UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

Memorandum

Date: March 10, 2003

TO : William H. King, Jr., ESEE

THROUGH: Warren J. Prunella, Associate Executive Director for Economic Analysis

FROM : Terrance R. Karels, EC

SUBJECT : Economic Considerations --- GFCIs

You asked that Economic Analysis provide you with some preliminary estimates of the costs and benefits of a proposal for additional Ground Fault Circuit Interrupters (GFCIs) in new residential installations. While some residential circuits already require GFCI protection, there are approximately 10 circuits per residence (excluding dedicated circuits for certain major appliances such as furnaces or central air conditioning) that do not require GFCI protection.

Electrocution Cost to Society

The Commission's Directorate for Epidemiology reports that there was an average of 196 residential electrocutions in the US related to consumer products over the 5-year period 1995-1999.[1] Some of these deaths occurred in locations prior to the electricity entering the home (such as in contact with overhead power lines), and would not be protected by GFCIs within the home. Also, some electrocutions have occurred in older homes in locations that have been addressed in later construction. An examination of locations and scenarios in which consumer electrocutions occurred in 1999[2] indicates that about 53% of electrocutions occurred in scenarios for which GFCI protection would not be effective, or which have been previously addressed. Thus, based on the 1999 study, 47% of the electrocutions (or an average of 92 deaths per year) could have been addressed with the inclusion of GFCI protection in homes. An earlier UL study found GFCI protection to be 81% to 95% effective in preventing electrocution deaths.[3] Thus, 75-88 deaths per year may be averted by expanding the coverage of GFCI protection to other circuits in the residence (196 x .47 x (.81 to .95)).

For analytical purposes, the CPSC assigns a statistical value per life of $5 million. Thus, the addition of GFCI protection to other circuits in the residence would result in a reduction of the cost to society of electrocution of $375 to $440 million per year ($5 million x 75-88). There are likely other incidents that may involve injuries, but not death. Since the number and severity

[1] "1999 Electrocutions associated with Consumer Products," Hazard Analysis Division, Directorate for Epidemiology, July 2002

[2] This is the latest extensive study of electrocution hazard patterns, and for that reason is used to forecast future electrocution scenarios. In certain situations, midpoint analysis has been used to allocate unknown locations.

[3] "Analysis of Protection By GFCIs," 1982, Underwriters Laboratories

of these injuries is not now known, we have not included injury costs in the calculation of societal costs associated with residential electrocutions.

Housing Units

According to Census Bureau data,[4] there was an average of 102.3 million occupied housing units in the US over the period 1995-99, the period that corresponds to the 5-year period of reported electrocution deaths. It is reasonable to assume that, although many of these housing units may have some limited GFCI protection (GFCI protection in bathrooms and other locations), few would have the extent of GFCI protection as in the proposal. Thus, the potential for electrocution is likely to be spread over the entire stock of housing units. Thus, the societal cost of electrocutions in the US would be $3.67-$4.30 per household per year ($375 million/102.3 million and $430 million/102.3 million).

Savings Over the Life of the GFCI

In 1982, at about the time that GFCIs entered widespread use, Underwriters Laboratories estimated that the expected useful life of GFCIs averaged about 40 years.[5] The benefits of GFCIs are expected to accrue over the entire useful life of the products.

The total benefits would be the present discounted value of the reduction in societal costs associated with residential electrocutions over the useful life of the GFCIs. If the expected annual societal costs are discounted at 3% per year, with a 40-year useful life, and assuming that the benefits are distributed evenly over the life of the GFCIs, the present discounted benefits would be $86 to $100 per household. The discount rate has a significant effect on the present value of societal costs. For example, at a 7% discount rate, the present discounted value of societal costs addressed by GFCIs would be $49.50 to $58 over a useful life of 40 years.

If GFCIs experienced a shorter expected useful life, the present discounted value of societal costs would decline. If a 30-year useful life is used, discounted at 3%, the discounted value would be $73 to $86 over the lifetime of the product. If a 30-year useful life is used in conjunction with a 7% discount rate, the discounted value would be $46.50 to $54.50 over the product's useful life.

Cost of GFCIs

In order to provide protection to a circuit, a GFCI receptacle could be used as the first receptacle in each circuit series. This would provide GFCI protection for each receptacle on that circuit. Economics staff reviewed offerings among local hardware and do-it-yourself stores, and found that GFCI receptacles varied in price from about $5 to over $20, and that non-GFCI receptacles varied in price from less that $1 to over $14. ES staff noted that GFCI receptacle devices are commonly available at about $6 each, and that the average cost of a non-GFCI

[4] Statistical Abstract of the United States: 2001

[5] UL based its estimate based on reported service experience from the field at that time. ES staff note that significant improvements in GFCI designs over the intervening 20 years.

receptacle is about $1.[6] There is not expected to be an increase in labor costs associated with the installation of a GFCI receptacle in place of a non-GFCI receptacle in new housing. According to ES staff, there are about 10 additional circuits per household that would be provided with GFCI protection. Thus, the average cost differential for adding GFCI protection would be $5 per circuit for each of the 10 circuits protected, or $50 per household.

Comparison of Costs and Benefits

As shown above, the expected average cost of adding GFCIs would be $50 per household. These costs are borne at installation. The benefits, in the form of reduction of societal costs associated with residential electrocutions, continue over the lifetime of the GFCIs, and are subject to discounting.

If GFCIs experienced a 40-year useful life, and if discounted at 3%, the expected benefits (i.e., about $86 to $100 per household) would be greater than the cost. In this case, the net benefits per household (benefits minus costs) would range from about $36 to $50. Even at a 7% discount rate, the expected benefits (about $49.50 to $58 per household) would be greater than or equal to the costs; the net benefits would range from about zero to $8 per household.

If GFCIs experienced a 30-year useful life, and if discounted at 3%, the benefits (i.e., $73 to $86 per household) would be greater than the costs, yielding a net benefit of $23 to $36. Using a 7% discount rate, the estimated benefits would be ($46.50 to $54.50 per household) would be about equal to costs.

The analysis above assumes a $5 price differential between GFCI and non-GFCI receptacles. If, however, the price differential is greater than $5, the results of the analysis could change. For example, if the price differential were $10 (and, hence, the cost of protecting 10 circuits were $100), the benefits would equal the costs only if the benefits are discounted at 3% for 40 years.

[6] Available information do not allow for computing the average or modal cost of these products, but the review of retail offerings indicates that the price differential suggested by ES (i.e., about $5 per receptacle) may be appropriate.