Southern California Edison
1994 Residential CFB
Manufacturers' Incentive Program

Fourth Year Retention Study

Study ID Number 524

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EXECUTIVE SUMMARY

This report estimates survival of residentially installed compact fluorescent bulbs subsidized by Edison's 1994 manufacturers' incentive program, using conservative survival modeling techniques over a collection of sample surveys performed by various vendors in 1995, 1997, and 1999.

The study reveals that

- Bulb estimated expected useful life, allowing for burnouts, remodels, accidents, and migration from the Edison territory, is approximately 6.1 years over the sample.
- The standard error of 0.59 years obtained from the study indicates that Edison's filed assumption of 5.8 years for residential CFB expected useful life should remain in effect.

1. INTRODUCTION: GENERAL PROGRAM AND DATA SOURCE DESCRIPTION.

This study presents estimates of measure retention for the Southern California Edison Company's (Edison) 1994 Compact Fluorescent Bulb Manufacturers' Incentive Program. According to the first year impact study of the program, "Edison provided an average incentive of five dollars per CFL to eleven participating manufacturers who were willing to pass the full incentive amount on through their distribution systems." Additionally, the impact study notes that more than 700 retail outlets in Edison territory were involved, and that "more than $3,000,000 in incentives were paid for 613,000 CFLs (XENERGY, 1996: 1-1).

The task of the current study is to estimate the effective useful life (EUL) for bulbs installed under the program (gross and net savings estimates having been performed by XENERGY), where bulb death consists of a bulb becoming inoperable and/or being removed from operation in the home. Retention of operable bulbs within the Edison territory is considered to be a function of operating hours, location, migration, and various behavioral effects including remodels and accidents.

The filed ex ante EUL for this program is 5.8 years, or 69.6 months. As it developed, the true median bulb life span lies somewhat beyond the observation period so far available, so that a survival regression approach is adopted to arrive at an extrapolated value and a precision estimate for that extrapolation. A number of data sources, involving telephone survey samples taken at various intervals, were brought to bear upon the problem. Their variety is a key feature of this study, and so it is appropriate that they and their mnemonics are introduced early:

POSTCD95: A file of 26,613 "bounce back" postcards returned by a fraction of residential customers to the manufacturers and then transferred via Edison program management to Decision Sciences Research Associates (DSRA) for keypunching. The postcards varied somewhat in format (e.g., in reporting categories for locations in which the customer contemplated or was using the bulb, and in whether counts or "check-offs" were used for locations) as well as in incentive for mailing the card. These cards represent the early portion of the r<u>etail</u> phase of this manufacturers' incentive program – retail purchases occurring in late 1994 and early 1995.

FRAME95: A file of 9,751 records derived from POSTCD95 by DSRA, representing DSRA's effort to create a "frame" of useable addresses and phone numbers for survey work. The work involved both aggregation of bulb counts, accepting a certain amount of error due to unreliability and variability of postcard formats, and moderately aggressive "deduping" of multiple cards concerning the same customers and bulbs. Telephone numbers were updated by DSRA for Athens Research use in February of 1999.

XEN9512: As part of a multi-program, multi-utility statewide impact evaluation, XENERGY's 1996 evaluation included the 1994 CFB program in its telephone survey data collection (based on DSRA's frame data). Filtering for SCE customers (a different program by San Diego Gas and Electric was also under evaluation) who recalled purchasing a CFL during the program period, a total of 167 customer survey responses were included in XEN9512. The bulb observations from this program were all either interval censored deaths between the estimated Christmas 1994 median installation date for the sample and the various November-December 1995 telephone interviews, or right censored (alive) at the interview date.

DSRA9702: DSRA conducted a telephone survey of program participants based on FRAME95, in February of 1997. Of a total of 530 respondents, 519 contributed to the current evaluation tdue to recall of program bulb purchase and installation, and 477 thanks to specific knowledge of installation and disposition of program-supported bulbs. The survey inquired about bulbs installed, bulbs installed under the program, program bulb removals, and reasons for removal, over a standard set of locations in the home. As in XEN9512, the data are completely censored, interval or right, over a period of approximately 25 months..

DSRAFOLL: For a subset of DSRA9702 respondents reporting some bulbs alive, Luth Research performed a followup telephone survey, completing a total of 160 interviews. In these recent (February 1999) interviews, we sought to overcome the deficit in uncensored individual bulb death dates, in order to more effectively estimate survival through a period beyond the last observation date. Customers were asked about specific bulbs that they had mentioned having survived to February 1997, and the date (quarter and year estimate) of subsequent removals was obtained. Up to three of the locations at the home mentioned in the prior survey were investigated (randomly if more than three had been mentioned), and, in the frequent event that more than two program bulbs were or had been in the location, the customer was asked (randomly) about the one either closest or farthest from the customer's position by the telephone. As part of the process, bulbs that were earlier reported dead in the locations surveyed were also investigated for date of death. It was also possible for the customer to report to DSRA in 1997 a live bulb or bulbs, in, for example, the family room, and provide a date of death <u>prior</u> to those interviews – due to a combination of recall problems in either survey, or the respondent having reported a live bulb in 1997 but understanding the interview in 1999 to be referring to another program bulb matching the location specified. In any case of a bulb's reported demise or survival in the 1999 interview, the estimated year and quarter of the event was recorded, and, importantly, the count of survivors or dead bulbs in DSRA9702 properly decremented for the location in question. DSRAFOLL is thus a data set that describes the lives of individual bulbs, overcoming some of the non-specificity in referring to bulbs and to bulb life spans that characterizes the DSRA9702 data set.

DSRANONC, or "UPDU,V,W,X": In order to assess the import, if any, of response or sample selection bias in this study, Luth was provided with a frame of failed 1997 interviews (NONContacts), divided into categories of nonresponse:

- U: Phone contact, made, but no interview conducted
- V: Made phone contact, no interview but no refusal
- W: Phone contact made, refuse/deny participation
- X: Phone not in service

A total of 62 interviews were completed with these prior DSRA9702 contact failures, giving the current study some capability to address nonresponse. Following a randomized approach to locations identified in POSTCD95, these customers were asked about (at most) a single program-subsidized bulb in each of up to three locations they had identified in the bounce-back card.

LUTHGENP: In addition to followup on respondents and nonrespondents to the DSRA9702 survey, the sample was expanded cross-sectionally to include respondents from the "GENeral Population." In fact, since the postcard file and the deduped/aggregated "frame" file FRAME95 are based on voluntary decisions by customers, they cannot be construed as representing any identifiable population. However, there is value in expanding the 1999 survey to include customers who have not been sifted through a previous survey. From an outbound sample of 957 FRAME95 customers with useable contact information, Luth interviewed a total of 251 customers regarding bulbs, again following a randomized approach to single bulbs in up to three postcard-identified locations.

In estimating survival curves, we began (Phase 1) by using a combination of appropriately weighted data from the DSRANONC, DSRAFOLL, and LUTHGENP data to make initial model regressor and distribution choices and estimate survival coefficients for scale (and shape). The results were taken forward into Phase 2, in which the voluminous but censored XEN9512 and DSRA9702 data were included. Tests were conducted at this phase to determine the legitimacy of maintaining the earlier-derived scale/shape parameters, and fit between various hazard functions and regressor specifications was evaluated. Settling upon a final model in systematic fashion, a survival curve and associated EUL was estimated, by applying model regression parameters to the best available data on population averages, taken from DSRA9702 (in fact, a number of "scenarios" other than the population average were also evaluated – various hours of use assumptions, for example). The EUL was then adjusted for the estimated small proportion of program participants who leave the territory each month, and the proportion of their program bulbs that would leave with them due to use in a detached or moveable fixture (table lamp, etc.). Finally, making amends for the cluster (premise) sampling that underlies the data collection for the units of analysis (bulbs), we conducted a sample replication analysis using customer premises as the units of resampling, leading to somewhat larger standard errors and confidence intervals than the statistical package product (SAS LIFEREG) yields under simple random sampling assumptions.

Section 2 elaborates and clarifies methods (data development and analysis), and Section 3 presents results from the development of a final survival model.

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DATA COLLECTION AND DATA DEVELOPMENT.

2.1 File ALL_DUR1 – final analysis data set.

File ALL_DUR1 is the analysis data set used in the survival regressions. We introduce the final file first in order to make discussion of its development flow more smoothly. ALL_DUR1 combines, in common survival analysis-ready format, all data on lifespan, censoring dates, subsample membership, self reported hours of bulb use, lighting control type, dwelling type, dwelling tenure, location of bulb(s) within home, bulb count, and case weights.

ALL_DUR1 contains a total of 3931 study/customer/location/outcome records, with counts of number of bulbs added to each record. Table 2.A presents the total number of customers, total number of customer/locations, total number of records, number of bulbs, and weighted number of bulbs per study or data source.

Note that data sources DSRA9702A, B, C are identical "sub-studies" which take different approaches to a problem posed by the way DSRA9702 questioned customers about program bulb installation and survival. Customers were asked, per location, (a) whether CFBs were currently in use, (b) if none, if they ever had used them there, (c) how many CFBs were currently in use, (d) the number of these which were CFBs from the 94/95 program, and (e) what happened to any program CFBs not currently in use. In some cases, it is logically impossible to use this data to precisely determine the number of surviving and deceased program bulbs ever installed at the location. For example, a customer reporting eight CFBs currently in use outside, five of which are reportedly program bulbs, who goes on to indicate that "any" may have failed, may reasonably be inferred to be reporting anywhere from 1 to 3 bulb deaths (there are other more complicated possibilities, but this indeterminacy probably dominates the DSRA9702 estimation problem). We therefore provided for three ways of handling such situations: assume the maximum number of deaths, the minimum number of deaths, and the average of the two figures. Most of the survival analysis work assumes "maximum deaths" and therefore is based on selecting DSRA9702A rather than DSRA9702B,C records for analysis. In fact, "minimum- and mid-deaths" alternatives are investigated in only one place in the analysis, to check on the sensitivity of results to this conservative measurement assumption.

TABLE 2.A: Summary Counts for Final Analysis file ALL_DUR1.

STUDY	Unique Customers	Unique Locns	Records	Bulbs	Wtd. Bulbs
DSRAFOLL	151	246	262	262	262
DSRANONC	44	53	53	53	53
DSRA9702A -maxdead	477	987	1033	2041	2041
DSRA9702B -mid-dead	477	987	1066	2041	2041
DSRA9702C -mindead	477	987	1066	2041	2041
LUTHGENP	190	246	246	246	246
XENERGY	167	189	205	686	686
	======	======	======	======	======
	1983	3695	3931	7370	7370

Considering Table 2.A further, note that 151 of 160 unique customers involved in the DSRA survivor study were able to indicate whether or not program bulbs had died, and are included in this analysis. 246 unique locations are considered, with live vs. dead bulbs within the same location accounting for the slightly larger number of 1-bulb records. Weights (relative weights) are constructed to correct each study sample to the DSRA9702-based estimate of the proportion of bulbs per location, and return the number bulbs existing in the sample.

Note that of the earlier-reported 62 customers responding under DSRANONC, only 44 are able to discuss program bulbs informatively. In DSRA9702A, 477 of 526 surveyed respondents were able to recall installation of program bulbs and their disposition/survival. DSRA9702A requires only 1033 records to account for 2041 bulbs, as compared to 1066 for the less aggressive DSRA9702B,C , because there are a handful of locations in which the procedure fails all the bulbs where B and C do not, leaving no need for a bulb-weighted survivor record.

LUTHGENP also drops from 251 to 190 records due to lack of customer recall of installation and disposition, while the XENERGY sample total accords with the total reported in Section 1 because the filtering from the larger XENERGY data set included "bulb-knowledge" as a condition.

A model run for a Phase 2 analysis with all data (but only the "max death" DSRA9702 data), would include 1721 customers, 1832 locations, and 3288 implied bulbs.

We now turn to descriptive data for the 5 studies or constituent samples (DSRANONC, so that their contributions and problems may be better understood before they "disappear" into a combined regression analysis.

2.21 XEN9512 sample.

Table 2.B1 begins a round of descriptive tables on each study sample comprising analysis file ALL_DUR1. Note that the 686 bulbs in the XENERGY study are all censored. Approximately six percent are interval censored deaths occurring between Christmas 1994 and sundry interview dates (in this table a duration in months equal to half of the censoring interval is reported, but these values are never used in the survival analysis), and the remainder have survived the 11-12 month period and are right censored. As observed in the unweighted XENERGY data, we find that nine percent of the program bulbs studied were located outside, and that this is inflated to 21 percent by applying analytical weights based on the overall DSRA9702 distribution. All other data sources were weighted to reflect DSRA9702 at a somewhat more refined "location" level, however in this case the incongruity between the categories used by XENERGY interviewers and DSRA interviewers demanded working at a lowest common denominator –simply inside versus outside. In the survival analysis, each bulb in the XENERGY study is weighted by

$$p_{\text{loc,DSRA9702}} \; / \; p_{\text{loc,XEN9512.}}$$

where P is the proportion of study bulbs in the "loc" of interest (here, either indoors or outdoors). The XENERGY sample contributes some information about the early success of program bulbs, but is not much help in developing a survival curve, due to blanket censoring over a very short observation period.

Table 2.B1 - XENERGY DURATION AND LOCATION

Observation Status	Life, months	Unwtd Freq.	Unwtd Pct.	Weighted Freq.	Wtd. Pct.
Intvl cens	5.6	5	0.73	4.7	0.69
Intvl cens	5.6	6	0.87	6.4	0.93
Intvl cens	5.6	3	0.44	4.0	0.59
Intvl cens	5.6	2	0.29	1.7	0.25
Intvl cens	5.7	2	0.29	1.7	0.25
Intvl cens	5.7	2	0.29	4.6	0.67
Intvl cens	5.7	2	0.29	1.7	0.25
Intvl cens	5.7	7	1.02	7.3	1.06
Intvl cens	5.7	1	0.15	0.9	0.13
Intvl cens	5.8	6	0.87	6.2	0.90

					(5.71)
Right cens	11.1	4	0.58	6.3	0.92
Right cens	11.1	72	10.50	66.5	9.69
Right cens	11.1	96	13.99	92.2	13.44
Right cens	11.2	41	5.98	35.6	5.20
Right cens	11.2	58	8.45	53.3	7.77
Right cens	11.2	20	2.92	21.7	3.16
Right cens	11.3	17	2.48	19.0	2.78
Right cens	11.3	78	11.37	73.5	10.71
Right cens	11.3	44	6.41	42.5	6.20
Right cens	11.4	60	8.75	74.9	10.92
Right cens	11.4	96	13.99	92.2	13.45
Right cens	11.4	2	0.29	1.7	0.25
Right cens	11.5	3	0.44	2.6	0.38
Right cens	11.6	39	5.69	35.3	5.15
Right cens	11.6	20	2.92	29.2	4.26
		-----	------	-----	-----
		686	100.0	686.0	100.0

Location	Unwtd Freq.	Unwtd Pct.	Weighted Freq.	Wtd. Pct.
INSIDE	623	90.82	541.6	78.95
OUTSIDE	63	9.18	114.4	21.05
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	686	100.00	686.0	100.00

DSRA9702 sample.

Table 2.B2 displays basic data for the DSRA9702 survey's voluminous contribution to analytical file ALL_DUR1. We choose DSRA9702A, which aggressively "failed" all possible program bulbs in a location where customer responses were ambiguous due to the content of questions on disposition. Variant A, rather than C, which failed a minimum number, or B, which failed the mean of A and C under ambiguous circumstances, is used in the survival regression analysis, with B andC appearing in sensitivity tests only.

Thirteen percent of bulbs failed in the 25.8 month period between Christmas, 1994 and February, 1997. These are entirely interval censored, and are left in this state in the Phase 2 survival regressions. In second panel of the table, we encounter the distribution over discrete locations which informs the weighting. Note that the ALL_DUR1 unweighted percentages are very close to the weighted percentages. This is because the "parent" DSRA9702 file, containing both analysis cases and cases where customers were unable to indicate dispositions and installations definitively, is the basis for the relative weight's numerator, and the records selected for ALL_DUR1 inclusion are very similarly distributed.

Table 2.B2 - DSRA9702A DURATION AND LOCATION

Observation Status	Life, months	Unwtd Freq.	Unwtd Pct.	Weighted Freq.	Wtd. Pct.
Intvl cens	12.9	270	13.23	270.1	13.23
Right cens	25.7	1771	86.77	1771	86.77
		-----	------	-----	-----
		2041	100.0	2041	100.0

Location Number	descrip	Unwtd Freq.	Unwtd Pct.	Weighted Freq.	Wtd. Pct.
1	01-OUTSIDE	431	21.12	429.6	21.05
2	02-LIV/FAM RM	479	23.47	482.6	23.64
3	03-OFICE/DEN	116	5.68	117.5	5.76
4	04-DINE/BKFST	46	2.25	45.3	2.22
5	05-KITCHEN	199	9.75	206.1	10.10
6	06-BATHRM	147	7.20	145.4	7.13
7	07-GAR/BASEMT	138	6.76	133.9	6.56
8	08-HALL/CLOSET	85	4.16	85.7	4.20
9	09-BEDROOM	276	13.52	274.5	13.45
10	10-OTHR LOC	124	6.08	120.4	5.90
		-----	------	-----	-----
		2041	100.0	2041	100.0

2.23 DSRAFOLL sample.

Table 2.B3 describes the much-less censored followup on specific, randomly selected bulbs at the homes of customers reporting survivor bulbs in the DSRA9702 (DSRA9702 records, as explained earlier, are decremented for survivors and dead bulbs in accordance with DSRAFOLL results). Seventy percent of this followup sample survived to be right censored at the 49-50 months corresponding to Luth interviews in February 1999. Another 5 percent are interval censored responses, in which the respondent indicated that the bulb in question had burnt out or been removed since the DSRA survey of 1997, but could not provide a year and quarter. The remaining 25 percent of bulbs experienced deaths in the four year interval which could be assigned a year and season, and are accordingly assigned ages at death corresponding to the midpoint of the season involved.

DSRAFOLL, as well as DSRANONC and particularly LUTHGENP, provide some basis for estimating survival regressions without strong or arbitrary assumptions about the shape of the hazard function at work through fairly long observation periods.

Table 2.B3 - DSRAFOLL DURATION AND LOCATION

Observation Status	Life, months	Unwtd Freq.	Unwtd Pct.	Weighted Freq.	Wtd. Pct.
Dead/rem	1.7	5	1.91	5.2	2.00
Dead/rem	13.7	2	0.76	2.4	0.91
Dead/rem	16.7	2	0.76	2.4	0.90
Dead/rem	17.7	2	0.76	1.8	0.69
Dead/rem	19.7	2	0.76	2.0	0.76
Dead/rem	22.7	2	0.76	2.4	0.90
Dead/rem	25.7	10	3.82	13.8	5.28
Dead/rem	28.6	4	1.53	3.7	1.43
Dead/rem	29.7	1	0.38	1.0	0.38
Dead/rem	31.7	1	0.38	0.8	0.31
Dead/rem	34.7	1	0.38	1.6	0.60
Dead/rem	37.7	6	2.29	6.9	2.64
Dead/rem	40.6	3	1.15	6.3	2.42
Dead/rem	41.7	4	1.53	3.4	1.32
Dead/rem	43.7	4	1.53	4.1	1.57
Dead/rem	45.7	1	0.38	0.8	0.31
Dead/rem	46.7	6	2.29	4.6	1.77
Dead/rem	47.7	1	0.38	0.6	0.24
Dead/rem	49.7	2	0.76	1.9	0.74
					(25.17)
Intvl cens	37.6	14	5.34	13.0	4.97
Right cens	49.7	189	72.14	183.1	69.87
		-----	------	-----	-----
		262	100.0	262.0	100.0

Location Number	descrip	Unwtd Freq.	Unwtd Pct.	Weighted Freq.	Wtd. Pct.
1	01-OUTSIDE	35	13.36	55.1	21.05
2	02-LIV/FAMILY RM	76	29.01	61.9	23.64
3	03-OFF/DEN	24	9.16	15.1	5.76
4	04-DINE/BKFST	1	0.38	5.8	2.22
5	05-KITCHEN	34	12.98	26.5	10.10
6	06-BATHRM	16	6.11	18.7	7.13
7	07-GAR/BASEMT	22	8.40	17.2	6.56
8	08-HALL/CLOSET	11	4.20	11.0	4.20
9	09-BEDROOM	39	14.89	35.2	13.45
10	10-OTHR LOC	4	1.53	15.5	5.90
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		262	100.0	262.0	100.0

2.24 DSRANONC sample.

Table 2.B4 describes the sample of customers and bulbs brought into ALL_DUR1 by Luth telephone surveys of failed contact attempts from DSRA9702. Eight percent of bulbs (weighted) experienced death/removal with a remembered date, and another six percent are interval censored. 86 percent of bulbs are reportedly survivors through February 1999 (right censored). One role of this sample is to include in the survival regressions an indication of the extent to which sample survey selection effects could have biased the survival analysis.

Table 2.B4 - DSRANONC DURATION AND LOCATION

Observation Status	Life, months	Unwtd Freq.	Unwtd Pct.	Weighted Freq.	Wtd. Pct.
Dead/rem	1.7	1	1.89	0.6	1.05
Dead/rem	5.7	1	1.89	0.6	1.05
Dead/rem	7.7	1	1.89	2.7	5.16
Dead/rem	13.7	1	1.89	0.6	1.05

					(8.31)
Intvl cens	24.9	5	9.43	3.1	5.90
Right cens	49.7	44	83.02	45.5	85.78
		-----	------	-----	-----
		53	100.0	53.0	100.0

Location Number	descrip	Unwtd Freq.	Unwtd Pct.	Weighted Freq.	Wtd. Pct.
1	01-OUTSIDE	2	3.77	11.4	21.53
2	02-LIV/FAMILY	23	43.40	12.8	24.18
3	03-OFF/DEN	1	1.89	3.1	5.89
5	05-KITCHEN	2	3.77	5.5	10.33
6	06-BATHRM	4	7.55	3.9	7.29
7	07-GAR/BASEMT	7	13.21	3.6	6.71
8	08-HALL/CLOSET	1	1.89	2.3	4.30
9	09-BEDROOM	10	18.87	7.3	13.75
10	10-OTHR LOC	3	5.66	3.2	6.03
		-----	------	-----	-----
		53	100.0	53.0	100.0

2.25 Luth Research "GENPOP" sample.

Table 2.B5 describes the sample of customers and bulbs from the Luth Research effort to broaden the overall sample cross-sectionally. 22 percent of bulbs were reportedly removed/burnt out by February 1999, with 8 percent interval

censored (assigned an age range for death of between 15 days and 49.7 months). The Luth sample contains, proportionally, fewer outside bulb locations and more living room and family room bulbs than the DSRA9702 survey which is serving as our <u>best estimate</u> of the population distribution of bulbs.

Table 2.B5 - LUTHGENP DURATION AND LOCATION

Observation Status	Life, months	Unwtd Freq.	Unwtd Pct.	Weighted Freq.	Wtd. Pct.
Dead/rem	0.5	3	1.22	2.2	0.90
Dead/rem	1.7	3	1.22	4.1	1.67
Dead/rem	4.6	2	0.81	1.9	0.76
Dead/rem	7.7	2	0.81	1.7	0.69
Dead/rem	10.7	1	0.41	0.6	0.25
Dead/rem	13.7	2	0.81	3.4	1.37
Dead/rem	17.7	2	0.81	3.4	1.37
Dead/rem	19.7	3	1.22	2.6	1.05
Dead/rem	25.7	1	0.41	0.7	0.29
Dead/rem	28.6	1	0.41	0.6	0.25
Dead/rem	29.7	1	0.41	0.9	0.35
Dead/rem	31.7	1	0.41	0.7	0.29
Dead/rem	37.7	1	0.41	0.9	0.36
Dead/rem	41.7	1	0.41	0.9	0.35
Dead/rem	43.7	3	1.22	2.3	0.94
Dead/rem	46.7	3	1.22	2.2	0.88
Dead/rem	49.7	6	2.44	4.9	2.00
					(13.76)
Intvl cens	24.9	20	8.13	20.6	8.37
Right cens	49.7	190	77.24	191.6	77.87
		-----	------	-----	-----
		246	100.0	246.0	100.0

Location Number	descrip	Unwtd Freq.	Unwtd Pct.	Weighted Freq.	Wtd. Pct.
1	01-OUTSIDE	20	8.13	53.0	21.53
2	02-LIV/FAMILY RM	82	33.33	59.5	24.18
3	03-OFF/DEN	3	1.22	14.5	5.89
5	05-KITCHEN	29	11.79	25.4	10.33
6	06-BATHRM	21	8.54	17.9	7.29
7	07-GAR/BASEMT	27	10.98	16.5	6.71
8	08-HALL/CLOSET	4	1.63	10.6	4.30
9	09-BEDROOM	47	19.11	33.8	13.75
10	10-OTHR LOC	13	5.28	14.8	6.03
		-----	------	-----	-----
		246	100.0	246.0	100.0

2.26 Potential covariates/regressors in survival models.

Table 2.B6 presents means from the various samples, on variables entertained as covariates in the Phase 1 and Phase 2 survival models. Note that the samples are largely single family, according to the mean of a single family dwelling binary variable (SFDET in the regression reporting). In order to maintain cases in the analysis where data on a substantive variable are missing, we follow the standard practice of "plugging" the potential regressor with an arbitrary value (we use the DSRA9702-based mean for consistency), and then include an additional binary flagging the record as having been "plugged" on the substantive variable (Cohen and Cohen, 1983). Plugging is nearly nonexistent for both dwelling type and tenure (OWNED in the regression reporting).

The bulk of DSRA9702 and DSRAFOLL bulbs are reportedly manually controlled. Unfortunately, control type is not a viable regressor in an overall study because its missing/nonmissing status coincides perfectly with sample membership (mean values on the proportion plugged equals 1.00 for XEN9512, DSRANONC, and LUTHGEN). Hours per day are quite similar across the sample, but it will be noted that DSRA9702 sample means are plugged in for all XEN9512 and large proportions of the smaller DSRANONC and LUTHGEN samples.

Table 2.B6 - WEIGHTED MEANS, POTENTIAL MODEL VARIABLES

	STUDY SAMPLE				
Variable	XENERGY	DSRA9702	DSRAFOLL	DSRANONC	LUTHGEN
Single fam. det, propn.	0.72	0.86	0.87	0.74	0.87
Single fam., propn plug	0.01	0.00	0.00	0.01	0.01
Dwelling owned,propn	0.78	0.88	0.92	0.83	0.93
Dwelling owned, plug	0.01	0.00	0.00	0.01	0.01
Manual cntl, propn	0.84	0.83	0.93	0.83	0.83
Manual cntl, propn plug	1.00	0.00	0.00	1.00	1.00
Hrs/day, mean	4.82	5.38	4.07	4.22	4.29
Hrs/day, propn plug	1.00	0.01	0.00	0.79	0.50
locations	205	1033	262	53	246
wtd sum, bulbs	686	2041	262	53	246

2.3. Conservatively Assigned Install Date.

Lacking an exact date of purchase or date of installation from the bounce-back cards which serve as the "tracking system" for this market transformation program, it is necessary to fix upon a reasonable date for the median install date for bulbs evaluated/tracked in this study. Although the 1994 CFBs supported by the manufacturers' incentive program were far from completely sold by early 1995, when DSRA received the 26,000 postcards for keypunching, we are interested in obtaining a central value for these reported purchases upon which sampling depended (rather than the date upon which half of the entire stock of program-supported bulbs had been sold. Discussions with DSRA and the Edison program manager suggested that, on average, six weeks were likely to transpire between postcard mailing to the manufacturer, and final keypunching by DSRA. The program manager indicated that cards were relayed from manufacturer to Edison to DSRA in small enough bundles to imply a fairly continuous process. Relying upon DSRA's records on keypunching (Table 2.C below), December 25, 1994 appears to be a reasonable assumption for the median installation date (for bulbs that were in fact installed). We interpolate through February keypunching to estimate that February 6 is the median key punch date, roughly consistent with Christmas of 1994 for the median customer mailing date, a proxy for installation date.

Table 2.C: Postcard Keypunch Dates, Courtesy of DSRA

Jan 1995	42.7%
Feb 1995	31.7%
Mar 1995	23.7%
Apr 1995	1.3%
May 1995	.5%

2.4 Summary of Analysis Attrition, General Flowchart of Data Development.

As input survey records of various types are converted to customer location records pertaining to one or more bulbs, it is possible to lose sight of the attrition of original respondents, as the restrictions upon location-specific responses are implemented. Table 2.D itemizes the attrition from completed responses available to this study from various surveys.

Table 2.D: Attrition of Completed Survey Data.

DSRANONC (UPDU,V,W,X).

Program BLD005C reads 62 complete responses.

BLD006B1 requires that location specific responses meet restriction must remember installing and know whether bulb in use. Result is 44 respondents.

LUTHGENP

Program BLD005 reads 251 complete respondents.

BLD006B1 requires that location specific responses meet restriction must remember installing and know whether bulb in use”. Result is 190 respondents.

DSRAFOLL

Program BLD005 reads 160 complete responses.

BLD007 requires that location specific responses for bulbs referred to in survey have a disposition response. Result is 151 respondents.

XENERGY

Program BLD006C requires that XENERGY survey file ANAL1.REF1215C records reflect rebated bulb purchase and SCE customer status. Result is 167 respondents from voluminous survey file covering several programs.

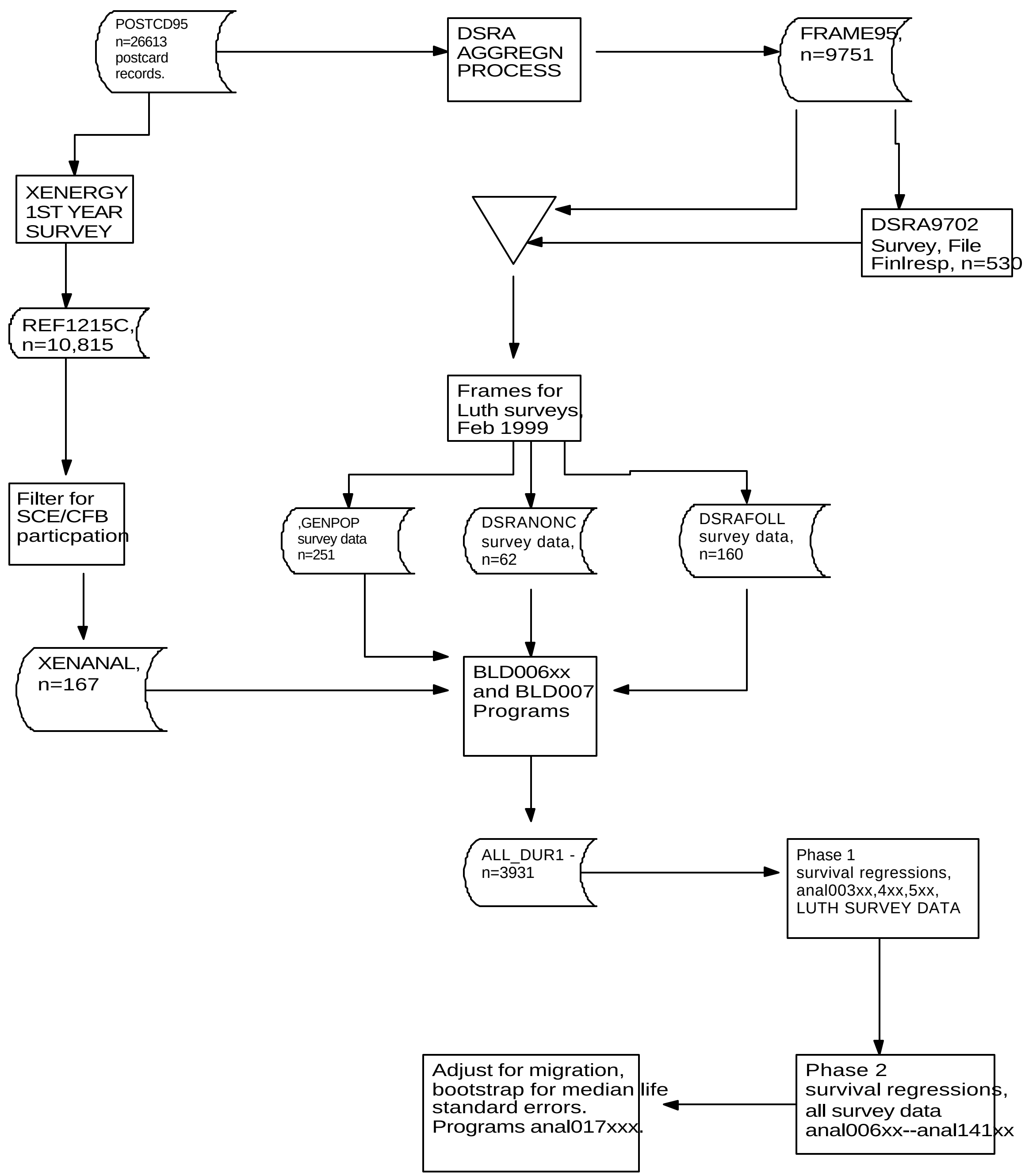
DSRA9702

Program BLD007 reads DSRA file FINLRESP(n=530), requires customer acknowledge ever having CFLs in some location. Result is X9702 with 1147 location records and 519 underlying respondent ids. BLD007 produces X9702A location file from X9702, requiring that program bulbs be in use or have been in use at some point in time, reducing to 481 unique customers. BLD007 then decrements X9702A into X9702B for bulbs covered in DSRAFOLL, reducing extant unique customers to 477 due to four customers having no bulbs left in any location after decrement from DSRAFOLL.

Figure 1 is an overall data development flowchart, applying to all but some auxiliary activities described in the next section.

FIGURE 1

HIGH LEVEL CHART OF CFL STUDY DATA DEVELOPMENT



2.5 Development of exit proportion, mover rate, and attached fixture proportion.

In modeling bulb survival, a survivor function or "SDF" is calculated, giving the estimated probability of lifetime T going beyond time **t**:

$$S(t) = Pr(T>t).$$

[This is the inverse of the cumulative distribution function or CDF, indicating the probability of death at or prior to time t.] If time is measured in months, and the SDF indicates that a particular month S(t) drops below 0.5, then the median expected life or EUL under the specified model and available data lies in the month just concluded – between **t** and **t-1.**

In estimating the EUL for bulbs from territiorial or system perspective, it is logically necessary to consider not only the deaths of bulbs due to burnout, accident, and remodeling at the installation site, but also those due to migration of operable bulbs from the Edison territory.

Accordingly, we looked for data reflecting (a) the monthly probability of a program participant moving, during the period Christmas, 1994 through February, 1999, (b) the probability of the move taking the participant out of the territory, and (c) the probability that a bulb would be taken.

First, we matched names and addresses from the FRAME95 data to Edison's CSS/CDB administrative/billing tables, in order to find the service account for the participant, at or before Christmas 1994. Several match algorithms were attempted, and a total of 6,057 Edison service accounts were safely identified from historical tables. We then calculated the proportion of service accounts which closed, through February 5, 1999, roughly a 49 month period. The result was that sixteen percent of participant accounts appeared to have closed, a proxy for a program-specific mover rate. Assuming an exponential decrease in stable service accounts, the proportion of existing stable participants not moving during any given month is calculated at 0.996448 per month ("p_stay").

Turning to the probability of a move taking the participant out of the territory, we rely on the somewhat aggressive figure of 0.398 (p_exit), taken from work conducted using Census, SCAG, Department of Finance, and Department of Motor Vehicle data, that estimated the territory-wide and per-county probability of an Edison customer move being a territory exit. This work was undertaken by Athens Reesearch to support residential retention studies in general, and is summarized in Appendix F.

Finally, we obtained from DSRA9702 an estimate of the proportion of program bulbs that are used in moveable fixtures rather than attached to the dwelling. This is a proxy for the probability of bulbs being taken with the customer when a move occurs ("p_take"). The estimated proportion "p_take" is 0.3834, with a small standard error of 0.0214.

Combining the three figures, we obtained an estimate of the proportion of remaining bulbs at month **t** which will leave the territory, taking their savings potential as well as their risk of in situ failure, prior to **t+1**:

$$p\_migrate = (1-p\_stay)\ (p\_exit)(p\_take) = 0.0005,$$

and the complementary proportion avoiding emigration from the territory is 0.9995.

In practice, when final or near-final survival models have been estimated, we calculate the standard SDF relating to retention at the dwelling, and then adjust it using p_migrate to produce a second SDF, accounting for the small probability of bulbs exiting the territory during month **t.**:

$$S\_mig_t = (S_t/S_{t-1})\ \ (S\_mig_{t-1})\ \ (1-p\_migrate)\ .$$

2.6 Estimation Procedures.

Here, we characterize the survival estimation of Section 3 in advance, so that we can make shorter work of its presentation.

General model characterization. In estimating parametric time-to-event models, we use SAS procedure LIFEREG, and consider a variety of models. A carefully considered hierarchy of model development is followed through two major phases of data inclusion. At each step, two to five distinct models or assumptions about the distribution of error or time-to-event are considered:

a. The "generalized gamma" model, a flexible accelerated failure time model which allows estimation of scale (rate of hazard change), and shape (change in rate of hazard change).

b. The more parsimonious Weibull model, an accelerated failure time and proportional hazards model, which allows a scale parameter to be estimated (apart from coefficients on substantive covariates).

c. The more restrictive exponential model, which does not allow for fitting of scale or shape parameters.

d. The log normal model, a model assuming a non-monotonic hazard, where the log(hazard) is modelled on hazard at time 0, individual characterstics, and the interaction of time with individual characterstics. This model allows estimation of a scale parameter.

e. The log-logistic model, which also allows for, but does not assume, non-monotonic hazard, and estimates a scale parameter. Practically, it appears to have flexibility similar to the Weibull model.

In practice, we find throughout estimation that the exponenential and log normal approaches, regardless of substantive choices on covariates, result in substantially worse fit than the others, substantially more gradual SDF curves, and correspondingly higher EULs. Since this pattern persists throughout, we do not discuss exponential/log normal results in this report. Among remaining models, we find, almost invariably, that the flexible generalized gamma has the smallest EUL predictions and (marginally) best model fit, with the log-logistic model resulting in the largest EUL predictions and somewhat inferior fit.

Phases. As discussed at various points earlier, a massive amount of interval-censored data comes with inclusion of the DSRA9702 and XEN9512 survey contributions to analysis file ALL_DUR1, while the recent Luth Research surveys at 49 months provide, in the main, estimates of time-at-death for specific bulbs, if not right censored (alive at survey). We make use of the opportunities in this situation by dividing the estimation into two phases, seeking to avoid making any unfounded assumptions about times of death or hazard functions within the large datasets' censored intervals. Essentially, we systematically derive provisional generalized gamma, Weibull, and log-logistic model estimates over the Luth data (DSRANONC, DSRAFOLL, and LUTHGENP) in Phase 1. With these results in hand, particularly estimated shape and scale parameters, we move to Phase 2, including all the DSRA9702 and XEN9512 data in the modeling. In systematically arriving at a slightly revised set of substantive covariates, we also examine the restriction or null hypothesis that scale and/or shape parameters brought forward (fixed rather than allowed to vary) from Phase 1 provide adequate fit to the less informative, heavily censored aggregate now formed by including DSRA9702 and XEN9512.

Covariates - negotiable and otherwise. In finalizing models, we insist on including terms reflecting sample or study source, in order to guard against (estimate terms controlling for) impacts that are essentially driven by study eccentricities and differences. On substantive grounds relating to the potential impacts of weather and hours of use, we always include a dummy for outside location, and a daily hours of use term (paired with a "Cohen and Cohen" binary flagging plugged missing values on that term). The less clearly relevant variables reflecting dwelling type, dwelling ownership, and manual vs. sensor/automatic controls are ultimately asked to justify themselves in the regression.

Evaluation criteria. In assessing model fit, we rely on overall likelihood ratio chi square results, chi square results for parameter restrictions, and, in Phase 1, the observed pattern of Cox-Snell residuals as observed over non-censored cases. In making covariate selections, t values and associated probabilities have been used as a rough guide (recognizing that the clustering in this sample makes these less valid inference tools), paired with overall chi square changes associated with variable addition/deletion. We use visual scans of the parameter correlation matrix to make rough assessments of the nature and extent of multicollinearity problems, recognizing that a certain amount of multicollinearity is to be expected where collections of binaries are used to identify exclusive categories , or where missing data remedies are more frequently applied in one portion of the sample than in others.

Application of estimated models. Having estimated a given model, and stored parameters and predicted values, we apply the model results in various ways. We produce and print a file of quantile estimates -- times at which the SDF reaches quantiles 90, 75, 50 (median), 25, and 10, based on evaluating the model at various levels of regressor values , including mean values from DSRA9702, which provides the study EUL estimate, prior to migration adjustment.

Using post-processor code adapted from Allison (Allison, 1995: Appendix 1; see Appendix), we produce a file containing the SDF (probability of survival to month **t**) evaluated at months 0.1, 0.5, and 1 through 150, for plotting purposes as well as estimation of the migration-adjusted SDF. This is accomplished by combining time and parameter estimates befitting the functional form of the model (gamma, Weibull, etc.). For final or near-final models, this result is then adjusted to obtain a migration- adjusted SDF, and thereby a migration-adjusted EUL (fractional months interpolated using the SDF).

Bootstrap. For the final and near-final models, we also run a bootstrap macro to calculate standard errors. Sample replication techniques like the bootstrap are helpful where complex calculations (like the migration-adjusted median derived from a particular survival model evaluated at model variables' means from a particular sample!) are involved, or where intra-cluster correlation is impacting the efficiency of the sample in complex ways. Here, we bootstrap over the entire data set, sampling with replacement repeatedly (150 times), but at the customer rather than location or bulb level. This provides a somewhat wider standard error on the EUL than is obtained from the SAS software (or than would be if bootstrapping were performed at the location/bulb level).

Sensitivities. In addition to evaluating the scale/shape restrictions based on Phase 1 results, and the net causal impact of household or lighting control variables, we consider some sensitivity issues. First, we evaluate model results at levels of key regressors (hours of use, inside/outside) to determine whether predicted survival results make sense comparatively. We examine the effect on the estimated EUL due to using less aggressive assumptions about bulb death in ambiguous DSRA9702 cases – i.e., by including in the survival regression data from DSRA9702C ("min death") rather than DSRA9702A ("max death"). Finally, we recognize that DSRA9702, while likely the best available representative of the "population" of program participants, and certainly the best source of data against which models can be applied to obtain point estimates, has an essentially unknown relationship to the true population of participants, due to the uncontrolled nature of the bounce-back postcard mechanism. We check the sensitivity of overall results by rerunning the final/near-final models using weights based on our best approximation of the distribution of program bulb installations or intended installations, from a file based on an aggressive "deduping" of the postcard file.

SURVIVAL RESULTS.

3.1 Phase 1 Results.

We begin by working through the development of final Phase 1 specifications.

Survival regressions 31, 32, and 35 start Phase 1 by estimating generalized gamma, Weibull, and log-logistic models respectively, over 561 Luth survey bulb/location records representing 385 respondents, with case weighting as described in section 2.21. Table 3.A1 shows simple unweighted counts of bulb records by Luth study type and location, and Table 3.A2 gives weighted bulb counts by study and location.

Table 3.A1: Phase 1 Study Sources and Bulb Locations
(unweighted records)

STUDY	Frequency	Percent	Cumulative Frequency	Cumulative Percent
DSRAFOLL	262	46.7	262	46.7
DSRANONC	53	9.4	315	56.1
LUTHGEN	246	43.9	561	100.0

LOCNUM	LOC	Frequency	Percent	Cumulative Frequency	Cumulative Percent
1	01-OUTSIDE	57	10.2	57	10.2
2	02-LIV/FAMO	181	32.3	238	42.4
3	03-OFF/DEN	28	5.0	266	47.4
4	04-DINE/BKFST	1	0.2	267	47.6
5	05-KITCHEN	65	11.6	332	59.2
6	06-BATHRM	41	7.3	373	66.5
7	07-GAR/BASEMT	56	10.0	429	76.5
8	08-HALL/CLOS	16	2.9	445	79.3
9	09-BEDROOM	96	17.1	541	96.4
10	10-OTHR LOC	20	3.6	561	100.0

Table 3.A2: Phase 1 Study Sources and Bulb Locations
(weighted bulb counts)

STUDY	Frequency	Percent	Cumulative Frequency	Cumulative Percent
DSRAFOLL	262	46.7	262	46.7
DSRANONC	53	9.4	315	56.1
LUTHGEN	246	43.9	561	100.0

LOCNUM	LOC	Frequency	Percent	Cumulative Frequency	Cumulative Percent
1	01-OUTSIDE	119.504918	21.3	119.504918	21.3
2	02-LIV/FAMO	134.242072	23.9	253.74699	45.2
3	03-OFF/DEN	32.6896862	5.8	286.436676	51.1
4	04-DINE/BKFST	5.81123171	1.0	292.247908	52.1
5	05-KITCHEN	57.3409249	10.2	349.588833	62.3
6	06-BATHRM	40.4601853	7.2	390.049018	69.5
7	07-GAR/BASEMT	37.2448064	6.6	427.293825	76.2
8	08-HALL/CLOS	23.847394	4.3	451.141219	80.4
9	09-BEDROOM	76.3652505	13.6	527.506469	94.0
10	10-OTHR LOC	33.4935309	6.0	561	100.0

Regressions 31, 32 and 35 include terms reflecting study sample membership (DSRAFOLL, DSRANONC), outside vs. inside location (OUTSIDE), respondent estimate of hours of use per day (HRSDAY and missing data plug binary HRSDAYP), and SCALE/SHAPE terms as appropriate per model type. Turning to table 3.B1, note that coefficient estimates for DSRAFOLL are consistently negative across models, indicating somewhat lower net expected survival for DSRA followup customers than for the reference Luth GENPOP category of respondents. Coefficients on DSRANONC are consistently positive, indicating that previous DSRA contact failures have slightly higher net survival. In no case is there evidence, however, that the sample membership terms could not be due to chance events in the samples drawn. Coefficients for outside location (OUTSIDE) are consistently but insignificantly negative in this sample, regardless of model type, possibly reflecting the effect of the elements, net of hours of use, upon survival. Hours of use are, expectedly, negatively related to survival across all three models, with significance levels high enough to suggest a “real finding.” The generalized gamma model coefficients on SCALE and SHAPE are both well over twice their standard errors, and the SCALE parameters for the Weibull and log-logistic variants are evidently necessary for good model fit (regression 33, an exponential model not shown but fitting this specification, indicated that the restriction of no SCALE parameter, preventing an incline in hazard over time, was a highly significant source of fit difficulties). Table 3.B2 provides log likelihoods for the three similarly specified models, as well as predicted EUL’s or median life spans when model parameters are applied to average characteristics from the DSRA9702 file. The pattern set here will persist through this analysis: the generalized gamma approach has slightly better apparent fit based on chi square, and a lower predicted EUL.

Table 3.B1: '30 Series' Regression Results: Parameters

Run 031: Generalized Gamma specification

INTERCPT	5.0025	0.1622	0.0001
DSRAFOLL	-0.1611	0.1418	0.2560
DSRANONC	0.2724	0.2911	0.3494
OUTSIDE	-0.0950	0.1337	0.4775
HRSDAY	-0.0394	0.0108	0.0003
HRSDAYP	0.2051	0.1847	0.2667
SCALE	0.4575	0.1636	
SHAPE	1.7123	0.6173	

log likelihood chi square= -427.52

Run 032: Weibull specification

Parameter	Estimate	Std Error	Prob
INTERCPT	5.0735	0.1747	0.0001
DSRAFOLL	-0.1499	0.1548	0.3326
DSRANONC	0.2477	0.2950	0.4010
OUTSIDE	-0.0956	0.1481	0.5183
HRSDAY	-0.0504	0.0124	0.0001
HRSDAYP	0.2368	0.1949	0.2241
SCALE	0.7318	0.0602	

log likelihood chi square= -429.48

Run 035: Log-logistic specification

Parameter	Estimate	Std Error	Prob
INTERCPT	4.9601	0.1812	0.0001
DSRAFOLL	-0.1127	0.1685	0.5038
DSRANONC	0.2192	0.3004	0.4656
OUTSIDE	-0.0707	0.1628	0.6641
HRSDAY	-0.0657	0.0177	0.0002
HRSDAYP	0.2819	0.2060	0.1711
SCALE	0.6846	0.0552	

```
log likelihood chi square=   -431.96
```

Table 3.B2: "30 Series" Fit and EUL Results		
	LL2CHI (df)	Estimated EUL (months)
Run 031 (Generalized gamma)	-427.52 (8)	85.45
Run 032 (Weibull)	-429.48 (7)	91.55
Run 035 (Log-logistic)	-431.96 (7)	116.40

Moving on from the initial specifications, we estimated a set of regressions in runs 41, 42, and 45 (again, generalized gamma, Weibull, and log-logistic), which used runs 31, 32, and 35 as bases against which to test the value of

(a) adding home ownership terms.
(b) adding single family dwelling type terms (binary for single family plus binary for missing data plug).
(c) adding manual control terms
(d) converting hours per day to log(0.5+ hours/day) to improve fit and overcome possible outlier influences connected to extreme values on this variable.

The results of the "40 series" effort, not tabled here, are apparent in the specification of regressions 51, 52, and 55, which (a) exclude home ownership terms, (b) include single family dwelling terms, (c) exclude control type terms (these compete for variance with hours/day), and (d) replace the hours/day with its log transform. Table 3.C1 provides model output for the generalized gamma, Weibull, and log-logistic variants of the specification. Compared to the regressions in the initial "30 series," much remains the same; however, we find new positive impacts for single family dwelling, as well as a pronounced improvement in fit (highly significant reduction in -2*log likelihood) thanks to introduction of the substitution of logged hours per day. Median expected life spans and fit statistics, again reflecting the superior fit of the gamma model (marginally better fit than Weibull, significantly better than log logistic, based on chi square tests), are reported in Table 3.C2.

While likelihood ratio chi square results appear to favor the somewhat more complex generalized gamma model, another approach to fit assessment leads to possible ambiguity. In the context of covariate-adjusted survival models, graphic evaluation of model fit is best performed using residuals on predicted time-to-event, and visual checking that Cox-Snell residuals are exponentially distributed with constant hazard (Allison, 1995: 94-95). Plotting a re-estimated survivor function (using an exponential distribution, via SAS procedure LIFETEST) against these residuals, a perfect fit of the initial model would imply a perfect diagonal fit of the log(re-estimate survivor function) against the Cox-Snell residual. Figures 2.A and 2.B provide this diagnostic plot for the generalized gamma (regression 51) and Weibull specifications (regression 52). Despite the better likelihood ratio results for the generalized gamma, it could easily be argued that the Weibull Cox-Snell plot indicates equal or slightly superior fit.

Table 3.C1: '50 Series' Regression Results: Parameters

Run 051: Generalized Gamma specification

Parameter	Estimate	Std Error	Prob
INTERCPT	4.9977	0.2089	0.0001
DSRAFOLL	-0.0904	0.1367	0.5082
DSRANONC	0.2669	0.2919	0.3605
OUTSIDE	-0.1630	0.1313	0.2144
LOGHRS	-0.3528	0.0737	0.0001
HRSDAYP	0.3744	0.18767	0.0460
SFDET	0.2835	0.1469	0.0536
SFDETP	15.3469	19190	0.9994
SCALE	0.4320	0.1751	
SHAPE	1.8134	0.7452	

log likelihood chi square= -415.94

Run 052: Weibull specification

Parameter	Estimate	Std Error	Prob
INTERCPT	4.9571	0.2222	0.0001
DSRAFOLL	-0.0545	0.1539	0.7233
DSRANONC	0.2569	0.2950	0.3838
OUTSIDE	-0.1510	0.1461	0.3014
LOGHRS	-0.4034	0.0810	0.0001
HRSDAYP	0.4219	0.1996	0.0346
SFDET	0.3927	0.1648	0.0172
SFDETP	14.6292	22210	0.9995
SCALE	0.7247	0.0593	

log likelihood chi square= -417.99

Run 055: Log-logistic specification

Parameter	Estimate	Std Error	Prob
INTERCPT	4.6982	0.2333	0.0001
DSRAFOLL	0.0002	0.1719	0.9992
DSRANONC	0.2470	0.3013	0.4122
OUTSIDE	-0.1173	0.1591	0.4605
LOGHRS	-0.4454	0.0917	0.0001
HRSDAYP	0.4665	0.2138	0.0291
SFDET	0.5223	0.1915	0.0064
SFDETP	13.8907	23394	0.9995
SCALE	0.6736	0.0539	

```
log likelihood chi square=   -420.67
```

Table 3.C2: "50 Series" Fit and EUL Results		
	LL2CHI (df)	Estimated EUL (months)
Run 051 (Generalized gamma)	-417.99 (10)	79.08
Run 052 (Weibull)	-415.94 (9)	83.03
Run 055 (Log-logistic)	-420.67 (9)	88.62

Based on the foregoing, we take the generalized gamma results from Phase 1, regression 51, forward into Phase 2 as the "provisional leading model." Figures 3.A and 3.B illustrate the somewhat steeper survival curve (probability of surviving to month t) obtaining for generalized gamma as opposed to the Weibull specification.

FIGURE 2.A: DIAGNOSTIC PLOT OF COX-SNELL RESIDUALS

RUN051 (GENERALIZED GAMMA)

The LIFETEST Procedure

-Log(Survival Function) Estimates

```
  -LOG SDF |
           |
       1.4 +
           |                                                                                                           +A
           |                                                                                                       ++++
           |                                                                                                    +++
           |                                                                                                ++++
       1.2 +                                                                                             +++
           |                                                                                         ++++
           |                                                                                      +++
           |                                                                                  ++++
N          |                                                                               +++
e      1.0 +                                                                           ++++
g          |                                                                       ++++
a          |                                                                    +++
t          |                                                                ++++
i          |                                                             +++
v      0.8 +                                                         ++++
e          |                                                      +++
           |                                                  ++++
L          |                                                A+
o          |                                                +
g      0.6 +                                                A
           |                                               A
S          |                                          A+++A
D          |                                         +A
F          |                                       AA
       0.4 +                                     AA
           |                                   AA
           |                               AAAA
           |                            AAAA
           |                         AA+A
       0.2 +                     AAAAA
           |                   AAA
           |                AAAA
           |              AAA
           |           A+AA
       0.0 +          AA
```

```
                 |
                 -----------+------+------+------+------+------+------+------+------+------+------+------+------+------+------+-
----------
                          0.0    0.1    0.2    0.3    0.4    0.5    0.6    0.7    0.8    0.9    1.0    1.1    1.2    1.3    1.4

                                                     Cox-Snell Residuals   E
```

FIGURE 2.B: DIAGNOSTIC PLOT OF COX-SNELL RESIDUALS

RUN052 (WEIBULL)

```
The LIFETEST Procedure

-Log(Survival Function) Estimates

  -LOG SDF |
           |
       1.4 +                                                                                                          +A
           |                                                                                                       +++
           |                                                                                                   ++++
           |                                                                                                +++
           |                                                                                             +++
       1.2 +                                                                                          +++
           |                                                                                      ++++
           |                                                                                   +++
           |                                                                                +++
N          |                                                                             +++
e      1.0 +                                                                          +++
g          |                                                                      ++++
a          |                                                                   +++
t          |                                                                +++
i          |                                                             +++
v      0.8 +                                                         ++++
e          |                                                      +++
           |                                                    A+
L          |                                                   A
o          |                                                  +
g      0.6 +                                                +A
           |                                               A
S          |                                           A++A
D          |                                        A+A
F          |                                      A+A
       0.4 +                                    AA
           |                                  AA
           |                                AA
           |                             +AA
           |                          AAA
       0.2 +                      AAAAA
           |                   AAA
           |                 AAA
           |              AAAA
           |           A+AA
       0.0 +          A
```

```
                    |
                    -----------+------+------+------+------+------+------+------+------+------+------+------+------+------+------+-
----------
                              0.0    0.1    0.2    0.3    0.4    0.5    0.6    0.7    0.8    0.9    1.0    1.1    1.2    1.3    1.4

                                                                 Cox-Snell Residuals   E
```

FIGURE 3.A: PLOT OF SURVIVAL CURVE

RUN051 (GENERALIZED GAMMA)

Plot of P_SURV*MONTHS. Symbol used is 's'.

```
   1.0 +  ss
       |       s
       |            s
       |                 s
   0.9 +                      s
       |
       |                           s
       |                                s
   0.8 +
       |                                     s
       |
       |                                          s
 P 0.7 +                                               s
       |
 s     |                                                    s
 u     |
 r 0.6 +                                                         s
 v     |
 i     |                                                              s
 v     |
 a 0.5 +                                                                   s
 l     |                                                                        s
       |
 (     |                                                                             s
 S 0.4 +
 D     |                                                                                  s
 F     |
 )     |                                                                                       s
   0.3 +                                                                                            s
       |
       |                                                                                                 s
       |
   0.2 +                                                                                                      s
       |                                                                                                           s
       |                                                                                                                s
       |
s
   0.1 +
s
       |
       |
       |
```

```
    0.0 +
        ---+---------+---------+---------+---------+---------+---------+---------+---------+---------+---------+---------+--
-------+--
           0        12        24        36        48        60        72        84        96       108       120       132
144

                                                   Months from installation
```

```
                                                  FIGURE 3.B:  PLOT OF SURVIVAL CURVE

                                                             RUN052 (WEIBULL)

                                             Plot of P_SURV*MONTHS.  Symbol used is 's'.

   1.0 +  ss
       |       s
       |            s
       |                 s
   0.9 +
       |                      s
       |                           s
       |
   0.8 +                                s
       |                                     s
       |
       |                                          s
 P 0.7 +
       |                                               s
 s     |                                                    s
 u     |
 r 0.6 +                                                         s
 v     |                                                              s
 i     |
 v     |                                                                   s
 a 0.5 +                                                                        s
 l     |
       |                                                                             s
 (     |                                                                                  s
 S 0.4 +                                                                                       s
 D     |                                                                                            s
 F     |                                                                                                 s
 )     |                                                                                                      s
   0.3 +                                                                                                           s
       |                                                                                                                s
       |
s
       |
s
   0.2 +
       |
       |
       |
   0.1 +
       |
       |
       |
```

```
   0.0 +
       ---+---------+---------+---------+---------+---------+---------+---------+---------+---------+---------+---------+--
-------+--
          0        12        24        36        48        60        72        84        96       108       120       132
144

                                                   Months from installation
```

3.2 Phase 2 Results.

The Phase 2 analysis, which moves into the estimation process data from the DSRA9702 and XEN9512 data sets, is based on the unweighted record and customer totals displayed in Table 3.D. Details beyond those offered in this section are provided in Appendix E. Based on the development from Phase 1, it is possible to make somewhat shorter work of describing the efforts in Phase 2.

Table 3.D: Phase 2 Study Sources, Bulb Locations, Respondents

(unweighted records)

STUDY	Frequency	Percent	Cumulative Frequency	Cumulative Percent
DSRAFOLL	262	14.6	262	14.6
DSRANONC	53	2.9	315	17.5
DSRA9702A -maxd	1033	57.4	1348	74.9
LUTHGEN	246	13.7	1594	88.6
XENERGY	205	11.4	1799	100.0

LOCNUM	LOC	Frequency	Percent	Cumulative Frequency	Cumulative Percent
.		205	11.4	205	11.4
1	01-OUTSIDE	190	10.6	395	22.0
2	02-LIV/FAMO	470	26.1	865	48.1
3	03-OFF/DEN	103	5.7	968	53.8
4	04-DINE/BKFST	36	2.0	1004	55.8
5	05-KITCHEN	173	9.6	1177	65.4
6	06-BATHRM	114	6.3	1291	71.8
7	07-GAR/BASEMT	129	7.2	1420	78.9
8	08-HALL/CLOS	74	4.1	1494	83.0
9	09-BEDROOM	256	14.2	1750	97.3
10	10-OTHR LOC	49	2.7	1799	100.0

(Unweighted counts of respondents)

STUDY	Frequency	Percent	Cumulative Frequency	Cumulative Percent
DSRAFOLL	151	14.7	151	14.7
DSRANONC	44	4.3	195	19.0
DSRA9702A -maxd	477	46.4	672	65.3
LUTHGEN	190	18.5	862	83.8
XENERGY	167	16.2	1029	100.0

Table 3E presents descriptions, likelihood ratios and EULs for various Phase 2 models , prior to focusing on the "100 series" and the "110 series."

We began with a group of model runs (the "60 series" through the "90 series") varying the constraints on shape and scale parameters and, unfortunately, including parameter SFDETP (binary for plugging single family detached dummy SFDET for missing data). This generated a stream of runs in which the essentially perfect collinearity between combinations of study membership dummies and absence of plugging occurrences made calculation of all parameters impossible. Sheepishly, but with substantive clues from some of these false starts that SFDET (single family detached binary) is of less consequence in the larger data set than in Phase 1, we begin again with the "100 series," which constrains scale and shape parameters to values brought forward from Phase 1 final results, and omits SDFET from the specification. Table 3E indicates slightly (but significantly) better fit for the generalized gamma over the Weibull and log-logistic alternatives for the "100 series" specification (and, as before, an EUL several months smaller than the Weibull). The "160 series" experimented with putting SFDET (but not its plug indicator SFDETP) back into the equation, with no change whatsoever in either fit or estimated EUL, for any model type.

Considering the fixing of scale and shape parameters, to which we will later return, note that the chi square or likelihood ratio evidence is that fit does not improve at all by freeing the parameters in the "110 series" -- implying that bringing forward knowledge of these parameters from Phase 1 has not led to any contradictions from the expanded data set. Taking into account some sensitivity considerations using the "120 series," and zeroing in on the gamma and Weibull models for economy, we note that if the "100 series" regressions are weighted by our best estimate of the distribution of bulbs across locations from the postcard file, rather than the DSRA9702 distribution in which we have much more confidence, the EUL changes are small relative to differences among model specifications that rely more appropriately on DSRA9702, giving us confidence that neither weighting issues nor sample selectivity in DSRA9702 are likely to have appreciably biased estimation.

Turning to the "130 and 140 series," we examine the impact of estimating these models using DSRA9702 data which less aggressively fails bulbs in ambiguous circumstances (selecting DSRA9702C "min death" or DSRA9702B "mid death" for series 130 and 140 respectively). Even with scale/shape parameters fixed as in the "100 series" we see that our use of "max death" DSRA9702A data has quite clearly lowered our EULs. However, we note that the EULs using DSRA9702A data more closely approximate those observed in the relatively uncensored estimations of Phase 1, so that we can have some confidence in our conservatism here.

Table 3.E: Phase 2 Model Descriptions, Summaries

Series 100: Scale/shape parameters fixed, regressors are --

Sample identifer dummies:	DSRAFOLL, DSRANONC, LUTHGEN, DSRA9702
Location binary:	OUTSIDE
Hours/day:	LOGHRS
Binary, hours/day plug:	HRSDAYP
Scale and shape	SCALE, SHAPE (gamma only)

	Likelihood	DF	EUL (months)
Gamma (101)	-1357.91	8	75.60
Weibull (102)	-1361.26	8	83.45
Log-logistic (105)	-1364.96	8	93.95

Series 160: Scale/shape parameters fixed, add SFDET binary to 100

	Likelihood	DF	EUL (months)
Gamma (161)	-1357.91	10	75.61
Weibull (162)	-1361.26	9	83.46
Log-logistic (165)	-1364.95	9	93.95

Series 110: Scale/shape parameters of 100 series freed.

	Likelihood	DF	EUL (months)
Gamma (111)	-1357.36	10	75.60
Weibull (112)	-1361.10	9	83.45
Log-logistic (115)	-1364.91	9	93.95

Series 120: 100 series, weighting to postcard frame.

	Likelihood	DF	EUL (months)
Gamma (121)	-1306.36	8	71.99
Weibull (122)	-1307.83	8	79.05
Log-logistic (125)	(Not estimated)		

Series 130: 100 series, calibrating on DSRA9702A (minimum assumptions re. bulb failure in ambiguous DSRA9702 cases).

	Likelihood	DF	EUL (months)
Gamma (131)	-1134.39	8	111.20
Weibull (132)	-1136.99	8	122.00
Log-logistic (135)	(Not estimated)		

Series 140: 100 series, calibrating on DSRA9702B (moderate assumptions re. bulb failure in ambiguous DSRA9702 cases).

	Likelihood	DF	EUL (months)
Gamma (141)	-1254.39	8	89.40
Weibull (142)	-1257.73	8	98.56
Log-logistic (145)	(Not estimated)		

In tables 3.F and 3.G, we display model coefficients and other results for the "100 series" and "110 series," respectively, limiting attention to generalized gamma and Weibull models. Models in the "100 series" constrain scale and shape coefficients to values obtained from Phase 1, where there was considerably less interval censoring to deal with. Within Table 3.F, we note that the scale and shape parameter restrictions result in coefficient-specific Lagrangian multiplier chi square values that are trivial. Table 3.G displays the same models with scale and shape parameters freely estimated. In the case of the Weibull model (run 112), the obtained coefficient for the scale parameter is significant as estimated, <u>but very close in value to the Phase 1 value</u>, leading to more confidence in our approach. For the Gamma models (101 vs. 111), we note that shape and scale parameters change somewhat, as the model deals in 111 with volumes of deaths occurring in wide one and three year intervals. In neither model type, however, do we see any pronounced changes in substantive model coefficients. Finally, we note that the constraints produce essentially identical overall likelihood ratio chi squares, indicating that overall fit does not improve with freeing of scale and shape parameters from their Phase 1 values – instead there is a relatively minor rearrangement of coefficient values.

Substantively interpreting generalized gamma results in regression 101, note that the DSRAFOLL (DSRA9702 survivor bulbs) and DSRA9702 coefficients indicate that these samples differ negatively from the adjusted survival established of reference group XEN9512. On the other hand, the coefficient for DSRANONC (followup on prior DSRA9702 contact failures) indicates that group membership here gives a substantial boost to reported survival. This indicates that sample selection effects, as far as we can study them here, lead to somewhat <u>lower</u> EUL's.

Continuing our substantive coefficient tour, we note that OUTSIDE status modestly decreases net survival, as it has throughout our modeling efforts. We also note that hours per day (logged to reduce outlier impacts), maintains its pronounced negative impact upon survival.

<u>Based on the moderate but significant difference in likelihood ratio chi squares between regressions 101 and 102, and the evidence favoring our use of Phase 1 scale and shape values, we accept generalized gamma model 101 as our "final" model accounting for bulb survival in the assembled samples</u>.

Table 3.F "100 Series" Regression Results: Parameters

Run 101: Generalized Gamma specification

Variable	DF	Estimate	Std Err	ChiSquare	Pr>Chi	Label/Value
INTERCPT	1	5.6638482	0.271305	435.8207	0.0001	Intercept
DSRAFOLL	1	-0.7102345	0.27694	6.577056	0.0103	Dummy, DSRA followup
DSRANONC	1	0.68820552	0.288846	5.676808	0.0172	Dummy, DSRA noncont
LUTHGEN	1	0.1427644	0.154842	0.850089	0.3565	Dummy, LUTH GENPOP
DSRA9702	1	-0.6435428	0.270594	5.656126	0.0174	Dummy, DSRA9702
OUTSIDE	1	-0.0768778	0.081399	0.892006	0.3449	Dummy, outside
LOGHRS	1	-0.23418	0.049373	22.49706	0.0001	Log(hrs/day + .5)
HRSDAYP	1	-0.7913617	0.238889	10.97386	0.0009	Missing data dummy
SCALE	0	0.43199	0			Gamma scale parm
SHAPE	0	1.81341	0			Gamma shape parm

Lagrange Multiplier ChiSquare for Scale 0.772482 Pr>Chi is 0.3795.
Lagrange Multiplier ChiSquare for Shape1 0.541083 Pr>Chi is 0.4620.
Log Likelihood for GAMMA -1357.91068

Run 102: Weibull specification

Variable	DF	Estimate	Std Err	ChiSquare	Pr>Chi	Label/Value
INTERCPT	1	5.55165012	0.233795	563.8611	0.0001	Intercept
DSRAFOLL	1	-0.5696974	0.241211	5.578224	0.0182	Dummy, DSRA follow
DSRANONC	1	0.68354411	0.288462	5.615079	0.0178	Dummy, DSRA noncont
LUTHGEN	1	0.13560485	0.15847	0.732243	0.3922	Dummy, LUTH GENPOP
DSRA9702	1	-0.5015368	0.229769	4.764543	0.0291	Dummy, DSRA9702
OUTSIDE	1	-0.0869141	0.084799	1.050519	0.3054	Dummy, outside
LOGHRS	1	-0.2311992	0.050209	21.20366	0.0001	Log(hrs/day + .5)
HRSDAYP	1	-0.6714742	0.196281	11.70313	0.0006	Missing data dummy
SCALE	0	0.72469	0			Scale parameter

Lagrange Multiplier ChiSquare for Scale 0.328145 Pr>Chi is 0.5668.
Log Likelihood for WEIBULL -1361.260352

Table 3.G "110 Series" Regression Results: Parameters

Run 111: Generalized Gamma specification

Variable	DF	Estimate	Std Err	ChiSquare	Pr>Chi	Label/Value
INTERCPT	1	5.55705797	0.661223	70.63087	0.0001	Intercept
DSRAFOLL	1	-0.6192315	0.324141	3.649547	0.0561	Dummy, DSRA follow
DSRANONC	1	0.73389648	0.276987	7.020212	0.0081	Dummy, DSRA noncont
LUTHGEN	1	0.22152643	0.17201	1.658608	0.1978	Dummy, LUTH GENPOP
DSRA9702	1	-0.5976841	0.300097	3.966613	0.0464	Dummy, DSRA9702
OUTSIDE	1	-0.0718804	0.076321	0.88703	0.3463	Dummy, outside
LOGHRS	1	-0.2185775	0.048771	20.08554	0.0001	Log(hrs/day + .5)
HRSDAYP	1	-0.7837517	0.259911	9.092983	0.0026	Missing data dummy
SCALE	1	0.2458876	1.004043			Gamma scale parm
SHAPE	1	3.00024916	12.24989			Gamma shape parm

Log Likelihood for GAMMA -1357.36536

Run 112: Weibull specification

Variable	DF	Estimate	Std Err	ChiSquare	Pr>Chi	Label/Value
INTERCPT	1	5.42721613	0.312441	301.7301	0.0001	Intercept
DSRAFOLL	1	-0.4904828	0.26982	3.304441	0.0691	Dummy, DSRA follow
DSRANONC	1	0.71493367	0.282316	6.412983	0.0113	Dummy, DSRA noncont
LUTHGEN	1	0.18798147	0.177543	1.121039	0.2897	Dummy, LUTH GENPOP
DSRA9702	1	-0.4485541	0.239258	3.514771	0.0608	Dummy, DSRA9702
OUTSIDE	1	-0.0836008	0.081607	1.049456	0.3056	Dummy, outside
LOGHRS	1	-0.2223038	0.050643	19.26852	0.0001	Log(hrs/day + .5)
HRSDAYP	1	-0.6445642	0.194267	11.00865	0.0009	Missing data dummy
SCALE	1	0.69574118	0.050546			Scale parameter

Log Likelihood for WEIBULL -1361.103403

3.21 Illustrations on scenarios: location, hours of use.

To illustrate model sensitivities, we evaluate runs 101 and 102 (generalized gamma and Weibull), at various values of substantively critical variables OUTSIDE and hours/day (evaluated at corresponding log(0.5+hrs/day) values), and present this small selection of scenarios in Table 3H. Note that the net effect of moving bulbs outside appears to be an EUL reduction of 5-8 months, and moving from 1 to 10 hours of daily use appears to reduce median longevity by about three years.

Table 3.H Scenario Evaluation, Location and Hours/Day

Scenario: DSRA9702 means, except:	EUL, 101, Gamma	EUL, 102, Weibull
Change hrs to 1	96.47	106.10
Change hrs to 10	61.16	67.69
Change hrs to 20	52.59	57.99
Outside location	71.15	77.92
Inside location	76.84	85.00

Figure 4 illustrates the survival probabilities (SDF) associated with bulb age, based on final generalized gamma model 101.

```
                                                   FIGURE 4:  PLOT OF SURVIVAL CURVE

                                                        RUN101 (GENERALIZED GAMMA)

                                             Plot of P_SURV*MONTHS.  Symbol used is 's'.

   1.0 +  ss
       |       s
       |            s
       |                 s
   0.9 +
       |                      s
       |                           s
       |
   0.8 +                                s
       |
       |                                     s
       |                                          s
 P 0.7 +
       |                                               s
 s     |
 u     |                                                    s
 r 0.6 +
 v     |                                                         s
 i     |
 v     |                                                              s
 a 0.5 +
 l     |                                                                   s
       |
 (     |                                                                        s
 S 0.4 +
 D     |                                                                             s
 F     |                                                                                  s
 )     |
   0.3 +                                                                                       s
       |
       |                                                                                            s
       |                                                                                                 s
   0.2 +
       |                                                                                                      s
       |                                                                                                           s
       |                                                                                                                s
   0.1 +
s
       |
s
       |
       |
```

```
   0.0 +
       ---+---------+---------+---------+---------+---------+---------+---------+---------+---------+---------+---------+--
-------+--
          0        12        24        36        48        60        72        84        96       108       120       132
144

                                                    Months from installation
```

3.22 Migration and bootstrapped results, for final model 101. As described in Section 2.5, we produce the model 101 SDF for months 0.1 to 150, obtaining confirmation of the relatively "canned" output on quantiles from SAS procedure LIFEREG, and also providing us with a survival function that can be adjusted through time to reflect the very small proportion of bulbs expected to leave the territory per month. Table 3.I shows the EUL and migration-adjusted EUL based on model 101. The table also includes our bootstrap estimate, accounting for clustering of results over customers, of the standard error for each EUL – based on 150 sample replications (simple random sampling allowing replication) of 1029 customers.

Table 3.I: Bootstrapped Standard Error, Over Customer Clusters, For Run 101 (Generalized Gamma)- EULS Unadjusted and Adjusted For Migration.

	From Model	Migration-Adjusted
EUL	75.603	73.239
Standard error	7.528	7.045

Concluding our discussion of Phase 2 regressions, and our report, we present the final migration-adjusted ex post EUL from model 101, 80% and 90% confidence intervals. and the probability, given the program ex ante EUL of 5.8 years or 69.6 months, that our migration-adjusted estimate of 73.24 months could occur by chance given a true population value of 5.8 years. The evidence suggests that the current study, which approached the data conservatively at every turn, cannot contradict the ex ante expected useful life – the finding is well within the range of sampling variability.

Table 3.I: Ex ante vs. Ex post EUL: Confidence Bounds, p.

	Months	Years
Ex ante EUL	69.60	5.80
Migration adjusted EUL	73.23	6.10
Standard error, clustering-adjusted	7.045	0.587
80% interval (+/- 1.28 s.e.)	+/- 9.02	+/- 0.751
90% interval (+/- 1.64 s.e.)	+/- 11.55	+/- 0.962
t (1029 customers- 10 parms -1)	0.5153	
p(h0: ex ante=ex post)	0.6065	

* note: t value and df applied to calculate p as follows, interactive SAS:

```
14   data joe;
15    t= 0.51526;df=  1018;
16    p= 2*(1-probt(t,df)); put _all_; run;

T=0.51526 DF=1018 P=0.6064832131 _ERROR_=0 _N_=1
NOTE: The data set WORK.JOE has 1 observations and 3 variables.
NOTE: The DATA statement used 0.00 CPU seconds and 4023K.
```

REFERENCES

Allison, Paul

Survival Analysis Using the SAS® System: A Practical Guide. SAS Institute: 1995.

Cohen, Jacob, and Patricia Cohen

Multivariate Regression in Practice. Lawrence Erlbaum Asociates, 1983.

XENERGY, Inc.

Residential Appliance Efficiency Incentives Program: Fluorescent Lighting (CFL) 1994 First Year Statewide Impact Study. SCE Study ID 513.

Appendix A:

Tables 6 and 7 for the California M&E Protocols

Protocol Table 6.B
Results of Retention Study
SCE 1994Residential CFL Manufacturers' Incentive Proaram
Fourth Year Retention Study
Study ID # 524

Item 1			Item 2		Item 3	Item 4	Item 5	Item 6		Item 7	Item 8	Item 9
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)	"Like" Measures Associated with Studied Measure
	Compact Fluorescent Bulbs		5.8		6.1	5.8	0.59	5.3	6.9	0.607	1.00	

Ex Ante Source References: 1 California Protocol Table F.

M&E Protocols Table 7
1994 Residential CFL Manufacturers' Rebate Third/Fourth Year Retention Study
Study ID # 524

1. **OVERVIEW**.

a. Title: Southern California Edison 1994 Residential CFL Manufacturers' Rebate Third/Fourth Year Retention Study. Study ID 544.

b. Program Year: 1994. Description. Manufacturers' rebate program of 1994, attempting to expand CFL penetration into residential market from late 1994 forward.

c. End Uses and Measures: Residential lighting, compact fluorescent bulbs, various manufacturers and wattages.

d. Methods and models.
Hazard models estimated over a combination of several telephone sample followup surveys, including covariates for study source, hours of use, location. Models were estimated <u>after</u> initial model development and scale/shape parameter estimation using relatively uncensored "Luth99" survey sample data. Final model (101) is a generalized gamma specification, including covariates for study source, outside/inside location, logarithm of hours, gamma scale and shape parameters fixed at values obtained in phase 1 analysis over Luth99 samples. Major model competitors (gamma model with scale/shape values freed and Weibull model with free scale parameter and similar regressor specification) are presented in Tables 3.E, 3.G. EUL from model 101 is adjusted for migration probability, using post-processor.

e. Analysis sample size. The following table summary refers to final regression analysis file all_dur1, documented at length in Section 2. We provide

	Date	Observation/ Reference Period	Customers	Bulbs Studied
XEN9512	12/95	12/94-12/95	167	686
DSRA9702	2/97	12/94-2/97	477	2041
DSRANONC	2/99	12/94-2/99	44	53
DSRAFOLL	2/99	12/94-2/99	151	262
LUTHGENP	2/99	12/94-2/99	190	686
			----	----
			1029	3288

XEN9512 is the original impact survey for this program, DSRA9702 is a followup on a separate sample of 530 customers drawn from bounce-back cards. DSRANONC and DSRAFOLL are specific followups on DSRA9702 contact failures and reported bulb survivals at 2/97. LUTHGENP is a survey of as-yet unsampled population members from the bounce-back cards.

2. DATA BASE MANAGEMENT

a. Specific data sources for specific data elements.

POSTCD99, FRAME99 – postcard bounce back files used for identifiers in all sample surveys. FRAME99 is DSRA's moderately aggressive deduping of POSTCD99.

XEN9512 and DSRA9702 – 1995 and 1997 follow up on participating customers.

DSRAFOLL – 2/99 followup on DSRA9702 surveys where customer reported program bulb survival.

DSRANONC - 2/99 followup on DSRA9702 survey attempts which failed, by general reason for failure.

LUTHGENP - 2/99 new sample draw from FRAM99, to expand sample cross-sectionally.

DMV drivers license address change, Census PUMS90, Department of Finance Demographic Trends data – combined to yield estimated proportion of movers who exit Edison territory.

Edison CDB/CSS administrative files – matched to names and addresses from FRAME99 to yield proportion of participants who move during 49 month period.

b. Diagram and describe data attrition process starting with program data base for participants. Include specific numbers and decision points. Attrition categories by source.

Please see attached Figure 1, also available in text of report. Also please see attached Table 2.D, which documents analysis filtering of completed surveys. See attached Table B.1 from Appendix B, which provides survey dispositions.

c. Describe internal/organizational data quality checks and data quality procedures.

DSRA, Xenergy, and Luth Research all provide consistently high quality survey administration and quality controls. In our data processing work, several keys were used in identifying customers and linking between various data sources:

Name and address was matched algorithmically from participant files to Edison files in order to obtain service account information necessary to identify customer movement.

XENERGY's "FSCID," DSRA's "RESPID" and "FID," our "ID2LUTH," Luth's "CASE_ID" and our final "ANAL_ID" were all used as keys at various points in data development/analysis.

d. Summarize data not used.

None

3. SAMPLING

a. Procedures and protocols, describe sampling procedures and protocols.

DSRA9702 (respondent n=530) and XEN9512(respondent n=167) were brought into this study from previous studies by other vendors. Using DSRA9702 and FRAME99/POSTCD99 as sources, we developed “availability” frames for Luth Research use in following up on

DSRAFOLL - DSRA9702 survey participants reporting surviving bulbs in 1997.
DSRANONC - DSRA9702 survey contact failures, included as a means of assessing/controlling sample selectivity.
LUTHGENP - General population of program participants, untouched by prior surveys.

For these surveys, outbound frame counts and obtained completed samples are as follows:

DSRAFOLL complete 160/448.
DSRANONC complete 62/346
LUTHGENP complete 251/957

In analysis, customer-specific location records, referring to one or several bulbs, served as analysis units. Relative weights were derived for them such that each survey’s sum of weights equaled its contribution of bulbs, but the distribution of bulbs across locations matched that observed in the 530 surveys obtained in DSRA9702. DSRA9702 thus serves as our best source on the distribution of bulbs across locations within homes, and was used as such in “post-stratification” by location.

b. Survey information.

Instruments for 1999 surveys available in Appendix C. See (a) above for gross response rates, and Appendix B for details on responses. Reasons for refusals not tabulated!

Several analytical approaches were used to assess/control response bias in practical ways:

a. Assessment of impact of alternative weighting, to determine what role our use of DSRA9702 as a proxy for population distributions on bulb location may have played in affecting EUL estimates.

b. Explicit inclusion and analysis of impact of former DSRA9702 contact failures in analysis.

c. Tested for bias in EUL estimation due to ambiguities in DSRA9702 questionning about program bulbs. Adopted most conservative (low-EUL-producing) alternative.

c. Statistical descriptions. Key variables in final models. The following are weighted distributional data on regressors entering final model anal0101, used in generating the ex post EUL for the study.

Variable	Label	N	Std Dev
DSRAFOLL	Dummy for DSRA followup sample	1799	0.3662
DSRANONC	Dummy for DSRA re-try sample	1799	0.1703
LUTHGEN	Dummy for LUTH general pop sample	1799	0.3558
DSRA9702	Dummy for DSRA9702 sample	1799	0.6561
OUTSIDE	Dummy for outside locn	1799	0.5517
LOGHRS	Log(hrs/day + .5)	1799	1.0919
HRSDAYP	Var hrsday1 mean-plugged	1799	0.5972
SFDET	SINGLE FAMILY DETACHED	1799	0.5054
SFDETP	Var sfdet1 mean-plugged	1799	0.0800

Variable	Label	Minimum	Maximum
DSRAFOLL	Dummy for DSRA followup sample	0.0000	1.0000
DSRANONC	Dummy for DSRA re-try sample	0.0000	1.0000
LUTHGEN	Dummy for LUTH general pop sample	0.0000	1.0000
DSRA9702	Dummy for DSRA9702 sample	0.0000	1.0000
OUTSIDE	Dummy for outside locn	0.0000	1.0000
LOGHRS	Log(hrs/day + .5)	-0.6931	3.1987
HRSDAYP	Var hrsday1 mean-plugged	0.0000	1.0000
SFDET	SINGLE FAMILY DETACHED	0.0000	1.0000
SFDETP	Var sfdet1 mean-plugged	0.0000	1.0000

4. DATA SCREENING AND ANALYSIS

a. Treatment of outliers.

Outliers and high leverage data were not eliminated or downweighted. We did assess impact of less aggressive classficiation of bulb failure over DSRA9702 data. Outliers assessed in part using Cox-Snell residuals plots, by use of highly flexible generalized gamma model. In model development, used log transformation of reported hours of bulb use per day, successfully improving fit due to elimination of the role of extreme (e.g. 24 hour) reports.

b. Treatment of background variables.

Not applicable, although we did address demographic trends in our estimation of the proportion of movers who exit Southern California Edison territory – see appendix F.

c. Screening for final data set all_dur1.

Please see attached Table 2.D from the report text, which documents analysis filtering of completed surveys. We have reprised it in Table 7 for reviewer convenience.

d. Model statistics. The following reprises Table 3.F, for run anal0101 (generalized gamma, fixed scale and shape parameters). Please also see appendix E, which contains information on both final Phase 1 competitors and final Phase 2 competitors among models considered.

Table 3.G "100 Series" Regression Results: Parameters

Run 101: Generalized Gamma specification

Variable	DF	Estimate	Std Err	ChiSquare	Pr>Chi	Label/Value
INTERCPT	1	5.6638482	0.271305	435.8207	0.0001	Intercept
DSRAFOLL	1	-0.7102345	0.27694	6.577056	0.0103	Dummy, DSRA followup
DSRANONC	1	0.68820552	0.288846	5.676808	0.0172	Dummy, DSRA noncont
LUTHGEN	1	0.1427644	0.154842	0.850089	0.3565	Dummy, LUTH GENPOP
DSRA9702	1	-0.6435428	0.270594	5.656126	0.0174	Dummy, DSRA9702

```
OUTSIDE    1 -0.0768778 0.081399  0.892006  0.3449 Dummy, outside
LOGHRS     1   -0.23418 0.049373  22.49706  0.0001 Log(hrs/day + .5)
HRSDAYP    1 -0.7913617 0.238889  10.97386  0.0009 Missing data dummy
SCALE      0    0.43199        0                   Gamma scale parm
SHAPE      0    1.81341        0                   Gamma shape parm

Lagrange Multiplier ChiSquare for Scale 0.772482 Pr>Chi is 0.3795.
Lagrange Multiplier ChiSquare for Shape1 0.541083 Pr>Chi is 0.4620.
Log Likelihood for GAMMA  -1357.91068
```

e. Specification.

Please see sections 3.1 and 3.2, and summary tables therein, for copious description of model development and rationales.

Regarding heterogeneity – we address it very directly by including information in the model upon which customers and customer locations vary in survival-consequential ways – hours of use, dwelling type, ownership of residence, and indoor/outdoor location.

Omitted factors. None occur to us.

f. Error in measuring variables.

The Luth surveys made strong efforts to pin down customers on the quarter and year in which deceased bulbs had burnt out or expired.

Additionally, our log transform of hours/day use provided a much better fit in models, indicating implicitly that some "cleaning up" of the hours/day effect had been achieved.

g. Influential data points.

Primarily handled by the modeling – flexible gamma model. Assessed implicitly with Cox-Snell residuals analysis. Assessed impact of influential data in a gross way by testing for various levels of aggressiveness in classifying ambiguous DSRA9702 data, and by examining an alternative weighting of regression data to the crude location distribution evidenced in the bounce-back cards.

h. Missing data.

For certain model variables entertained, missing data on regressors was addressed by assigning a central value and including a binary in the regression which flagged this occurrence. Missing data in the form of customer knowledge of the installation/disposition of bulbs lead to filtering out of the location/bulbs in question.

i. Precision.
Please see sections 3.22 and 2.6, where this is carefully explained. We used bootstrap procedures to estimate the true standard error for the EUL, making allowances for clustering of bulb outcomes within customers. Sample replications =150, clusters (customers) =1029, accounting for 1799 bulb location records in the analyis data set.

For portions of the model development, we use the canned output (coefficient standard errors and particularly likelihood ratio chisquares) to assist in judging model fit (in addition to residual plots).

However, to overcome the probable underestimation of variance due to clustering among observations of locations and bulbs, we performed two types of bootstrap applications, for final "competitor" models.

Sample replication procedures like the bootstrap are good practical alternatives to algebraic manipulations when both the parameter sought (the EUL as a point estimate from a multivariate model), and the sample (cluster, with variable number of psu's) are quite complex. The first bootstrap created 150 independently selected SRSWR location samples built from the analysis data set, and found the means and standard deviations of the 150 resultant EULs and migration-adjusted EULs. That is, each SRSWR sample was in fact a sample of locations within customer premises, equal to the number of such "clusters" in the regression data set, and if a particular location was included or not included, all bulbs in the location were treated accordingly. The standard deviations of the "location-bootstrap" exercises were, as expected, somewhat larger than the canned standard errors obtained earlier. To account for the true impacts of customer level clustering upon bulb-level regression estimation variance, we performed a similar procedure over the unique respondents rather than locations in the regression sample. That is, each replication sample was a sample of customer-clusters, with locations and bulbs for a given cluster included or excluded per the random disposition of the customer/respondent. For any given model specification evaluated, the yet-larger EUL and migration-adjusted EUL standard deviations over the 150 "customer-bootstrap" replications were taken to be the appropriate EUL standard errors.

FIGURE 1

HIGH LEVEL CHART OF CFL STUDY DATA DEVELOPMENT

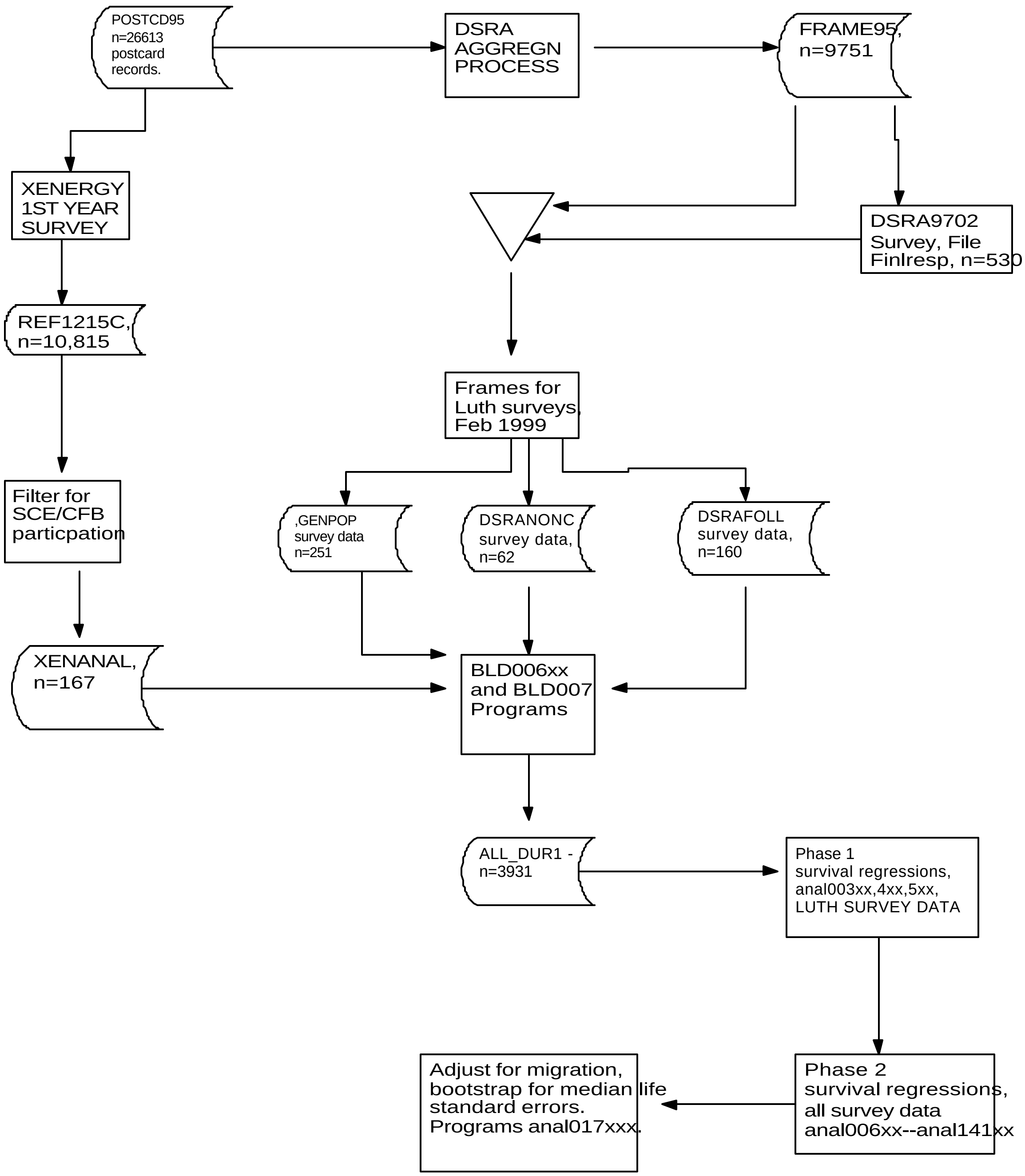


Table 2.D: Attrition of Completed Survey Data.

```
DSRANONC (UPDU,V,W,X).
       Program BLD005C reads 62 complete responses.
              BLD006B1 requires that location specific responses meet
              restriction must remember installing and know whether bulb in
              use.  Result is 44 respondents.
LUTHGENP
       Program BLD005 reads 251 complete respondents.
              BLD006B1 requires that location specific responses meet
              restriction must remember installing and know whether bulb in
              use”.  Result is 190 respondents.
DSRAFOLL
       Program BLD005 reads 160 complete responses.
              BLD007  requires that location specific responses for bulbs
              referred to in survey have a disposition response.  Result is
              151 respondents.
XENERGY
       Program BLD006C requires that XENERGY survey file ANAL1.REF1215C
              records reflect rebated bulb purchase and SCE customer
              status.   Result is 167 respondents from  voluminous survey
              file covering several programs.
DSRA9702
       Program  BLD007 reads DSRA file FINLRESP(n=530), requires customer
              acknowledge ever having CFLs in some location.  Result is
              X9702 with 1147 location records and 519 underlying
              respondent ids.  BLD007 produces X9702A location file from
              X9702, requiring that program bulbs be in use or have been in
              use at some point in time,  reducing to 481 unique customers.
              BLD007 then decrements X9702A into X9702B
              for bulbs covered in DSRAFOLL,  reducing extant unique
              customers to 477 due to four customers having no bulbs left
              in any location after decrement from DSRAFOLL.
```

Figure 1 is an overall data development flowchart, applying to all but some auxiliary activities described in the next section.

Appendix B:

Survey Dispositions:
1999 Surveys

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------- DSRAFOLL FREQUENCIES ----------

S900. Disposition, SCE codes

R31	Frequency	Percent	Cumulative Frequency	Cumulative Percent
NO ANSWER	96	21.4	96	21.4
BUSY	5	1.1	101	22.5
ANSWERING MACHINE	19	4.2	120	26.8
DISCONNECTED PHONE/NOT IN SERVICE	47	10.5	167	37.3
WRONG NUMBER	6	1.3	173	38.6
NO SUCH PERSON	15	3.3	188	42.0
RESPONDENT NOT AVAILABLE FOR STUDY DURATION	39	8.7	227	50.7
BUSINESS/GOVERNMENT PHONE	9	2.0	236	52.7
INITIAL REFUSAL	23	5.1	259	57.8
COMPUTER TONE	2	0.4	261	58.3
LANGUAGE BARRIER/SPANISH	3	0.7	264	58.9
LANGUAGE BARRIER/OTHER	5	1.1	269	60.0
CALLBACK	7	1.6	276	61.6
MID-INTERVIEW TERMINATE	3	0.7	279	62.3
SCE EMPLOYEE	1	0.2	280	62.5
NOT A RESIDENCE	8	1.8	288	64.3
COMPLETE	160	35.7	448	100.0

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---- LUTHGENP --------

S900. Disposition, SCE codes

Cumulative

Cumulative

R30	Frequency	Percent	Frequency	Percent
NO ANSWER	143	14.9	143	14.9
BUSY	33	3.4	176	18.4
ANSWERING MACHINE	18	1.9	194	20.3
DISCONNECTED PHONE/NOT IN SERVICE	228	23.8	422	44.1
WRONG NUMBER	28	2.9	450	47.0
NO SUCH PERSON	54	5.6	504	52.7
RESPONDENT NOT AVAILABLE FOR STUDY DURATION	71	7.4	575	60.1
RESPONDENT UNDER 18	4	0.4	579	60.5
BUSINESS/GOVERNMENT PHONE	28	2.9	607	63.4
INITIAL REFUSAL	21	2.2	628	65.6
COMPUTER TONE	23	2.4	651	68.0
LANGUAGE BARRIER/SPANISH	12	1.3	663	69.3
LANGUAGE BARRIER/OTHER	7	0.7	670	70.0
CALLBACK	2	0.2	672	70.2
MID-INTERVIEW TERMINATE	4	0.4	676	70.6
SCE EMPLOYEE	1	0.1	677	70.7
NOT A RESIDENCE	29	3.0	706	73.8
COMPLETE	251	26.2	957	100.0

------DSRANONC -------

S900. Disposition, SCE codes

R30	Frequency	Percent	Cumulative Frequency	Cumulative Percent
NO ANSWER	127	36.7	127	36.7
BUSY	5	1.4	132	38.2
ANSWERING MACHINE	13	3.8	145	41.9
DISCONNECTED PHONE/NOT IN SERVICE	54	15.6	199	57.5
WRONG NUMBER	15	4.3	214	61.8
NO SUCH PERSON	27	7.8	241	69.7
RESPONDENT NOT AVAILABLE FOR STUDY DURATION	11	3.2	252	72.8
RESPONDENT UNDER 18	1	0.3	253	73.1
BUSINESS/GOVERNMENT PHONE	6	1.7	259	74.9
INITIAL REFUSAL	6	1.7	265	76.6
COMPUTER TONE	11	3.2	276	79.8
LANGUAGE BARRIER/SPANISH	1	0.3	277	80.1
LANGUAGE BARRIER/OTHER	3	0.9	280	80.9
CALLBACK	1	0.3	281	81.2
NOT A RESIDENCE	3	0.9	284	82.1
COMPLETE	62	17.9	346	100.0

Appendix C:

Copies of Survey Instruments

Instrument for Luth 1999
GENPOP and DSRANONC Surveys.

```
T THE SAMPLE NAME, IF ANY IS \:CNAM:
T THE CALLBACK NAME IS:   \:CBNAME:
T 50. Hello,  I'm  ____ calling from Luth Research, on behalf of
T Southern California Edison, the electric company.
T We are assisting Edison in a study of compact fluorescent light bulbs.
T In 1995, Edison received a postcard from this address indicating that
T you had purchased one or more compact fluorescent bulbs for your home.
T We are calling to ask you about your experience with these bulbs, and
T to find if the bulbs are still providing satisfactory service.
T 50 I understand that this is a residence?
R     1                            NO not residence
R     2                            Yes continue
R     X                            Dispose of call


T Q101  May I speak to \:cnam: or another person who would know about
T this purchase?
R     1                            Correct person
R     2                            Correct person called to line
R     3                            Refused
R     4                            Not home, unavailable
R     5                            No such person at this address/phone number
R     6                            Language problem


T Q111 Thanks, may I call back later?
R     1                            Yes
R     2                            No


T Q300 Do you recall putting in one or more  rebated bulb(s) in the
T \b\:r1:\e in late 1994 or early 1995?
R     1                            Yes
R     2                            No
R     3                            Not sure
R     4                            Installed after May 1995


T Q302  Thinking about this particular rebated bulb ..
T Is it currently in use in this location?
R     1                            Yes
R     2                            No
R     3                            Not sure
R     4                            Other response


T Q303  Was it damaged or stolen, removed because of poor service,
T or did it simply burn out?
R     1                            Damaged
R     2                            Stolen
R     3                            Removed, poor service
R     4                            Simply burned out
R     5                            Moved to a new location at the home
R     6                            Don't know
R     7                            Other response
R     8                            No answer


T INTERVIEWER:
```

```
T ENTER THE YEAR \bAND\e THE SEASON! (WINTER,SPRING,SUMMER,FALL)
T PROBE FOR BEST ESTIMATE
T YOU CAN ACCEPT A RANGE FOR THE YEAR, BUT PROBE FOR EXACT YEAR!!


T Q305  Was this rebated bulb  replaced?
R     1                            Yes
R     2                            No
R     3                            Not sure
R     4                            Other response
R     5                            NO answer


T Q306  Did you replace it with another compact fluorescent or
T another type of bulb, like an incandescent?
R     1                            Replaced it with CFL, including a rebated...
R     2                            Replaced with an incandescent bulb?
R     3                            Replaced with other type of bulb
R     4                            Replaced, don't know type
R     5                            Other response
R     6                            No answer

T Q307  Just two more quick questions about the rebated bulb in question.
T Was/is the bulb installed in a moveable lamp or a fixture attached
T to the dwelling?
R     1                            Moveable lamp
R     2                            Attached fixture
R     3                            Other response
R     4                            No answer

T Q308 Approximately how many hours per day would you say that this
T lamp or fixture is switched on (burning, in use).
T INTERVIEWER: ENTER NUMBER OF HOURS
T 0 = LESS THAN 1 HOUR
T DK = DON'T KNOW
T OR = OTHER RESPONSE


T Q300 Do you recall putting in one or more  rebated bulb(s) in the
T \b\:r2:\e in late 1994 or early 1995?
R     1                            Yes
R     2                            No
R     3                            Not sure
R     4                            Installed after May 1995


T Q302  Thinking about this particular rebated bulb ..
T Is it currently in use in this location?
R     1                            Yes
R     2                            No
R     3                            Not sure
R     4                            Other response


T Q303  Was it damaged or stolen, removed because of poor service,
T or did it simply burn out?
R     1                            Damaged
R     2                            Stolen
R     3                            Removed, poor service
R     4                            Simply burned out
R     5                            Moved to a new location at the home
```

```
R     6                           Don't know
R     7                           Other response
R     8                           No answer


T INTERVIEWER:
T ENTER THE YEAR \bAND\e THE SEASON! (WINTER,SPRING,SUMMER,FALL)
T PROBE FOR BEST ESTIMATE
T YOU CAN ACCEPT A RANGE FOR THE YEAR, BUT PROBE FOR EXACT YEAR!!


T Q305  Was this rebated bulb  replaced?
R     1                           Yes
R     2                           No
R     3                           Not sure
R     4                           Other response
R     5                           NO answer


T Q306  Did you replace it with another compact fluorescent or
T another type of bulb, like an incandescent?
R     1                           Replaced it with CFL, including a rebated...
R     2                           Replaced with an incandescent bulb?
R     3                           Replaced with other type of bulb
R     4                           Replaced, don't know type
R     5                           Other response
R     6                           No answer


T Q307  Just two more quick questions about the rebated bulb in question.
T Was/is the bulb installed in a moveable lamp or a fixture attached
T to the dwelling?
R     1                           Moveable lamp
R     2                           Attached fixture
R     3                           Other response
R     4                           No answer


T Q308 Approximately how many hours per day would you say that this
T lamp or fixture is switched on (burning, in use).
T INTERVIEWER: ENTER NUMBER OF HOURS
T 0 = LESS THAN 1 HOUR
T DK = DON'T KNOW
T OR = OTHER RESPONSE


T Q300 Do you recall putting in one or more  rebated bulb(s) in the
T \b\:r3:\e in late 1994 or early 1995?
R     1                           Yes
R     2                           No
R     3                           Not sure
R     4                           Installed after May 1995


T Q302  Thinking about this particular rebated bulb ..
T Is it currently in use in this location?
R     1                           Yes
R     2                           No
R     3                           Not sure
R     4                           Other response
```

```
T Q303  Was it damaged or stolen, removed because of poor service,
T or did it simply burn out?
R     1                             Damaged
R     2                             Stolen
R     3                             Removed, poor service
R     4                             Simply burned out
R     5                             Moved to a new location at the home
R     6                             Don't know
R     7                             Other response
R     8                             No answer


T INTERVIEWER:
T ENTER THE YEAR \bAND\e THE SEASON! (WINTER,SPRING,SUMMER,FALL)
T PROBE FOR BEST ESTIMATE
T YOU CAN ACCEPT A RANGE FOR THE YEAR, BUT PROBE FOR EXACT YEAR!!


T Q305  Was this rebated bulb  replaced?
R     1                             Yes
R     2                             No
R     3                             Not sure
R     4                             Other response
R     5                             NO answer


T Q306  Did you replace it with another compact fluorescent or
T another type of bulb, like an incandescent?
R     1                             Replaced it with CFL, including a rebated...
R     2                             Replaced with an incandescent bulb?
R     3                             Replaced with other type of bulb
R     4                             Replaced, don't know type
R     5                             Other response
R     6                             No answer


T Q307  Just two more quick questions about the rebated bulb in question.
T Was/is the bulb installed in a moveable lamp or a fixture attached
T to the dwelling?
R     1                             Moveable lamp
R     2                             Attached fixture
R     3                             Other response
R     4                             No answer


T Q308 Approximately how many hours per day would you say that this
T lamp or fixture is switched on (burning, in use).
T INTERVIEWER: ENTER NUMBER OF HOURS
T 0 = LESS THAN 1 HOUR
T DK = DON'T KNOW
T OR = OTHER RESPONSE


T Q602  Is the home where these bulbs were installed owner-occupied or rented?
R     1                             Owner occupied
R     2                             Rented
R     3                             Don't know/unsure
R     4                             Other response
```

```
T Q603  Would you describe the home as ..
R     1                            Single family detached
R     2                            A duplex,triplex, or fourplex
R     3                            An apartment or condominium with more tha...
R     4                            Mobile home
R     5                            Other
R     6                            Don't know/unsure


T Q960  Spoke to person of record  \:cnam:
R     1                            Yes
R     2                            No

T May I please have your name for validation purposes?


T S900.  Thank you very much for your time.   Goodbye.
R    01                            NO ANSWER
R    02                            BUSY
R    03                            ANSWERING MACHINE
R    04                            DISCONNECTED PHONE/NOT IN SERVICE
R    05                            WRONG NUMBER
R    06                            NO SUCH PERSON
R    07                            RESPONDENT NOT AVAILABLE FOR STUDY DURATION
R    08                            RESPONDENT UNDER 18
R    09                            BUSINESS/GOVERNMENT PHONE
R    11                            INITIAL REFUSAL
R    12                            COMPUTER TONE
R    13                            LANGUAGE BARRIER/SPANISH
R    14                            LANGUAGE BARRIER/OTHER
R    15                            CALLBACK
R    16                            MID-INTERVIEW TERMINATE
R    17                            SCE EMPLOYEE
R    19                            NOT A RESIDENCE
R    20                            COMPLETE
```

Instrument for Luth 1999
DSRAFOLL Survey.

```
T THE SAMPLE NAME, IF ANY IS \:CNAM:
T THE CALLBACK NAME IS:   \:CBNAME:
T Hello,  I'm  ____ calling from Luth Research, on behalf of
T Southern California Edison, the electric company. We are assisting
T Edison in a study of compact fluorescent light bulbs. In 1997, an
T Edison contractor called you and learned that some bulbs that you
T purchased in late 1994 or early 1995 as part of a rebate program
T that Edison funds, had survived until that point - we're calling
T back to briefly check on how these bulbs are doing at your residence.
T We just have a few questions, and your confidential answers will
T be very helpful in this study of the performance of energy efficient
T lighting.
T 50    I understand that this is a residence?
R     1                             NO not residence
R     2                             Yes continue
R     X                             Dispose of call


T Q101  May I speak to \:cnam: or another person who would know about
T a CFB purchase?
R     1                             Correct person
R     2                             Correct person called to line
R     3                             Refused
R     4                             Not home, unavailable
R     5                             No such person at this address/phone number
R     6                             Language problem

T Q111 Thanks, may I call back later?
R     1                             Yes
R     2                             No

T INTERVIEWER:
T ENTER THE YEAR \bAND\e THE SEASON! (WINTER,SPRING,SUMMER,FALL)
T PROBE FOR BEST ESTIMATE
T YOU CAN ACCEPT A RANGE FOR THE YEAR, BUT PROBE FOR EXACT YEAR!!

T Q303 One final question about the rebated bulb(s) that were removed,damaged,
T or burned out according to the 1997 survey:
T How many were in moveable lamps or other moveable fixtures not attached
T to the dwelling?
R     1                             Moveable lamp - number
R     2                             Other response
R     3                             No answer

T INTERVIEWER:  ENTER NUMBER OF MOVEABLE LAMPS  PROBE FOT BEST ESTIMATE.
T DON'T KNOW = DK

T Q353  Thinking about this particular rebated bulb ..
T Is it currently in use in this location?
R     1                             Yes
R     2                             No
R     3                             Not sure
R     4                             Other response

T Q354  Was it damaged or stolen, removed because of poor service,
T or did it simply burn out?
R     1                             Damaged
R     2                             Stolen
R     3                             Removed, poor service
R     4                             Simply burned out
```

```
R     5                             Moved to a new location at the home
R     6                             Don't know
R     7                             Other response
R     8                             No answer

T Q354.5 Please try to remember when this particular rebated bulb stopped
T working -- the month and season of the year if you are able to
T estimate it.
T (If hesitant) we're looking for the best that you can recall so that
T we can learn more about how well these energy conserving bulbs survive
T out there in the real world.
T INTERVIEWER:
T ENTER THE YEAR \bAND\e THE SEASON! (WINTER,SPRING,SUMMER,FALL)
T PROBE FOR BEST ESTIMATE
T YOU CAN ACCEPT A RANGE FOR THE YEAR, BUT PROBE FOR EXACT YEAR!!

T Q355  Was it replaced?
R     1                             Yes
R     2                             No
R     3                             Not sure
R     4                             Other response
R     5                             NO answer

T Q356  Did you replace it with another compact fluorescent or
T another type of bulb, like an incandescent?
R     1                             Replaced it with CFL, including a rebated...
R     2                             Replaced with an incandescent bulb?
R     3                             Replaced with other type of bulb
R     4                             Replaced, don't know type
R     5                             Other response
R     6                             No answer

T What other type of bulb was that?

T Q357 Another question about the rebated bulb. Was/is the bulb installed
T in a moveable lamp or a fixture attached to the dwelling?
R     1                             Moveable lamp
R     2                             Attached fixture
R     3                             Other response
R     4                             No answer

T Q358 One last question about the rebated bulb. Approximately how many
T hours per day would you say this fixture or lamp is switched on
T (burning, in use).
T INTERVIEWER: ENTER NUMBER OF HOURS
T 0 = LESS THAN 1 HOUR
T DK = DON'T KNOW
T OR = OTHER RESPONSE

T INTERVIEWER:
T ENTER THE YEAR \bAND\e THE SEASON! (WINTER,SPRING,SUMMER,FALL)
T PROBE FOR BEST ESTIMATE
T YOU CAN ACCEPT A RANGE FOR THE YEAR, BUT PROBE FOR EXACT YEAR!!

T Q303 One final question about the rebated bulb(s) that were removed,damaged,
T or burned out according to the 1997 survey:
T How many were in moveable lamps or other moveable fixtures not attached
T to the dwelling?
R     1                             Moveable lamp - number
R     2                             Other response
R     3                             No answer
```

```
T INTERVIEWER:  ENTER NUMBER OF MOVEABLE LAMPS  PROBE FOT BEST ESTIMATE.
T DON'T KNOW = DK

T Q353  Thinking about this particular rebated bulb ..
T Is it currently in use in this location?
R     1                            Yes
R     2                            No
R     3                            Not sure
R     4                            Other response

T Q354  Was it damaged or stolen, removed because of poor service,
T or did it simply burn out?
R     1                            Damaged
R     2                            Stolen
R     3                            Removed, poor service
R     4                            Simply burned out
R     5                            Moved to a new location at the home
R     6                            Don't know
R     7                            Other response
R     8                            No answer

T Q354.5 Please try to remember when this particular rebated bulb stopped
T working -- the month and season of the year if you are able to
T estimate it.
T (If hesitant) we're looking for the best that you can recall so that
T we can learn more about how well these energy conserving bulbs survive
T out there in the real world.
T INTERVIEWER:
T ENTER THE YEAR \bAND\e THE SEASON! (WINTER,SPRING,SUMMER,FALL)
T PROBE FOR BEST ESTIMATE
T YOU CAN ACCEPT A RANGE FOR THE YEAR, BUT PROBE FOR EXACT YEAR!!

T Q355  Was it replaced?
R     1                            Yes
R     2                            No
R     3                            Not sure
R     4                            Other response
R     5                            NO answer

T Q356  Did you replace it with another compact fluorescent or
T another type of bulb, like an incandescent?
R     1                            Replaced it with CFL, including a rebated...
R     2                            Replaced with an incandescent bulb?
R     3                            Replaced with other type of bulb
R     4                            Replaced, don't know type
R     5                            Other response
R     6                            No answer

T What other type of bulb was that?

T Q357 Another question about the rebated bulb. Was/is the bulb installed
T in a moveable lamp or a fixture attached to the dwelling?
R     1                            Moveable lamp
R     2                            Attached fixture
R     3                            Other response
R     4                            No answer

T Q358 One last question about the rebated bulb. Approximately how many
T hours per day would you say this fixture or lamp is switched on
T (burning, in use).
```

```
T INTERVIEWER: ENTER NUMBER OF HOURS
T 0 = LESS THAN 1 HOUR
T DK = DON'T KNOW
T OR = OTHER RESPONSE

T INTERVIEWER:
T ENTER THE YEAR \bAND\e THE SEASON! (WINTER,SPRING,SUMMER,FALL)
T PROBE FOR BEST ESTIMATE
T YOU CAN ACCEPT A RANGE FOR THE YEAR, BUT PROBE FOR EXACT YEAR!!

T Q303 One final question about the rebated bulb(s) that were removed,damaged,
T or burned out according to the 1997 survey:
T How many were in moveable lamps or other moveable fixtures not attached
T to the dwelling?
R     1                            Moveable lamp - number
R     2                            Other response
R     3                            No answer

T INTERVIEWER:  ENTER NUMBER OF MOVEABLE LAMPS  PROBE FOT BEST ESTIMATE.
T DON'T KNOW = DK

T Q353  Thinking about this particular rebated bulb ..
T Is it currently in use in this location?
R     1                            Yes
R     2                            No
R     3                            Not sure
R     4                            Other response

T Q354  Was it damaged or stolen, removed because of poor service,
T or did it simply burn out?
R     1                            Damaged
R     2                            Stolen
R     3                            Removed, poor service
R     4                            Simply burned out
R     5                            Moved to a new location at the home
R     6                            Don't know
R     7                            Other response
R     8                            No answer

T Q354.5 Please try to remember when this particular rebated bulb stopped
T working -- the month and season of the year if you are able to
T estimate it.
T (If hesitant) we're looking for the best that you can recall so that
T we can learn more about how well these energy conserving bulbs survive
T out there in the real world.
T INTERVIEWER:
T ENTER THE YEAR \bAND\e THE SEASON! (WINTER,SPRING,SUMMER,FALL)
T PROBE FOR BEST ESTIMATE
T YOU CAN ACCEPT A RANGE FOR THE YEAR, BUT PROBE FOR EXACT YEAR!!

T Q355  Was it replaced?
R     1                            Yes
R     2                            No
R     3                            Not sure
R     4                            Other response
R     5                            NO answer

T Q356  Did you replace it with another compact fluorescent or
T another type of bulb, like an incandescent?
R     1                            Replaced it with CFL, including a rebated...
R     2                            Replaced with an incandescent bulb?
```

```
R     3                             Replaced with other type of bulb
R     4                             Replaced, don't know type
R     5                             Other response
R     6                             No answer

T What other type of bulb was that?

T Q357 Another question about the rebated bulb. Was/is the bulb installed
T in a moveable lamp or a fixture attached to the dwelling?
R     1                             Moveable lamp
R     2                             Attached fixture
R     3                             Other response
R     4                             No answer

T Q358 One last question about the rebated bulb. Approximately how many
T hours per day would you say this fixture or lamp is switched on
T (burning, in use).
T INTERVIEWER: ENTER NUMBER OF HOURS
T 0 = LESS THAN 1 HOUR
T DK = DON'T KNOW
T OR = OTHER RESPONSE

T 602  Just two more questions about your home, if I may.
T Is the home where these bulbs were installed owner-occupied or rented?
R     1                             Owner occupied
R     2                             Rented
R     3                             Don't know/unsure
R     4                             Other response

T Q603  Would you describe the home as ..
R     1                             Single family detached
R     2                             A duplex,triplex, or fourplex
R     3                             An apartment or condominium with more tha...
R     4                             Mobile home
R     6                             Don't know/unsure
R     7                             Other response

T S900.  Thank you very much for your time.   Goodbye.
R    01                             NO ANSWER
R    02                             BUSY
R    03                             ANSWERING MACHINE
R    04                             DISCONNECTED PHONE/NOT IN SERVICE
R    05                             WRONG NUMBER
R    06                             NO SUCH PERSON
R    07                             RESPONDENT NOT AVAILABLE FOR STUDY DURATION
R    08                             RESPONDENT UNDER 18
R    09                             BUSINESS/GOVERNMENT PHONE
R    11                             INITIAL REFUSAL
R    12                             COMPUTER TONE
R    13                             LANGUAGE BARRIER/SPANISH
R    14                             LANGUAGE BARRIER/OTHER
R    15                             CALLBACK
R    16                             MID-INTERVIEW TERMINATE
R    17                             SCE EMPLOYEE
R    19                             NOT A RESIDENCE
R    20                             COMPLETE
```

R= Resp OldPunch New Code Text

Appendix D:

Final Model Run and Auxiliary/ Followup Data

Final Phase 2 Run ANAL0101.

```
1anal0101 - phase 2 analysis over all data, adding dsra9702/xen                                        00:08 Monday, March
22, 1999   1
 ------------------------------------------------------------
 --rundesc= Phase 2 modeling (drop sfdet to end modeling) , model ggam2e ---
 --(dist type= gamma )
-
 WEIGHT USED= bulbs * wsamp
0OUTDATASETS PREFIXED AS  ggam2e
0MODEL TYPE =  gamma
0COVARIATES ARE  dsrafoll dsranonc luthgen dsra9702                                               outside loghrs hrsdayp
0DOING DESCRIPTIVE STATS FIRST?  NO


1anal0101 - phase 2 analysis over all data, adding dsra9702/xen                                        00:08 Monday, March
22, 1999   2
 ------------------------------------------------------------
 --rundesc= Phase 2 modeling (drop sfdet to end modeling) , model ggam2e ---
 ----------- model results --------------

 Lifereg  Procedure

 Data Set          =WORK.INPUT
 Dependent Variable=Log(LO2MO)    Low months,iterval censoring
 Dependent Variable=Log(UP2MO)    Upper months, intvl censoring
 Weight Variable   =WT    Casewt: bulbs * wsamp
 Noncensored Values=    99  Right Censored Values=   1482
 Left Censored Values=   0  Interval Censored Values= 218
 Observations with Missing Values=  12


 Log Likelihood for GAMMA  -1357.91068
```

```
 -------------------------------------------------------------
 --rundesc= Phase 2 modeling (drop sfdet to end modeling) , model ggam2e ---
 ----------- model results --------------

 Lifereg  Procedure

 Variable  DF   Estimate  Std Err ChiSquare  Pr>Chi Label/Value

 INTERCPT   1  5.6638482 0.271305  435.8207  0.0001 Intercept
 DSRAFOLL   1 -0.7102345  0.27694  6.577056  0.0103 Dummy for DSRA followup sample
 DSRANONC   1 0.68820552 0.288846  5.676808  0.0172 Dummy for DSRA re-try sample
 LUTHGEN    1  0.1427644 0.154842  0.850089  0.3565 Dummy for LUTH general pop sample
 DSRA9702   1 -0.6435428 0.270594  5.656126  0.0174
 OUTSIDE    1 -0.0768778 0.081399  0.892006  0.3449 Dummy for outside locn
 LOGHRS     1   -0.23418 0.049373  22.49706  0.0001 Log(hrs/day + .5)
 HRSDAYP    1 -0.7913617 0.238889  10.97386  0.0009 Var  hrsday1   mean-plugged
 SCALE      0    0.43199        0                   Gamma scale parameter
 SHAPE      0    1.81341        0                   Gamma shape parameter
 Lagrange Multiplier ChiSquare for Scale 0.772482 Pr>Chi is 0.3795.

 Lagrange Multiplier ChiSquare for Shape1 0.541083 Pr>Chi is 0.4620.



 Estimated Correlation Matrix

                     INTERCPT          DSRAFOLL          DSRANONC           LUTHGEN          DSRA9702

    INTERCPT         1.000000         -0.936189         -0.212589         -0.532554         -0.945561
    DSRAFOLL        -0.936189          1.000000          0.208581          0.523590          0.950315
    DSRANONC        -0.212589          0.208581          1.000000          0.336584          0.213809
     LUTHGEN        -0.532554          0.523590          0.336584          1.000000          0.535723
    DSRA9702        -0.945561          0.950315          0.213809          0.535723          1.000000
     OUTSIDE         0.052641         -0.011189         -0.031622         -0.038595         -0.015975
      LOGHRS        -0.184453         -0.047927          0.006357          0.001891         -0.090987
     HRSDAYP        -0.849320          0.857980          0.028453          0.209148          0.878679
       SCALE                0                 0                 0                 0                 0
       SHAPE                0                 0                 0                 0                 0

                      OUTSIDE            LOGHRS           HRSDAYP             SCALE             SHAPE

    INTERCPT         0.052641         -0.184453         -0.849320                 0                 0
    DSRAFOLL        -0.011189         -0.047927          0.857980                 0                 0
```

DSRANONC	-0.031622	0.006357	0.028453	0	0
LUTHGEN	-0.038595	0.001891	0.209148	0	0
DSRA9702	-0.015975	-0.090987	0.878679	0	0
OUTSIDE	1.000000	-0.400355	-0.010179	0	0
LOGHRS	-0.400355	1.000000	-0.100082	0	0
HRSDAYP	-0.010179	-0.100082	1.000000	0	0
SCALE	0	0	0	0	0
SHAPE	0	0	0	0	0

--rundesc= Phase 2 modeling (drop sfdet to end modeling) , model ggam2e ---

-------- estimates, selected covariate levels ----------

CNTLNAME	QUANTILE	PTIME	LOWER80	UPPER80	LOWER90	UPPER90	STDE
DSRAFOLL	0.1000	19.77	18.00	21.72	17.53	22.30	0.07
DSRAFOLL	0.2500	40.59	36.95	44.58	35.99	45.78	0.07
DSRAFOLL	0.5000	70.73	64.39	77.69	62.71	79.77	0.07
DSRAFOLL	0.7500	101.8	92.68	111.8	90.27	114.8	0.07
DSRAFOLL	0.9000	127.4	116.0	139.9	112.9	143.7	0.07
DSRANONC	0.1000	80.07	51.37	124.8	45.34	141.4	0.35
DSRANONC	0.2500	164.3	105.4	256.1	93.07	290.2	0.35
DSRANONC	0.5000	286.4	183.7	446.3	162.2	505.6	0.35
DSRANONC	0.7500	412.2	264.5	642.4	233.4	727.8	0.35
DSRANONC	0.9000	515.7	330.9	803.8	292.1	910.6	0.35
LUTHGEN	0.1000	46.41	34.92	61.66	32.24	66.80	0.22
LUTHGEN	0.2500	95.25	71.68	126.6	66.17	137.1	0.22
LUTHGEN	0.5000	166.0	124.9	220.5	115.3	238.9	0.22
LUTHGEN	0.7500	238.9	179.8	317.5	166.0	343.9	0.22
LUTHGEN	0.9000	298.9	224.9	397.2	207.6	430.2	0.22
XENERGY	0.1000	40.23	28.67	56.46	26.06	62.10	0.26
XENERGY	0.2500	82.58	58.84	115.9	53.49	127.5	0.26
XENERGY	0.5000	143.9	102.5	201.9	93.21	222.1	0.26
XENERGY	0.7500	207.1	147.6	290.7	134.2	319.7	0.26
XENERGY	0.9000	259.1	184.6	363.7	167.9	400.0	0.26
DSRA9702	0.1000	21.14	19.94	22.41	19.61	22.79	0.05
DSRA9702	0.2500	43.39	40.92	46.00	40.25	46.77	0.05
DSRA9702	0.5000	75.60	71.30	80.16	70.14	81.49	0.05
DSRA9702	0.7500	108.8	102.6	115.4	101.0	117.3	0.05
DSRA9702	0.9000	136.2	128.4	144.4	126.3	146.8	0.05
OUTSIDE	0.1000	19.89	18.01	21.97	17.52	22.60	0.08
OUTSIDE	0.2500	40.83	36.97	45.10	35.95	46.38	0.08
OUTSIDE	0.5000	71.15	64.42	78.59	62.65	80.82	0.08
OUTSIDE	0.7500	102.4	92.73	113.1	90.18	116.3	0.08
OUTSIDE	0.9000	128.1	116.0	141.5	112.8	145.5	0.08
INSIDE	0.1000	21.48	20.17	22.89	19.81	23.30	0.05
INSIDE	0.2500	44.10	41.40	46.97	40.67	47.82	0.05
INSIDE	0.5000	76.84	72.13	81.85	70.86	83.32	0.05
INSIDE	0.7500	110.6	103.8	117.8	102.0	119.9	0.05
INSIDE	0.9000	138.4	129.9	147.4	127.6	150.1	0.05
MANUAL	0.1000	21.14	19.94	22.41	19.61	22.79	0.05
MANUAL	0.2500	43.39	40.92	46.00	40.25	46.77	0.05
MANUAL	0.5000	75.60	71.30	80.16	70.14	81.49	0.05

MANUAL	0.7500	108.8	102.6	115.4	101.0	117.3	0.05
MANUAL	0.9000	136.2	128.4	144.4	126.3	146.8	0.05
NONMAN	0.1000	21.14	19.94	22.41	19.61	22.79	0.05
NONMAN	0.2500	43.39	40.92	46.00	40.25	46.77	0.05
NONMAN	0.5000	75.60	71.30	80.16	70.14	81.49	0.05
NONMAN	0.7500	108.8	102.6	115.4	101.0	117.3	0.05
NONMAN	0.9000	136.2	128.4	144.4	126.3	146.8	0.05
HRS=1	0.1000	26.97	24.47	29.73	23.80	30.56	0.08
HRS=1	0.2500	55.36	50.22	61.03	48.86	62.73	0.08

--rundesc= Phase 2 modeling (drop sfdet to end modeling) , model ggam2e ---
-------- estimates, selected covariate levels ----------

CNTLNAME	QUANTILE	PTIME	LOWER80	UPPER80	LOWER90	UPPER90	STDE
HRS=1	0.5000	96.47	87.50	106.3	85.14	109.3	0.08
HRS=1	0.7500	138.9	126.0	153.1	122.5	157.3	0.08
HRS=1	0.9000	173.7	157.6	191.5	153.3	196.8	0.08
HRS=10	0.1000	17.10	15.91	18.38	15.59	18.75	0.06
HRS=10	0.2500	35.10	32.66	37.72	32.01	38.49	0.06
HRS=10	0.5000	61.16	56.91	65.72	55.77	67.06	0.06
HRS=10	0.7500	88.04	81.92	94.60	80.28	96.54	0.06
HRS=10	0.9000	110.1	102.5	118.4	100.4	120.8	0.06
HRS=20	0.1000	14.62	13.19	16.21	12.81	16.69	0.08
HRS=20	0.2500	30.01	27.06	33.27	26.29	34.26	0.08
HRS=20	0.5000	52.29	47.16	57.98	45.81	59.69	0.08
HRS=20	0.7500	75.27	67.88	83.46	65.94	85.92	0.08
HRS=20	0.9000	94.17	84.93	104.4	82.49	107.5	0.08

```
 -----------------------------------------------------------
 --rundesc= Phase 2 modeling (drop sfdet to end modeling) , model ggam2e ---
 -------- Plotting Cox-Snell Residuals ------------
 ------------ (Via LIFETEST) ---------------------

 The LIFETEST Procedure

 Summary of the Number of Censored and Uncensored Values

     Total     Failed   Censored  %Censored

      1799        317       1482    82.3791

 NOTE: There were 12 observations with missing values, negative time values or frequency values less than 1.
```

```
1anal0101 - phase 2 analysis over all data, adding dsra9702/xen                                      00:08 Monday, March
22, 1999  13
 ------------------------------------------------------------
 --rundesc= Phase 2 modeling (drop sfdet to end modeling) , model ggam2e ---
 ---- Estimated Survival Probabilities - Plotted -----

                                             Plot of P_SURV*MONTHS.  Symbol used is 's'.

   1.0 +  ss
       |       s
       |            s
       |                 s
   0.9 +
       |                      s
       |                           s
       |
   0.8 +                                s
       |
       |                                     s
       |                                          s
 P 0.7 +
       |                                               s
 s     |
 u     |                                                    s
 r 0.6 +
 v     |                                                         s
 i     |
 v     |                                                              s
 a 0.5 +
 l     |                                                                   s
       |
 (     |                                                                        s
 S 0.4 +
 D     |                                                                             s
 F     |                                                                                  s
 )     |
   0.3 +                                                                                       s
       |
       |                                                                                            s
       |                                                                                                 s
   0.2 +
       |                                                                                                      s
       |                                                                                                           s
       |                                                                                                                s
   0.1 +
s
       |
s
```

```
           |
           |
       0.0 +
           ---+---------+---------+---------+---------+---------+---------+---------+---------+---------+---------+---------+--
-------+--
              0        12        24        36        48        60        72        84        96       108       120       132
144

                                                    Months from installation
```

Appendix E1:

Phase 1 “final competitor” models (including diagnostics and followups)

Phase 1 End Models
ANAL0051, 52, 55.

```
 ------------------------------------------------------------
 ------ bulb weighted statuses and times, overall  ------
 ----------- model results --------------

 Lifereg  Procedure

 Data Set          =WORK.INPUT
 Dependent Variable=Log(LO2MO)    Low months,iterval censoring
 Dependent Variable=Log(UP2MO)    Upper months, intvl censoring
 Weight Variable   =WT    Casewt: bulbs * wsamp
 Noncensored Values=    99  Right Censored Values=    423
 Left Censored Values=   0  Interval Censored Values=  39
 Observations with Missing Values=  12


 Log Likelihood for GAMMA -415.9368858
```

------ bulb weighted statuses and times, overall ------
----------- model results --------------

Lifereg Procedure

Variable	DF	Estimate	Std Err	ChiSquare	Pr>Chi	Label/Value
INTERCPT	1	4.99772174	0.208868	572.53	0.0001	Intercept
DSRAFOLL	1	-0.0904284	0.136684	0.437701	0.5082	Dummy for DSRA followup sample
DSRANONC	1	0.26690671	0.291906	0.836054	0.3605	Dummy for DSRA re-try sample
OUTSIDE	1	-0.1630067	0.131289	1.541547	0.2144	Dummy for outside locn
LOGHRS	1	-0.3528612	0.07372	22.91079	0.0001	Log(hrs/day + .5)
HRSDAYP	1	0.37443034	0.187668	3.980734	0.0460	Var hrsday1 mean-plugged
SFDET	1	0.28347859	0.146871	3.725342	0.0536	SINGLE FAMILY DETACHED
SFDETP	1	15.3469202	19190.68	6.395E-7	0.9994	Var sfdet1 mean-plugged
SCALE	1	0.43198814	0.175139			Gamma scale parameter
SHAPE	1	1.81341135	0.745172			Gamma shape parameter

Estimated Correlation Matrix

	INTERCPT	DSRAFOLL	DSRANONC	OUTSIDE	LOGHRS
INTERCPT	1.000000	-0.424267	-0.061201	-0.025952	-0.591531
DSRAFOLL	-0.424267	1.000000	0.043274	-0.080501	0.030248
DSRANONC	-0.061201	0.043274	1.000000	-0.023728	0.016203
OUTSIDE	-0.025952	-0.080501	-0.023728	1.000000	-0.029108
LOGHRS	-0.591531	0.030248	0.016203	-0.029108	1.000000
HRSDAYP	-0.146831	0.519386	-0.274832	-0.159939	-0.126442
SFDET	-0.423596	-0.133243	0.081528	-0.149384	-0.073135
SFDETP	0.000027304	6.5815124E-8	0.000002477	-0.000004645	-0.000020846
SCALE	-0.056414	0.051048	0.017121	-0.010147	-0.415096
SHAPE	0.151512	-0.062629	-0.001129	-0.009326	0.339570

	HRSDAYP	SFDET	SFDETP	SCALE	SHAPE

INTERCPT	-0.146831	-0.423596	0.000027304	-0.056414	0.151512
DSRAFOLL	0.519386	-0.133243	6.5815124E-8	0.051048	-0.062629
DSRANONC	-0.274832	0.081528	0.000002477	0.017121	-0.001129
OUTSIDE	-0.159939	-0.149384	-0.000004645	-0.010147	-0.009326
LOGHRS	-0.126442	-0.073135	-0.000020846	-0.415096	0.339570
HRSDAYP	1.000000	-0.115563	0.000012314	0.119134	-0.086285
SFDET	-0.115563	1.000000	0.000006004	0.279427	-0.252141
SFDETP	0.000012314	0.000006004	1.000000	0.000002994	0.000010611
SCALE	0.119134	0.279427	0.000002994	1.000000	-0.978038
SHAPE	-0.086285	-0.252141	0.000010611	-0.978038	1.000000

\---

\------ bulb weighted statuses and times, overall ------

\-------- estimates, selected covariate levels ----------

CNTLNAME	QUANTILE	PTIME	LOWER80	UPPER80	LOWER90	UPPER90	STDE
DSRAFOLL	0.1000	20.20	6.53	62.51	4.75	85.89	0.88
DSRAFOLL	0.2500	41.46	21.97	78.24	18.37	93.54	0.50
DSRAFOLL	0.5000	72.24	51.29	101.7	46.58	112.0	0.27
DSRAFOLL	0.7500	104.0	77.28	139.9	71.09	152.1	0.23
DSRAFOLL	0.9000	130.1	90.22	187.6	81.39	207.9	0.29
DSRANONC	0.1000	28.87	8.87	93.97	6.37	130.9	0.92
DSRANONC	0.2500	59.26	28.51	123.2	23.20	151.4	0.57
DSRANONC	0.5000	103.3	61.99	172.0	53.70	198.6	0.40
DSRANONC	0.7500	148.6	91.51	241.5	79.84	276.8	0.38
DSRANONC	0.9000	186.0	109.4	316.2	94.22	367.1	0.41
LUTHGEN	0.1000	22.11	7.18	68.04	5.24	93.35	0.88
LUTHGEN	0.2500	45.38	24.06	85.61	20.12	102.3	0.50
LUTHGEN	0.5000	79.08	55.57	112.5	50.32	124.3	0.28
LUTHGEN	0.7500	113.8	83.34	155.5	76.35	169.7	0.24
LUTHGEN	0.9000	142.4	97.70	207.6	87.87	230.8	0.29
XENERGY	0.1000	22.11	7.18	68.04	5.24	93.35	0.88
XENERGY	0.2500	45.38	24.06	85.61	20.12	102.3	0.50
XENERGY	0.5000	79.08	55.57	112.5	50.32	124.3	0.28
XENERGY	0.7500	113.8	83.34	155.5	76.35	169.7	0.24
XENERGY	0.9000	142.4	97.70	207.6	87.87	230.8	0.29
DSRA9702	0.1000	22.11	7.18	68.04	5.24	93.35	0.88
DSRA9702	0.2500	45.38	24.06	85.61	20.12	102.3	0.50
DSRA9702	0.5000	79.08	55.57	112.5	50.32	124.3	0.28
DSRA9702	0.7500	113.8	83.34	155.5	76.35	169.7	0.24
DSRA9702	0.9000	142.4	97.70	207.6	87.87	230.8	0.29
OUTSIDE	0.1000	19.44	6.25	60.49	4.54	83.24	0.89
OUTSIDE	0.2500	39.91	20.80	76.56	17.32	91.95	0.51
OUTSIDE	0.5000	69.53	47.59	101.6	42.78	113.0	0.30
OUTSIDE	0.7500	100.1	71.26	140.6	64.77	154.7	0.27
OUTSIDE	0.9000	125.2	83.96	186.8	75.03	209.0	0.31
INSIDE	0.1000	22.88	7.44	70.41	5.42	96.58	0.88
INSIDE	0.2500	46.97	24.89	88.63	20.82	106.0	0.50

INSIDE	0.5000	81.85	57.45	116.6	52.01	128.8	0.28
INSIDE	0.7500	117.8	86.11	161.2	78.85	176.0	0.24
INSIDE	0.9000	147.4	101.0	215.2	90.76	239.4	0.30
MANUAL	0.1000	22.11	7.18	68.04	5.24	93.35	0.88
MANUAL	0.2500	45.38	24.06	85.61	20.12	102.3	0.50
MANUAL	0.5000	79.08	55.57	112.5	50.32	124.3	0.28
MANUAL	0.7500	113.8	83.34	155.5	76.35	169.7	0.24
MANUAL	0.9000	142.4	97.70	207.6	87.87	230.8	0.29
NONMAN	0.1000	22.11	7.18	68.04	5.24	93.35	0.88
NONMAN	0.2500	45.38	24.06	85.61	20.12	102.3	0.50
NONMAN	0.5000	79.08	55.57	112.5	50.32	124.3	0.28
NONMAN	0.7500	113.8	83.34	155.5	76.35	169.7	0.24
NONMAN	0.9000	142.4	97.70	207.6	87.87	230.8	0.29
HRS=1	0.1000	31.92	10.01	101.7	7.23	141.0	0.91
HRS=1	0.2500	65.51	33.35	128.7	27.58	155.6	0.53

------ bulb weighted statuses and times, overall ------
-------- estimates, selected covariate levels ----------

CNTLNAME	QUANTILE	PTIME	LOWER80	UPPER80	LOWER90	UPPER90	STDE
HRS=1	0.5000	114.2	76.31	170.8	68.13	191.3	0.31
HRS=1	0.7500	164.3	113.9	237.0	102.8	262.8	0.29
HRS=1	0.9000	205.6	133.6	316.3	118.4	357.0	0.34
HRS=10	0.1000	16.06	5.35	48.25	3.92	65.75	0.86
HRS=10	0.2500	32.97	17.91	60.69	15.09	72.06	0.48
HRS=10	0.5000	57.45	41.41	79.72	37.76	87.41	0.26
HRS=10	0.7500	82.70	62.26	109.8	57.48	119.0	0.22
HRS=10	0.9000	103.5	73.19	146.3	66.40	161.2	0.27
HRS=20	0.1000	12.69	4.28	37.58	3.16	51.00	0.85
HRS=20	0.2500	26.04	14.30	47.41	12.08	56.11	0.47
HRS=20	0.5000	45.37	32.87	62.63	30.02	68.58	0.25
HRS=20	0.7500	65.31	49.42	86.31	45.69	93.35	0.22
HRS=20	0.9000	81.71	58.40	114.3	53.13	125.7	0.26

```
 ------------------------------------------------------------
 ------ bulb weighted statuses and times, overall  ------
 -------- Plotting Cox-Snell Residuals ------------
 ------------ (Via LIFETEST) ---------------------

 The LIFETEST Procedure

 -Log(Survival Function) Estimates

   -LOG SDF |
            |
        1.4 +
            |                                                                                                             +A
            |                                                                                                         ++++
            |                                                                                                      +++
            |                                                                                                  ++++
        1.2 +                                                                                               +++
            |                                                                                           ++++
            |                                                                                        +++
            |                                                                                    ++++
 N          |                                                                                 +++
 e      1.0 +                                                                             ++++
 g          |                                                                         ++++
 a          |                                                                      +++
 t          |                                                                  ++++
 i          |                                                               +++
 v      0.8 +                                                           ++++
 e          |                                                        +++
            |                                                    ++++
 L          |                                                  A+
 o          |                                                  +
 g      0.6 +                                                  A
            |                                                 A
 S          |                                           A+++A
 D          |                                          +A
 F          |                                        AA
        0.4 +                                      AA
            |                                    AA
            |                                AAAA
            |                             AAAA
            |                          AA+A
        0.2 +                      AAAAA
            |                    AAA
            |                 AAAA
            |               AAA
            |            A+AA
```

```
          0.0 +           AA
              |
              -----------+------+------+------+------+------+------+------+------+------+------+------+------+------+------+-
----------
                         0.0    0.1    0.2    0.3    0.4    0.5    0.6    0.7    0.8    0.9    1.0    1.1    1.2    1.3    1.4

                                                            Cox-Snell Residuals   E
```

```
1anal0051 -  phase 1 analysis over relatively non-censored data                                      17:40 Sunday, March
21, 1999  23
 ------------------------------------------------------------
 ------ bulb weighted statuses and times, overall  ------
 ---- Estimated Survival Probabilities - Plotted -----

                                             Plot of P_SURV*MONTHS.  Symbol used is 's'.

   1.0 +  ss
       |       s
       |            s
       |                 s
   0.9 +                      s
       |
       |                           s
       |                                s
   0.8 +
       |                                     s
       |
       |                                          s
 P 0.7 +                                               s
       |
 s     |                                                    s
 u     |
 r 0.6 +                                                         s
 v     |
 i     |                                                              s
 v     |
 a 0.5 +                                                                   s
 l     |                                                                        s
       |
 (     |                                                                             s
 S 0.4 +
 D     |                                                                                  s
 F     |
 )     |                                                                                       s
   0.3 +                                                                                            s
       |
       |                                                                                                 s
       |
   0.2 +                                                                                                      s
       |                                                                                                           s
       |                                                                                                                s
       |
s
   0.1 +
s
       |
```

```
      |
      |
  0.0 +
      ---+---------+---------+---------+---------+---------+---------+---------+---------+---------+---------+---------+--
-------+--
         0        12        24        36        48        60        72        84        96       108       120       132
144

                                                  Months from installation
```

```
1anal0052 -  phase 1 analysis over relatively non-censored data                                     17:43 Sunday, March
21, 1999   1
 ------------------------------------------------------------
 --rundesc= Phase 1 modeling , model weib1c ---
 --(dist type= weibull )
-
 WEIGHT USED= bulbs * wsamp
0OUTDATASETS PREFIXED AS  weib1c
0MODEL TYPE =  weibull
0COVARIATES ARE  dsrafoll dsranonc outside loghrs hrsdayp sfdet sfdetp
0DOING DESCRIPTIVE STATS FIRST?  NO


1anal0052 -  phase 1 analysis over relatively non-censored data                                     17:43 Sunday, March
21, 1999   2
 ------------------------------------------------------------
 --rundesc= Phase 1 modeling , model weib1c ---
 ----------- model results --------------

 Lifereg  Procedure

 Data Set          =WORK.INPUT
 Dependent Variable=Log(LO2MO)    Low months,iterval censoring
 Dependent Variable=Log(UP2MO)    Upper months, intvl censoring
 Weight Variable   =WT    Casewt: bulbs * wsamp
 Noncensored Values=    99  Right Censored Values=    423
 Left Censored Values=   0  Interval Censored Values=  39
 Observations with Missing Values=  12


 Log Likelihood for WEIBULL -417.9862059
```

--rundesc= Phase 1 modeling , model weib1c ---

----------- model results --------------

Lifereg Procedure

Variable	DF	Estimate	Std Err	ChiSquare	Pr>Chi	Label/Value
INTERCPT	1	4.95705288	0.222223	497.5886	0.0001	Intercept
DSRAFOLL	1	-0.0544975	0.15392	0.125361	0.7233	Dummy for DSRA followup sample
DSRANONC	1	0.25694429	0.295036	0.758453	0.3838	Dummy for DSRA re-try sample
OUTSIDE	1	-0.1510471	0.146149	1.068158	0.3014	Dummy for outside locn
LOGHRS	1	-0.4033925	0.081	24.80165	0.0001	Log(hrs/day + .5)
HRSDAYP	1	0.42190342	0.199627	4.46672	0.0346	Var hrsday1 mean-plugged
SFDET	1	0.39267977	0.164789	5.678306	0.0172	SINGLE FAMILY DETACHED
SFDETP	1	14.6291937	22210.28	4.338E-7	0.9995	Var sfdet1 mean-plugged
SCALE	1	0.72469277	0.05929			Extreme value scale parameter

Estimated Correlation Matrix

	INTERCPT	DSRAFOLL	DSRANONC	OUTSIDE	LOGHRS
INTERCPT	1.000000	-0.408755	-0.088887	-0.028756	-0.594449
DSRAFOLL	-0.408755	1.000000	0.053921	-0.064032	-0.021128
DSRANONC	-0.088887	0.053921	1.000000	-0.019170	0.020601
OUTSIDE	-0.028756	-0.064032	-0.019170	1.000000	-0.061023
LOGHRS	-0.594449	-0.021128	0.020601	-0.061023	1.000000
HRSDAYP	-0.151393	0.546554	-0.268002	-0.121833	-0.165026
SFDET	-0.443175	-0.114713	0.099735	-0.098339	-0.059936
SFDETP	0.000017877	0.000003133	0.000001137	-0.000001151	-0.000018939
SCALE	0.394230	-0.012813	0.066737	-0.047905	-0.378338

	HRSDAYP	SFDET	SFDETP	SCALE
INTERCPT	-0.151393	-0.443175	0.000017877	0.394230
DSRAFOLL	0.546554	-0.114713	0.000003133	-0.012813

DSRANONC	-0.268002	0.099735	0.000001137	0.066737
OUTSIDE	-0.121833	-0.098339	-0.000001151	-0.047905
LOGHRS	-0.165026	-0.059936	-0.000018939	-0.378338
HRSDAYP	1.000000	-0.116994	0.000011012	0.160528
SFDET	-0.116994	1.000000	0.000007892	0.178316
SFDETP	0.000011012	0.000007892	1.000000	0.000051152
SCALE	0.160528	0.178316	0.000051152	1.000000

--rundesc= Phase 1 modeling , model weib1c ---

-------- estimates, selected covariate levels ----------

CNTLNAME	QUANTILE	PTIME	LOWER80	UPPER80	LOWER90	UPPER90	STDE
DSRAFOLL	0.1000	20.08	17.52	23.01	16.86	23.90	0.11
DSRAFOLL	0.2500	41.57	37.41	46.19	36.32	47.59	0.08
DSRAFOLL	0.5000	78.63	69.81	88.56	67.51	91.57	0.09
DSRAFOLL	0.7500	129.9	111.7	151.1	107.1	157.7	0.12
DSRAFOLL	0.9000	187.7	156.7	224.9	148.9	236.6	0.14
DSRANONC	0.1000	27.41	18.28	41.11	16.31	46.08	0.32
DSRANONC	0.2500	56.76	38.00	84.79	33.94	94.93	0.31
DSRANONC	0.5000	107.4	71.27	161.7	63.51	181.5	0.32
DSRANONC	0.7500	177.4	116.2	271.0	103.1	305.3	0.33
DSRANONC	0.9000	256.3	165.5	396.9	146.3	448.9	0.34
LUTHGEN	0.1000	21.20	17.60	25.53	16.71	26.90	0.15
LUTHGEN	0.2500	43.90	37.19	51.81	35.50	54.29	0.13
LUTHGEN	0.5000	83.03	69.66	98.97	66.30	104.0	0.14
LUTHGEN	0.7500	137.2	112.4	167.5	106.3	177.2	0.16
LUTHGEN	0.9000	198.2	158.5	247.7	148.9	263.8	0.17
XENERGY	0.1000	21.20	17.60	25.53	16.71	26.90	0.15
XENERGY	0.2500	43.90	37.19	51.81	35.50	54.29	0.13
XENERGY	0.5000	83.03	69.66	98.97	66.30	104.0	0.14
XENERGY	0.7500	137.2	112.4	167.5	106.3	177.2	0.16
XENERGY	0.9000	198.2	158.5	247.7	148.9	263.8	0.17
DSRA9702	0.1000	21.20	17.60	25.53	16.71	26.90	0.15
DSRA9702	0.2500	43.90	37.19	51.81	35.50	54.29	0.13
DSRA9702	0.5000	83.03	69.66	98.97	66.30	104.0	0.14
DSRA9702	0.7500	137.2	112.4	167.5	106.3	177.2	0.16
DSRA9702	0.9000	198.2	158.5	247.7	148.9	263.8	0.17
OUTSIDE	0.1000	18.82	14.73	24.04	13.75	25.75	0.19
OUTSIDE	0.2500	38.97	31.04	48.92	29.12	52.16	0.18
OUTSIDE	0.5000	73.70	58.40	93.02	54.70	99.31	0.18
OUTSIDE	0.7500	121.8	94.88	156.3	88.45	167.7	0.20
OUTSIDE	0.9000	175.9	134.6	230.0	124.8	248.0	0.21
INSIDE	0.1000	21.89	18.15	26.40	17.21	27.83	0.15
INSIDE	0.2500	45.32	38.30	53.64	36.53	56.24	0.13

INSIDE	0.5000	85.72	71.68	102.5	68.17	107.8	0.14
INSIDE	0.7500	141.7	115.7	173.5	109.2	183.7	0.16
INSIDE	0.9000	204.6	163.1	256.6	153.1	273.5	0.18
MANUAL	0.1000	21.20	17.60	25.53	16.71	26.90	0.15
MANUAL	0.2500	43.90	37.19	51.81	35.50	54.29	0.13
MANUAL	0.5000	83.03	69.66	98.97	66.30	104.0	0.14
MANUAL	0.7500	137.2	112.4	167.5	106.3	177.2	0.16
MANUAL	0.9000	198.2	158.5	247.7	148.9	263.8	0.17
NONMAN	0.1000	21.20	17.60	25.53	16.71	26.90	0.15
NONMAN	0.2500	43.90	37.19	51.81	35.50	54.29	0.13
NONMAN	0.5000	83.03	69.66	98.97	66.30	104.0	0.14
NONMAN	0.7500	137.2	112.4	167.5	106.3	177.2	0.16
NONMAN	0.9000	198.2	158.5	247.7	148.9	263.8	0.17
HRS=1	0.1000	32.26	26.45	39.33	25.02	41.59	0.15
HRS=1	0.2500	66.80	54.90	81.28	51.95	85.89	0.15

--rundesc= Phase 1 modeling , model weib1c ---

-------- estimates, selected covariate levels ----------

CNTLNAME	QUANTILE	PTIME	LOWER80	UPPER80	LOWER90	UPPER90	STDE
HRS=1	0.5000	126.3	101.6	157.0	95.61	166.9	0.17
HRS=1	0.7500	208.8	163.2	267.0	152.3	286.2	0.19
HRS=1	0.9000	301.6	229.9	395.6	213.0	427.0	0.21
HRS=10	0.1000	14.71	11.78	18.37	11.07	19.56	0.17
HRS=10	0.2500	30.47	25.15	36.91	23.83	38.96	0.15
HRS=10	0.5000	57.63	47.74	69.56	45.28	73.35	0.15
HRS=10	0.7500	95.23	77.85	116.5	73.56	123.3	0.16
HRS=10	0.9000	137.6	110.5	171.2	103.9	182.1	0.17
HRS=20	0.1000	11.23	8.60	14.68	7.97	15.82	0.21
HRS=20	0.2500	23.26	18.40	29.41	17.22	31.42	0.18
HRS=20	0.5000	44.00	35.17	55.04	33.02	58.62	0.17
HRS=20	0.7500	72.71	57.81	91.45	54.19	97.54	0.18
HRS=20	0.9000	105.0	82.56	133.6	77.16	142.9	0.19

```
 ------------------------------------------------------------
 --rundesc= Phase 1 modeling , model weib1c ---
 -------- Plotting Cox-Snell Residuals ------------
 ------------ (Via LIFETEST) ---------------------

 The LIFETEST Procedure

 -Log(Survival Function) Estimates

   -LOG SDF |
            |
        1.4 +                                                                                                          +A
            |                                                                                                       +++
            |                                                                                                   ++++
            |                                                                                                +++
            |                                                                                             +++
        1.2 +                                                                                          +++
            |                                                                                      ++++
            |                                                                                   +++
            |                                                                                +++
 N          |                                                                             +++
 e      1.0 +                                                                          +++
 g          |                                                                      ++++
 a          |                                                                   +++
 t          |                                                                +++
 i          |                                                             +++
 v      0.8 +                                                         ++++
 e          |                                                      +++
            |                                                    A+
 L          |                                                   A
 o          |                                                  +
 g      0.6 +                                                +A
            |                                               A
 S          |                                           A++A
 D          |                                        A+A
 F          |                                      A+A
        0.4 +                                    AA
            |                                  AA
            |                                AA
            |                             +AA
            |                          AAA
        0.2 +                      AAAAA
            |                   AAA
            |                 AAA
            |              AAAA
            |           A+AA
```

```
       0.0 +           A
           |
           -----------+------+------+------+------+------+------+------+------+------+------+------+------+------+------+-
----------
                      0.0    0.1    0.2    0.3    0.4    0.5    0.6    0.7    0.8    0.9    1.0    1.1    1.2    1.3    1.4

                                                           Cox-Snell Residuals   E
```

```
 ------------------------------------------------------------
 --rundesc= Phase 1 modeling , model weib1c ---
 ---- Estimated Survival Probabilities - Plotted -----

                                             Plot of P_SURV*MONTHS.  Symbol used is 's'.

   1.0 +  ss
       |       s
       |            s
       |                 s
   0.9 +
       |                      s
       |                           s
       |
   0.8 +                                s
       |                                     s
       |
       |                                          s
 P 0.7 +
       |                                               s
 s     |                                                    s
 u     |
 r 0.6 +                                                         s
 v     |                                                              s
 i     |
 v     |                                                                   s
 a 0.5 +                                                                        s
 l     |
       |                                                                             s
 (     |                                                                                  s
 S 0.4 +                                                                                       s
 D     |                                                                                            s
 F     |                                                                                                 s
 )     |                                                                                                      s
   0.3 +                                                                                                           s
       |                                                                                                                s
       |
s
       |
s
   0.2 +
       |
       |
       |
   0.1 +
       |
```

```
       |
       |
   0.0 +
       ---+---------+---------+---------+---------+---------+---------+---------+---------+---------+---------+---------+--
-------+--
          0        12        24        36        48        60        72        84        96       108       120       132
144

                                                   Months from installation
```

```
1anal0055 -  phase 1 analysis over relatively non-censored data                                       17:44 Sunday, March
21, 1999   1
 ------------------------------------------------------------
 --rundesc= Phase 1 modeling , model llog1c ---
 --(dist type= llogistic )
-
 WEIGHT USED= bulbs * wsamp
0OUTDATASETS PREFIXED AS  llog1c
0MODEL TYPE =  llogistic
0COVARIATES ARE  dsrafoll dsranonc outside loghrs hrsdayp sfdet sfdetp
0DOING DESCRIPTIVE STATS FIRST?  NO


1anal0055 -  phase 1 analysis over relatively non-censored data                                       17:44 Sunday, March
21, 1999   2
 ------------------------------------------------------------
 --rundesc= Phase 1 modeling , model llog1c ---
 ----------- model results --------------

 Lifereg  Procedure

 Data Set          =WORK.INPUT
 Dependent Variable=Log(LO2MO)    Low months,iterval censoring
 Dependent Variable=Log(UP2MO)    Upper months, intvl censoring
 Weight Variable   =WT    Casewt: bulbs * wsamp
 Noncensored Values=    99  Right Censored Values=    423
 Left Censored Values=   0  Interval Censored Values=  39
 Observations with Missing Values=  12


 Log Likelihood for LLOGISTC  -420.671301
```

```
 ------------------------------------------------------------
 --rundesc= Phase 1 modeling , model llog1c ---
 ----------- model results --------------

 Lifereg  Procedure
```

Variable	DF	Estimate	Std Err	ChiSquare	Pr>Chi	Label/Value
INTERCPT	1	4.69820288	0.23333	405.4348	0.0001	Intercept
DSRAFOLL	1	0.00017237	0.171886	1.006E-6	0.9992	Dummy for DSRA followup sample
DSRANONC	1	0.24703971	0.301282	0.672337	0.4122	Dummy for DSRA re-try sample
OUTSIDE	1	-0.1173833	0.159055	0.544651	0.4605	Dummy for outside locn
LOGHRS	1	-0.4454406	0.091677	23.60809	0.0001	Log(hrs/day + .5)
HRSDAYP	1	0.46648472	0.213774	4.761714	0.0291	Var hrsday1 mean-plugged
SFDET	1	0.52229066	0.191474	7.440575	0.0064	SINGLE FAMILY DETACHED
SFDETP	1	13.8906926	23394.74	3.525E-7	0.9995	Var sfdet1 mean-plugged
SCALE	1	0.67360581	0.053914			Logistic scale parameter

Estimated Correlation Matrix

	INTERCPT	DSRAFOLL	DSRANONC	OUTSIDE	LOGHRS
INTERCPT	1.000000	-0.401844	-0.120280	-0.028465	-0.454661
DSRAFOLL	-0.401844	1.000000	0.061156	-0.035268	-0.111879
DSRANONC	-0.120280	0.061156	1.000000	-0.013898	0.020495
OUTSIDE	-0.028465	-0.035268	-0.013898	1.000000	-0.129848
LOGHRS	-0.454661	-0.111879	0.020495	-0.129848	1.000000
HRSDAYP	-0.187456	0.582406	-0.255201	-0.058249	-0.228444
SFDET	-0.514954	-0.086858	0.112258	-0.049330	-0.134059
SFDETP	0.000011336	0.000004607	0.000000147	0.000000840	-0.000015128
SCALE	0.303015	0.010323	0.055281	-0.012990	-0.326076

	HRSDAYP	SFDET	SFDETP	SCALE
INTERCPT	-0.187456	-0.514954	0.000011336	0.303015
DSRAFOLL	0.582406	-0.086858	0.000004607	0.010323

DSRANONC	-0.255201	0.112258	0.000000147	0.055281
OUTSIDE	-0.058249	-0.049330	0.000000840	-0.012990
LOGHRS	-0.228444	-0.134059	-0.000015128	-0.326076
HRSDAYP	1.000000	-0.093454	0.000009851	0.143184
SFDET	-0.093454	1.000000	0.000006950	0.177470
SFDETP	0.000009851	0.000006950	1.000000	0.000044949
SCALE	0.143184	0.177470	0.000044949	1.000000

--rundesc= Phase 1 modeling , model llog1c ---
-------- estimates, selected covariate levels ----------

CNTLNAME	QUANTILE	PTIME	LOWER80	UPPER80	LOWER90	UPPER90	STDE
DSRAFOLL	0.1000	20.18	17.57	23.17	16.90	24.09	0.11
DSRAFOLL	0.2500	42.29	37.69	47.45	36.49	49.01	0.09
DSRAFOLL	0.5000	88.64	77.27	101.7	74.34	105.7	0.11
DSRAFOLL	0.7500	185.8	153.7	224.6	145.7	236.9	0.15
DSRAFOLL	0.9000	389.4	302.1	502.0	281.2	539.2	0.20
DSRANONC	0.1000	25.83	17.00	39.24	15.11	44.14	0.33
DSRANONC	0.2500	54.13	35.76	81.95	31.82	92.09	0.32
DSRANONC	0.5000	113.5	74.19	173.5	65.84	195.5	0.33
DSRANONC	0.7500	237.8	152.0	372.1	134.0	422.0	0.35
DSRANONC	0.9000	498.5	308.0	806.8	268.9	923.8	0.38
LUTHGEN	0.1000	20.17	16.49	24.67	15.59	26.11	0.16
LUTHGEN	0.2500	42.28	35.13	50.89	33.35	53.61	0.14
LUTHGEN	0.5000	88.62	72.64	108.1	68.69	114.3	0.16
LUTHGEN	0.7500	185.8	146.5	235.5	137.1	251.7	0.19
LUTHGEN	0.9000	389.3	291.1	520.7	268.3	565.1	0.23
XENERGY	0.1000	20.17	16.49	24.67	15.59	26.11	0.16
XENERGY	0.2500	42.28	35.13	50.89	33.35	53.61	0.14
XENERGY	0.5000	88.62	72.64	108.1	68.69	114.3	0.16
XENERGY	0.7500	185.8	146.5	235.5	137.1	251.7	0.19
XENERGY	0.9000	389.3	291.1	520.7	268.3	565.1	0.23
DSRA9702	0.1000	20.17	16.49	24.67	15.59	26.11	0.16
DSRA9702	0.2500	42.28	35.13	50.89	33.35	53.61	0.14
DSRA9702	0.5000	88.62	72.64	108.1	68.69	114.3	0.16
DSRA9702	0.7500	185.8	146.5	235.5	137.1	251.7	0.19
DSRA9702	0.9000	389.3	291.1	520.7	268.3	565.1	0.23
OUTSIDE	0.1000	18.39	14.18	23.85	13.18	25.66	0.20
OUTSIDE	0.2500	38.54	30.11	49.34	28.09	52.89	0.19
OUTSIDE	0.5000	80.79	62.49	104.4	58.14	112.3	0.20
OUTSIDE	0.7500	169.3	127.1	225.6	117.2	244.6	0.22
OUTSIDE	0.9000	354.9	254.6	494.7	231.9	543.1	0.26
INSIDE	0.1000	20.68	16.84	25.39	15.90	26.89	0.16
INSIDE	0.2500	43.34	35.86	52.39	34.00	55.25	0.15

INSIDE	0.5000	90.85	74.15	111.3	70.04	117.8	0.16
INSIDE	0.7500	190.4	149.6	242.3	139.8	259.3	0.19
INSIDE	0.9000	399.1	297.5	535.5	273.9	581.6	0.23
MANUAL	0.1000	20.17	16.49	24.67	15.59	26.11	0.16
MANUAL	0.2500	42.28	35.13	50.89	33.35	53.61	0.14
MANUAL	0.5000	88.62	72.64	108.1	68.69	114.3	0.16
MANUAL	0.7500	185.8	146.5	235.5	137.1	251.7	0.19
MANUAL	0.9000	389.3	291.1	520.7	268.3	565.1	0.23
NONMAN	0.1000	20.17	16.49	24.67	15.59	26.11	0.16
NONMAN	0.2500	42.28	35.13	50.89	33.35	53.61	0.14
NONMAN	0.5000	88.62	72.64	108.1	68.69	114.3	0.16
NONMAN	0.7500	185.8	146.5	235.5	137.1	251.7	0.19
NONMAN	0.9000	389.3	291.1	520.7	268.3	565.1	0.23
HRS=1	0.1000	32.07	26.03	39.51	24.54	41.90	0.16
HRS=1	0.2500	67.21	54.58	82.77	51.48	87.76	0.16

--rundesc= Phase 1 modeling , model llog1c ---
-------- estimates, selected covariate levels ----------

CNTLNAME	QUANTILE	PTIME	LOWER80	UPPER80	LOWER90	UPPER90	STDE
HRS=1	0.5000	140.9	111.5	178.0	104.4	190.1	0.18
HRS=1	0.7500	295.3	223.6	390.0	206.7	421.8	0.22
HRS=1	0.9000	618.9	443.1	864.5	403.3	949.7	0.26
HRS=10	0.1000	13.48	10.50	17.30	9.79	18.55	0.19
HRS=10	0.2500	28.25	22.55	35.38	21.17	37.70	0.18
HRS=10	0.5000	59.21	47.28	74.16	44.37	79.01	0.18
HRS=10	0.7500	124.1	96.72	159.3	90.17	170.8	0.19
HRS=10	0.9000	260.1	194.3	348.3	179.0	378.1	0.23
HRS=20	0.1000	10.00	7.38	13.57	6.77	14.78	0.24
HRS=20	0.2500	20.97	15.88	27.69	14.68	29.94	0.22
HRS=20	0.5000	43.95	33.52	57.63	31.06	62.20	0.21
HRS=20	0.7500	92.13	69.30	122.5	63.97	132.7	0.22
HRS=20	0.9000	193.1	140.7	265.0	128.7	289.6	0.25

```
1anal0055 -  phase 1 analysis over relatively non-censored data                                      17:44 Sunday, March
21, 1999   8
 ------------------------------------------------------------
 --rundesc= Phase 1 modeling , model llog1c ---
 -------- Plotting Cox-Snell Residuals ------------
 ------------ (Via LIFETEST) ---------------------

 The LIFETEST Procedure

 -Log(Survival Function) Estimates

   -LOG SDF |
       1.50 +                                                                                                            +A
            |                                                                                                         +++
            |                                                                                                      +++
            |                                                                                                   +++
            |                                                                                                +++
            |                                                                                             +++
       1.25 +                                                                                          +++
            |                                                                                       +++
            |                                                                                    +++
            |                                                                                ++++
 N          |                                                                             +++
 e          |                                                                          +++
 g     1.00 +                                                                       +++
 a          |                                                                    +++
 t          |                                                                 +++
 i          |                                                              +++
 v          |                                                           +++
 e          |                                                         A+
       0.75 +                                                         +
 L          |                                                      ++A
 o          |                                                    A+
 g          |                                                   A
            |                                                  A
 S          |                                              ++++A
 D     0.50 +                                         A++++
 F          |                                       A+A
            |                                     AA
            |                                   AAA
            |                                 AA
            |                              AAAA
       0.25 +                         AAAAA
            |                     AAAAA
            |                  AAAA
            |               AAAA
            |           AAAAA
            |        AAAA
```

```
      0.00 +       A
           |
           --------+-------+-------+-------+-------+-------+-------+-------+-------+-------+-------+-------+-------+------
-+--------
                  0.0     0.1     0.2     0.3     0.4     0.5     0.6     0.7     0.8     0.9     1.0     1.1     1.2
1.3

                                                    Cox-Snell Residuals   E
```

```
1anal0055 -  phase 1 analysis over relatively non-censored data                                      17:44 Sunday, March
21, 1999  13
 ------------------------------------------------------------
 --rundesc= Phase 1 modeling , model llog1c ---
 ---- Estimated Survival Probabilities - Plotted -----

                                             Plot of P_SURV*MONTHS.  Symbol used is 's'.

   1.0 +  ss
       |       s
       |            s
       |                 s
   0.9 +
       |                      s
       |
       |                           s
   0.8 +                                s
       |
       |                                     s
       |                                          s
 P 0.7 +
       |                                               s
 s     |                                                    s
 u     |
 r 0.6 +                                                         s
 v     |                                                              s
 i     |                                                                   s
 v     |                                                                        s
 a 0.5 +                                                                             s
 l     |                                                                                  s
       |                                                                                       s
 (     |                                                                                            s
 S 0.4 +                                                                                                 s    s
 D     |                                                                                                           s
 F     |                                                                                                                s
s
 )     |
s
   0.3 +
       |
       |
       |
   0.2 +
       |
       |
       |
   0.1 +
```

```
      |
      |
      |
  0.0 +
      ---+---------+---------+---------+---------+---------+---------+---------+---------+---------+---------+---------+--
-------+--
         0        12        24        36        48        60        72        84        96       108       120       132
144

                                                  Months from installation
```

Appendix E2:

Phase 2 “final competitor” models
(including diagnostics and followups)

Phase 2 Final Competitor Models
ANAL0102 (Weibull, scale fixed),
ANAL0111 (Generalized gamma, scale and shape freed).

```
1anal0102 - phase 2 analysis over all data, adding dsra9702/xen                                    00:09 Monday, March
22, 1999   1
 ------------------------------------------------------------
 --rundesc= Phase 2 modeling, dropping sfdet , model weib2e ---
 --(dist type= weibull )
-
 WEIGHT USED= bulbs * wsamp
0OUTDATASETS PREFIXED AS  weib2e
0MODEL TYPE =  weibull
0COVARIATES ARE  dsrafoll dsranonc luthgen dsra9702                                      outside loghrs hrsdayp
0DOING DESCRIPTIVE STATS FIRST?  no
```

```
 -----------------------------------------------------------
 --rundesc= Phase 2 modeling, dropping sfdet , model weib2e ---
 ----------- model results --------------

 Lifereg  Procedure

 Data Set          =WORK.INPUT
 Dependent Variable=Log(LO2MO)    Low months,iterval censoring
 Dependent Variable=Log(UP2MO)    Upper months, intvl censoring
 Weight Variable   =WT    Casewt: bulbs * wsamp
 Noncensored Values=    99  Right Censored Values=   1482
 Left Censored Values=   0  Interval Censored Values= 218
 Observations with Missing Values=  12


 Log Likelihood for WEIBULL -1361.260352
```

```
 ------------------------------------------------------------
 --rundesc= Phase 2 modeling, dropping sfdet , model weib2e ---
 ----------- model results --------------

 Lifereg  Procedure

 Variable  DF   Estimate  Std Err ChiSquare  Pr>Chi Label/Value

 INTERCPT   1 5.55165012 0.233795  563.8611  0.0001 Intercept
 DSRAFOLL   1 -0.5696974 0.241211  5.578224  0.0182 Dummy for DSRA followup sample
 DSRANONC   1 0.68354411 0.288462  5.615079  0.0178 Dummy for DSRA re-try sample
 LUTHGEN    1 0.13560485  0.15847  0.732243  0.3922 Dummy for LUTH general pop sample
 DSRA9702   1 -0.5015368 0.229769  4.764543  0.0291
 OUTSIDE    1 -0.0869141 0.084799  1.050519  0.3054 Dummy for outside locn
 LOGHRS     1 -0.2311992 0.050209  21.20366  0.0001 Log(hrs/day + .5)
 HRSDAYP    1 -0.6714742 0.196281  11.70313  0.0006 Var  hrsday1   mean-plugged
 SCALE      0    0.72469        0                   Extreme value scale parameter
 Lagrange Multiplier ChiSquare for Scale 0.328145 Pr>Chi is 0.5668.
```

Estimated Correlation Matrix

	INTERCPT	DSRAFOLL	DSRANONC	LUTHGEN	DSRA9702
INTERCPT	1.000000	-0.905766	-0.225019	-0.601529	-0.926276
DSRAFOLL	-0.905766	1.000000	0.217339	0.581966	0.921683
DSRANONC	-0.225019	0.217339	1.000000	0.302101	0.227745
LUTHGEN	-0.601529	0.581966	0.302101	1.000000	0.607332
DSRA9702	-0.926276	0.921683	0.227745	0.607332	1.000000
OUTSIDE	0.044102	-0.003015	-0.023247	-0.014680	0.000526
LOGHRS	-0.234945	-0.025950	0.008879	0.007680	-0.084091
HRSDAYP	-0.803823	0.807420	0.030316	0.284278	0.842218
SCALE	0	0	0	0	0

	OUTSIDE	LOGHRS	HRSDAYP	SCALE

INTERCPT	0.044102	-0.234945	-0.803823	0
DSRAFOLL	-0.003015	-0.025950	0.807420	0
DSRANONC	-0.023247	0.008879	0.030316	0
LUTHGEN	-0.014680	0.007680	0.284278	0
DSRA9702	0.000526	-0.084091	0.842218	0
OUTSIDE	1.000000	-0.406239	0.007375	0
LOGHRS	-0.406239	1.000000	-0.101474	0
HRSDAYP	0.007375	-0.101474	1.000000	0
SCALE	0	0	0	0

--rundesc= Phase 2 modeling, dropping sfdet , model weib2e ---

-------- estimates, selected covariate levels ----------

CNTLNAME	QUANTILE	PTIME	LOWER80	UPPER80	LOWER90	UPPER90	STDE
DSRAFOLL	0.1000	19.90	17.93	22.10	17.41	22.76	0.08
DSRAFOLL	0.2500	41.22	37.12	45.76	36.05	47.13	0.08
DSRAFOLL	0.5000	77.95	70.21	86.55	68.17	89.13	0.08
DSRAFOLL	0.7500	128.8	116.0	143.0	112.7	147.3	0.08
DSRAFOLL	0.9000	186.1	167.6	206.6	162.7	212.8	0.08
DSRANONC	0.1000	69.70	46.15	105.3	41.09	118.2	0.32
DSRANONC	0.2500	144.3	95.56	218.0	85.10	244.8	0.32
DSRANONC	0.5000	273.0	180.7	412.3	160.9	462.9	0.32
DSRANONC	0.7500	451.1	298.7	681.3	266.0	765.0	0.32
DSRANONC	0.9000	651.6	431.4	984.0	384.2	1105	0.32
LUTHGEN	0.1000	40.29	32.10	50.58	30.11	53.92	0.18
LUTHGEN	0.2500	83.44	66.47	104.7	62.35	111.7	0.18
LUTHGEN	0.5000	157.8	125.7	198.1	117.9	211.2	0.18
LUTHGEN	0.7500	260.8	207.7	327.4	194.9	349.0	0.18
LUTHGEN	0.9000	376.7	300.1	472.9	281.5	504.1	0.18
XENERGY	0.1000	35.18	26.37	46.94	24.32	50.91	0.23
XENERGY	0.2500	72.86	54.61	97.20	50.36	105.4	0.23
XENERGY	0.5000	137.8	103.3	183.8	95.24	199.4	0.23
XENERGY	0.7500	227.7	170.7	303.8	157.4	329.5	0.23
XENERGY	0.9000	328.9	246.5	438.8	227.3	475.9	0.23
DSRA9702	0.1000	21.31	20.10	22.58	19.78	22.95	0.05
DSRA9702	0.2500	44.12	41.63	46.76	40.96	47.53	0.05
DSRA9702	0.5000	83.45	78.74	88.45	77.46	89.90	0.05
DSRA9702	0.7500	137.9	130.1	146.2	128.0	148.6	0.05
DSRA9702	0.9000	199.2	187.9	211.1	184.9	214.6	0.05
OUTSIDE	0.1000	19.90	17.96	22.04	17.45	22.68	0.08
OUTSIDE	0.2500	41.20	37.19	45.64	36.14	46.97	0.08
OUTSIDE	0.5000	77.92	70.35	86.31	68.35	88.83	0.08
OUTSIDE	0.7500	128.8	116.3	142.6	113.0	146.8	0.08
OUTSIDE	0.9000	186.0	167.9	206.0	163.2	212.0	0.08
INSIDE	0.1000	21.70	20.38	23.11	20.02	23.53	0.05
INSIDE	0.2500	44.94	42.20	47.86	41.45	48.72	0.05

INSIDE	0.5000	85.00	79.81	90.53	78.40	92.14	0.05
INSIDE	0.7500	140.5	131.9	149.6	129.6	152.3	0.05
INSIDE	0.9000	202.9	190.5	216.1	187.1	219.9	0.05
MANUAL	0.1000	21.31	20.10	22.58	19.78	22.95	0.05
MANUAL	0.2500	44.12	41.63	46.76	40.96	47.53	0.05
MANUAL	0.5000	83.45	78.74	88.45	77.46	89.90	0.05
MANUAL	0.7500	137.9	130.1	146.2	128.0	148.6	0.05
MANUAL	0.9000	199.2	187.9	211.1	184.9	214.6	0.05
NONMAN	0.1000	21.31	20.10	22.58	19.78	22.95	0.05
NONMAN	0.2500	44.12	41.63	46.76	40.96	47.53	0.05
NONMAN	0.5000	83.45	78.74	88.45	77.46	89.90	0.05
NONMAN	0.7500	137.9	130.1	146.2	128.0	148.6	0.05
NONMAN	0.9000	199.2	187.9	211.1	184.9	214.6	0.05
HRS=1	0.1000	27.10	24.60	29.86	23.93	30.69	0.08
HRS=1	0.2500	56.12	50.93	61.84	49.56	63.55	0.08

\--

--rundesc= Phase 2 modeling, dropping sfdet , model weib2e ---

\-------- estimates, selected covariate levels ----------

CNTLNAME	QUANTILE	PTIME	LOWER80	UPPER80	LOWER90	UPPER90	STDE
HRS=1	0.5000	106.1	96.33	117.0	93.74	120.2	0.08
HRS=1	0.7500	175.4	159.2	193.3	154.9	198.6	0.08
HRS=1	0.9000	253.4	229.9	279.2	223.8	286.9	0.08
HRS=10	0.1000	17.28	16.06	18.60	15.73	18.99	0.06
HRS=10	0.2500	35.79	33.25	38.52	32.57	39.32	0.06
HRS=10	0.5000	67.69	62.89	72.85	61.61	74.37	0.06
HRS=10	0.7500	111.9	103.9	120.4	101.8	122.9	0.06
HRS=10	0.9000	161.6	150.1	173.9	147.1	177.5	0.06
HRS=20	0.1000	14.81	13.32	16.46	12.93	16.96	0.08
HRS=20	0.2500	30.66	27.58	34.09	26.77	35.12	0.08
HRS=20	0.5000	57.99	52.15	64.48	50.62	66.43	0.08
HRS=20	0.7500	95.83	86.19	106.6	83.65	109.8	0.08
HRS=20	0.9000	138.4	124.5	153.9	120.8	158.6	0.08

```
 ------------------------------------------------------------
 --rundesc= Phase 2 modeling, dropping sfdet , model weib2e ---
 ---- Estimated Survival Probabilities - Plotted -----

                                            Plot of P_SURV*MONTHS.  Symbol used is 's'.

   1.0 +  ss
       |       s
       |            s
       |                 s
   0.9 +
       |                      s
       |                           s
       |
   0.8 +                                s
       |                                     s
       |
       |                                          s
 P 0.7 +
       |                                               s
 s     |                                                    s
 u     |
 r 0.6 +                                                         s
 v     |                                                              s
 i     |
 v     |                                                                   s
 a 0.5 +                                                                        s
 l     |                                                                             s
       |
 (     |                                                                                  s
 S 0.4 +                                                                                       s
 D     |                                                                                            s
 F     |                                                                                                 s
 )     |                                                                                                      s
   0.3 +                                                                                                           s
       |                                                                                                                s
       |
s
       |
s
   0.2 +
       |
       |
       |
   0.1 +
       |
```

```
          |
          |
     0.0 +
          ---+---------+---------+---------+---------+---------+---------+---------+---------+---------+---------+---------+--
-------+--
             0        12        24        36        48        60        72        84        96       108       120       132
144
```

```
1anal0111 - phase 2 analysis over all data, adding dsra9702/xen                              00:09 Monday, March
22, 1999   1
 -----------------------------------------------------------
 --rundesc= Phase 2 modeling,drop sfdet , model ggam2f ---
 --(dist type= gamma )
-
 WEIGHT USED= bulbs * wsamp
0OUTDATASETS PREFIXED AS  ggam2f
0MODEL TYPE =  gamma
0COVARIATES ARE  dsrafoll dsranonc luthgen dsra9702                                    outside loghrs hrsdayp
0DOING DESCRIPTIVE STATS FIRST?  NO
1anal0111 - phase 2 analysis over all data, adding dsra9702/xen                              00:09 Monday, March
22, 1999   2
 -----------------------------------------------------------
 --rundesc= Phase 2 modeling,drop sfdet , model ggam2f ---
 ----------- model results --------------

 Lifereg  Procedure

 Data Set          =WORK.INPUT
 Dependent Variable=Log(LO2MO)    Low months,iterval censoring
 Dependent Variable=Log(UP2MO)    Upper months, intvl censoring
 Weight Variable   =WT    Casewt: bulbs * wsamp
 Noncensored Values=    99  Right Censored Values=   1482
 Left Censored Values=   0  Interval Censored Values= 218
 Observations with Missing Values=  12


 Log Likelihood for GAMMA  -1357.36536
```

```
 -----------------------------------------------------------
 --rundesc= Phase 2 modeling,drop sfdet , model ggam2f ---
 ----------- model results --------------

 Lifereg  Procedure

 Variable  DF   Estimate  Std Err ChiSquare  Pr>Chi Label/Value

 INTERCPT   1 5.55705797 0.661223  70.63087  0.0001 Intercept
 DSRAFOLL   1 -0.6192315 0.324141  3.649547  0.0561 Dummy for DSRA followup sample
 DSRANONC   1 0.73389648 0.276987  7.020212  0.0081 Dummy for DSRA re-try sample
 LUTHGEN    1 0.22152643  0.17201  1.658608  0.1978 Dummy for LUTH general pop sample
 DSRA9702   1 -0.5976841 0.300097  3.966613  0.0464
 OUTSIDE    1 -0.0718804 0.076321   0.88703  0.3463 Dummy for outside locn
 LOGHRS     1 -0.2185775 0.048771  20.08554  0.0001 Log(hrs/day + .5)
 HRSDAYP    1 -0.7837517 0.259911  9.092983  0.0026 Var  hrsday1   mean-plugged
 SCALE      1  0.2458876 1.004043                   Gamma scale parameter
 SHAPE      1 3.00024916 12.24989                   Gamma shape parameter


 Estimated Correlation Matrix

                      INTERCPT           DSRAFOLL           DSRANONC            LUTHGEN           DSRA9702

    INTERCPT          1.000000          -0.582891          -0.154779          -0.382115          -0.580185
    DSRAFOLL         -0.582891           1.000000           0.262919           0.629993           0.956837
    DSRANONC         -0.154779           0.262919           1.000000           0.387237           0.251526
     LUTHGEN         -0.382115           0.629993           0.387237           1.000000           0.592076
    DSRA9702         -0.580185           0.956837           0.251526           0.592076           1.000000
     OUTSIDE         -0.004343           0.023846          -0.017558          -0.000582           0.009332
      LOGHRS         -0.132034           0.100149           0.070173           0.174968           0.023148
     HRSDAYP         -0.528241           0.863500           0.073001           0.294265           0.901473
       SCALE         -0.831651           0.073633           0.000720           0.006339           0.095141
       SHAPE          0.838034          -0.082192          -0.004279          -0.016000          -0.101399


                       OUTSIDE             LOGHRS            HRSDAYP              SCALE              SHAPE

    INTERCPT         -0.004343          -0.132034          -0.528241          -0.831651           0.838034
```

DSRAFOLL	0.023846	0.100149	0.863500	0.073633	-0.082192
DSRANONC	-0.017558	0.070173	0.073001	0.000720	-0.004279
LUTHGEN	-0.000582	0.174968	0.294265	0.006339	-0.016000
DSRA9702	0.009332	0.023148	0.901473	0.095141	-0.101399
OUTSIDE	1.000000	-0.354664	0.005175	-0.000151	-0.001098
LOGHRS	-0.354664	1.000000	-0.029560	-0.056603	0.050702
HRSDAYP	0.005175	-0.029560	1.000000	0.109027	-0.113021
SCALE	-0.000151	-0.056603	0.109027	1.000000	-0.999839
SHAPE	-0.001098	0.050702	-0.113021	-0.999839	1.000000

--rundesc= Phase 2 modeling,drop sfdet , model ggam2f ---
-------- estimates, selected covariate levels ----------

CNTLNAME	QUANTILE	PTIME	LOWER80	UPPER80	LOWER90	UPPER90	STDE
DSRAFOLL	0.1000	20.88	0.00	12E12	0.00	24E15	21.14
DSRAFOLL	0.2500	41.06	0.00	455E6	0.00	44E9	12.67
DSRAFOLL	0.5000	68.47	0.02	215E3	0.00	207E4	6.29
DSRAFOLL	0.7500	92.66	2.24	3825	0.79	10891	2.91
DSRAFOLL	0.9000	107.9	7.35	1583	3.46	3369	2.10
DSRANONC	0.1000	80.81	0.00	44E12	0.00	88E15	21.11
DSRANONC	0.2500	158.9	0.00	172E7	0.00	163E9	12.65
DSRANONC	0.5000	264.9	0.09	815E3	0.01	78E5	6.27
DSRANONC	0.7500	358.5	8.71	14752	3.06	41965	2.90
DSRANONC	0.9000	417.5	28.21	6178	13.22	13182	2.11
LUTHGEN	0.1000	48.41	0.00	26E12	0.00	53E15	21.11
LUTHGEN	0.2500	95.17	0.00	103E7	0.00	98E9	12.65
LUTHGEN	0.5000	158.7	0.05	486E3	0.01	464E4	6.27
LUTHGEN	0.7500	214.8	5.30	8713	1.87	24686	2.89
LUTHGEN	0.9000	250.1	17.26	3626	8.13	7691	2.09
XENERGY	0.1000	38.79	0.00	21E12	0.00	42E15	21.11
XENERGY	0.2500	76.26	0.00	821E6	0.00	78E9	12.65
XENERGY	0.5000	127.2	0.04	39E4	0.00	372E4	6.27
XENERGY	0.7500	172.1	4.21	7033	1.48	19966	2.90
XENERGY	0.9000	200.4	13.66	2940	6.42	6258	2.10
DSRA9702	0.1000	21.34	0.00	12E12	0.00	24E15	21.14
DSRA9702	0.2500	41.95	0.00	467E6	0.00	45E9	12.68
DSRA9702	0.5000	69.96	0.02	221E3	0.00	213E4	6.29
DSRA9702	0.7500	94.68	2.28	3931	0.80	11211	2.91
DSRA9702	0.9000	110.2	7.47	1628	3.50	3471	2.10
OUTSIDE	0.1000	20.16	0.00	11E12	0.00	23E15	21.14
OUTSIDE	0.2500	39.64	0.00	442E6	0.00	42E9	12.68
OUTSIDE	0.5000	66.10	0.02	208E3	0.00	201E4	6.29
OUTSIDE	0.7500	89.46	2.15	3717	0.75	10602	2.91
OUTSIDE	0.9000	104.2	7.05	1539	3.30	3283	2.10
INSIDE	0.1000	21.66	0.00	12E12	0.00	25E15	21.14
INSIDE	0.2500	42.59	0.00	475E6	0.00	46E9	12.68

INSIDE	0.5000	71.03	0.02	224E3	0.00	216E4	6.29
INSIDE	0.7500	96.12	2.31	3991	0.81	11384	2.91
INSIDE	0.9000	111.9	7.58	1653	3.55	3525	2.10
MANUAL	0.1000	21.34	0.00	12E12	0.00	24E15	21.14
MANUAL	0.2500	41.95	0.00	467E6	0.00	45E9	12.68
MANUAL	0.5000	69.96	0.02	221E3	0.00	213E4	6.29
MANUAL	0.7500	94.68	2.28	3931	0.80	11211	2.91
MANUAL	0.9000	110.2	7.47	1628	3.50	3471	2.10
NONMAN	0.1000	21.34	0.00	12E12	0.00	24E15	21.14
NONMAN	0.2500	41.95	0.00	467E6	0.00	45E9	12.68
NONMAN	0.5000	69.96	0.02	221E3	0.00	213E4	6.29
NONMAN	0.7500	94.68	2.28	3931	0.80	11211	2.91
NONMAN	0.9000	110.2	7.47	1628	3.50	3471	2.10
HRS=1	0.1000	26.79	0.00	15E12	0.00	31E15	21.14
HRS=1	0.2500	52.66	0.00	589E6	0.00	57E9	12.68

--rundesc= Phase 2 modeling,drop sfdet , model ggam2f ---

-------- estimates, selected covariate levels ----------

CNTLNAME	QUANTILE	PTIME	LOWER80	UPPER80	LOWER90	UPPER90	STDE
HRS=1	0.5000	87.83	0.03	278E3	0.00	268E4	6.30
HRS=1	0.7500	118.9	2.85	4958	1.00	14160	2.91
HRS=1	0.9000	138.4	9.32	2055	4.37	4388	2.11
HRS=10	0.1000	17.51	0.00	99E11	0.00	2E16	21.14
HRS=10	0.2500	34.42	0.00	382E6	0.00	37E9	12.67
HRS=10	0.5000	57.40	0.02	18E4	0.00	174E4	6.29
HRS=10	0.7500	77.68	1.88	3215	0.66	9160	2.91
HRS=10	0.9000	90.45	6.15	1331	2.89	2835	2.10
HRS=20	0.1000	15.13	0.00	85E11	0.00	17E15	21.14
HRS=20	0.2500	29.74	0.00	33E7	0.00	32E9	12.67
HRS=20	0.5000	49.59	0.02	156E3	0.00	15E5	6.29
HRS=20	0.7500	67.11	1.62	2772	0.57	7895	2.91
HRS=20	0.9000	78.15	5.32	1148	2.50	2444	2.10

```
1anal0111 - phase 2 analysis over all data, adding dsra9702/xen                                      00:09 Monday, March
22, 1999  13
 ------------------------------------------------------------
 --rundesc= Phase 2 modeling,drop sfdet , model ggam2f ---
 ---- Estimated Survival Probabilities - Plotted -----

                                             Plot of P_SURV*MONTHS.  Symbol used is 's'.

   1.0 +  ss
       |       s
       |            s
       |                 s
   0.9 +
       |                      s
       |                           s
       |
   0.8 +                                s
       |
       |                                     s
       |
 P 0.7 +                                          s
       |
 s     |                                               s
 u     |
 r 0.6 +                                                    s
 v     |
 i     |                                                         s
 v     |
 a 0.5 +
 l     |                                                              s
       |
 (     |                                                                   s
 S 0.4 +
 D     |
 F     |                                                                        s
 )     |
   0.3 +                                                                             s
       |
       |
       |                                                                                  s
   0.2 +
       |                                                                                       s
       |
       |                                                                                            s
   0.1 +
       |                                                                                                 s
       |
       |                                                                                                      s
```

```
    0.0 +                                                                                                                          s     s
s     s
        ---+---------+---------+---------+---------+---------+---------+---------+---------+---------+---------+---------+--
-------+--
           0        12        24        36        48        60        72        84        96       108       120       132
144

                                                              Months from installation
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Appendix F:

Documentation for Estimation of Proportion of Movers Exiting Edison Territory.

Peterson, John W

From: Peterson, John W
Sent: Thursday, February 25,1999 12:24 PM
To: 'dohrmann@adm-energy.com'
Subject: Estimated Proportions of SCE Territory Movers Exiting the Territory

Don, in the previous electronic mailing I provided you with tables indicating, for various Southern California counties and for the entirety of the Edison territory, estimates of the proportion of total residential moves by Edison customers which involved leaving the territory. The estimates are provided for years 1991-1997 overall, and by 1-, 2-, and 3-year groupings of years. The estimates were fashioned somewhat laboriously from a variety of sources:

a. Census PUMS 1990, CA whole. Southern California Association of Governments staff ran a program that I emailed to them, to provide me with aggregate counts on households and population by PUMA zone and County. This was required in order to allow reconciliation at various points in the analysis between whole counties and the fractions of their populations that exist within SCE territory.

b. Census PUMS 1990, SCE territory. Edison uses a version of PUMS90 that was tailored to its geography by John R. Pitkin. It contains only those PUMAS which are "touched" by Edison territory, at times omitting unserved PUMAS that lie within counties partially served by Edison. When the Edison boundary "splits" a PUMA, Pitkin allocates sample points to intra- vs. extra-Edison status based on small area demographic estimation techniques. This file provided me with "origin PUMA" (1980 zone system) for movers since 1985, and "destination PUMA... (1990 zone system). It also provided me with estimates of the intra-SCE proportions of population and households within counties only partially served by Edison, which were combined with data from step A to get rough proportions for factoring down totals from the PUMS90 information on population movement. Combining information from a and b yielded per county and overall estimates of the circa-1 990 movement of residential population within the S(51~ territory (moves beginning in Edison territory and ending within the territory).

c. DLAC (Drivers' License Address Change) data. The California DMV, in conjunction with California DOF, provides extensive tables based on drivers license address changes, yielding various matrices on annual movement among California counties and between California counties and other states. Treated as a proxy for movement by adults, but not inclusive of movements within a given county, the inter-county data which involved Edison counties was factored into migration within the territory and migration to portions outside the boundaries of the territory, the [after to be combined with the more easily obtained DLAC data on movement from Edison territory into non Edison counties or states. This yielded, per Edison-touched county and the territory, an estimate of driver and state ID card address changes that took individuals out of the territory.

d. SCAG and DOF population and household size data. These data series were used to update the internal movement population data from PUMS90 to be sensitive to population growth in each of the Edison counties, to convert DLAC data reflecting adult movement to estimates of residential population movement, and to convert, per county and year, the internal and external mover data back to households in a fashion sensitive to geography-by-year variations in household size.

Per SCE-touched county and over the entire county, then, it was possible to aggregate by year or collection of years to obtain estimates of total movement by Edison residents and of the components due to internal movement and movement out of the territory, allowing fairly robust estimation of the proportion of movement initiated in SCE territory which entails leaving the territory.

The procedure yields reasonable estimates of this proportion, although estimation of inter-county migration, or Californian on California migration is generally recognized to be a difficult exercise, particularly in intercensal periods. In the course of doing this small analysis, I encountered work by State of California demographers Hans P. Johnson and Richard Lovelady (Johnson and Lovelady, "Migration between California and Other States: 1985- which speaks quite carefully to these problems. By examining some of the the totals on the California-other US interchanges gathered from various sources by Johnson and Lovelady, I gained confidence in the reasonableness of my estimates.

John Peterson

@Edison Location G03/3-B7; Phone 626-302-8309(Pax 28309);Fax 626-302-6253(Pax 26253); E-mail petersjw@sce.com, petersjw@aol.com

1migr002k -- produce estimates 23:47 Wednesday, February 24, 1999 12

-- migsum1: method 1 estimate proportion exiting territory--

---- one year proportion exit, plus overall 91-97

OCNTYNAM	EXIT90	EXIT91	EXIT92	EXIT93	EXIT94	EXIT95	EXIT96	EXIT97	EXIT9197
027-INYO	0.735	0.711	0.683	0.648	0.690	0.706	0.721	0.746	0.707
029-KERN	0.819	0.819	0.820	0.822	0.815	0.820	0.824	0.832	0.822
031-KINGS	0.663	0.653	0.645	0.638	0.620	0.629	0.637	0.654	0.643
037-LOS ANGELES	0.320	0.319	0.319	0.320	0.301	0.299	0.296	0.292	0.309
059-ORANGE	0.400	0.398	0.396	0.396	0.371	0.374	0.376	0.384	0.387
065-RIVERSIDE	0.485	0.491	0.498	0.507	0.491	0.503	0.513	0.535	0.504
071-SAN BERNARDINO	0.452	0.457	0.465	0.475	0.453	0.458	0.462	0.472	0.462
107-TULARE	0.424	0.422	0.422	0.423	0.404	0.420	0.435	0.465	0.428
111-VENTURA	0.472	0.468	0.463	0.459	0.441	0.437	0.433	0.426	0.450
TTT -- TERRITORY	0.387	0.387	0.388	0.391	0.370	0.375	0.377	0.381	0.382

1migr002k -- produce estimates 23:47 Wednesday, February 24, 1999 13

-- migsum1: method 1 estimate proportion exiting territory--

---- two year proportion exit, plus overall 91-97

OCNTYNAM	EXIT9091	EXIT9192	EXIT9293	EXIT9394	EXIT9495	EXIT9596	EXIT9697	EXIT9197
027-INYO	0.724	0.698	0.666	0.670	0.698	0.714	0.734	0.707
029-KERN	0.819	0.820	0.821	0.819	0.818	0.822	0.828	0.822
031-KINGS	0.658	0.649	0.641	0.629	0.625	0.633	0.646	0.643
037-LOS ANGELES	0.319	0.319	0.320	0.311	0.300	0.298	0.294	0.309
059-ORANGE	0.399	0.397	0.396	0.384	0.372	0.375	0.380	0.387
065-RIVERSIDE	0.488	0.494	0.502	0.499	0.497	0.508	0.524	0.504
071-SAN BERNARDINO	0.455	0.461	0.470	0.464	0.456	0.460	0.467	0.462
107-TULARE	0.423	0.422	0.423	0.414	0.412	0.427	0.450	0.428
111-VENTURA	0.470	0.466	0.461	0.450	0.439	0.435	0.430	0.450
TTT -- TERRITORY	0.387	0.387	0.389	0.380	0.372	0.376	0.379	0.382

-- migsum1: method 1 estimate proportion exiting territory--

---- three year proportion exit, plus overall 91-97

OCNTYNAM	EXIT9092	EXIT9193	EXIT9294	EXIT9395	EXIT9496	EXIT9597	EXIT9197
027-INYO	0.711	0.683	0.674	0.683	0.706	0.725	0.707
029-KERN	0.820	0.821	0.819	0.819	0.820	0.825	0.822
031-KINGS	0.654	0.645	0.635	0.629	0.629	0.641	0.643
037-LOS ANGELES	0.319	0.319	0.314	0.307	0.299	0.296	0.309
059-ORANGE	0.398	0.397	0.388	0.381	0.374	0.378	0.387
065-RIVERSIDE	0.491	0.498	0.499	0.500	0.502	0.517	0.504
071-SAN BERNARDINO	0.458	0.466	0.465	0.462	0.458	0.464	0.462
107-TULARE	0.423	0.423	0.417	0.416	0.420	0.441	0.428
111-VENTURA	0.468	0.463	0.455	0.446	0.437	0.432	0.450
TTT -- TERRITORY	0.387	0.388	0.383	0.379	0.374	0.378	0.382

-- migsum2: method 2 estimate proportion exiting territory--

---- one year proportion exit, plus overall 91-97

OCNTYNAM	EXIT90	EXIT91	EXIT92	EXIT93	EXIT94	EXIT95	EXIT96	EXIT97	EXIT9197
027-INYO	0.733	0.709	0.680	0.645	0.687	0.704	0.719	0.744	0.705
029-KERN	0.818	0.818	0.819	0.821	0.814	0.819	0.823	0.831	0.821
031-KINGS	0.662	0.653	0.645	0.638	0.620	0.629	0.637	0.654	0.642
037-LOS ANGELES	0.320	0.318	0.319	0.320	0.301	0.299	0.296	0.292	0.308
059-ORANGE	0.400	0.397	0.396	0.395	0.370	0.374	0.376	0.384	0.387
065-RIVERSIDE	0.485	0.490	0.498	0.506	0.491	0.502	0.512	0.535	0.503
071-SAN BERNARDINO	0.451	0.457	0.465	0.475	0.453	0.457	0.461	0.471	0.462
083-SANTA BARBARA	0.531	0.523	0.516	0.510	0.493	0.497	0.500	0.508	0.510
107-TULARE	0.424	0.422	0.422	0.423	0.404	0.419	0.435	0.464	0.427
111-VENTURA	0.469	0.464	0.460	0.456	0.438	0.434	0.430	0.423	0.447
TTT -- TERRITORY	0.388	0.388	0.389	0.392	0.371	0.376	0.378	0.383	0.383

-- migsum2: method 2 estimate proportion exiting territory--

---- two year proportion exit, plus overall 91-97

OCNTYNAM	EXIT9091	EXIT9192	EXIT9293	EXIT9394	EXIT9495	EXIT9596	EXIT9697	EXIT9197
027-INYO	0.721	0.695	0.664	0.668	0.696	0.711	0.732	0.705
029-KERN	0.818	0.819	0.820	0.818	0.816	0.821	0.827	0.821
031-KINGS	0.658	0.649	0.641	0.629	0.624	0.633	0.646	0.642
037-LOS ANGELES	0.319	0.319	0.319	0.310	0.300	0.297	0.294	0.308
059-ORANGE	0.398	0.396	0.395	0.383	0.372	0.375	0.380	0.387
065-RIVERSIDE	0.488	0.494	0.502	0.499	0.497	0.508	0.524	0.503
071-SAN BERNARDINO	0.454	0.461	0.470	0.464	0.455	0.459	0.466	0.462
083-SANTA BARBARA	0.527	0.520	0.513	0.502	0.495	0.498	0.504	0.510
107-TULARE	0.423	0.422	0.423	0.413	0.412	0.427	0.450	0.427
111-VENTURA	0.467	0.462	0.458	0.447	0.436	0.432	0.426	0.447
TTT -- TERRITORY	0.388	0.389	0.391	0.382	0.374	0.377	0.381	0.383

-- migsum2: method 2 estimate proportion exiting territory--

---- three year proportion exit, plus overall 91-97

OCNTYNAM	EXIT9092	EXIT9193	EXIT9294	EXIT9395	EXIT9496	EXIT9597	EXIT9197
027-INYO	0.709	0.680	0.672	0.680	0.703	0.723	0.705
029-KERN	0.819	0.819	0.818	0.818	0.819	0.824	0.821
031-KINGS	0.653	0.645	0.634	0.629	0.629	0.640	0.642
037-LOS ANGELES	0.319	0.319	0.313	0.307	0.299	0.295	0.308
059-ORANGE	0.398	0.396	0.387	0.380	0.373	0.378	0.387
065-RIVERSIDE	0.491	0.498	0.498	0.500	0.502	0.517	0.503
071-SAN BERNARDINO	0.458	0.466	0.464	0.462	0.457	0.463	0.462
083-SANTA BARBARA	0.524	0.517	0.507	0.500	0.496	0.501	0.510
107-TULARE	0.423	0.422	0.416	0.415	0.419	0.440	0.427
111-VENTURA	0.464	0.460	0.451	0.443	0.434	0.429	0.447
TTT -- TERRITORY	0.389	0.390	0.384	0.380	0.375	0.379	0.383

---- internal hh migration estimates, 1990-1997 ------
---- based on pums90, dof pop90-98, scag/dof hhsize ---

OCNTYNAM	MIGINT90	MIGINT91	MIGINT92	MIGINT93	MIGINT94	MIGINT95	MIGINT96	MIGINT97
027-INYO	105	105	104	104	104	100	96	99
029-KERN	378	390	402	406	412	397	397	413
031-KINGS	375	386	395	402	407	395	393	409
037-LOS ANGELES	99328	100727	102149	102392	102887	96594	95495	100006
059-ORANGE	44557	45198	46042	46491	46796	43507	43205	45952
065-RIVERSIDE	11199	11582	11862	12007	12076	12112	12261	12639
071-SAN BERNARDINO	24503	25139	25616	25704	25675	27462	28066	27677
083-SANTA BARBARA	2633	2665	2692	2683	2697	2599	2583	2694
107-TULARE	5087	5224	5339	5406	5465	5301	5295	5496
111-VENTURA	12156	12247	12396	12476	12564	12789	12853	13021
TTT -- TERRITORY	200322	203662	206997	208073	209082	201255	200645	208408

---- enternal migration estimates, 1990-1997 ------
---- based on DLAC, dof pop90-98, scag/dof hhsize ---

OCNTYNAM	DLX90	DLX91	DLX92	DLX93	DLX94	DLX95	DLX96	DLX97
027-INYO	287	255	222	189	230	236	247	287
029-KERN	1704	1755	1821	1867	1807	1793	1840	2037
031-KINGS	737	726	717	708	665	668	689	774
037-LOS ANGELES	46640	47068	47773	48142	44252	41160	40125	41232
059-ORANGE	29653	29800	30141	30397	27525	25953	26011	28609
065-RIVERSIDE	10545	11144	11748	12315	11658	12228	12890	14545
071-SAN BERNARDINO	20142	21153	22248	23214	21237	23150	24032	24677
083-SANTA BARBARA	2985	2921	2874	2796	2624	2565	2578	2777
107-TULARE	3742	3815	3898	3964	3699	3829	4069	4766
111-VENTURA	10740	10620	10557	10461	9780	9813	9681	9544
TTT -- TERRITORY	127174	129257	132000	134053	123476	121395	122162	129248

Appendix G:

SAS Contents and Means,
File ALL_DUR1

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CONTENTS PROCEDURE

Data Set Name: ANAL3.ALL_DUR1                        Observations:         3931
Member Type:   DATA                                  Variables:            80
Engine:        V609                                  Indexes:              0
Created:       14:49 Saturday, March 20, 1999        Observation Length:   550
Last Modified: 14:49 Saturday, March 20, 1999        Deleted Observations: 0
Protection:                                          Compressed:           NO
Data Set Type:                                       Sorted:               NO
Label:         Duration file, for analysis

-----Engine/Host Dependent Information-----

Data Set Page Size:       49152
Number of Data Set Pages: 45
File Format:              607
First Data Page:          1
Max Obs per Page:         89
Obs in First Data Page:   70
Physical Name:            LDM21.CFL.RETENT3.SASDATA
Release Created:          6.090460
Release Last Modified:    6.090460
Created by:               LDM21
Last Modified by:         LDM21
Subextents:               7
Total Blocks Used:        360

              -----Alphabetic List of Variables and Attributes-----

 #    Variable    Type    Len    Pos    Label
-------------------------------------------------------------------------------
43    ANAL_ID     Num       8    318    Unique cust ident, by source
61    ATTRIB      Num       6    397    Dur, months midpt handlng of intvls
15    AUTO        Num       3     85    Cntl- auto
49    AUTOP       Num       3    341    Var  auto1     mean-plugged
31    BULBS       Num       4    239    Bulbs involved
30    CDATE       Num       6    233    Censored install date
```

29	CDATEC	Char	6	227	Censored install date
78	CKUNIT	Num	8	526	
79	CKWPOP	Num	8	534	
80	CKWSAMP	Num	8	542	
17	CNTLUNK	Num	3	91	Cntl- unknown
51	CNTLUNKP	Num	3	347	Var cntlunk1 mean-plugged
10	COMM	Num	3	58	COMMERCIAL/OTHER NONRES
47	COMMP	Num	3	335	Var comm1 mean-plugged
23	DUR	Num	8	117	Duration in days
56	DUR1	Num	8	371	Dur for midpt handling of intervals
25	DURMO	Num	8	133	Duration in months
24	DURYR	Num	8	125	Duration in years
62	DUR1MO	Num	6	403	Dur, months midpt handlng of intvls
65	DUR1YR	Num	6	421	Dur, years midpt handlng of intvls

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CONTENTS PROCEDURE

#	Variable	Type	Len	Pos	Label
33	D97_DT	Num	6	249	DOD of sampled prevdead bulb
34	D97_DTC	Char	6	255	DOD of sampled prevdead bulb
19	EL9701	Num	4	97	ELIG9702- INUSEP EXISTS OR DEAD_D
20	EL9702	Num	4	101	ELIG9702- INUSEP EXISTS OR DEAD_D/DK_D
21	ELTRKG	Num	4	105	ELTRKG - none now but trkg estimate ava
53	FOUTSIDE	Num	4	353	Outside dummy, for pop wtg
55	FRMLOC	Char	12	359	Simple location, for pop wtg
54	FRMLOCNO	Char	2	357	Simple location no, for pop wtg
37	FSCID	Num	8	273	
36	G95_DODC	Char	6	267	Gen/upd dodc if not in use
18	HRSDAY	Num	3	94	Hours/day
52	HRSDAYP	Num	3	350	Var hrsday1 mean-plugged
3	IDATE	Num	6	25	INSTALL DATE
5	IDATEC	Char	6	37	INSTALL DATE,CHAR
35	ID2LUTH	Num	6	261	SCE assigned id for Luth 2 use
22	INSTALLD	Num	8	109	Installation, at risk, est, decrem
26	INSTALLX	Num	6	141	Installed (at risk), est,orig
57	LO2	Num	8	379	Lower for interval censoring
12	LOC	Char	15	64	Location
13	LOCNUM	Num	3	79	Location index
63	LO2MO	Num	6	409	Low months,iterval censoring
66	LO2YR	Num	6	427	Low years,iterval censoring
14	MANUAL	Num	3	82	Cntl- manual
48	MANUALP	Num	3	338	Var manual1 mean-plugged
9	MDU_MOB	Num	3	55	MDU OR MOBILE HOME
46	MDU_MOBP	Num	3	332	Var mdu_mob1 mean-plugged
27	NOTE1	Char	40	147	Descrip of install
28	NOTE2	Char	40	187	Descrip of death/censor
4	ODATE	Num	6	31	INTERVIEW DATE
6	ODATEC	Char	6	43	INTERVIEW DATE,CHAR
11	OWNED	Num	3	61	OWNER OCCUPIED
44	OWNEDP	Num	3	326	Var owned1 mean-plugged
77	POPCORR	Num	8	518	

70	PROP_POP	Num	8	462	Population propn deduped frm file
69	PROPINST	Num	8	454	Installation propn
71	PSAMP	Num	8	470	Locnum propn, sample
72	PSAMPL	Num	8	478	Frmlocno proportion
40	RANDX1	Num	8	294	
41	RANDX2	Num	8	302	
42	RANDX3	Num	8	310	
2	RESPID	Num	8	17	Respid, 1997 DSRA survey
76	SAMCORR	Num	8	510	
7	SCE	Num	3	49	SCE CUSTOMER BINARY
16	SENSOR	Num	3	88	Cntl- sensor
50	SENSORP	Num	3	344	Var sensor1 mean-plugged
8	SFDET	Num	3	52	SINGLE FAMILY DETACHED
45	SFDETP	Num	3	329	Var sfdet1 mean-plugged

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CONTENTS PROCEDURE

#	Variable	Type	Len	Pos	Label
1	SOURCE	Char	17	0	FILE SOURCE
59	STATUS1	Char	1	395	Status of rec, for midpt handling
60	STATUS2	Char	1	396	Status of rec, for intvl handling
68	STUDY	Char	15	439	
32	S97_DODC	Char	6	243	199702,svvr, dod if not in use
38	TYPEXEN	Char	10	281	Type of xenergy rec-in,out,both
58	UP2	Num	8	387	Upper for interval censoring
64	UP2MO	Num	6	415	Upper months, intvl censoring
67	UP2YR	Num	6	433	Upper years, intvl censoring
75	WPOP	Num	8	502	Wt to frame bulb tots
74	WSAMP	Num	8	494	Wt to DSRA 9702 locnum
73	WUNIT	Num	8	486	Unit weight
39	XOUTSIDE	Num	3	291	Xenergy outside dummy

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CONTENTS PROCEDURE

-----Variables Ordered by Position-----

#	Variable	Type	Len	Pos	Label
1	SOURCE	Char	17	0	FILE SOURCE
2	RESPID	Num	8	17	Respid, 1997 DSRA survey
3	IDATE	Num	6	25	INSTALL DATE
4	ODATE	Num	6	31	INTERVIEW DATE
5	IDATEC	Char	6	37	INSTALL DATE,CHAR
6	ODATEC	Char	6	43	INTERVIEW DATE,CHAR
7	SCE	Num	3	49	SCE CUSTOMER BINARY
8	SFDET	Num	3	52	SINGLE FAMILY DETACHED
9	MDU_MOB	Num	3	55	MDU OR MOBILE HOME
10	COMM	Num	3	58	COMMERCIAL/OTHER NONRES
11	OWNED	Num	3	61	OWNER OCCUPIED
12	LOC	Char	15	64	Location
13	LOCNUM	Num	3	79	Location index
14	MANUAL	Num	3	82	Cntl- manual
15	AUTO	Num	3	85	Cntl- auto
16	SENSOR	Num	3	88	Cntl- sensor
17	CNTLUNK	Num	3	91	Cntl- unknown
18	HRSDAY	Num	3	94	Hours/day
19	EL9701	Num	4	97	ELIG9702- INUSEP EXISTS OR DEAD_D
20	EL9702	Num	4	101	ELIG9702- INUSEP EXISTS OR DEAD_D/DK_D
21	ELTRKG	Num	4	105	ELTRKG - none now but trkg estimate ava
22	INSTALLD	Num	8	109	Installation, at risk, est, decrem
23	DUR	Num	8	117	Duration in days
24	DURYR	Num	8	125	Duration in years
25	DURMO	Num	8	133	Duration in months
26	INSTALLX	Num	6	141	Installed (at risk), est,orig
27	NOTE1	Char	40	147	Descrip of install
28	NOTE2	Char	40	187	Descrip of death/censor
29	CDATEC	Char	6	227	Censored install date
30	CDATE	Num	6	233	Censored install date
31	BULBS	Num	4	239	Bulbs involved

32	S97_DODC	Char	6	243	199702,svvr, dod if not in use
33	D97_DT	Num	6	249	DOD of sampled prevdead bulb
34	D97_DTC	Char	6	255	DOD of sampled prevdead bulb
35	ID2LUTH	Num	6	261	SCE assigned id for Luth 2 use
36	G95_DODC	Char	6	267	Gen/upd dodc if not in use
37	FSCID	Num	8	273	
38	TYPEXEN	Char	10	281	Type of xenergy rec-in,out,both
39	XOUTSIDE	Num	3	291	Xenergy outside dummy
40	RANDX1	Num	8	294	
41	RANDX2	Num	8	302	
42	RANDX3	Num	8	310	
43	ANAL_ID	Num	8	318	Unique cust ident, by source
44	OWNEDP	Num	3	326	Var owned1 mean-plugged
45	SFDETP	Num	3	329	Var sfdet1 mean-plugged

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CONTENTS PROCEDURE

#	Variable	Type	Len	Pos	Label
46	MDU_MOBP	Num	3	332	Var mdu_mob1 mean-plugged
47	COMMP	Num	3	335	Var comm1 mean-plugged
48	MANUALP	Num	3	338	Var manual1 mean-plugged
49	AUTOP	Num	3	341	Var auto1 mean-plugged
50	SENSORP	Num	3	344	Var sensor1 mean-plugged
51	CNTLUNKP	Num	3	347	Var cntlunk1 mean-plugged
52	HRSDAYP	Num	3	350	Var hrsday1 mean-plugged
53	FOUTSIDE	Num	4	353	Outside dummy, for pop wtg
54	FRMLOCNO	Char	2	357	Simple location no, for pop wtg
55	FRMLOC	Char	12	359	Simple location, for pop wtg
56	DUR1	Num	8	371	Dur for midpt handling of intervals
57	LO2	Num	8	379	Lower for interval censoring
58	UP2	Num	8	387	Upper for interval censoring
59	STATUS1	Char	1	395	Status of rec, for midpt handling
60	STATUS2	Char	1	396	Status of rec, for intvl handling
61	ATTRIB	Num	6	397	Dur, months midpt handlng of intvls
62	DUR1MO	Num	6	403	Dur, months midpt handlng of intvls
63	LO2MO	Num	6	409	Low months,iterval censoring
64	UP2MO	Num	6	415	Upper months, intvl censoring
65	DUR1YR	Num	6	421	Dur, years midpt handlng of intvls
66	LO2YR	Num	6	427	Low years,iterval censoring
67	UP2YR	Num	6	433	Upper years, intvl censoring
68	STUDY	Char	15	439	
69	PROPINST	Num	8	454	Installation propn
70	PROP_POP	Num	8	462	Population propn deduped frm file
71	PSAMP	Num	8	470	Locnum propn, sample
72	PSAMPL	Num	8	478	Frmlocno proportion
73	WUNIT	Num	8	486	Unit weight
74	WSAMP	Num	8	494	Wt to DSRA 9702 locnum
75	WPOP	Num	8	502	Wt to frame bulb tots
76	SAMCORR	Num	8	510	
77	POPCORR	Num	8	518	
78	CKUNIT	Num	8	526	

79	CKWPOP	Num	8	534
80	CKWSAMP	Num	8	542

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Variable	Label	N	Minimum	Maximum	Mean
RESPID	Respid, 1997 DSRA survey	3427	10007.000	21976.000	11795.967
IDATE	INSTALL DATE	3931	12777.000	12777.000	12777.000
ODATE	INTERVIEW DATE	3931	13114.000	14290.000	13641.256
SCE	SCE CUSTOMER BINARY	3632	0.000	1.000	0.974
SFDET	SINGLE FAMILY DETACHED	3931	0.000	1.000	0.870
MDU_MOB	MDU OR MOBILE HOME	3931	0.000	1.000	0.113
COMM	COMMERCIAL/OTHER NONRES	3931	0.000	1.000	0.028
OWNED	OWNER OCCUPIED	3931	0.000	1.000	0.900
LOCNUM	Location index	3726	1.000	10.000	4.629
MANUAL	Cntl- manual	3931	0.000	1.000	0.900
AUTO	Cntl- auto	3931	0.000	1.000	0.055
SENSOR	Cntl- sensor	3931	0.000	1.000	0.024
CNTLUNK	Cntl- unknown	3931	0.000	1.000	0.021
HRSDAY	Hours/day	3931	0.000	24.000	4.428
EL9701	ELIG9702- INUSEP EXISTS OR DEAD_D	3165	0.000	1.000	0.955
EL9702	ELIG9702- INUSEP EXISTS OR DEAD_D/DK_D	3165	0.000	1.000	0.985
ELTRKG	ELTRKG - none now but trkg estimate ava	3165	0.000	1.000	0.015
INSTALLD	Installation, at risk, est, decrem	3165	1.000	85.000	2.232
DUR	Duration in days	3931	0.000	1513.000	843.967
DURYR	Duration in years	3931	0.000	4.142	2.311
DURMO	Duration in months	3931	0.000	49.708	27.728
INSTALLX	Installed (at risk), est,orig	3165	1.000	85.000	2.262
CDATE	Censored install date	3931	12798.000	12798.000	12798.000
BULBS	Bulbs involved	3931	0.167	85.000	1.875
D97_DT	DOD of sampled prevdead bulb	11	12829.000	14228.000	13780.182
ID2LUTH	SCE assigned id for Luth 2 use	299	100190.000	118203.000	109461.625
FSCID		205	52520122.000	55065089.000	54262017.459
XOUTSIDE	Xenergy outside dummy	205	0.000	1.000	0.166
RANDX1		3931	0.000	0.999	0.501
RANDX2		3931	0.001	1.000	0.503
RANDX3		3931	0.000	1.000	0.499
ANAL_ID	Unique cust ident, by source	3931	1110007.000	58065089.000	4267964.229
OWNEDP	Var owned1 mean-plugged	3931	0.000	1.000	0.002
SFDETP	Var sfdet1 mean-plugged	3931	0.000	1.000	0.002
MDU_MOBP	Var mdu_mob1 mean-plugged	3931	0.000	1.000	0.002

COMMP	Var comm1 mean-plugged	3931	0.000	1.000	0.002
MANUALP	Var manual1 mean-plugged	3931	0.000	1.000	0.128
AUTOP	Var auto1 mean-plugged	3931	0.000	1.000	0.128
SENSORP	Var sensor1 mean-plugged	3931	0.000	1.000	0.128
CNTLUNKP	Var cntlunk1 mean-plugged	3931	0.000	1.000	0.128
HRSDAYP	Var hrsday1 mean-plugged	3931	0.000	1.000	0.104
FOUTSIDE	Outside dummy, for pop wtg	3931	0.000	1.000	0.128
DUR1	Dur for midpt handling of intervals	3931	15.000	1513.000	796.873
LO2	Lower for interval censoring	3931	15.000	1513.000	747.954
UP2	Upper for interval censoring	625	15.000	1513.000	822.178
ATTRIB	Dur, months midpt handlng of intvls	0	.	.	.
DUR1MO	Dur, months midpt handlng of intvls	3931	0.493	49.708	26.181
LO2MO	Low months,iterval censoring	3931	0.493	49.708	24.573

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Variable	Label	N	Minimum	Maximum	Mean
UP2MO	Upper months, intvl censoring	625	0.493	49.708	27.012
DUR1YR	Dur, years midpt handlng of intvls	3931	0.041	4.142	2.182
LO2YR	Low years,iterval censoring	3931	0.041	4.142	2.048
UP2YR	Upper years, intvl censoring	625	0.041	4.142	2.251
PROPINST	Installation propn	3931	0.022	0.790	0.173
PROP_POP	Population propn deduped frm file	3931	0.062	0.924	0.200
PSAMP	Locnum propn, sample	3931	0.004	0.908	0.181
PSAMPL	Frmlocno proportion	3931	0.012	0.908	0.257
WUNIT	Unit weight	3931	1.000	1.000	1.000
WSAMP	Wt to DSRA 9702 locnum	3931	0.508	5.811	1.007
WPOP	Wt to frame bulb tots	3931	0.145	24.790	1.075
SAMCORR		3931	1.000	1.023	1.002
POPCORR		3931	1.000	1.023	1.002
CKUNIT		3931	0.167	85.000	1.875
CKWPOP		3931	0.132	70.065	1.877
CKWSAMP		3931	0.373	82.531	1.875

Appendix H:

Description of data and programs transmitted to CPUC (ECO Northwest)

Documentation of Data Transmission to ECO Northwest

We are transmitting the following files and programs, which have been in use on SCE's MVS system.

General purpose frame file.

POSTFRM7. This is a 19,372-record combination of FRAME95 and POSTCD95, as described in the text. The basic record is the individual bounce-back postcard. DSRA-contributed key variable FID indicates a unique "participation record" referring to distinct bulb purchases by distinct customers (customers of at least one manufacturer were motivated by a contest to submit multiple cards). Our slightly different (more aggressive) ID2LUTH keys was developed prior to receiving DSRA FRAME95, and was used in "frame" work for identifying customers to be surveyed by Luth Research. We have many records in POSTFRM7 than DSRA has unique "FIDs" because we include records in POSTFRM7 which have inadequate information for contacting customers DSRA For the last time, we note that the post card files are not really a frame for any well-understood population, due to the low post-card turn-in rate and unknown variations in manufacturer practice, customer motivations, etc. For this reason, we preferred DSRA9702 as a probably less imperfect source of "population parameters" for use in point estimation of EULs. Various flags have been appended to POSTFRM7 (through iterations 1-7) in data development, having to do with selection into various Luth Research samples, etc.

Location: zipped SAS export file postfrm7.xpt (Postfrm7 n=19372)

Survey data

We include basic survey data as received.

FINLRESP (n=530). These are completed surveys from DSRA9702. They are processed somewhat in programs in the BLDxx series (see below), on their way to inclusion in ALL_DUR1 as bulb location records.

DSRA620(n=448) Outbound sample including completed surveys, for DSRAFOLL (Luth research followup on DSRA9702 survivors)

DSRA620O (n=124) "Other response" and uncoded data, merges to DSRA620 via Caseid.

GENPOP (n=957) Outbound sample including completed surveys, for LUTHGENP (Luth's excursion into the general population of postcard submissions, rather than followups on DSRA).
GENPOP0 (n=100) "Other response and uncoded data, merges to GENPOP via Caseid.

UPDU(n=118), UPDV(n=89), UPDW(n=79),UPDX(n=60) Outbound samples for various categories of nonresponse to DSRA9702 survey, including completed surveys.
UPDUO(n=17), UPDVO(n=4), UPDWO(n=12), UPDXO(n=4). "Other response" and uncoded data, merges to UPDU,V,W,X by Caseid.

DXEN2(n=167). Rather than provide the larger 10,815-record XENERGY survey file covering a variety of programs, DXEN2 limits itself to CFB program participants.

All survey files are located in zipped transport file surveys.xpt.

Survival Analysis File ALL_DUR1.

We include the final customer/bulb location/duration file ALL_DUR1 (n=3931).

This analysis file is located in zipped transport file modls.xpt.

Model output files.

We include model output files pertaining to the final model (run 101, generalized gamma):
GGAM2E1: file of control observations used in evaluation of scenarios (post processing LIFEREG)
GGAM2E2: file of data for plotting SDF and residuals
GGAM2E3: parameter estimates for LIFEREG.

We include WEIB2E1-2E3, files created by competitor run 102, Weibull distribution. We also include files GGAM2F1-F3, pertaining to run 111, which is run 101 modified to allow free estimation of scale and shape parameters.

This analysis file is located in zipped transport file modls.xpt.

File construction/data development programs.

We include mainframe programs in the BLD series, concatenated into file BLDSAS.TXT. These programs are located in a PDS on the Edison program. For transport, we flatten them out into a concatenation. Before the commencement of each program in the concatenation, we put in a piece of text flagging and naming the program by name: starting in column1 – HELLOECONW-&PROGNAM. This can be read in by SAS and symputted into a file name macro variable should the need arise to "unpack" this concatenation.

We add file AADOC, which is a running note-description of programs in the BLD series.

This concatenation of file contruction/data development programs is located in zipped directory PGMS.

ANALxxx programs.

We include concatenation of all ANALxxx (analysis file) into ANALSAS.TXT, as described for the BLD files above. Note that programs in the 30-50 series are phase 1 modeling efforts, the 60-90 series are superseded efforts in phase 2, the 100-140 and 160 series are phase 2 modeling efforts, ANAL0153 estimates medians adjusted for bulb migration, ANAL0152 estimates the monthly exit/stayer rate, and series 170 and 180 are bootstrap standard error estimation programs.

ANALSAS.TXT is located in zipped directory PGMS

MISC program.

We include a concatenation of miscellaneous programs ("includable" format or format linker programs, in the main), into MISCSAS.TXT.

MISCSAS.TXT is located in zipped directory PGMS