

7.3 Implementation of Recommendations

7.3.1 Perspectives of Various Actors Concerned About Safety

Successful implementation of bathtub and shower area safety recommendations requires the involvement and cooperation of three prominent groups; government, industry and consumers. Each of these three groups views the problem of safety and its implementation in different ways. Certain government agencies are mandated to play an important and, if necessary, leading role in the process of reducing injury. Government activity may include studying the problem to assess the type, frequency and severity of accidents, and then initiating action to reduce the rate of injury. Manufacturers in general, approach the problem with an awareness both of the risks to the consumer of certain products and also of the barriers to improvement of the situation. In making innovations, manufacturers must contend with engineering, design, and testing problems, competition for the available market of buyers and users; cooperation among various business interests; manufacturing constraints including materials, labor, retooling, etc.; advertising and educational costs; and distribution and sales problems. Manufacturers are bound by professional and legal responsibility for their products, and by the constraints of voluntary and/or mandatory controls, whether they be prescriptive standards (which may reduce market innovation) or performance guidelines, which indicate the desired performance for the user (which may stimulate innovation). Manufacturers risk loss through introduction of products in untested markets and risk liability for consumer injuries associated with products (particularly those identified as "safety products"), although injuries may result from consumer misuse, improper installation or other considerations not within the manufacturer's control.

The consumer may believe that he is exercising reasonable caution in the bathtub and shower area, especially since the probability of accident to a given individual is

relatively low. Thus, he may not be aware of danger until injury is imminent or has already occurred. This naivety and lack of awareness are factors for most consumers who may feel products will perform their specified function with minimal risk. It follows that the consumer may not perceive sufficient risk to warrant the investment of time and money in the purchase and installation of safety performance bathtub and shower area products. Moreover, even should such a need be perceived, buyers frequently lack sufficient information to purchase, install, and use safety products correctly. In addition, those groups in society who are most in need of protection are often those people least able to effect changes, for economic or other reasons. Three primary groups in this situation are children, the elderly, and the handicapped.

The consumer also retains the option, if injury occurs, of seeking redress through government agencies or the courts directed at builders, wholesalers, retailers or manufacturers.

With these perspectives in mind, it becomes clear that in order to achieve increased bathtub and shower area safety, each group must, whenever possible, time and coordinate its separate roles and responsibilities with the effort of other appropriate elements.

The two sections that follow suggest where effort be placed by the government, industry, and consumers for effective implementation of products and concepts that can reduce bathtub and shower area injury. The first section deals with cooperative information dissemination through education and advertising to government, industry and consumers. The second section concerns cooperative product development between government and industry with feedback from the consumer.

7.3.2 Cooperative Information Dissemination

Education and advertising are two means by which information may be communicated.

Educational and advertising efforts serve two primary functions. First, a market for safety products can be developed, thereby eliminating a significant number of bathtub injuries each year and yielding concomitant savings for the nation as a whole. The problem of the manufacturer in trying to reach this market, however, is that a low level of awareness exists in some of the endangered groups, although not in all of them (the elderly and the handicapped are generally aware of safety issues). Therefore, if education effort were undertaken which can raise the consumer's level of awareness of potential hazards associated with the bathtub/shower area, then a significant market for safety products will also be opened up. Manufacturers at present also face the problem of not wanting their products to be associated with danger.

The second function of educational and advertising efforts is to influence the behavior of the user, not only in selection, but also in installation and operation of products. At present, many safety products and bathtub products generally are misused by the consumer.

The process of developing an educational program includes first, identification of the purpose of an educational effort; second, identification of a target population; and third, development of a methodology to reach the specified target group for the stated purpose. Suggestions of components for such an educational program are listed below. These ideas do not represent a complete program for education, but rather are avenues to be explored.

Education (and advertising) target groups include:

- architects, designers, industrial engineers, and manufacturers;
- wholesalers and retailers of bathtub and shower area fixtures, fittings, and accessories;
- builders, contractors and tradesmen who buy, build, and install products;
- related trade unions, both local and national;
- users, including parents, housewives; children, handicapped and elderly, those who buy occasionally install on a do-it-yourself basis;

- potential large clients, such as hotels, motels, condominiums, hospitals, nursing homes, and government itself;
- economic or social groups where physical changes in environment may be less likely, such as welfare groups.

Methodology Suggestions:

- developed appropriately for the target groups above, including graphic non-verbal illustration to reach the widest audience;
- pointed not only to dangers and safety itself, but indirectly supporting safety products and procedures through more "attractive-positive" issues of beauty, energy conservation, money saved or well-being;
- directed to stimulate the market for retrofit safety products, since this is a large and vital group to address;
- repeated briefly and frequently, to increase buyers' and users' acceptance of emphasis on safety.

Government can effectively educate in its non-profit role through:

- television, radio, and other electronic media;
- newspaper articles, magazine stories and explanatory pamphlets;
- libraries and community information resource centers;
- social welfare agencies;
- workshops and conferences where data (including NEISS) studies are presented to other government sectors, industry and consumers.

Industry can educate through:

- trade associations. Strengthened communication and cooperation among fixtures, fittings and accessories manufacturers in trade associations could mean:
 - larger scale, more comprehensive user safety awareness education,
 - increased promotion of understanding within industry of user needs in, for example, trade journals, newsletters,
 - development of improved designs based on safety and other performance guidelines,

--more effective education toward actual buyers, wholesalers, contractors and trademen in trade journals, pamphlets, newsletters.

- increased media exposure;
- newspaper and newsletters;
- messages on other related bathroom products including soap packages, toilet paper wrapping, shampoo bottle labels, etc.
- elementary and secondary school course materials, for example, incorporated into hygiene, safety, and home economics curricula;
- community information resource centers such as libraries, community centers and churches;
- trade unions within their shops;
- instructions for or on the products themselves which are more safety conscious, graphic and colorful;
- products themselves that are installed in the field that fulfill real needs; i.e., fixtures, fittings, and accessories with safety performance features that can teach effectively and promote new markets as well.

Consumer groups can educate through:

- lobbies to governmental regulatory agencies;
- workshops on home safety themes;
- house to house preventive medicine campaigns that include safety

Industry can utilize advertising of safety products through:

- the use of generic and specific brands for safety and economic interests
- advertising graphics and copy emphasizing improved safety features of specific products;
- placing emphasis on popular issues such as beauty or energy conservation, the money savings of a safer product or even the violence of injuries;

- the use of resources of government or industry associations to nationally advertise a class (generic) of safety products.

Government can promote safety by advertising the use of generic safety products in the bathtub and shower.

7.3.3 Cooperative Product Development

An increased level of safety performance of fixtures, fittings, and accessories may be achieved through product development by industry with government cooperation.

Government efforts include:

- accessing and articulating social needs and their scope through statistics, reports, and conferences;
- cooperation with industry in the development of voluntary standards;
- where required, the promulgation of industry guidelines and mandatory standards.

Industrial cooperative efforts include:

- the review of existing domestic and foreign safety performance ideas and products for use where possible;
- shelving or alteration of those products which may be implicated in injury in order to meet safety guidelines;
- making explicit the necessity of additional safety performance in products and utilizing available and industry-developed safety performance guidelines along with the usual performance requirements strength, durability, fashion, etc., in the design and engineering of original and retrofit equipment;
- the resolving of product conflicts in the design and testing stages, including "fit" between new products and older environments as well as the potential new hazards introduced;
- realizing that safety performance guidelines do not limit but rather increase the necessity for designer's creativity. In this way they might be challenged

to devise safety performance fixtures, fittings or accessories equal to or less in cost than those currently available in order to overcome powerful economic deterrents;

- realizing the possible long term market for original equipment;
- realizing the immediate and potentially vast add-on market;
- realizing that acceptance of new safety performance procedures and products is contingent upon exposure (Industry can time its introduction or reintroduction of products with its own and the government's safety education and advertising efforts);
- the realization that the development of safety performance procedures and products that are consumer based and government or industry sponsored and that also conform to voluntary or mandatory standards may reduce industry liability.

BIBLIOGRAPHY

The data sources in this bibliography are organized into these five categories:

- Accident statistics on bathtub accidents;
- Methodological work on accidents and safety;
- Design data on bathtubs and showers;
- Safety research regarding bathtubs and showers; and
- Economic methodology.

Accident Statistics

1. National Electronic Injury Surveillance System, Consumer Product Safety Commission.

Consumer Product Safety Commission's Data from 119 hospital emergency rooms classified according to product involved.

2. Estimates of Injuries Involving Various Environmental Factors, from HEW Public Health Service, Consumer Protection and Environmental Health Service, Environmental Control Administration, Bureau of Community Environmental Management.

Estimates from the Health Interview Survey conducted by the National Center for Health Statistics on injuries from tubs and showers, hot water in bathrooms, and glass doors in baths and patios.

3. Kansas Accidental Death Report, Kansas State Department of Health, Division of Vital Statistics.

Classification of accidental deaths between 1953 and 1962 by place and cause of injury.

4. "Home Danger Spots," Home Safety Review, February, 1963.

Data from Metropolitan Life Insurance Company on death claim records of 663 policyholders.

5. "Cause and Prevention of Domestic Burning Accidents," British Medical Journal, 1964, 2, 1421-1427, J.P. Bull, et al.

Statistics on deaths from burns, causes of deaths, and distribution of home burns in relation to nature of accident.

6. Glass Door Injury Survey, by William J. Holland and Walter U. Johnson, Public Health Service, HEW.

Data on glass door injuries in Dade County, Florida.

7. Reports of the Epidemiology and Surveillance of Injuries No. FY70-R2, "Estimates of Accidental Deaths Involving Various Environmental Factors," John H. Morrison.

Estimates of the number of accidental deaths involving various environmental factors.

8. Home Safety Project, State of California.

Home accidental injuries by type and object of accident, age and sex, as reported by San Francisco Emergency Hospitals.

9. "Drowning: Epidemiology and Prevention," Parker E. Dietz and Susan P. Baker, American Journal of Public Health, April, 1974, pp. 303-311.

Investigation of 178 accidental drownings in Maryland.

10. Investigation and Application of Home Injury Survey Data in Development of Prevention Procedures, University of Michigan, School of Public Health, 1953 - Appendix B: Environmental Appraisal.

Statistics on facilities involved in bathroom injuries.

Methodological Work on Accidents and Safety

1. "Energy Damage - the Ten Counter-Measure Strategies," William Hadden, Jr., M.D., The Journal of Trauma, Vol. 13, No. 4, pp. 321-331, 1973.
2. "Concepts and Principles of Measurement with Applications to the Evaluation of Safety Performance," by William E. Tarrants, National Highway Traffic Safety Administration.

Safety performance evaluation methods, criteria, for determining safety effectiveness, testing methods.

3. Systems Safety Analysis: A Modern Approach to Safety Problems, by J.L. Recht, National Safety Council.

Application of systems analysis to safety problems, discusses fault tree analysis, and error rates and costs.

4. "Injury--A Major Environmental Problem," Ross A. McFarland, Architectural Environmental Health, Volume 19, August, 1969.

Major trends in accident research, applications of biotechnology in control of injuries.

5. "Safety System Dynamics for Consumer Products--Some Factors Affecting Decisions about Safety," by Carl C. Clark, National Commission on Product Safety, 1970.

Testing, economics of safety, role of the consumer and retailer.

6. Home Accident Prevention, Appendix on Accident Type Classification, 1955.

Definition of Accident Types.

7. "Some Conceptual Approaches to the Accident Phenomenon," Current Research in Childhood Accidents, Edward A. Suchman, Albert C. Scherzer.

Definition of an accident, decision making approach to accidents, accident proneness, systems analysis.

8. "An Epidemiological Approach to Control," California State Department of Public Health, Director of Public Health, Malcolm H. Merrill; Home Safety Project Chief, Gilbert L. Rhodes.

Description of the "accident chain" and method of analysis.

9. Motor Vehicle Accident Costs, Wilbur Smith and Associates, 1966.

An economic analysis which is transferable to home accidents.

10. Behavioral Approaches to Accident Research, Jacobs, et al., Association for the Aid of Crippled Children, 1961.

Contributions of the behavioral sciences to concept formation in accident research.

Design Data on Bathtubs and Showers

1. A Design Guide for Home Safety, Teledyne Brown Engineering, for HUD, 1972.

Design suggestions for bathrooms, stairs, windows, doors, kitchens, floors, electrical and exteriors. Also includes statistical data, terminology and checklists.

2. Increasing Residential Safety through Performance Design, Buffalo Organization for Social and Technological Innovation, Phase I, NBS Report, NBS-I-35758, August 3, 1971, Phase II, U. S. Public Health Service, December 31, 1973.

3. The Bathroom, Alexander Kira, Cornell University Center for Housing and Environmental Studies, 1966.

Discusses sociological and psychological considerations in bathroom use and proposed improved bathroom design.

4. A Guide to Bathroom Design, Goulden Gontran, Great Britain, 1966.

Diagrams and descriptions of possible bathtub configurations, showers, and bath fittings.

5. Designing for the Disabled: A Manual of Technical Information, by Selwyn Goldsmith, Royal Institute of British Architects, 1963.

Suggested various bathtub and shower designs for the handicapped and elderly.

6. Housing to the Physically Impaired: A Guide for Planning and Design, Robert C. Weaver, HUD.

Suggests bathroom design features for physically impaired.

7. Bathrooms: Planning Considerations, Glenn H. Beyer and Alexander Kira.

Design data on bathroom, diagrams, including accessories and fixtures.

8. A Checklist for Retirement Houses, H.A. Steinberg, University of Illinois.

Checklist of minor precautions.

9. "The Bathroom," Home Safety Review, January, 1958.

Suggestions to make the bathroom safer.

10. Backett, E. Maurice, Domestic Accidents, Public Health Papers #26, WHO, Geneva, 1965.

Includes a checklist of possible hazards in the bathroom.

Safety Research

1. "Childhood Accidents and Injuries," from Behavioral Science on Pediatric Medicine, by Ross A. McFarland, and Roland C. Moore.

Types of childhood fatalities, non-fatal injury rates, analysis of causes of accidental injuries.

2. Research in Accidents, with Special Reference to Preschool Children, Scherzer and Suchman.

3. A Critique of Accident Research, Ross A. McFarland, 1962.

Overview of accident research, discussing basic problems such as over-simplification of accident cause, conceptual limitations, experimental problems, and lack of research on accident prevention measures. Bibliography.

4. Uniform Definitions of Home Accidents, HEW, Public Health Service, 1958.

Defines home accidents, possible injuries, factors in accidents, measurement of accidents and defines general terms in accident prevention.

5. Home Accident Prevention: A Guide for Health Workers, Public Health Service.

Human factors in home accidents, including age factors.

6. Manual on Home Accident Prevention for Public Health Nurses, Mass. Department of Public Health, Vlado A. Getting.

Human factors diagram and list of bathroom accidents and their causes, type of injury, and method for prevention.

7. Accident Prevention Research, Barry Griffith King.

Discusses biological factors in accidents and effects of stress.

8. "Accidents to Old People in Their Homes," John Agate, British Medical Journal, 1966, 2, 785-788.

Causation and physical characteristics of the elderly, prevention. Comments on bathroom safety.

Economic Methodology

1. Readings in Welfare Economics, Kenneth Arrow and Tibor Scitovsky, Richard D. Irwin, Inc., Homewood, Illinois, 1969.
2. Human Capital, Gary S. Becker, National Bureau of Economic Research, No. 80, Columbia University Press, 1964.
3. Optimizing Criteria for Priority Ranking Home Accidents, BOSTI, Buffalo Organization for Social and Technological Innovation, Inc., Buffalo, 1971.
4. "The Problem of Social Cost," H. Coase, Journal of Law and Economics, 1960.
5. Economics of Mental Illness, Rashi Fein, New York, Basic Books, 1958.
6. "The Utility Analysis of Choices Involving Risk," Milton Friedman and L.N. Savage, Journal of Political Economy, August, 1948.
7. "Civil Aviation Expenditures," Gary Fromm, in R. Dorfman (ed), Measuring Benefits of Government Investment, Washington, D.C., Brookings Institution, 1965.
8. Gary Fromm, "Comment" on T.C. Schelling's paper, "The Life You Save May be Your Own," in S.B. Chase, Jr. (ed), Problems in Public Expenditure, Washington, D.C., Brookings Institution, 1968.
9. The Economics of Health, Herbert E. Klarman, Columbia University Press, New York, 1965.
10. Cost-Benefit Analysis, E.J. Mishan, Praeger Publishers, New York, 1970.
11. "Risk Versus Benefit: Solution or Dream," H.J. Otway, Los Alamos Scientific Lab, AEC, LA-4860-MS, 1972.
12. "Cost-Benefit Analysis: A Survey," A.P. Prest and Ralph Turvey, Economic Journal, December, 1965.

13. "The Economic Value of Human Life," Dorothy P. Rise and Barbara S. Cooper, A.J.P.H., Volume 57, No. 11.
14. The Measurement of Social Welfare, J. Rothenburg, New Jersey, Prentice-Hall, 1961.
15. "The Life You Save May be Your Own," T.C. Schelling, in S.B. Chase, Jr. (ed), Problems in Public Expenditure, Washington, D.C., Brookings Institution, 1968.
16. "Motor Vehicle Accident Costs, Washington Metropolitan Area," Wilbur Smith and Associates, Washington, D.C., 1966.
17. "Social Benefit versus Technological Risk," Chauncey Starr, Science, Vol. 165.

APPENDIX*

SUMMARY OF OPINIONS EXPRESSED AT
BATHTUB/SHOWER SAFETY CONFERENCE

March 6 AND 7, 1975

*This Appendix contains a summary of the ideas presented at the Bathtub/Shower Safety Conference. The project staff does not necessarily endorse any or all of these opinions.

1. REPORT ON WORKING GROUP SESSIONS

WORKING GROUP 1: BATHTUB AND SHOWER STALL

I. Slips and Falls

A. Non-Skid Tub Surface

Agreement was readily reached upon the single most important performance guideline that should be established:

"Every tub and shower stall will be provided with a standing surface which is non-skid."

This performance guideline is important for new fixtures as well as for products designed to upgrade existing tubs and shower stalls.

To accomplish the desired level of performance, many issues must be resolved:

- Definitions of non-skid are required.
- Determination of the parameters of movement associated with accident sequences is required.
- A means of establishing the level of slip resistance is required and might be accomplished by evaluating all available slip testers.
- The test chosen must accurately simulate the wet foot and the extremes of bathing activity, as well as the conditions present in typical accident sequences, such as partially filled tubs, wet tubs, and soapy films.

B. Mobility Assistance Devices

Slips and falls can be reduced or eliminated for many members of the population through the provision of mobility assistance devices. In particular, these devices would include assists for entering and leaving the tub as well as assists for standing and sitting without losing the balance. Well positioned hand-holds are expected to fulfill the performance requirements. Hand-holds may be part of the original

Fittings for the handicapped are an additional consideration. One measure which has been adopted in Massachusetts in 5% of certain multiple-unit dwellings is to add a set of hot and cold water faucets in the back wall of the tub, where they may be reached by a handicapped person sitting on a seat across the tub. The need to test the temperature of the water as it comes out of the faucet is an additional design consideration.

B. Configuration of Fittings

Fittings should not injure users by their hardness or sharpness. Sanitation standards must be met, however, which require that fittings be made of materials which can be cleaned and which do not permit bacterial growth, and hard materials tend to fulfill these requirements more readily than do soft ones. What is needed is a material which meets both the safety and sanitation requirements.

A suggested retrofit measure is a soft, replaceable device (frequent replacement obviates the need for cleanability) which can be placed over the faucets. One problem to be solved in designing such a device is that a zinc-plated faucet, for example, will corrode if covered by a device which tends to trap water in contact with the faucet. Therefore, the device must be designed not to retain water. In addition, it must be designed such that it fits over the varying types of faucets.

C. Protrusion of Fittings

The user should not be able to fall against or bump against protruding sharp fittings. Recessed fittings provide a safety advantage here and are also considered esthetically appealing; however, such fittings do require a greater wall thickness. This problem is solvable, as is indicated by the fact that many mixing valves also require greater wall thickness. In fiber glass tubs, recessed fittings require extra molds. In all tub/shower installations, recessed fittings may imply more complex rough plumbing.

II. Burns and Scalds

A. Anti-scald devices

The user is prevented from being burned because water at a hazardous temperature cannot be accessed. A thermostatic control combined with a pressure valve will achieve this purpose; however, such a system tends to be too expensive to be widely implemented except where mandated by codes. A simpler cut-off device which cuts off the flow of water after it reaches a hazardous temperature has the disadvantage that it will then take up to 15 minutes for the water flow to be restarted. An inexpensive device without this characteristic would be an ideal product innovation for either new or retrofit installations. Another method is to turn down the temperature of the water heater and to provide localized heating devices for appliances such as the dishwasher which require water hot enough to be injurious to human beings. Such a countermeasure requires the education of the homeowner and the cooperation of other manufacturers, since it is, in effect, a remodelling of the entire home water heating system.

One innovative concept which emerged was a "timed water sequence", where water of a reduced temperature would be available at the typical bathing time, and hotter water would be available at other times of the day that might even coincide with "off-peak energy production hours."

Local temperature reduction might be possible by employing a heat exchanger along the hot water supply run. Ideally, heat removed from the water supply line would be put to use elsewhere, e.g., a heating supply duct. A heat exchanger could also be employed at the water outlet of the fixture itself. Such a heat exchanger would be of rather large size and would require tub redesign, in all probability.

B. Child-Proof Faucets

The user, in this case a child, would be prevented from accessing water at a dangerously high temperature because the faucet is difficult to manipulate (the "aspirin cap" solution). Faucets which require two motions rather than one or which require greater physical strength to

tub design or may be manufactured as a retrofit product. The tests associated with such mobility assistance aids must accurately reflect the dynamic loads such aids might be subjected to in a fall or near fall.

C. Lowered Tub Rim Height

Although a performance guideline was not suggested, conference participants felt that lowered rim heights were one feasible approach to prevention of trips and falls associated with the tub rim, entering and exiting the tub. The key to the utility of lowered rim heights rests in the relationship between the overflow drain and the top of the tub. Some participants felt that this dimension could be reduced while others felt that overflow from the tub would be a problem, should that dimension be decreased.

D. Design Tubs to Encourage Lowering of User Center of Gravity

There were a series of suggestions for design approaches that would encourage the maintenance of a low center of gravity while showering. Bathtubs can specifically be designed to facilitate showering so that the accidents that occur would be reduced. They could further be designed to encourage sitting while showering, emphasizing such features as seats, more flat area, and the European flexible hose showers for use in sitting positions.

The elimination of combination units was strongly endorsed by conference participants. Some members felt that there was an inherent lack of safety in the dual purpose, combination unit. Separate bathtubs and showers were felt to be desirable by most participants. All participants however, agreed that redesigning the tub to make it suitable for showering was second best to separate areas for the two activities.

E. Greater Resilience of the Bathtub Surface

The large number of injuries in the NEISS data base associated with impact of the body with the tub, especially the tub rim, suggest

that one intervention strategy is to make the tub more resilient. Conference participants pointed out that the effectiveness of such a measure has not been proven. Within the current bathtub stock, a range of resiliencies exists; yet, no evidence shows that the more resilient tubs cause less severe injuries. Better data is needed before such a solution to bathtub injuries is implemented.

Bathtub sanitation standards require that the bathtub surface be cleanable and not allow bacterial growth, which presents a special threat in moist environments. Hard materials tend to meet these requirements more effectively than do softer materials. Thus a new material developed for use in bathtubs must meet these sanitation requirements as well as any possible guideline for resiliency which might be adopted.

F. Improved Geometry of the Tub Edge

Of injuries involving contact with the bathtub surface, a large number involve the tub edge or rim. Therefore, it was suggested that tub rims of greater radius of curvature may be safer. Conference participants felt that, as with the tub resiliency, a significant variation of tub edge geometries now exists and yet, no significant correlation has been drawn between injuries and tub edge geometry. Further analytical and empirical studies of this relationship is needed before performance guidelines relating to tub edge geometry are implemented.

A cushion to fit over the bathtub edge or a cushioned rail might be developed as retrofit products to address this problem. Conference participants felt that there were numerous practical problems associated with such a product, but that it deserved further consideration.

II. Burns and Scalds

It was primarily felt by participants that the important elimination of burns and scalds could be achieved by controlling the water temperature at the hot water source, a concept to be addressed by the working group on fittings.

A. Visual Display of Water Temperature

A second approach to scalds had to do with a visual display of water temperature. Brainstormed concepts included liquid crystal thermometers that were a part of the tub, and tubs that changed colors dependent upon temperature. The point was made that scalds are harder to avoid than drownings, because you can see water depth, but you cannot see water temperature.

B. Tub Insulation

A related issue has to do with insulating a tub so that the water temperature would be maintained more nearly constant, and the necessity to add very hot water would be reduced. A novel concept was suggested that has some interest for future home energy systems. An insulated tub could store water for solar energy storage in the tub jacket and greatly enhance the comfort of tub bathing.

C. Enlargement of Shower Stall

Another approach to avoiding burns and scalds was the repositioning of the controls for showers or the redesigning of shower stalls and tubs to allow the user to stand out of the spray while adjusting the water temperature. Conference participants suggested that the shower stall should be large enough (36" x 42" or 42" square) to allow the user a place of refuge if the water is accidentally turned on to a hazardous temperature.

III. Drownings

It was felt that educating parents not to leave children alone in the tub is the most important means of addressing the problem of drownings.

The only mechanical intervention strategy for drownings discussed was the use of a drain which would not allow water to accumulate at a hazardous level, discussed by the working group on fittings.

One additional point discussed by this working group was that much might be learned by studying European bathtubs and showers, because of the design variations which exist. One major variation is the widespread use of the "telephone" shower, which allows the user to shower without standing up. A comparison of accident rates between this system and American systems would be a valuable means of relating injuries to specific design factors, as many of the sociological and anthropometric factors of American and European users will be roughly the same. Certain cultural differences exist for which data must be adjusted; however, it was agreed that such an investigation would probably be fruitful.

turn would present no problems in design and development. One potential problem, however, is that faucets which require greater manual dexterity are unsuitable for the elderly and the handicapped, as are faucets which require greater strength. Therefore, such a product could only be offered to a limited market. Another problem is that even a faucet with a complex turn-on pattern is not foolproof. Educating parents not to allow children in the bathroom unattended was felt by conference participants to be the best solution to this problem.

C. Placement of Fittings

Fittings should be placed such that the user will not confuse the hot and cold water faucets. In addition, the user should have a place of refuge in the shower, away from the stream of water, in case overly hot water is accidentally turned on.

The right hand tub is safer than the left hand tub because the hot water faucet is further away from the user and therefore less likely to be turned on by accident. Faucets should be placed out of the reach of children to prevent their misuse; however this consideration may conflict with best placement for adults.

III. Drownings

A. Child-Proof Faucets

The considerations in II.B. above, for prevention of burns, also apply to prevention of a hazardous accumulation of water, if extended to include the cold-water faucet.

B. Regulating the level of water through the drain

The user cannot admit a hazardous level of water into the tub. A device could be incorporated into the drain, either in original construction or as a retrofit device, which does not allow water to accumulate at all. Thus the bather cleans himself or herself just with running water. This device is feasible to design and develop and could be moderate in cost. The problem is that it is possible for a child to drown in even one inch of water. Educating parents not to leave children unattended was agreed upon by conference participants as the most effective means of preventing drownings.

WORKING GROUP 3: BATHTUB AND SHOWER STALL ACCESSORIES

Accessories may be implicated in bathtub and shower area injuries by their presence or by their absence. A major concern expressed by conference participants is that consumer education is needed on the selection, installation, and use of accessories. At present, certain accessory products may be ineffectual in preventing injury and even may contribute to injury because the product is not installed correctly or is used for a function other than the intended one. (The obvious example is the towel rack, soap dish, or other accessory used as a hand hold.)

On the following pages, accessory products relating to each of the major types of accidents are discussed. Under each accessory type, the problem is briefly stated, a broad performance guideline is suggested, and when relevant, examples are stated.

I. Slips and Falls

A. Hand holds (grab bars)

The hand hold is required to help the user maintain the balance and steady himself or herself if necessary. Hand holds are conspicuous not by their failure as much by their absence.

Hand holds should be devised which will permit balance control during entering and leaving the bathtub and shower and during the process of cleansing. This balance control should be provided for normal and handicapped users of all ages. Education and advertising may be utilized for encouraging proper selection, placement, and use of hand holds. The primary qualities which were felt by conference participants to be necessary for handholds are low cost, strength, durability, design, beauty, resilience, shatter resistance, light weight, and well-secured. It was suggested that hand holds should be rubber-coated or made of fiber glass or nylon to prevent injury from the user falling against the hand hold, and it was also suggested that hand holds might be spring-mounted to provide a breakaway effect.

B. Non-Slip Appliques

Slipping on the bathroom floor, the tub edge, or the tub interior, often results in laceration, contusion, or even fracture. Problems associated with the use of non-slip appliques are that when wet and soapy, they may become nearly as slippery as the original surface, they may be difficult to clean, and they may become dislodged with time. In addition, it

requires a certain level of user awareness to install the appliques at all.

Non-slip appliques should be designed such that they are semi-permanent and render the floor or tub surfaces non-slip by feet of users of all ages under normal aqueous bathing conditions. Appliques should also be attractive, cleanable, and low in cost. It is essential that they fit older surfaces as well as new ones, as it is expected that the primary market will be older tubs and floors.

C. Bathmats

While many homes have bathtubs fitted with bathmats, accident data shows that a surprising number of injuries occur even with the bathmats in place. A mat which is worn or dirty or which has water under it or soapy conditions surrounding it may not be very effective in preventing slips and falls.

Where integral or semi-permanent applied elements cannot be utilized; however, the use of a non-slip bathmat is still a reasonable method of preventing accidents. The surface must be non-slip on both the side adhered to the tub and the side the user steps on under normal aqueous bathing conditions with all types of users. In addition, the bathmat should be durable, attractive, inexpensive, cleanable, non-obstructive, and should be able to fit both old and new tubs. Review of materials, design and surface properties of present bathmats under field conditions should provide the guidance toward the problem solution.

D. Guard Rails

A guard rail will be used in much the same way as a hand hold or grab bar, and the performance considerations mentioned in I.A. above will be applicable. The guard rail can serve the additional function of preventing children from entering the tub when unattended, because the guard rail acts as a barrier. Such a guard rail must be simple to install and reliable for support and guard functions on new and older bathtubs. This device may have many of the same physical materials and properties as the grab bar, but it must be mountable on new and older tub edges and preferably removable.

E. Shower Doors

In losing balance or slipping and falling, the user may break the tub enclosure or shower stall door glass. However, the glass may also break if the door is suddenly closed or from prior cracks, flaws, or

WORKING GROUP 2: BATHTUB AND SHOWER FITTINGS

I. Slips and Falls

A. Placement of Fittings

The fittings should be placed such that the user's center of gravity remains low, and the user's reach beyond his or her center of gravity is minimized. One problem which manufacturers encounter in indicating the proper placement of fittings is that the manufacturer is only providing options for plumbers; it is the plumbers who actually decide on placement. Therefore, the cooperation of installers is necessary to implement safer placement of fittings. Often, the length of the supply piping run is the critical factor in placement of fittings. Unusual placement may require extra piping and extra labor on the part of the plumber. Local plumbing codes also create some constraints.

The chief problem in placement of fittings arises from the frequent dual use of the tub as a shower. Fittings should be near the point of entry and at standing height for the shower, but should be placed low for the bath in order to keep the user's center of gravity low.

The use of the "telephone" shower (a showerhead on a flexible hose) would serve to keep the user's center of gravity low, as it can be used in a sitting position. Such a device is especially appropriate for the elderly and handicapped, for whom a sitting position may be necessary. In order to use the telephone shower, a means must be devised to assure that water is not siphoned up into the water system. The problem with present anti-siphon devices is that they are fallible, and the user is not warned when the device fails.

Uniform placement of the hot water faucet to the left of the cold water faucet is important because if the user is surprised, he or she is more likely to slip and fall. Braille letters and color coded faucets are now in use to address this problem. Size, texture, and shape of the faucets could all be used to aid user discrimination between the hot and cold.

perhaps thermal stress. The frame or track into which this glass or door is set becomes a further source for laceration and even amputation of digits, not only from direct contact but from closure as well.

Thus the user should not be injured by the panel which supports the tub or shower stall from the surrounding area. Neither the frame or track should have the capacity to lacerate or otherwise injure under all normal aqueous bathing or showering conditions.

Some standards prohibiting the use of shatterable material in shower enclosures have already been set. A variety of plastics with scratch resistance could be employed. The frame and track of the shower enclosure must be mechanically jam proof, should not be slammable, and should close without the possibility of catching small body parts. The frame and track itself should be of softer materials or less angular configuration, and perhaps recessed into a modified rub without sharp edges, pinch points, or burrs. Finally, the top rail, if any, should be high enough to prevent contact with the user's head.

F. Soap Dishes

An interesting problem which emerged in discussion with respect to soap dishes is that in one case, soap dishes which were designed with a horizontal bar to hold the washcloth were then used as hand holds, a job for which the structure was unsuited. This problem can be corrected by designing soap dishes in such a way that they discourage grasping or are affixed in such a way that they function as an effective hand hold or grab bar. They also should not be shaped such that contact, whether by falling or grasping, causes injury.

Soap may be well contained, as is shampoo, in soft lightweight easily visible plastic containers, whereas hand holds may be placed so as to obviate the need to hold on to the soap dish. Where soap dishes are designed for dual use as a hand hold, they should meet the same performance guidelines as hand holds.

G. Towel racks

Towel racks, like soap dishes, may be used as hand holds although they were not designed or installed for this purpose. Towel racks, too, should either be designed to discourage holding or grasping or should be designed to meet the performance guidelines for hand holds. Towel racks may also be hazardous as a protruding object in the path of a

person falling, so they should be designed to reduce this hazard.

(Possible methods such as increasing the softness, decreasing the angularity, and spring-mounting for breakaway are also applicable here.)

The dual purpose towel rack/hand hold should be strong, durable, lightweight, shatterproof, softly configured, low cost, attractive, and resilient. It should be easily and firmly installable.

H. New Concepts for Product Development

The following list of items were mentioned by the working group as possible concepts for product development.

- Add-on tub edge that increases wall height to limit children's entry and encourage seated entry at comfortable user height. Can be soft to prevent edge injuries, decorative, telescoping to fit, inexpensive to buy and simple to install.
- Pedestal to raise tub and thus wall height and limit user to seated entry.
- Add-on soft mantel over tub sides edges. Can be cleanable, decorative, and inexpensive.
- Closures that are net-like and firmly supported to enable user to catch himself and which additionally buffet any contact.
- Soaps that do not precipitate vision problems.
- Add-on warnings and directions.
- Emergency inflatable tub rings.
- Accordion type shower closures that are soft, translucent, lightweight, and inexpensive.
- Adult harnesses with ceiling mounts and slip clutch governor (as in safety belts).

II. Burns and Scalds

Most of the measures felt to be effective in preventing burns relate to limitation of the heat of water entering the tub and have been previously discussed in terms of fittings. These accessories include devices to limit inflow temperature, devices to cut off water of hazardous temperatures, and stream size and direction controllers. A few possible accessories outside of this category are presented below.

A. Stick-on Warnings

Educational messages (particularly concerning the danger of leaving children unattended in the tub) may be presented through decals or other structures. A stick-on product has the advantage over messages stamped

into a fixture or other permanent structure that it is suitable for retrofit and that the consumer does not have to live with it for the life of the bathroom.

B. Spray-on Coolants

A spray-on coolant functions similarly to a piece of ice applied to a burn. Having such a first-aid measure available in the bathroom can reduce injury once the accident has occurred.

C. Improved first-aid kits

Similarly, a complete first-aid kit and manual will help reduce injury suffered from burns and scalds. In addition, a local clinic or doctor's telephone number should be displayed.

D. Tub water heater

A device which heats water after it has entered the tub would serve to prevent surprise burns. Such a device would be designed to be immersible in the tub and would include ground fault devices for general electrical hazard protection.

III. Drownings

Like burns, drownings are best addressed through education of the parent or user. Few accessories currently address themselves to this problem.

A. Bath seats

Bath seats may be used to keep children out of deep water and also for adults and children to prevent slips and falls. For some users, straps will be necessary to keep them from falling out of the bath seat. Bath seats should be designed to provide seated support in tubs for users of all ages. Seating should be stable, reduce the probability of slipping more deeply into water, be attractive, reasonable in cost, and pose no impact threat if fallen on. Bath seats may be constructed of plastic resilient materials of soft configuration with wide bases. Integral safety straps should be included for children. They should have non-slip surfaces on the base.

B. Inflatable Tub Insert

A product might be developed which would be placed in the bottom of the tub, but which would self-activate in emergencies to inflate and raise the child up out of the water.

C. Alarms

Some type of sensory device could be developed to set off an alarm

when a dangerous situation occurs. A "dead man" device was suggested which would be activated when the user lies motionless in the tub bottom. Other signals could also be used to trigger an alarm.

D. Flotation collars

A light, inexpensive, comfortable and non-interfering flotation collar could be used to keep a child's head out of water. Such a collar could be inflated throughout the bath or might be designed to activate during an emergency situation.

E. Harnesses

Harnesses could be devised to hold children upright in the tub. Prototypical devices have been designed for the handicapped, which might be adapted for children and the elderly.

F. Bathroom telephone and intercoms

The value of having a telephone or intercom in the bathroom is that it would reduce the need for parental absence, a primary factor in drowning of children.

G. Safety Manuals

First aid manuals giving information on resuscitation, kept available in the bathroom, can speed the treatment of accidents.

