂⊃ Standard thermostat *(Allows you to set the temperature and turn the air conditioner on or off. You cannot set on/off times.)*
3⊂⊃ No thermostat *(Simple on/off control)* *(Go to C6.)*

C5 What is the typical thermostat temperature setting of your main central cooling system for each time period during the cooling season? *(Choose one answer for each time period.)*

	Off	Below 70°F	70 – 73°F	74 – 76°F	77 – 80°F	Over 80°F
Morning *(6am–9am)* (CMRNSET)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Day *(9am-5pm)* (CDAYSET)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Evening *(5pm-9pm)* (CEVNSET)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Night *(9pm-6am)* (CNITESET)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃

C6 Has maintenance been performed on your central air conditioning system in the past 12 months? (CLMAINTN)

1⊂⊃ Yes
2⊂⊃ No

ROOM AIR CONDITIONING/COOLING (Window / Wall Units)

C7 Please tell us the characteristics of each room air conditioning/cooling unit below.

1⊂⊃ No room air conditioning/cooling units *(Go to D1.)* (NOROOMAC)

	Unit 1	Unit 2	Unit 3
Type of Room AC/Cooling Unit	(ACTYP1)	(ACTYP2)	(ACTYP3)
Window/wall air conditioner	1⊂⊃	1⊂⊃	1⊂⊃
Window/wall heat pump	2⊂⊃	2⊂⊃	2⊂⊃
Window/wall evaporative cooler *(swamp cooler)*	3⊂⊃	3⊂⊃	3⊂⊃
Age of Room AC/Cooling Unit	(ACAGE1)	(ACAGE2	(ACAGE3)
Less than one year	1⊂⊃	1⊂⊃	1⊂⊃
1 – 3 years	2⊂⊃	2⊂⊃	2⊂⊃
4 – 8 years	3⊂⊃	3⊂⊃	3⊂⊃
9 – 13 years	4⊂⊃	4⊂⊃	4⊂⊃
More than 13 years	5⊂⊃	5⊂⊃	5⊂⊃

C8 Please indicate how often your room air conditioning/cooling unit(s) is/are turned on during the cooling season. *(Choose one answer for each time period.)*

Time Period	Never	Rarely *(1-2 days per week)*	Sometimes *(3-4 days per week)*	Often *(5-6 days per week)*	Always *(7 days per week)*
Morning *(6am-9am)* (CMRNUSE)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Day *(9am–5pm)* (CDAYUSE)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Evening *(5pm–9pm)* (CEVNUSE)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Night *(9pm–6am)* (CNITEUSE)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Hot weekday afternoon *(noon–6pm)* (CHOTUSE)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃

Water Heating

D1 Do you pay for heating water at your residence? (PAYWH)

1⊂⊃ Yes 2⊂⊃ No, it is part of my rent/condo fee *(Go to D6.)*
3⊂⊃ No hot water heater *(Go to D6.)*

D2 What type of water heating systems do you use in your home?

(PWHFUEL3 – Plugged Water Heating Fuel)

	Main Water Heater *(Mark only ONE BOX in this column)*	**Additional Water Heater(s)** *(Mark ALL BOXES that apply)*
NATURAL GAS		
Standard tank	1⊂⊃ (PWHNGTNK)	1⊂⊃ (AWHNGTNK)
Whole house tankless system	1⊂⊃ (PWHNGWHT)	1⊂⊃ (AWHNGWHT)
ELECTRIC		
Standard tank	1⊂⊃ (PWHELTNK)	1⊂⊃ (AWHELTNK)
Heat pump	1⊂⊃ (PWHELHP)	1⊂⊃ (AWHELHP)
Whole house tankless system	1⊂⊃ (PWHELWHT)	1⊂⊃ (AWHELWHT)
Point-of use tankless system	1⊂⊃ (PWHELPNT)	1⊂⊃ (AWHELPNT)
PROPANE		
Standard tank	1⊂⊃ (PWHLPTNK)	1⊂⊃ (AWHLPTNK)
Whole house tankless system	1⊂⊃ (PWHLPWHT)	1⊂⊃ (AWHLPWHT)
SOLAR		
With no backup system	1⊂⊃ (PWHSLRN)	1⊂⊃ (AWHSLRN)
With natural gas backup	1⊂⊃ (PWHSLRG)	1⊂⊃ (AWHSLRG)
With propane backup	1⊂⊃ (PWHSLRP)	1⊂⊃ (AWHSLRP)
With electric backup	1⊂⊃ (PWHSLRE)	1⊂⊃ (AWHSLRE)
OTHER FUEL	1⊂⊃ (PWHOTSYS)	1⊂⊃ (AWHOTSYS)

*Describe: (*WHOTSYSD)_____

D3 What is the typical hot water heater temperature setting? *(Medium is the standard factory setting.)* (WHTEMP)

1⊂⊃ Low *(below 130°F)* 2⊂⊃ Medium *(130°F – 150°F)* 3⊂⊃ High *(over 150°F)*

D4 How old is your primary water heating system? (PRWHAGE)

1⊂⊃ Less than one year 3⊂⊃ 4 – 8 years 5⊂⊃ 14 – 30 years
2⊂⊃ 1 – 3 years 4⊂⊃ 9 – 13 years 6⊂⊃ Over 30 years

D5 Does your hot water heater(s) have an insulation blanket(s)? (TANKINS)

1⊂⊃ Yes 2⊂⊃ No

D6 How many total showers and baths are taken in your home on a **typical day**?

	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10 or more**
Showers / day (SHWRDAY)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Baths / day (BATHSDAY)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃

D7 Do you have low-flow showerheads installed in the shower(s)? *(Low-flow showerheads use 2.5 gallons per minute or less and have been standard since 1993.)* (SHOWERHD)

1⊂⊃ Yes, all showers 2⊂⊃ Yes, some showers 3⊂⊃ No

D8 Do the faucets in your home have water-saving aerators? *(Aerators are add-on devices that reduce the water usage by mixing air into the water stream.)* (AERATORS)

1⊂⊃ Yes, all faucets 2⊂⊃ Yes, some faucets 3⊂⊃ No

Laundry

E1 Do you have the use of laundry equipment in your home? (LNDRYEQP)

1⊂⊃ Yes 2⊂⊃ No, laundry facilities are located in a common area of the building. *(Go to F1.)*
3⊂⊃ I do not use laundry facilities in my building *(Go to F1.)*

E2 What type of clothes washer do you have? (CWTYP)
(Do not include coin-operated machines or machines in common areas.)

1⊂⊃ Top loading washer 2⊂⊃ Front loading washer

E3 How old is your clothes washer? (CWAGE)

1⊂⊃ Less than one year 3⊂⊃ 6 – 8 years 5⊂⊃ 16 – 30 years
2⊂⊃ 1 – 5 years 4⊂⊃ 9 – 15 years 6⊂⊃ Over 30 years

E4 For each wash temperature below, how many loads of clothes do you wash in your home during a **typical week**?

	Number Clothes Washer Loads per Week										
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10 or more**
Hot water (CWHWLD)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Warm water (CWWWLD)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Cold water (CWCWLD)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃

E5 What type of clothes dryer do you have? (CDTYP)
(Do not include coin-operated machines or machines in common areas.)

1⊂⊃ I do not have a clothes dryer 3⊂⊃ Electric dryer
2⊂⊃ Natural gas dryer 4⊂⊃ Bottled gas *(Propane, Butane, LP)*

E6 How many loads of clothes do you dry in your clothes dryer during a **typical week**? (DRYLDS)

1⊂⊃ None 3⊂⊃ 2 5⊂⊃ 4 7⊂⊃ 6 9⊂⊃ 8 11⊂⊃ 10 or more
2⊂⊃ 1 4⊂⊃ 3 6⊂⊃ 5 8⊂⊃ 7 10⊂⊃ 9

Food Preparation

F1 Which of the following cooking appliances are used in your home? *(Choose all that apply.)*

Cooking Appliance	**Type of Fuel**				**Age In Years**			
	Nat. Gas	**Elec-tric**	**Bottled Gas**	**Other**	**0–5 yrs**	**6–10 yrs**	**11–15 years**	**Over 15 years**
Cooktop, stovetop or Range	1⊂⊃ (CKRNTYP)	2⊂⊃	3⊂⊃	4⊂⊃	1⊂⊃ (CKRNA)	2⊂⊃	3⊂⊃	4⊂⊃
Oven(s)	1⊂⊃ (CKOVTYP)	2⊂⊃	3⊂⊃	4⊂⊃	1⊂⊃ (CKOVA)	2⊂⊃	3⊂⊃	4⊂⊃
Outdoor barbecue	1⊂⊃ (CKBBTYP)	2⊂⊃	3⊂⊃	4⊂⊃	1⊂⊃ (CKBBQA)	2⊂⊃	3⊂⊃	4⊂⊃

F2 During a typical **week**, how often do you use your range or oven?

	Never	**Rarely** *(less than once per week)*	**Occasionally** *(1 – 2 times per week)*	**Sometimes** *(3 – 4 times per week)*	**Often** *(5 – 7 times per week)*
Breakfast (BRNOVUSE)	1⊂⊃	2⊂⊃	3⊂⊃	4⊂⊃	5⊂⊃
Lunch (LRNOVUSE)	1⊂⊃	2⊂⊃	3⊂⊃	4⊂⊃	5⊂⊃
Dinner (DRNOVUSE)	1⊂⊃	2⊂⊃	3⊂⊃	4⊂⊃	5⊂⊃
Other(ORNOVUSE)	1⊂⊃	2⊂⊃	3⊂⊃	4⊂⊃	5⊂⊃

F3 Do you have a **microwave oven**? (MWUSE)

1⊂⊃ Yes, and it is used often (7 or more times per week)
2⊂⊃ Yes, and it is used less than 7 times per week
3⊂⊃ No

F4 Do you have a **dishwasher**? (DISHWASH)

1⊂⊃ Yes 2⊂⊃ No *(Go to G1.)*

F5 How many dishwasher loads are run in a **typical week**? (DWLOADS)

1⊂⊃ None 3⊂⊃ 2 5⊂⊃ 4 7⊂⊃ 6 9⊂⊃ 8
2⊂⊃ 1 4⊂⊃ 3 6⊂⊃ 5 8⊂⊃ 7 10⊂⊃ 9 or more

Refrigerators

G1 How many refrigerators do you have plugged in? (RFNUM)

1⊂⊃ 0 *(Go to H1.)* 2⊂⊃ 1 3⊂⊃ 2 4⊂⊃ 3 or more

G2 Please tell us the characteristics of each refrigerator, and for any refrigerator you discarded in the past 12 months, in the table below.

	Refrig 1	Refrig 2	Refrig 3	Old Refrigerator Discarded in the Last 12 Months
Door Style	(RF1STY)	(RF2STY)	(RF3STY)	(RFDSCSTY)
Single-door	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Top Freezer – Bottom Refrigerator	2⊂⊃	2⊂⊃	2⊂⊃	2⊂⊃
Top Refrigerator – Bottom Freezer	3⊂⊃	3⊂⊃	3⊂⊃	3⊂⊃
Side-by-side	4⊂⊃	4⊂⊃	4⊂⊃	4⊂⊃
Size, in Cubic Feet	(RF1SZ)	(RF2SZ)	(RF3SZ)	(RFDSCSZ)
Mini *(under 13 cu. ft.)*	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Small *(13 – 16 cu. ft.)*	2⊂⊃	2⊂⊃	2⊂⊃	2⊂⊃
Medium *(17 – 19 cu. ft.)*	3⊂⊃	3⊂⊃	3⊂⊃	3⊂⊃
Large *(20 – 23 cu. ft.)*	4⊂⊃	4⊂⊃	4⊂⊃	4⊂⊃
Very large *(over 23 cu. ft.)*	5⊂⊃	5⊂⊃	5⊂⊃	5⊂⊃
Frost-free or Manual Defrost?	(RF1DEF)	(RF2DEF)	(RF3DEF)	(RFDSCDEF)
Automatic (frost-free)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Manual	2⊂⊃	2⊂⊃	2⊂⊃	2⊂⊃
Age of your Refrigerator	(RF1AGE)	(RF2AGE)	(RF3AGE)	(RFDSCAGE)
Less than two years	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
2 – 7 years	2⊂⊃	2⊂⊃	2⊂⊃	2⊂⊃
8 – 10 years	3⊂⊃	3⊂⊃	3⊂⊃	3⊂⊃
11 – 20 years	4⊂⊃	4⊂⊃	4⊂⊃	4⊂⊃
More than 20 years	5⊂⊃	5⊂⊃	5⊂⊃	5⊂⊃
Other Features	(RF1OTH)	(RF2OTH)	(RF3OTH)	(RFDSCOTH)
Through-the-door ice and water dispenser	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃

Freezers

H1 How many **stand-alone** freezers do you have plugged in? (FZNUM)
(Do not include freezers that are part of your refrigerator.)
1⊂⊃ 0 *(Go to I1.)* 2⊂⊃ 1 3⊂⊃ 2 or more

H2 Please tell us the characteristics for each stand-alone freezer, and for any stand-alone freezer you discarded in the past 12 months, in the table below.

	Freezer 1	Freezer 2	Old Freezer Discarded in the Last 12 Months
Style	(FZ1STY)	(FZ2STY)	(FZDSCSTY)
Upright, frost-free	1⊂⊃	1⊂⊃	1⊂⊃
Upright manual defrost	2⊂⊃	2⊂⊃	2⊂⊃
Chest frost-free	3⊂⊃	3⊂⊃	3⊂⊃
Chest manual defrost	4⊂⊃	4⊂⊃	4⊂⊃
Size, in Cubic Feet	(FZ1SZ)	(FZ2SZ)	(FZDSCSZ)
Small *(under 13 cu. ft.)*	1⊂⊃	1⊂⊃	1⊂⊃
Medium *(13 – 16 cu. ft.)*	2⊂⊃	2⊂⊃	2⊂⊃
Large *(over 16 cu. ft.)*	3⊂⊃	3⊂⊃	3⊂⊃
Age of your Freezer	(FZ1AGE)	(FZ2AGE)	(FZDSCAGE)
Less than two years	1⊂⊃	1⊂⊃	1⊂⊃
2 – 7 years	2⊂⊃	2⊂⊃	2⊂⊃
8 – 10 years	3⊂⊃	3⊂⊃	3⊂⊃
11 – 20 years	4⊂⊃	4⊂⊃	4⊂⊃
More than 20 years	5⊂⊃	5⊂⊃	5⊂⊃

Spas and Hot Tubs

I1 Do you have the use of a spa or hot tub at your home? (SPTYP)
(Do not include whirlpool tubs in your bathroom.)
1⊂⊃ Yes, and **I pay for its energy use**
2⊂⊃ Yes, but it is in a **common area** and **I do not pay for its energy use** *(Go to J1.)*
3⊂⊃ No spa or hot tub *(Go to J1.)*

I2 What fuel do you use to heat the spa or hot tub? (SPHTF)
1⊂⊃ Electricity 3⊂⊃ Solar and electricity 5⊂⊃ Bottled gas *(propane, butane, LP)*
2⊂⊃ Natural gas 4⊂⊃ Solar and natural gas 6⊂⊃ Other

I3 How large is the spa or hot tub? (SPSZ)
1⊂⊃ Small *(3 people or fewer)* 2⊂⊃ Medium *(4 – 6 people)* 3⊂⊃ Large *(7 or more people)*

I4 Where is the spa located? (SPLOC)
1⊂⊃ Outside, in the ground 2⊂⊃ Outside, above ground 3⊂⊃ Indoor spa

I5 Do you have an insulated cover on your spa or hot tub? (SPCOV)
1⊂⊃ Yes 2⊂⊃ No

I6 How often do you run the filter pump on your spa or hot tub?

	Summer *(May – Oct.)* (SMFLTPMP)	**Winter** *(Nov. – April)* (WNFLTPMP)
Never	1⊂⊃	1⊂⊃
Rarely	2⊂⊃	2⊂⊃
Only when we use it	3⊂⊃	3⊂⊃
1 – 3 hours every day	4⊂⊃	4⊂⊃
4 – 6 hours every day	5⊂⊃	5⊂⊃

I7 Please indicate how often you **heat** your spa or hot tub in the winter and summer.

	Summer *(May – Oct.)* (SMHTSPA)	**Winter** *(Nov. – April)* (WNHTSPA)
Never	1⊂⊃	1⊂⊃
0 – 2 times per month	2⊂⊃	2⊂⊃
3 – 8 times per month	3⊂⊃	3⊂⊃
9 or more times per month	4⊂⊃	4⊂⊃
Maintain set temperature	5⊂⊃	5⊂⊃

Pools

J1 Do you have the use of a swimming pool at your home? (PLTYP)

1⊂⊃ Yes, and **I pay for its energy use**
2⊂⊃ Yes, but it is in a **common area** and **I do not pay for its energy use** *(Go to K1.)*
3⊂⊃ No pool *(Go to K1.)*

J2 How large is your pool? *(An average-size pool is about 5 ft. deep by 40 ft. long by 20 ft. wide and holds 30,000 gallons of water.)* (PLSZ)

1⊂⊃ Less than 20,000 gallons 2⊂⊃ 20,000 – 40,000 gallons 3⊂⊃ More than 40,000 gallons

J3 How many **hours per day** do you operate your **swimming pool filter**?

	Summer *(May – Oct.)* (SMFLTHR)	**Winter** *(Nov. – April)* (WNFLTHR)
None	1⊂⊃	1⊂⊃
1 – 2	2⊂⊃	2⊂⊃
3 – 4	3⊂⊃	3⊂⊃
5 – 7	4⊂⊃	4⊂⊃
8 – 11	5⊂⊃	5⊂⊃
12 – 15	6⊂⊃	6⊂⊃
16 – 20	7⊂⊃	7⊂⊃
21 or more	8⊂⊃	8⊂⊃

J4 Which fuel do you use to heat your pool? (PLHTF)

1⊂⊃ Pool is not heated
2⊂⊃ Natural gas only
3⊂⊃ Electricity only
4⊂⊃ Electric heat pump only
5⊂⊃ Solar heater *(using solar collectors)*
6⊂⊃ Bottled gas only *(propane, butane, LP)*
7⊂⊃ Other

J5 Please indicate how often you **heat** your pool in the summer and winter.

	Summer *(May – Oct.)* (SMHTPL)	**Winter** *(Nov. – April)* (WNHTPL)
Never	1⊂⊃	1⊂⊃
Once a month	2⊂⊃	2⊂⊃
Once a week	3⊂⊃	3⊂⊃
2 – 4 times per week	4⊂⊃	4⊂⊃
Keep pool heated continuously	5⊂⊃	5⊂⊃

J6 Which of the following attributes does your pool have? *(Choose all that apply.)*

1⊂⊃ Cover (PLCOV) 1⊂⊃ Pool timer (PLTIMR) 1⊂⊃ Pool sweep (PLSWEEP) 1⊂⊃ Pool is indoors (PLINDOOR)

Entertainment and Technology

K1 How many televisions and accessories do you **use** in this home?

	None	**1**	**2**	**3 or more**
Home theater (THEATER)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Large screen television (greater than 36 inches) (BSTV)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Standard size television (36 inches or less) (CLTV)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Analog cable box (CABLE)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Digital cable box (DIGCABLE)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Digital satellite box (DSS)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
DVD Player (or combined DVD/VCR) (DVD)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
VCR (VCR)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Personal video recorders (e.g., TiVo, ReplayTV) (TIVO)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Stereo (MUSIC)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃

K2 How many total hours are all your **televisions** on each day? (TVUSE)
(Add up time for each television.)

1⊂⊃ Less than 1 hour
2⊂⊃ 1 – 4 hours
3⊂⊃ 5 – 8 hours
4⊂⊃ 9 – 12 hours
5⊂⊃ 13 – 16 hours
6⊂⊃ 17 – 20 hours
7⊂⊃ 21 – 30 hours
8⊂⊃ More than 30 hours

K3 How many **personal computer(s)** (PC, Macintosh, etc.) do you **use** in this home?
(Include both desktops and laptops.) (NPCS)

1⊂⊃ We have no computers in this home *(Go to K7.)*
2⊂⊃ 1 computer
3⊂⊃ 2 computers
4⊂⊃ 3 or more computers

K4 If you have one or more personal computer(s) in this home, how many total hours are they turned on each day? *(Add up time for each computer.)* (PCHRS)

1⊂⊃ Less than 1 hour
2⊂⊃ 1 – 4 hours
3⊂⊃ 5 – 8 hours
4⊂⊃ 9 – 12 hours
5⊂⊃ 13 – 16 hours
6⊂⊃ 17 – 20 hours
7⊂⊃ 21 – 30 hours
8⊂⊃ More than 30 hours

K5 How often does anyone in your home perform any of the following activities on your computer?

	Never	Rarely *(less than once a week)*	Occasionally *(several times a week)*	Frequently *(several times a day)*
Send or receive e-mail (EMAIL)	1⊂⊃	2⊂⊃	3⊂⊃	4⊂⊃
Browse the Internet for information (BRWSONLN)	1⊂⊃	2⊂⊃	3⊂⊃	4⊂⊃
Make purchases using the Internet (BUYONLN)	1⊂⊃	2⊂⊃	3⊂⊃	4⊂⊃
Pay bills on-line (BILLONLN)	1⊂⊃	2⊂⊃	3⊂⊃	4⊂⊃

K6 Do you (or someone else in your home) operate a business and/or work from your home? (WORKHOME)

1⊂⊃ No *(Go to K8.)*

2⊂⊃ Yes ➡ **K7** How many hours a week is someone working out of your home? (WKHRSHM)

1⊂⊃ 0 – 10 hours per week

2⊂⊃ 11 – 30 hours per week

3⊂⊃ More than 30 hours per week

K8 How many of the following products do you **use** in this home?

	None	One	Two	Three or more
Answering machine or service (ANSRMCHN)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Multifunction machine *(printer, fax, scanner, copier)* (MULTMCHN)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
FAX machine (FAX)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Printer for computer (PRTLAS)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Scanner (SCAN)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Copier (COPIER)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Internet access via traditional phone line (PHINT)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
DSL modem for Internet (DSLINT)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Cable modem for Internet (CBLINT)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Satellite communication for Internet (SATCMINT)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Home network *(LAN)* (NETWK)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Cell phone *(used by occupants of this home)* (CELL)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃

Lighting

L1 How many of the following lighting products do you use **inside** your home?

Interior Lighting Products	None	1 – 2	3 – 5	6 – 10	11 or More
Compact fluorescent lamps (ICFL)	1⊂⊃	2⊂⊃	3⊂⊃	4⊂⊃	5⊂⊃
Fixtures on Timers (ICTLTIMR)	1⊂⊃	2⊂⊃	3⊂⊃	4⊂⊃	5⊂⊃
Fixtures on Motion Detectors or Occupancy Sensors (ICTLOCCS)	1⊂⊃	2⊂⊃	3⊂⊃	4⊂⊃	5⊂⊃
Fixtures on a Dimming Switch (ICTLDIM)	1⊂⊃	2⊂⊃	3⊂⊃	4⊂⊃	5⊂⊃

L2 How many of the following lighting products do you use **outside** your home? *(Include items in your garage. Only include exterior lights that are paid for on your electricity bill.)*

	None	1 – 2	3 – 5	6 or More
Exterior Fixtures				
Exterior incandescent fixtures (EXINC)	1⊂⊃	2⊂⊃	3⊂⊃	4⊂⊃
Exterior compact fluorescent fixtures (EXCFL)	1⊂⊃	2⊂⊃	3⊂⊃	4⊂⊃
Low voltage landscape light system (EXLOWV)	1⊂⊃	2⊂⊃	3⊂⊃	4⊂⊃
HID (sodium vapor, metal halide) fixture (EXHID)	1⊂⊃	2⊂⊃	3⊂⊃	4⊂⊃
Exterior Lighting Controls	1⊂⊃	2⊂⊃	3⊂⊃	4⊂⊃
Fixtures on Timers (ECTLTIMR)	1⊂⊃	2⊂⊃	3⊂⊃	4⊂⊃
Fixtures on Dusk-to-Dawn Sensors (ECTLDSK)	1⊂⊃	2⊂⊃	3⊂⊃	4⊂⊃
Fixtures on Motion Detectors (ECTLMOTN)	1⊂⊃	2⊂⊃	3⊂⊃	4⊂⊃

Miscellaneous Appliances

M1 How many of each of the following appliances or equipment do you **use** in your home? *(Choose all that apply.)*

	None	1	2	3 or More
Portable fan (FNPORT)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Ceiling fan (FNCEIL)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Wind turbine attic ventilator (non-electric) (WNDATV)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Electric attic fan (FNATTIC)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Whole-house fan (FNWHOLE)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Electronic household air cleaner (AIRCLEAN)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Humidifier (HUM)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Dehumidifier (DEH)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Water purification system (WHPURIFY)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Heated waterbed (WBED)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Electric blanket (ELBLNKET)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Aquarium (AQUAR)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Trash compactor (TRSHCOMP)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Sauna – electric (SAUNA)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Electronic security system (SCRTYSYS)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Pond or water garden pump (POND)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Electric garage door opener (GRGDROPN)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃
Lawn mower – electric (LAWNMOWR)	1⊂⊃	1⊂⊃	1⊂⊃	1⊂⊃

M2 Do you use an electric well water pump to provide water for your home? (WLWTRPMP)

1⊂⊃ No *(Go to M5.)*

2⊂⊃ Yes

M3 Does your home also have access to city/county water sources? (WTRSRCES) 1⊂⊃ Yes 2⊂⊃ No

M4 How do you use your well water? (WLWTUSE)

1⊂⊃ Only for gardening and landscaping

2⊂⊃ Only for household use

3⊂⊃ Both household and gardening/landscape use

M5 Select any of the equipment and its fuel from the list that you **use** three or more hours per week?

	Electric	Natural Gas	Bottled Gas
Sump pump (SUMPPMP)	1⊂⊃		
Shop tools (SHOPTLS)	1⊂⊃		
Electric welding equipment (WELD)	1⊂⊃		
Electric air compressor (AIRCOMP)	1⊂⊃		
Large battery charger (BATCHRGE)	1⊂⊃		
Kiln for ceramics and pottery (KILN)	1⊂⊃	1⊂⊃	1⊂⊃
Medical equipment (e.g., respirator) (MEDICAL)	1⊂⊃	1⊂⊃	1⊂⊃

M6 Do you have an electric vehicle, electric wheelchair, or golf cart at your home? (ELVEH)

1⊂⊃ No *(Go to M8.)*
2⊂⊃ Yes, but it is a hybrid vehicle and does not need to be charged at home. *(Go to M8.)*
3⊂⊃ Yes, electric wheelchair/cart
4⊂⊃ Yes, electric car/vehicle

M7 Do you charge your electric vehicle at home? (CHRGVEH)

1⊂⊃ Yes 2⊂⊃ No

M8 Do you use any other equipment or large appliance that consumes a significant amount of electricity or natural gas in your home? (OLRGAPP)

1⊂⊃ Yes 2⊂⊃ No

(Please describe equipment and fuel.): (OLRGEQP), (OLRGFUEL) _____

M9 Please indicate if you have **added** any of the following appliances in the past 12 months. If the new item replaced an existing unit, please be sure to answer question **M10** as well. *(Choose all that apply.)*

Appliance	Added a New Unit	Fuel Type of New Unit: Elec	Nat. Gas	Other
Central heating	1⊂⊃ (CHADD)	(CHFUEL) 1⊂⊃	1⊂⊃	1⊂⊃
Central cooling	1⊂⊃ (CCADD)	(CCFUEL) 1⊂⊃		
Wall or window air conditioner	1⊂⊃ (WWADD)	(WWFUEL) 1⊂⊃		
Water heater	1⊂⊃ (WHADD)	(WHFUEL) 1⊂⊃	1⊂⊃	1⊂⊃
Stove top	1⊂⊃ (STADD)	(STFUEL) 1⊂⊃	1⊂⊃	1⊂⊃
Oven	1⊂⊃ (OVADD)	(OVFUEL) 1⊂⊃	1⊂⊃	1⊂⊃
Microwave oven	1⊂⊃ (MWADD)	(MWFUEL) 1⊂⊃		
Dishwasher	1⊂⊃ (DWADD)	(DWFUEL) 1⊂⊃		
Clothes washer	1⊂⊃ (CWADD)	(CWFUEL) 1⊂⊃		
Clothes dryer	1⊂⊃ (CDADD)	(CDFUEL) 1⊂⊃	1⊂⊃	1⊂⊃
Pool heater	1⊂⊃ (PHADD)	(PHFUEL) 1⊂⊃	1⊂⊃	1⊂⊃
Pool pump	1⊂⊃ (PPADD)	(PPFUEL) 1⊂⊃		
Hot tub/spa heater	1⊂⊃ (TBADD)	(TBFUEL) 1⊂⊃	1⊂⊃	1⊂⊃

1⊂⊃ Have not **added** any of the above appliances. (NOADD)

M10 Please indicate if you have **discarded** any of the following appliances in the past 12 months. Include both items that were replaced and those that were discarded without being replaced. *(Choose all that apply.)*

Appliance	Age of Discarded Unit: 1–10 years	11–20 years	Over 20 years	Fuel Type of Discarded Unit: Elec	Nat. Gas	Other
Central heating	(DCHAGE) 1⊂⊃	1⊂⊃	1⊂⊃	(DCHFL) 1⊂⊃	1⊂⊃	1⊂⊃
Central cooling	(DCCAGE) 1⊂⊃	1⊂⊃	1⊂⊃	(DCCFL) 1⊂⊃		
Wall or window air conditioner	(DWWAGE) 1⊂⊃	1⊂⊃	1⊂⊃	(DWWFL) 1⊂⊃		
Water heater	(DWHAGE) 1⊂⊃	1⊂⊃	1⊂⊃	(DWHFL) 1⊂⊃	1⊂⊃	1⊂⊃
Stove top	(DSTAGE) 1⊂⊃	1⊂⊃	1⊂⊃	(DSTFL) 1⊂⊃	1⊂⊃	1⊂⊃
Oven	(DOVAGE) 1⊂⊃	1⊂⊃	1⊂⊃	(DOVFL) 1⊂⊃	1⊂⊃	1⊂⊃
Microwave oven	(DMWAGE) 1⊂⊃	1⊂⊃	1⊂⊃	(DMWFL) 1⊂⊃		
Dishwasher	(DDWAGE) 1⊂⊃	1⊂⊃	1⊂⊃	(DDWFL) 1⊂⊃		
Clothes washer	(DCWAGE) 1⊂⊃	1⊂⊃	1⊂⊃	(DCWFL) 1⊂⊃		
Clothes dryer	(DCDAGE) 1⊂⊃	1⊂⊃	1⊂⊃	(DCDFL) 1⊂⊃	1⊂⊃	1⊂⊃
Pool heater	(DPHAGE) 1⊂⊃	1⊂⊃	1⊂⊃	(DPHFL) 1⊂⊃	1⊂⊃	1⊂⊃
Pool pump	(DPPAGE) 1⊂⊃	1⊂⊃	1⊂⊃	(DPPFL) 1⊂⊃		
Hot tub/spa heater	(DTBAGE) 1⊂⊃	1⊂⊃	1⊂⊃	(DTBFL) 1⊂⊃	1⊂⊃	1⊂⊃

1⊂⊃ Have not **discarded** any of the above appliances. (NODISCRD)

Household Information

Please provide answers to the following questions. **Your responses will be confidential** and no data will be used on an individual basis. The information is used to allow us to compare energy usage between various groups.

N1 In addition to the home described in this survey, do you own any other home in California that is occupied on a part-time basis by your family or as a vacation rental? *(Please do not answer yes for any full-time rental property or time-share units.)* (PTHME)

1⊂⊃ Yes 2⊂⊃ No (Go to *N3.*)

N2 Please provide the following information for your seasonal or vacation home that you own in California? *(Please do **not** provide information for the home described in this survey, any full-time rental property or any time-share units.)*

Location (PTHMELOC)	1⊂⊃ In the mountains 2⊂⊃ In the desert 3⊂⊃ Near a lake or river	4⊂⊃ Near the ocean 5⊂⊃ Other
Electricity is provided to this vacation home by: (PTHMEUTL)	1⊂⊃ PG&E 2⊂⊃ SCE 3⊂⊃ SDG&E	4⊂⊃ LADWP 5⊂⊃ Other

N3 What was the highest level of education completed by any head of household in the home? (EDUC)

1⊂⊃ Elementary *(grades 1 – 8)*
2⊂⊃ Some high school *(grades 9 – 12)*
3⊂⊃ High school graduate
4⊂⊃ Some college/trade/ vocational school
5⊂⊃ College graduate
6⊂⊃ Postgraduate degree

N4 What is the primary language spoken in this home? (ETHNIC)

1⊂⊃ English
2⊂⊃ Asian *(describe)* (ASIAETHD)_____
3⊂⊃ Spanish
4⊂⊃ Other *(describe)* (OTHETHD)_____

N5 Are any of the occupants of your home permanently disabled? (DISABLED)

1⊂⊃ No 2⊂⊃ Yes, 1 permanently disabled 3⊂⊃ Yes, 2 or more permanently disabled

N6 Which of the following ethnic groups are represented by your head(s) of household? *(Choose all that apply.)*

	Head of Household # 1	**Head of Household # 2**
American Indian, Alaska Native	1⊂⊃ (HOHIND1)	1⊂⊃ (HOHIND2)
Asian or Pacific Islander	1⊂⊃ (HOHASN1)	1⊂⊃ (HOHASN2)
Black, African American	1⊂⊃ (HOHBLK1)	1⊂⊃ (HOHBLK2)
Hispanic / Latino	1⊂⊃ (HOHLAT1)	1⊂⊃ (HOHLAT2)
White, Caucasian	1⊂⊃ (HOHWHT1)	1⊂⊃ (HOHWHT2)
Other	1⊂⊃ (HOHOTH1)	1⊂⊃ (HOHOTH2)

N7 Please check the range that best describes your household's **total annual income**. (INCOME) (AVGINC – Plugged continuous income, not including MM)

1⊂⊃ Less than $10,000
2⊂⊃ $10,000 – $19,999
3⊂⊃ $20,000 – $24,999
4⊂⊃ $25,000 – $29,999
5⊂⊃ $30,000 – $34,999
6⊂⊃ $35,000 – $39,999
7⊂⊃ $40,000 – $49,999
8⊂⊃ $50,000 – $59,999
9⊂⊃ $60,000 – $74,999
10⊂⊃ $75,000 – $99,999
11⊂⊃ $100,000 – $149,999
12⊂⊃ $150,000 or more

We may need to contact you to verify some of the information you have provided in the survey. Please provide your telephone number and the times that would be most convenient for you to be contacted. Your phone number will not be given out to anyone and will be used only for this research project. You will only be called if we need to follow-up on some of the information in the survey.

Phone Number *(Please write in your answer and fill out the circles to match each number in the box below.)* (PHONE)

1	2	3	-	4	5	6	-	7	8	9	10
0	0	0		0	0	0		0	0	0	0
1	1	1		1	1	1		1	1	1	1
2	2	2		2	2	2		2	2	2	2
3	3	3		3	3	3		3	3	3	3
4	4	4		4	4	4		4	4	4	4
5	5	5		5	5	5		5	5	5	5
6	6	6		6	6	6		6	6	6	6
7	7	7		7	7	7		7	7	7	7
8	8	8		8	8	8		8	8	8	8
9	9	9		9	9	9		9	9	9	9

Best Time to Call (TIMECALL)

1⊂⊃ Weekday mornings
2⊂⊃ Weekday afternoons
3⊂⊃ Weekday early evening
4⊂⊃ Weekday evening
5⊂⊃ Weekend

Thank you very much for your cooperation and assistance!

B

M&E PROTOCOLS TABLE 6B

Protocol Table 6B
Results of Ninth Year Persistence Study
Southern California Edison's 1994-1997 Appliance Recycling Programs
Study ID Numbers: 546B, 563

Item 1			Item 2		Item 3	Item 4	Item 5	Item 6		Item 7	Item 8
SCE Measure Code	Studied Measure Description	End Use	Ex Ante EUL	Source of Ex Ante EUL (ref. Ftnote)	Ex Post EUL from Study	Ex Post EUL to be used in Claim	Ex Post EUL Standard Error	80% Conf. Interval Lower Bound	80% Conf. Interval Upper Bound	p-Value for Ex Post EUL	EUL Realizat'n Rate (ex post/ex ante)
	Recycled refrigerators and freezers: 1994	Refrigeration	6.0	a	8.0	8.0	1.17	8.0	11.0	0.09	1.33
	Recycled refrigerators and freezers: 1995	Refrigeration	6.0	a	8.0	8.0	1.17	8.0	11.0	0.09	1.33
	Recycled refrigerators and freezers: 1996	Refrigeration	6.0	a	8.0	8.0	0.00	8.0	8.0	0.00	1.33
	Recycled refrigerators and freezers: 1997	Refrigeration	6.0	a	8.0	8.0	0.00	8.0	8.0	0.00	1.33

[a] Table C, SCE Regulatory Reporting, Analysis, and Policy Staff.

C

M&E PROTOCOLS TABLE 7B

C.1 OVERVIEW INFORMATION

a. Study Title and Study ID Number

Study Title: *Ninth Year Persistence Study of Southern California Edison's 1994 Through 1997 Appliance Recycling Programs.*

Study ID Number: 546B and 563.

b. Program, Program Years, and Program Description

Program: Appliance Recycling Program

Program years: 1994, 1995, 1996, and 1997

Program description: Offered incentives to customers to turn in their old appliances for destruction by means of ecologically responsible recycling of components and materials. The goals were

- to eliminate the use of a second appliance at participating premises; and
- to prevent the transfer of older, inefficient appliances into the used (secondary) appliance market.

c. End Uses and Measures Covered

This study covers the end use refrigeration and the measures refrigerators and stand-alone freezers.

d. Method and Models Used

This study estimates the length of time the savings estimated by the first-year impact evaluation will last or persist. In particular, per the Measurement and Evaluation Protocols, this study estimates the EUL (effective useful life) or median survival time of these savings; that is, the time at which half these savings are no longer being realized. The first-year impact evaluations of the 1994 through 1997 Appliance Recycling Programs identified two sources of net savings:

- savings resulting from removing appliances from participating premises that otherwise would have kept the appliance (direct savings), and
- savings resulting from preventing the transfer of older, inefficient appliances to premises within the SCE territory (indirect savings).

In light of these two sources of net savings, we considered three definitions of survival. A recycled appliance fails:

1. when a participating premise adds an appliance;
2. when it would have met its ultimate death anyway; or
3. when a participating premises adds an appliance or when the recycled appliance would have met its ultimate death anyway, whichever comes first.

Direct savings may be considered to fail for any of these reasons, although we focused on the latter two. Indirect savings were considered to fail when the recycled appliance would have met its ultimate death anyway.

For each program year 1994 through 1997, the estimate of the EUL was obtained from a single survival curve for direct and indirect savings combined. For each of these program years, the steps we took to estimate a single survival curve for direct and indirect savings were as follows.

1. Estimate the survival curve where failure is defined as when a participating premise adds an appliance.
2. Estimate the survival curve where failure is defined as when a recycled appliance would have met its ultimate death anyway.
3. Combine these two survival curves, which produces the survival curve where failure is defined as when a participating premise adds an appliance or when a recycled appliance would have met its ultimate death anyway, whichever comes first.
4. Combine the survival curve for direct savings with the survival curve for indirect savings.

A thorough discussion of these steps can be found in Section 2 Analysis Overview of the report. Only the key aspects of each step are listed here.

Failure: Participating Premise Adds an Appliance

- The number of years at which a participating premises adds an appliance was assumed to follow any of five possible distributions: Gamma, Weibull, Exponential, Log-normal, and Log-logistic.[1]
- The parameters of each assumed distribution were estimated using data collected from participating premises. Weights were employed in the estimation to ensure any systematic differences in the number of years at which an appliance was added across program years and nonmover (original participant)/mover (new occupant) combinations were appropriately reflected in the results.

[1] These are common distributional assumptions made when conducting this type of analysis.

- The selection of the most appropriate distribution was based on several criteria: implications for the failure rate over time, likelihood ratio test, analysis of residuals, and maximum of the log-likelihood function.

Failure: Ultimate Death

The survival curve where failure is defined as when a recycled appliance would have met its ultimate death anyway was estimated in two steps.

1. Estimate the survival curve where failure is defined as the ultimate death of the appliance using data collected from households that recently discarded an appliance.
2. Apply the results of this survival curve to the age distribution in the program tracking data for each of the years 1994 through 1997.

We considered to methods of estimating the survival curve where failure is defined as when an appliance meets its ultimate death (step 1): Kaplan-Meier and Life-table. The Kaplan-Meier method employs each of the appliance ages observed in the data, whereas the Life-table method allowed us to associate the same probability of survival with more than one appliance age by creating groups of appliance ages.

In step 2, separately for each program year, we applied the survival curve estimated in step 1 to the age distribution in the tracking data as follows.

- For each recycled appliance age *a* observed in the program tracking data, obtain from the estimated survival curve, for each year *t* since participating, the probability an appliance of that age would have survived at least an additional *t* years had it not been recycled $R(t \mid a)$.
- Combine these separate remaining useful life curves for each recycled appliance age *a* $R(t \mid a)$, where the curve for a given recycled appliance age is weighted by the fraction of recycled appliances in the program tracking data of that age.

Failure: Whichever Comes First

The survival curve where failure is defined as when a participating premise adds an appliance or when a recycled appliance would have met its ultimate death anyway, whichever comes first, is simply the product of the survival curves for each of the components.

Combined Survival Curve

For each program year 1994 through 1997, the survival curve for direct savings was combined with the survival curve for indirect savings by calculating a weighted sum of the two probabilities each year. The weights employed were the fraction of first-year net savings associated with each of type of savings (direct and indirect).

e. Analysis Sample Size

Table C-1 shows the sample sizes and populations employed in the analysis.

Table C-1
Analysis Sample Sizes and Populations

Analysis	# Appliances	Sample/ Population
Participating premises adds an appliance	481	Sample
Estimate survival curve where failure is ultimate death	169	Sample
Apply estimated survival curve for ultimate death to program tracking		
1994	45,439	Population
1995	31,879	Population
1996	26,752	Population
1997	36,106	Population

C.2 DATABASE MANAGEMENT

a. Data Sources and Elements

The data used in this study were obtained from a variety of sources:

- Program tracking data for program years 1994 through 1997: SAS data set onefile.sas7bdat. This file "stacks" the separate program tracking data sets for each year: recy94.xpt, recy95.xpt, recy96.xpt, and recy97.xpt.
- First-year impact evaluation conducted for the 1994 and 1996 programs: These data are in a single SAS data set forluth1.sas7bdat.
- 2003 California Statewide RASS: SAS data set survdata.sas7bdat.
- Survey of recent appliance discarders: SAS data set nonpart_july_1_2004.sas7bdat.
- Survey of participating premises conducted for the fourth-year persistence study and this current persistence study:
  - Fourth-year persistence study:
    - Raw survey data: SAS data set sta_mov.sas7bdat.
    - Cleaned and prepared survey data: SAS data sets ref_cln.sas7bdat and frz_cln.sas7bdat for refrigerators and freezers, respectively.
  - Current persistence study: SAS dataset part_july_14_2004.sas7bdat.

Each of these data sources and their elements are discussed in turn.

Program Tracking Data

For each appliance, the program tracking data provided:

- a unique premise identification number for the premise that recycled it,
- a unique customer identification number for the customer living at the premise at the time, and
- age when it was recycled.

First-Year Impact Evaluations of the Programs

The first-year impact evaluations conducted for the 1994 and 1996 programs provided the following data on each sampled participating premises:

- a unique premise identification number;
- complete address of the premise;
- name of the customer who recycled it;
- date of the impact evaluation survey;
- if recycled a refrigerator, number of refrigerators plugged in and running at the time of the impact evaluation; and
- if recycled a freezer, number of freezers plugged in and running at the time of the impact evaluation.

2003 California Statewide RASS

We used the 2003 California Statewide RASS data to identify recent appliance discarders in SCE territory. A respondent to this survey was identified as a recent appliance discarder if they answered any of the refrigerator discarded questions (G2) or any of the freezer discarded questions (H2).

Survey of Recent Appliance Discarders

The survey of recent appliance discarders collected the following data.

- Whether or not the appliance was in working condition when it was discarded.
  - If it was in working condition, whether or not it was in need of repair.
  - If it was not in working condition, whether or not it was worth repairing.
- Also, if it was not in working condition, the age of the appliance when it broke.
- The age of the appliance when it was discarded. (We attempted to obtain more precise age data than were collected by the 2003 California Statewide RASS. Also, these data were sometimes missing in the 2003 California Statewide RASS data.)
- How the appliance was discarded.
- If recently discarded more than one appliance or the data were missing in the 2003 California Statewide RASS data, various appliance characteristics.

Survey of Participating Premises

The survey of participating premises conducted for the current persistence study collected the following data.

- If recycled a refrigerator: Since the impact evaluation, whether or not the number of refrigerators plugged in and running at the same time for at least three months in a year ever exceeded the number plugged in and running at the time of the impact evaluation.
  - If so, when.
- If recycled a freezer: Since the impact evaluation, whether or not the number of freezers plugged in and running at the same time for at least three months in a year ever exceeded the number plugged in and running at the time of the impact evaluation.
  - If so, when.

The survey of participating premises conducted for the fourth-year persistence study collected similar data.

b. Data Attrition

The "data attrition" encountered in this study is discussed in C.3 Sampling (a. Sampling Procedures and Protocols and B. Survey Information).

c. Data Used to Merge Data Sets

The unique nine-digit customer/premise identification number was primarily used to merge data sets. The variable name in each of the relevant data sets is:

- onefile.sas7bdat: premno9,
- forluth1.sas7bdat: curprem9,
- sta_mov.sas7bdat, ref_cln.sas7bdat, frz_cln.sas7bdat: curr_pre, and
- part_july_14_2004.sas7bdat: curp.

Also, the unique seven-digit premise identification number (the first seven digits of the customer/premise identification number) was used to obtain updated contact information from SCE.

d. Data Collected Specifically for the Analysis but not Used

With the exception of some of the appliance characteristics collected by the survey of recent appliance discarders, all data collected specifically for the analysis were used. Appliance characteristics specific to only refrigerators or freezers were not used because the analysis of when an appliance meets its ultimate death included both refrigerators and freezers together. Therefore, only appliance characteristics common to both refrigerators and freezers were used in that analysis.

C.3 SAMPLING

a. Sampling Procedures and Protocols

Although this study does not draw any samples itself, it does have a couple of sampling aspects. Each of these aspects is considered in turn.

Failure: Participating Premises Adds an Appliance

The recycled appliances eligible for inclusion in this analysis of failure were the recycled appliances identified by the first-year impact evaluation of either program year 1994 or 1996 as otherwise would have been kept at the participating premises. Of these eligible recycled appliances, in order to be included in the analysis, the participating premises had to have completed a survey at the time of the fourth-year persistence study or for this current persistence study. Hence, of the 578 eligible recycled appliances, 481 or 83 percent were included in this analysis of failure. By program year and refrigerator/freezer, Table C-2 presents the number of these appliances per the first-year impact evaluations and the number included in this analysis of failure.

Table C-2
Recycled Appliances That Otherwise Would Have Been Kept

Refrigerator/ Freezer	Recycled Appliances Would-be Keepers		
	# Impact Evaluation Sample	Participating Premises Survey Complete (4th or 9th-year)	
		Number	% Impact Evaluation Sample
Program Year 1994			
Freezer	47	35	74%
Refrigerator	236	191	81%
Total	283	226	80%
Program Year 1996			
Freezer	46	43	93%
Refrigerator	249	212	85%
Total	295	255	86%
Total			
Freezer	93	78	84%
Refrigerator	485	403	83%
Total	578	481	83%

Failure: Ultimate Death

The recently discarded appliances available for inclusion in the first step of this analysis were from respondents to the 2003 California Statewide RASS identified as a recent appliance discarder in SCE territory.

b. Survey Information

The surveys relevant for this study are provided in Appendix A.

Failure: Participating Premise Adds an Appliance

We attempted to contact all but 14 of the 569 participating premises associated with a recycled appliance identified by the first-year impact evaluations as otherwise would have been kept at the participating premises. The 14 participating premises that we did not attempt to contact had added an appliance by the time of the fourth-year persistence study and had a different occupant than at the time of the fourth-year persistence study.

As Table C-3 shows, a survey was completed for 354 of the 555 participating premises, or 64 percent. Telephone numbers with a final status of not available/answering machine, call back, or busy were called at least ten times.

Table C-3
Participating Premises Sample Disposition

Final Status	Number	Percentage
Completed	354	64%
Incomplete	201	36%
Total sample	555	100%
Incomplete detail		
Not available/answering machine	44	22%
Call back	16	8%
Busy	2	1%
Language problem	15	7%
Incorrect address	4	2%
Refusal	52	26%
Disconnected telephone #	49	24%
Blocked incoming telephone #	16	8%
Computer tone	3	1%
Total incompletes	201	100%

Failure: Ultimate Death

We attempted to contact recent appliance discarders in SCE territory who hadn't moved since responding to the 2003 California Statewide RASS (to facilitate obtaining a telephone number). The sample disposition for the survey of recent appliance discarders is provided in Table C-4. A survey was completed with 160 of the 516 eligible discarders or 31 percent. Telephone numbers with a final status of not available/answering machine, call back, or busy were called at least ten times.

Table C-4
Recent Appliance Discarders Sample Disposition

Final Status	Number	Percentage
Completed	160	31%
Incomplete	356	69%
Total	516	100%
Incomplete detail		
Not available/answering machine	59	17%
Call back	8	2%
Busy	6	2%
Language problem	25	7%
Did not get rid of an appliance since Jan 2002	81	23%
Did not get rid of an appliance in last 5 years	25	7%
No such person	10	3%
Business telephone #	9	3%
Refusal	78	22%
Disconnected telephone #	40	11%
Blocked incoming telephone #	10	3%
Computer tone	5	1%
Total incompletes	356	100%

c. Statistical Descriptions

Of the 481 recycled appliances included in the analysis of failure defined as when a participating premise adds an appliance, 75 or 16 percent had failed (an appliance had been added) as of this ninth-year persistence study. Of the 169 recently discarded appliances included in the analysis of failure defined as when an appliance meets its ultimate death, 82 or 49 percent had failed (met their ultimate death).

C.4 DATA SCREENING AND ANALYSIS

a. Treatment of Outliers and Missing Data Points

Outliers are discussed in this section. Missing data points are discussed in the later section, h. Missing Data.

Failure: Participating Premises Adds an Appliance

The parameters of the distribution of the number of years at which a participating premise adds an appliance were estimated by fitting a general linear regression model to the log of these times observed in the data. Typically, the residuals of a fitted model are examined for the presence of any outliers. However, in this analysis, residuals do not have the typical definition and, therefore, we do not attempt to use the residuals to determine outliers. Although the residuals were not examined for the presence of any outliers, the generally high EUL estimates appear to be consistent with the low failure rate of 16 percent as of this ninth-year persistence study.

Failure: Ultimate Death

The appliance age data that are the basis for the estimated survival curve where failure is defined as when an appliance meets its ultimate death appear reasonable. The largest age observed in these data is 50 years. The recycled appliance ages in the program tracking data, which we understand are educated estimates by program staff, are as high as 77 years.

b. Background Variables

See the discussion of Omitted Factors Below (C.4.e.2).

c. Data Screens

The data employed in this analysis were not subject to any special screens.

d. Model Statistics

From the analysis of the number of years at which a participating premise adds an appliance, the standard model statistics for the selected final general linear regression models are provided in Table C-5. The p-value for the intercept corresponds to a test of the hypothesis that the intercept equals 0. SAS does not provide a p-value for the scale or shape parameters.

Table C-5
Selected General Linear Regression Model Statistics

	Intercept			Scale (dimensionless)	
Distribution	Estimate (*ln* (years))	Standard Error (*ln* (years))	P-value	Estimate	Standard Error
Log-logistic	11.26	0.58	<.0001	1.92	0.27
Weibull	11.60	0.61	<.0001	2.02	0.29

The parameter estimates in Table C-5 along with the results of the analysis of when a recycled appliance would have met its ultimate death anyway produce the EUL estimates in Table C-6.

Table C-6
Summary of EUL Estimates

Program Year	Measure	EUL (years)			
				80% Confidence Interval	
		ex ante	*ex post* (estimated from study)	Lower Bound	Upper Bound
1994	Freezer	6.0	8.0	8.0	11.0
	Refrigerator	6.0	8.0	8.0	11.0
1995	Freezer	6.0	8.0	8.0	11.0
	Refrigerator	6.0	8.0	8.0	11.0
1996	Freezer	6.0	8.0	8.0	8.0
	Refrigerator	6.0	8.0	8.0	8.0
1997	Freezer	6.0	8.0	8.0	8.0
	Refrigerator	6.0	8.0	8.0	8.0

e. Specification

The number of years at which a participating premises adds an appliance was assumed to follow any of five possible distributions: Gamma, Weibull, Exponential, Log-normal, and Log-logistic. In the analysis of when an appliance meets its ultimate death, the Kaplan-Meier method employs each of the appliance ages observed in the data. When the alternative Life-table method was employed, we specified the following groups of appliance ages:

- 0 to 8 years,
- 8 to 13 years,
- 13 to 18 years,
- 18 to 23 years,
- 23 to 28 years,
- 28 to 32 years,
- and so on.

These groups were based on the groups of appliance ages observed in the data collected from recent appliance discarders as well as in the program tracking data.

1. Heterogeneity

Failure: Participating Premise Adds an Appliance

In the analysis of the number of years at which a participating premise adds an appliance, two potential sources of heterogeneity were addressed via the weights employed in the analysis: program year and nonmover/mover. A nonmover is a participating premise at which the participant still resides and a mover is a participating premise from which the participant has moved. The weighting scheme ensured that any system differences in the number of years at which a participating premise adds an appliance across program years and nonmover/mover combinations was appropriately reflected in the results.

In addition, whether or not it was appropriate to analyze refrigerators and freezers together was tested. The null hypothesis that the coefficient on appliance type is zero could not be rejected at the 10 percent level of significance.

Failure: Ultimate Death

In the analysis of when an appliance meets its ultimate death, whether or not it was appropriate to analyze refrigerators and freezers together was also tested. Again, the null hypothesis that the coefficient on appliance type is zero was not rejected at the 10 percent level of significance. In addition, we tested whether defrost type (manual or frost-free), a characteristic common to both refrigerators and freezers, affected when an appliance meets its ultimate death. The null hypothesis that the coefficient on defrost type is zero could not be rejected at the 10 percent level of significance.

2. Omitted Factors

In light of the discussion of heterogeneity above, we have no particular concerns regarding omitted factors.

f. Error in Measuring Variables

We also have no particular concerns regarding error in measuring variables. Imprecision in the number of years at which a participating premise adds an appliance was accommodated by considering various distributions these data may follow. The apparent imprecision in the appliance ages collected from recent appliance discarders as well as in the program tracking data was addressed by using the Life-table method to estimate the survival curve where failure is defined as the ultimate death of an appliance.

g. Influential Data Points

Influential data points are not a concern. The analysis of the number of years at which a participating premise adds an appliance includes 83 percent of the recycled appliances eligible for inclusion in the analysis. Although the sample of appliance ages at discard is not large, it is

not small either (169). Furthermore, the estimated survival curve based on these data is applied to all appliances in the program tracking data.

h. Missing Data

Missing data were not an issue in this study.

i. Precision

In all but one case, precision was estimated using standard statistical formulas. The one exception was the development of the confidence interval around the remaining useful life curves. The remaining useful life curves are based on the estimated survival curve where failure is defined as the ultimate death of an appliance. The confidence interval around a point on a remaining useful life curve was created by borrowing the distances between the estimated survival curve and the lower and upper bounds of its confidence interval at this same point. Although this is an approximation, it is a reasonable approach. Furthermore, we think it is conservative approach because it is likely to result in a lower bound that is too low, which would make it more difficult to reject the *ex ante* EUL.

D

APPROVED WAIVER FOR STUDY METHODS

SOUTHERN CALIFORNIA EDISON COMPANY
RETROACTIVE WAIVER FOR 1994-1997
REFRIGERATOR RECYCLING MEASURE RETENTION STUDY
(Study ID #525B)
Approved by CADMAC on January 20, 1999

Background/Introduction

Southern California Edison conducts a residential refrigerator/freezer turn-in program in which incentives are offered to customers to turn in their old appliances for destruction, with ecologically responsible recycling of components and materials. The goals are:

(a) to eliminate second appliance use at participating residences; and
(b) to prevent the transfer of older, inefficient appliances into the secondary market.

The program has been evaluated twice for first year load impacts, first of the 1994 program (XENERGY, Study #515) and then of the 1996 program (XENERGY, Study #537). In these studies, energy savings were attributed to both phenomena (a) and (b) above – removing auxiliary appliances that would have been kept otherwise, and preventing operable but inefficient appliances from continuing to circulate in the territory, thereby increasing the use of more efficient appliances. Critical to these evaluations were timely survey self reports on alternative actions (including keeping and transferring) that would have taken place if participant respondents had not been able to avail themselves of the program.

There is no M&E Protocol specifically governing this program. Edison proposes to conduct one fourth-year and one ninth-year retention study to be applied to the four program years, 1994-1997. The participants sampled in the impact studies of program years 1994 and 1996 will form the sample for these studies, in order to make use of crucial survey information indicating which phenomenon (eliminated second appliance, or prevented transfer) is the savings-generating "measure" whose retention should be studied. The goal of the study is to provide survival analysis data (estimated survival tables, including median useful life) for both the eliminated spare appliance and prevented transfer "measures," as they apply to refrigerator and freezer recycling taken singly and together.

Based on the final reports, the impact analysis samples for 1994 and 1996 followed similar distributions on self-reported alternative actions, absent the program, as shown in Table 1, below.

Table 1
Reported Alternative Appliance Dispositions
From Studies 515 and 537

		1994			1996		
Alternative Disposition:		Refrig.	Freezer	All	Refrig.	Freezer	All
Keep:	number	205	34	239	250	47	297
	percent	51%	40%	49%	59%	60%	59%
Transfers, intra-SCE:	number	150	32	182	133	25	158
	percent	38%	38%	38%	31%	32%	31%
Transfers, extra-SCE:	number	12	9	21	27	4	31
	percent	3%	11%	4%	6%	5%	6%
Destroy:	number	32	10	42	16	2	18
	percent	8%	11%	9%	4%	3%	4%
Total respondents		399	85	484	426	78	504

The current proposal is to conduct a telephone survey at the premises at which analysis of original survey respondents indicated that the alternative disposition, absent the program, would have been keeping the appliance that was in fact recycled. Interviews will be attempted at all such premises. The current occupant, whether or not the original participant, will be asked about the number of appliances currently in use, and when additional appliances (if any) were acquired. This will fuel a survival analysis of the retention of "eliminated second appliances" – the first component of program savings in the original impact surveys. Note that more than 500 premises form the "proximate frame" for the reuse of the initial panels.

For prevented transfers, the proposal is to estimate the remaining operating life for appliances that would have been transferred intra-territorially absent the program. Where respondents have reported that the inefficient appliance picked up by the program would have been transferred into the secondary market, the savings are enjoyed during the remaining operating life of the hypothetically transferred appliance; these are the years which constitute retention of prevented transfers. This will be estimated by referring the recorded age of each appliance when picked up by the program to a refrigerator life table, which will provide survival parameters; e.g., probabilities of survival *n* more years and the number of years of continued life at which continued operation and failure become actuarially equiprobable for that appliance – the remaining operating life.

The refrigerator life table for use in the prevented transfers exercise may well be a synthesis from various sources, and the vendor assigned this study is carefully reviewing resources and the calculations required for their use.

Summary of Edison Request

This waiver request is in fact a proposal for a retention study on a program not specifically addressed by the Protocols. The proposal is to:

(a) Base survival research on follow-up use of original first year impact analysis survey panels.
(b) Estimate retention of the "measure" constituting prevention of second appliance use, using standard survival analysis techniques on re-survey data indicating self reported "reversion" to use of a spare appliance.
(c) Estimate retention of the "measure" constituting prevention of transfer to the secondary market using "actuarial" techniques predicting the remaining operating life of a hypothetically transferred appliance of the age at which transfer was actually prevented (at pickup date).
(d) Provide survival estimates for refrigerators and freezers, singly and combined.
(e) Generalize these estimates to the 1994-1997 recycling program years.

Program Summary

The following tables report on program costs, energy savings, and resource benefits, plus numbers of pickups in the program, by pickup year and appliance type. The energy savings data are based on the completed load impact studies for program years 1994 through 1996.

Table 2
Program Summary Data
(Costs and Resource Benefits in $1000's)

	1994	1995	1996	1997
Incentive Costs	$1,189	$4,640	$3,839	$5,251
Administrative Costs	$8,500	$ 448	$ 958	$1,182
Total Costs	$9,689	$5,088	$4,797	$6,433
Gross MWH savings	77,550	50,002	56,023	50,653
Gross MW reductions	10.244	6.601	8.565	11.293
Resource Benefit, net	$9,894	$7,029	$5,263	$5,809
Shareholder Earnings				

Table 3
Program Summary: Pickup Totals

Program Year	Refrigerator Pickups	Freezer Pickups	Total Pickups
1994	38,552	6,887	45,439
1995	26,395	5,484	31,879
1996	21,212	5,540	26,752
1997	29,087	7,019	36,106
Total	115,246	24,930	140,176

Parameter

No Protocol parameters apply directly. However, it may be inferred that the recycling program is understood to be governed by Protocol Table 9A (Residential AEI: Refrigeration) as applied to frequency of data collection, retention study due dates, and estimates obtained (per Table 9A, item 3).

Protocol Requirement

The retention study protocol requirement for the residential efficient refrigerator incentive program ("RES. AEI"), which may or may not be the intent of the Protocols for non-covered programs like the recycling program, is as follows:

(a) Fourth and ninth year retention studies, for program years 1994 and 1996 (Protocol Table 8A).
(b) Participant data from sequential program years are to be combined in order to provide a more "robust" retention sample (Table 9A, Item 3; silent on what is to be done if retention study depends upon data from first year impact study, and impact studies are not carried out annually).

Waiver Alternative

Edison proposes minor modifications of the Protocol requirements given above (which may or may not be deemed applicable anyway), and goes on to propose a methodology adapted to the unique circumstances of the recycling program:

(a) A "first round" retention study, generalized to 1994-1997 participating populations, building upon extant survey data from the 1994 and 1996 program years' first year impact studies.
(b) For premises at which participants would have kept using the appliance, which was in fact recycled in the program, conceptualize "failure" as the re-entry of a second appliance into the premise's connected load, and attempt to conduct telephone interviews and survival analysis over all premises participating in the earlier impact evaluation surveys.
(c) For premises at which participants' stated alternative action involved transfer into the secondary market, conceptualize "failure" as the hypothetically transferred appliance's operational death, at which point savings from its prevented transfer also expire, and calculate survival parameters by referring the age at pickup to an appliance life table synthesized for this project.
(d) Calculate survival parameters, including effective useful life and other more informative estimates, for both "keeper" and "transfer" scenarios, and their aggregate counterparts; also calculate these for refrigerators, freezers, and appliances combined; test hypothesis that combined measure EUL is equal to the ex ante value of six years.

Rationale

We include supporting arguments for facets of this proposal, which are not deviations from the Protocols, but are key features of the unique approach suggested.

Combining the 1994 and 1996 survey data provides some of the "robustness" which the Protocols now support, although 1994 and 1996 are not "sequential" in the apparent sense of the current Protocols.

Developing estimates from data based on re-contacting the first year impact studies' participant samples is both consistent with what may have been the original intent of the Protocols first year sample size requirements (Protocol Table 5's requirement of large samples sizes to allow for panel attrition), and necessary given that the analyst is only able to identify which program savings phenomenon applies – preventing continued use at participating residence, vs. preventing transfer to secondary market – based on the relatively timely original survey responses.

It will be noted that only the "prevented continued use" or "keeper" aspect of program savings requires actual re-contact with original survey participants (to elicit information on the timing of any reversion to spare appliance use). The "prevented transfer" aspect corresponds to a retention definition in which savings would accrue throughout the operational life of the appliance had it been transferred. For appliances whose participant owners indicated a transfer was the alternative disposition, the remaining operating life is calculable from a combination of the program tracking system's estimate of age at pickup, and an "actuarial" table for refrigerators or freezers.

Finally, the study will cast its re-survey of "would-be keeper" retention at the premise rather than household level. This is consistent with a conceptualization of the program at a system or utility

territory level (the approach to savings taken in the original impact studies of the program), and makes any post-program movements of participating households moot.

Summary of Retroactive Waiver for Study 525B

Possibly Relevant

Retention Measurement Requirements - Tables 8A, 9A

Parameter	Protocol Requirements	Waiver Alternative	Rationale
Table 8A	For RES. AEI, perform distinct retention studies for 1994 and 1996 program years.	Combine 1994 and 1996 impact samples for retention study to be conducted in late 1998.	Current Protocols' robustness-of-combined-years rationale; need for survey information to determine which type of program savings is undergoing retention study, in the individual case.
Table 9A.3	Combine years 1994 and 1995, 1996 and 1997 in retention studies.	See above	See above