Appendix A

Standardized List of Minor Home Repairs

STANDARDIZED LIST OF MINOR HOME REPAIRS

1.0 DEFINITION OF MINOR HOME REPAIR
A repair required to enable installation of weatherization measures or made to reduce infiltration.

STANDARDIZED LIST OF MINOR HOME REPAIRS

	STD	PG&E	SCGas	SDG&E	SCE
2.0 GENERAL REPAIRS/CATASTROPHIC ENVELOPE LEAKS					
2.1 Roof					
1. Replace missing shingles	NO	NO	NO	NO	NO
2. Place mastic over hole	NO	NO	NO	NO	YES
3. Flashing problems	NO	NO	NO	NO	NO
2.2 Small holes in interior surface of wall between conditioned and unconditioned space					
1. Repair holes 1" in diameter or smaller	YES	YES	YES	NO	YES
2. Repair holes between 1" and 6"	YES	YES	YES	NO	YES
2.3 Large holes in interior surface of wall between conditioned and unconditioned space[1]					
1. Repair large portion of drywall or plaster (up to 4 ft^2).	YES[2]	YES	NO	NO	YES
2. Replace entire drywall or wood panels (up to 8 ft^2).	YES[2]	YES	NO	NO	YES[3]
2.4 Exterior wall					
1. Patch stucco (up to 36 in^2)	YES	YES	YES	NO	YES
2. Replace siding	NO	YES	NO	NO	NO
3. Replace shingles	NO	YES	NO	NO	NO
2.5 Vents/Fans					
1. Repair range hood	NO	NO	NO	NO	NO
2. Repair range	NO	NO	NO	NO	NO
3. Repair exhaust vents	NO	NO	NO	NO	YES
4. Install exhaust vents	NO	NO	NO	NO	YES
2.6 Fireplace damper					
1. Adjust damper	NO	NO	NO	NO	NO
2. Clean damper	NO	NO	NO	NO	NO
3. Install new damper	NO	NO	NO	NO	NO
2.7 Windows					
1. Replace glazing compound	YES	YES	YES	YES	YES
2. Replace glass	YES	YES	YES	YES	YES
3. Replace sash	YES[3]	YES	YES	NO	YES
4. Repair or replace mullions/muntins	YES[3]	YES	NO	NO	YES
5. Install new window (not just glass)	YES[3]	YES	YES	NO	YES
6. Install casing	YES	YES	YES	YES	YES

[1] Structural/framing members not included
[2] Surface left in a prepared-for-paint condition.
[3] Replaced only on a case-by-case basis with Program Manager's prior approval.

STANDARDIZED LIST OF MINOR HOME REPAIRS

	STD	PG&E	SCGas	SDG&E	SCE
3.0 REPAIRS REQUIRED TO SUPPORT WEATHERSTRIPPING					
3.1 Door Replacement					
1. Install door stops	YES	YES	YES	YES	YES
2. Replace door	YES	YES	YES	YES	YES
3. Replace door jamb	YES	YES	YES	YES	YES
4. Plane bottom of door	YES	YES	YES	YES	YES
5. Cut off bottom of door	YES	YES	YES	YES	YES
6. Replace interior casing	YES	YES	YES	YES	YES
7. Replace exterior casing	YES	YES	YES	YES	YES
8. Replace complete pre-hung door unit	YES[3]	YES	NO	YES	YES
9. Adjust hinges	YES	YES	YES	YES	YES
10. Replace hinges	YES	YES	YES	YES	YES
11. Adjust loose screws	YES	YES	YES	YES	YES
12. Replace lock	YES	YES	YES	YES	YES
13. Replace existing night latch	YES	YES	YES	YES	YES
14. Install/adjust striker plate	YES	YES	YES	YES	YES
15. Repair/replace subseal[4]	YES	YES	YES	YES	YES
3.2 Threshold					
1. Install new threshold	YES	YES	YES	YES	YES
2. Seal threshold	YES	YES	YES	YES	YES
3. Install riser	YES	YES	YES	YES	YES

[4] Subseal is directly under the riser which is directly under the threshold.

STANDARDIZED LIST OF MINOR HOME REPAIRS

	STD	PG&E	SCGas	SDG&E	SCE
4.0 REPAIRS REQUIRED TO SUPPORT CAULKING					
1. Install backer rod	YES	YES	YES	YES	YES
2. Remove old paint	NO	NO	NO	NO	NO
3. Remove dry rot	NO	NO	NO	NO	NO
4. Surface must be free of dirt and oils	YES	YES	YES	YES	YES
5.0 REPAIRS REQUIRED TO SUPPORT INSTALLATION OF CEILING INSULATION					
5.1 Attic access					
1. Install weatherstripping	YES	YES	YES	YES	YES
2. Repair access panel	YES	YES	YES	YES	YES
3. Replace molding around access	YES	YES	YES	YES	YES
4. Cut new access hole/opening (interior only and only between joists)	YES	YES	YES	YES	YES
5.2 Reconnect Duct	YES	YES	NO	YES	YES
5.3 Seal Return Plenum	YES	NO	NO	YES	YES
5.4 Closet vent/ceiling					
1. Cover vent with flexible insulation	YES	YES	NO	NO	NO
2. Install solid material to cover opening	YES	YES	YES	YES	YES
5.5 Retractable ladder					
1. Install cover	YES	NO	NO	YES	NO
2. Install frame and cover	YES	NO	NO	YES	NO
3. Weatherstrip opening	YES	YES	NO	YES	NO
5.6 Repair holes in ceiling	YES	YES	NO	YES	YES
5.7 Exhaust vent					
1. Repair/replace bath vent pipe	YES	NO	YES	YES	YES
2. Repair/replace kitchen vent pipe	YES	NO	YES	YES	YES

STANDARDIZED LIST OF MINOR HOME REPAIRS

	STD	PG&E	SCGas	SDG&E	SCE
6.0 REPAIRS REQUIRED TO INSTALL ATTIC VENTILATION[5]					
6.1 Gable vent					
1. Install new vent	YES	YES	YES	YES	YES
2. Replace screen	YES	NO	YES	YES	YES
3. Repair existing wooden vent	YES	NO	NO	YES	YES
6.2 Turbine/dormer					
1. Install new vent	YES	YES	YES	YES	NO
2. Repair existing vent	YES	NO	NO	YES	NO
6.3 Eave/soffit					
1. Clean screen	YES	YES	YES	YES	NO
2. Replace screen	YES	NO	YES	YES	NO
3. Install new vent	YES	YES	YES	YES	NO
7.0 REPAIRS REQUIRED TO INSTALL WATER HEATER INSULATION					
7.1 P/T valve					
1. Install valve	NO	NO	NO	NO	NO
2. Reposition valve	NO	NO	NO	NO	NO
7.2 P/T drain line					
1. Install new P/T drain line	NO	NO	NO	NO	NO
2. Extend drain to exterior	NO	NO	NO	NO	NO
7.3 Install gas shut off valve	NO	NO	NO	NO	NO
7.4 Install combustion air vent[6]	ON HOLD	YES	NO	YES	NO
7.5 Repair floor	NO	NO	NO	NO	NO
7.6 Repair outside closet	NO	NO	NO	NO	NO
8.0 REPAIRS REQUIRED TO INSTALL ENERGY SAVER SHOWERHEADS					
1. Install adapter	YES	YES	YES	YES	YES

[5] Attic ventilation only installed in support of attic/ceiling insulation.
[6] Hold this one for CO/CAS discussion.

Appendix B

Ceiling Insulation Analysis

B.1 Introduction

This appendix discusses the Standardization Team's current approach to the analysis of ceiling insulation levels. The general approach is described in Section 2. As will be pointed out in Section 3, the implementation of this approach requires a variety of assumptions relating to insulation costs and benefits. At the present time, the analysis must be based on several highly uncertain assumptions with respect to electricity markets. Moreover, assumptions must be made that anticipate the recommendations of the RRM and LIMEC with respect to cost-effectiveness analysis. These issues are discussed in Section 4. As demonstrated in Section 5, variations in key assumptions can dramatically affect the results of the analysis. Section 6 offers some conclusions and recommendations.

B.2 General Approach

After discussion of existing policies, the reasons for those existing policies, and some of the issues surrounding ceiling insulation, it was decided that a cost analysis should be performed to help assess what levels of insulation made sense. The first attempt by the group was to examine cost effectiveness by comparing the value of customer energy savings versus installed costs. Installed cost estimates were derived from utility costs and an independent source, 1996 Means Residential Cost Data. However, calculation of the value of customer savings was a more involved process.

First, energy savings (in kWh and therms) had to be estimated. Standard ASHRAE (American Society of Heating, Refrigeration, and Air Conditioning Engineers) procedures were used for calculating U-Values.[1] These procedures are also incorporated in to the Title 24 Standards. Next, Heating/Cooling Degree Day (HDD/CDD) estimates were obtained from CEC Climate Zone weather data, and condensed down to the five climate zones to be used for the weatherization effort (see Appendix C). These two components were used to estimate heat loss/gain through the roof, which was then converted to source energy (gas/electric) energy use (therms or kWh). Assumed energy costs were then applied to obtain customer savings.

[1] 1997 ASHRAE Handbook of Fundamentals, Chapter 24.

An extensive range of insulation levels was examined for each climate zone. The base analyses were performed for both electric and gas heating systems with air conditioning. Since the team thought fuel-based insulation levels might be hard to implement, we also looked at an average of these two runs; one that weighted the natural gas/electric results as 90% /10% to reflect current fuels shares for space heating in California.

B.3 Assumptions

In order to conduct the analysis of ceiling insulation savings, several assumptions must be made. These assumptions relate to the installed cost of various levels of ceiling insulation, the lifetime of the insulation, the discount rate used to convert forecasted values to present discounted values, the current valuation of electricity and natural gas savings, and forecasted escalation rates for these valuations. Table B-1 contains the assumptions used in the baseline analysis.

Table B-1: Baseline Assumptions

Concept	Assumed Value
Installed Cost of Ceiling Insulation	
R-11	$0.35 per square foot
R-19	$0.47 per square foot
R-30	$0.63 per square foot
R-38	$0.75 per square foot
Lifetime of Ceiling Insulation	25 years
Discount Rate	8%
Retail Electricity Rate in 2000	$0.125
Avoided Electricity Cost (G, T & D) in 2000	$0.071
Natural Gas Rate in 2000	$1.00
Natural Gas Avoided Cost in 2000	$0.70
Escalation Rate for Retail Electricity Rate	3%
Escalation Rate for Avoided Electricity Cost	3%
Escalation Rate for Retail Natural Gas Rate	3%
Escalation Rate for Avoided natural Gas Cost	3%

Under the baseline scenario, we used the average of retail rates and avoided costs to value electricity and natural gas savings.

B.4 Issues Considered and Discussed

The issues that arose from team discussions are summarized briefly below.

- ***The Hardship/Comfort Issue.*** Adding insulation reduces heat losses/gains through the roof, and may also indirectly reduce infiltration. Increased comfort that might be experienced by the resident would include a reduction in radiative heat loss through the roof (similar to what is experienced when you stand next to a single-paned window in the winter time) and possibly a reduction in cold drafts originating from the attic. In the case of a bare, uninsulated attic, the comfort benefits are relatively clear. However, in the case where an existing level of insulation is present and more is to be added, the issue becomes one more of energy savings than comfort (i.e. running the heating system six hours instead of eight hours).

  However, comfort may be an important issue in the consideration of air conditioning savings. Because of the low air conditioning saturations among low income customers, the installation of ceiling insulation will affect cooling bills for only a small fraction of participants. However, insulation will affect comfort during hot days by keeping internal temperatures lower. In order to take this into account, we used an intentionally overstated assumption about the air conditioning saturation among low income customers: 50%.

  Comfort has also been taken into account indirectly through the use of engineering calculations of savings. These estimates ignore the well-documented fact that customers receiving conservation measures often take some of the potential savings from these measures in the form of comfort. That is, they choose a higher level of energy service (e.g., warmer homes in the winter) as a result of the increased efficiency of the home. This is sometimes called the "rebound effect." If we were to consider the rebound effect, we would use lower estimates of savings based on the general results of billing analyses of programs like this one. Ignoring the potential for the rebound effect essentially implies that we are treating increases in comfort associated with comfort tradeoffs as part of the benefits of insulation additions.

- ***Valuing Energy Savings.*** As noted in our Phase I Report, the valuation of energy savings could be conducted from the perspective of participants (using retail rates) or from a resource cost perspective (using avoided costs). Our Phase I report discussed the implications of using these alternative approaches in assessing program cost-effectiveness, and recommended that an average of retail rates and avoided costs be used. Our baseline analysis was based on this assumption. However, we conducted other analyses using retail rates or avoided costs.

- ***Forecasted Values.*** Whether avoided costs or retail rates or some combination of these is used to value energy savings from different ceiling insulation additions, a forecast of the chosen rate is necessary for the analysis. At this point, given recent events in the California electricity market, the accuracy of existing long-term forecasts of electricity prices and avoided costs may be subject to question.

In our baseline scenario, we used a 3% growth rate for retail rates and avoided costs. However, we tested the sensitivity of the results to this assumption by positing a 6% rte of escalation for one scenario.

- ***Specification of Insulation Level to be Installed.*** Two approaches are represented in the current policies and both were discussed. The PG&E approach is to install up to a specified, final R-value (R-30). The explanation for using this approach was ease of inspection and to address customer equity concerns. The approach utilized by the other utilities is to install a discrete R-value of insulation (R-11, R-19, R-30) based on the existing level of insulation. This explanation for using this approach was that it best reflects the standard practice of insulation installation for insulation contractors. The Team adopted the latter approach for the purposes of the analysis.
- ***Attic Access/Clearance Issue.*** Some homeowners may want to ensure adequate access to their attic. Installation of R-30 could drastically reduce homeowner access to attic. However, the customer now has the right to refuse the measure, which should prevent these types of situations, as long as the customer is presented with the option to refuse treatment.
- ***Fuel-Dependent Insulation Levels.*** The cost analysis showed clearly that the cost-effectiveness of attic insulation depends strongly on the heating fuel. However, some Program staff are reluctant to have separate policies on insulation levels for customers with gas and electric space heating. In recognition of this, the group developed analyses for three cases: electric space heating, gas space heating, and a mix of 90% gas and 10% electric. The analysis shown in this appendix focuses on the last approach.

B.5 Sensitivity of Results to Variation in Assumptions

B.5.1 Baseline Analysis

A baseline analysis was conducted using the baseline assumptions displayed in Table B-1. It also assumes a mix of 90% gas and 10% electric space heating. The results indicate *the present value of net benefits* associated with the installation of different levels of insulation in homes with different starting values. That is, they reflect the difference between the present value of 25 years' worth of energy savings and the installed cost of the insulation. Table B-2 presents the results of this analysis for the North Coast Climate Zone.

Table B-2: Baseline Results for North Coast Climate Zone

Initial R-Value	Amount of Ceiling Insulation Added to Existing Level			
	R-11	**R-19**	**R-30**	**R-38**
R-0	$4765.18	$5273.35	$5401.92	$5366.57
R-11	$296.10	$356.19	$350.86	>R-38
R-19	-$151.99	-$187.35	>R-38	>R-38

As shown in Table B-2, for a home with no existing ceiling insulation in the North Coast climate zone, the present value of net benefits is highest for the installation of R-30. For a comparable home with R-11 existing insulation, the present value of net benefits is highest for the installation of R-19. For homes with existing levels of insulation of R-19, no addition of insulation yields positive net benefits. As shown in Table B-3 for the North Coast, the implications of this analysis would be that R-30 would be installed where no insulation is present, R-19 would be installed where R-11 is present, and no insulation would be installed where R-19 is already present. The results of similar analyses for the other four climate zones are also presented in Table B-3.

Table B-3: Implied Ceiling Insulation Policies (Baseline Assumptions)

Climate Zone	*Existing* Ceiling Insulation Level	Insulation to be *Added*
North Coast	R-0	R-30
	R-11	R-19
	R-19	None
South Coast	R-0	R-19
	R-11	None
	R-19	None
Inland	R-0	R-30
	R-11	R-19
	R-19	None
Desert	R-0	R-30
	R-11	R-19
	R-19	None
Mountain	R-0	R-38
	R-11	R-19
	R-19	R-19

B.5.2 Impact of Variations in Assumptions

It should be recognized that the results of the analysis are very sensitive to specific assumptions about which there is considerable uncertainty. Tables B.3a, B.3b and B.3c illustrate the sensitive of the implied insulation policies for three alternative scenarios, defined as follows:

- ***Scenario 3a.*** Scenario 3a uses avoided costs to value gas and electricity savings, rather than an average of retail rates and avoided costs. Since avoided costs are lower than retail rates under our assumptions, scenario places a lower valuation on energy savings than the baseline case.
- ***Scenario 3b.*** Scenario 3b uses retail prices to value gas and electricity savings. This scenario places a higher valuation on savings than the baseline case.
- ***Scenario 3c.*** Scenario 3c uses retail prices, but assumes that retail rates escalate at 6% rather than 3% over the next 25 years. Of course, this implies a higher valuation of energy savings than the baseline case.

Table B-3a: Implied Ceiling Insulation Policies (Scenario 3a)

Climate Zone	*Existing* Ceiling Insulation Level	Insulation to be *Added*
North Coast	R-0	R-30
	R-11	R-19
	R-19	None
South Coast	R-0	R-19
	R-11	None
	R-19	None
Inland	R-0	R-30
	R-11	R-19
	R-19	None
Desert	R-0	R-30
	R-11	R-19
	R-19	None
Mountain	R-0	R-38
	R-11	R-19
	R-19	R-19

Table B-3b: Implied Ceiling Insulation Policies (Scenario 3b)

Climate Zone	*Existing* Ceiling Insulation Level	Insulation to be *Added*
North Coast	R-0	R-30
	R-11	R-19
	R-19	None
South Coast	R-0	R-30
	R-11	R-11
	R-19	None
Inland	R-0	R-30
	R-11	R-19
	R-19	None
Desert	R-0	R-30
	R-11	R-19
	R-19	None
Mountain	R-0	R-38
	R-11	R-19
	R-19	R-19

Table B-3c: Implied Ceiling Insulation Policies (Scenario 3c)

Climate Zone	*Existing* Ceiling Insulation Level	Insulation to be *Added*
North Coast	R-0	R-38
	R-11	R-19
	R-19	R-19
South Coast	R-0	R-30
	R-11	R-19
	R-19	None
Inland	R-0	R-38
	R-11	R-19
	R-19	R-19
Desert	R-0	R-38
	R-11	R-19
	R-19	R-19
Mountain	R-0	R-38
	R-11	R-19
	R-19	R-19

Table B-4 summarizes the results of the analyses under the four scenarios. As shown, the implied insulation values vary substantially across scenarios. Hidden in these results is the fact that implied values also change as assumptions with respect to installed costs and other factors vary.

Table B-4: Scenario Comparisons

Climate Zone	Existing Insulation	Most Cost-Effective Increases in Insulation			
		Baseline Scenario	**Scenario 3a** (avoided costs)	**Scenario 3b** (retail prices)	**Scenario 3c** (higher escalation)
North Coast	R-0	R-30	R-30	R-30	R-38
	R-11	R-19	R-19	R-19	R-19
	R-19	None	None	None	R-19
South Coast	R-0	R-19	R-19	R-30	R-30
	R-11	None	None	R-11	R-19
	R-19	None	None	None	None
Inland	R-0	R-30	R-30	R-30	R-38
	R-11	R-19	R-19	R-19	R-19
	R-19	None	None	None	R-19
Desert	R-0	R-30	R-30	R-30	R-38
	R-11	R-19	R-19	R-19	R-19
	R-19	None	None	None	R-19
Mountain	R-0	R-38	R-38	R-38	R-38
	R-11	R-19	R-19	R-19	R-19
	R-19	R-19	R-19	R-19	R-19

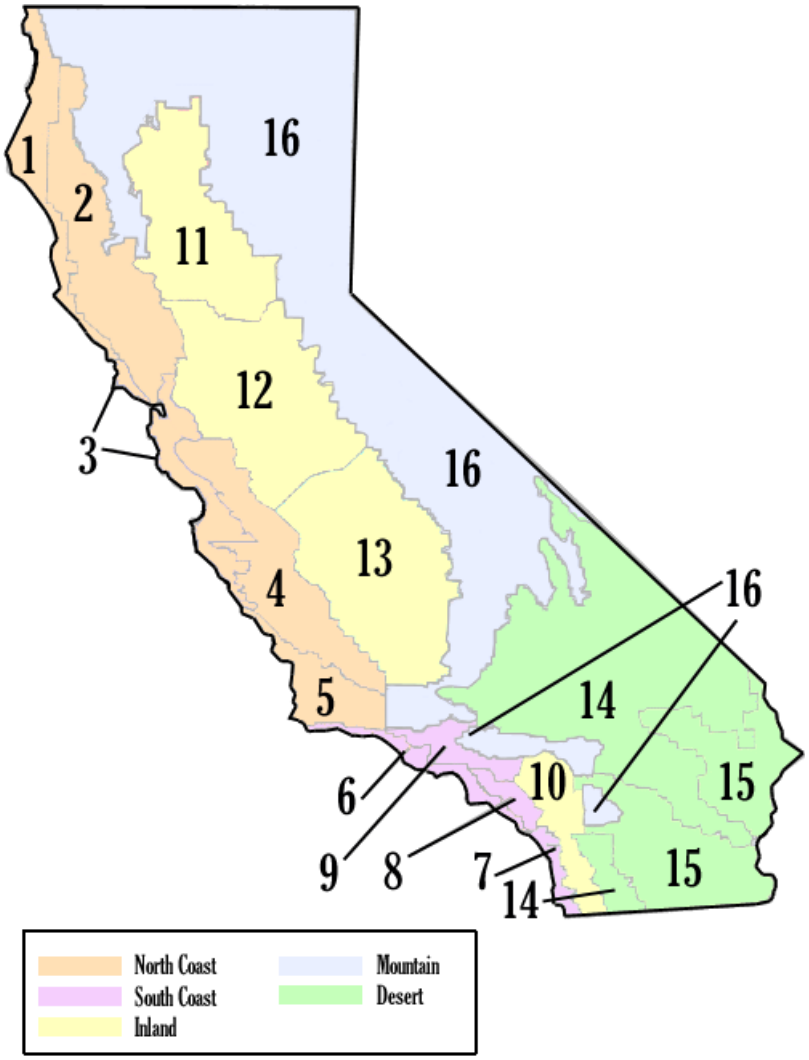
B.6 Conclusions and Recommendations

We conclude that there are several issues that need to be decided before the analysis discussed in this appendix can be finalized. Clearly, the results of discussions at RRM and LIMEC need to be reviewed carefully before the analysis is completed.

Appendix C

Climate Zones to be Used for Determining Attic/Ceiling Insulation Levels

Figure C-1: Proposed Climate Zones for Attic/Ceiling Insulation Levels



NOTE

California Energy Commission (CEC) climate zones (numbers on figure) are mapped to the five proposed ceiling/attic insulation climate zones as shown in Table C-1.

Table C-1: Attic/Ceiling Insulation Climate Zones versus CEC Climate Zones

Ceiling Insulation Climate Zone	CEC Climate Zone
NORTH COAST	1
	2
	3
	4
	5
SOUTH COAST	6
	7
	8
	9
INLAND	10
	11
	12
	13
DESERT	14
	15
MOUNTAIN	16