gasoline. Many of these injuries involved severe burns. A CPSC sponsored study estimated that the average societal cost of a hospitalized fire burn, including medical costs, lost productivity, administrative costs, legal costs, and pain and suffering was $900,000 (Miller, p. 74). The largest component was "pain and suffering," which was estimated to be $785,000 per case. Pain and suffering includes not only compensation for physical pain but also includes compensation for emotional trauma, damage to social relationships, and so on caused by disfigurement. If one assumes that all of the injuries involve fire burns requiring hospitalization, the annual societal costs of the injuries may be as high as $284 million. The annual societal costs of those injuries associated with gasoline vapors only may be as high as $215 million.

Societal Costs of Deaths

An average of 17 people die each year in incidents involving residential gas water heaters and all flammable vapors. Of these, an average of 14 incidents annually involved gasoline. Ideally, an estimate of the societal cost of a death should consider factors such as the suffering of the victim before death, the value of the lost production to society, and the premature loss to society of someone who may have filled multiple roles such as friend, parent, child, sibling and so on. The policy of the Directorate for Economic Analysis has been to assume a $2 million cost to society for each death. Following this policy, the cost to society of deaths involving all flammable vapors is $34 million annually. The cost to society of deaths involving gasoline vapors only is $28 million.

Property Damage

The property losses from fires involving residential gas water heaters and all flammable vapors is estimated to be $26 million annually. The property losses from fires involving gasoline vapors only is estimated to be $20 million (CPSC, 1994b).

Total Societal Costs

Fires involving residential gas water heaters and all flammable vapors cost society about $344 million annually. The total cost to society of only the incidents that involve gasoline vapors is about $263 million annually. Because there are an estimated 40 to 50 million residential gas water heaters in use in the United States, the expected cost to society of these incidents per water heater is $6.88 to $8.60 for incidents

involving all flammable vapors. Incidents involving gasoline account for approximately $5.26 to $6.58 of this amount.

Assuming a discount rate of 5 percent and an average useful life for a water heater of 11 years, modifications that prevented virtually all incidents involving the ignition of flammable vapors by gas water heaters would be worth between $59 and $74 over the life of the water heater. Modifications that only prevented the ignition of gasoline vapors would be worth between $45 and $57 over the life of the product.

These estimates are based upon the information available about the incidents involving gas water heaters igniting flammable vapors during the six year period from 1986 to 1991. These estimates may be revised should new information become available.

References

CPSC (1994a), "Economic Issues Concerning Modifying Water Heaters to Prevent the Accidental Ignition of Gasoline Vapors," CPSC Memorandum from Robert Franklin (ECSS) to Joseph Z. Fandey (ESSE) (April 18, 1994).

CPSC (1994b), "Summary of Data on Gas-Fueled Water Heaters and Flammable Vapors," CPSC Memorandum from William L. Rowe (EPHA) to Joseph Z. Fandey (ESEE) (April 18, 1994).

Miller, Ted R., et al., Estimating the Costs to Society of Cigarette Fire Injuries: Final Report, (July 1993).

DRAFT Billing Code 6355-01

CONSUMER PRODUCT SAFETY COMMISSION

16 CFR Part 1212

Gas Water Heaters

Advance Notice of Proposed Rulemaking; Request for Comments and Information

AGENCY: Consumer Product Safety Commission.

ACTION: Advance notice of proposed rulemaking.

SUMMARY: Based on information currently available to the Commission, the Commission has reason to believe that unreasonable risks of injury and death may be associated with gas water heaters that provide insufficient resistance to igniting vapors from flammable liquids that are spilled in the vicinity of the water heater. Each year, approximately 1,944 fires are caused by gas water heaters igniting flammable vapors, especially gasoline. These fires annually cause approximately 316 burn injuries and 17 deaths. This advance notice of proposed rulemaking ("ANPR") initiates a rulemaking proceeding under the authority of the Consumer Product Safety Act ("CPSA"). One result of the proceeding could be the promulgation of a rule mandating performance standards for gas water heaters.

The Commission solicits written comments from interested persons concerning the risks of injury and death associated with the ignition of flammable vapors by gas water heaters, the regulatory alternatives discussed in this notice, other possible means to address these risks, and the economic impacts of the various regulatory alternatives. The Commission also invites interested persons to submit an existing standard, or a statement of intent to modify or develop a voluntary standard, to address the risks of injury described in this notice.

DATE: Written comments and submissions in response to this notice must be received by the Commission by [insert date that is 60 days after publication].

ADDRESS: Comments should be mailed, preferably in five (5) copies, to the Office of the Secretary, Consumer Product Safety Commission, Washington, D.C. 20207-0001, or delivered to the Office of the Secretary, Consumer Product Safety Commission, Room 502, 4330 East-West Highway, Bethesda, Maryland 20814; telephone (301) 504-0800.

FOR FURTHER INFORMATION CONTACT: Joe Fandey, Directorate for Engineering Sciences, Consumer Product Safety Commission, Washington, D.C. 20207; telephone (301) 504-04508, ext. 1293.

SUPPLEMENTARY INFORMATION:

A. Background

For a number of years, the staff of the Consumer Product Safety Commission ("CPSC" or the "Commission") has been aware of incidents in which residential gas water heaters ignite the

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vapors from flammable liquids that are spilled in the vicinity of the water heater. Because the staff was not aware of any features that could be incorporated into water heaters to prevent such ignitions, the staff believed that the only way to address this risk was to try to change consumers' behavior.

In the spring of 1991, however, a New Orleans attorney, Edward F. Downing, III, made a presentation to the staff that included video tapes of tests which showed that raising water heaters on an 18-inch-high stand greatly reduced the risk of gasoline vapor ignition. (This elevation of water heaters by 18 inches was already required by the National Fuel Gas Code for gas water heaters installed in hazardous locations and garages.) Mr. Downing's tests also showed that ducting the air from 18 inches above the ground had the same effect as raising the water heater.

These measures reduce the risk of ignition because the vapors from gasoline and other flammable liquids are significantly heavier than air and accumulate in a layer at the floor of the room. By ensuring that the air coming into contact with the flames in the water heater is obtained at some distance off the floor — either by raising the water heater or ducting the air to a height of 18 inches — the bulk of the flammable vapors can be kept separate from the potential source of ignition. Accordingly, in many cases, the concentration of flammable vapor that constitutes the lower explosive limit ("LEL") for that substance will not be achieved.

The CPSC's staff arranged for Mr. Downing to make the same presentation for the American National Standards Institute

("ANSI") Z-21 Subcommittee, which is responsible for the ANSI voluntary standard for water heaters (ANSI Z21.10). That presentation occurred on November 13, 1991. Subsequently, an ANSI working group was formed to address this ignition issue. In addition, the Gas Appliance Manufacturers Association ("GAMA") funded a study of elevated water heaters to review available fire data and to examine the effects of elevation on ignition prevention. However, despite the staff's request, it was not allowed by GAMA to participate significantly in the development of, or testing during, the study.

In March of 1992, the Commission's staff formally requested that the ANSI subcommittee develop a performance standard that would provide ignition prevention performance at least equal to that achieved when a specified water heater is tested in a draft-free room at an elevation of 18 inches (or at another height if testing showed it to be needed). When the GAMA-funded study became available, it showed that, under some test conditions, flammable concentrations of vapors could be produced at the water heater.

The Commission's staff does not consider the resulting study to be particularly useful for its stated purpose. Although ignition occurred in a number of the scenarios tested with elevated gas water heaters, the test conditions were far more likely to result in ignition than those that probably caused many of the fires that have occurred in consumers' homes. For example, the GAMA study used relatively large amounts of gasoline in their spills (up to 2 gallons). Although the amount of gasoline

involved in the fires in consumers' homes is not known, it seems unlikely that consumers store or handle gasoline in quantities that would produce very many 2-gallon spills. In addition, GAMA's study heated the room and floor to unreasonably high temperatures, up to 1230F, which significantly increases the rate of vaporization. Even under this study's severe ignition conditions, however, a substantial benefit to elevating the water heaters was shown. In addition, fire data in the study suggest that elevating waters heaters may help reduce the number of fires.

When the GAMA-funded study was presented to the ANSI working group, a motion was made to disband the working group because stands for water heaters would not prevent all fires. The CPSC staff person at the working group meeting objected to that proposal, and described plans for CPSC testing of ways to retrofit existing water heaters to provide protection against ignition of flammable vapors. The working group then decided that if the staff could demonstrate a retrofit method which would prevent ignition, there would be no strong basis for not doing so in new water heaters. Accordingly, the working group agreed not to disband before the staff's work was completed.

The staff believed that even if satisfactory voluntary standards were developed, it would be important to protect the millions of consumers who already have gas water heaters that present a risk of ignition. The retrofit, to be practical, would have to be inexpensive, easy to install, and effective.

The Commission's Engineering Laboratory staff conducted tests of a potential retrofit at the fire-testing facility at the National Institute of Standards and Technology ("NIST"). This retrofit involved the installation of a barrier made from a 6-foot piece of sheet metal roof flashing formed in a 14-inch high circle around the base of the water heater and sealed to the floor with duct tape. Flammable vapors would have to go over this barrier before they could be exposed to the flames from the water heater.

CPSC testing of this retrofit showed the ability of a dam, or weir, at the base of the water heater to keep flammable vapors from the potential ignition source. These test results were presented to the ANSI working group, and GAMA then announced plans to test burners and perhaps other alternative designs to reduce the ignition risk.

In addition, CPSC staff subsequently performed additional work showing that the use of a dam or weir has no effect on the ability of a water heater burner to operate without producing increased levels of carbon monoxide. However, despite the information that the Commission's staff has provided to the ANSI working group, the staff has not received any indication that industry is taking steps to develop a satisfactory performance standard to address the risk of igniting flammable vapors.

In view of the lack of progress of the ANSI subcommittee toward implementing a performance standard for gas water heaters, the Commission has decided to publish this advance notice of proposed rulemaking ("ANPR"). Publication of this document

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commences a proceeding that ultimately could require gas-fired water heaters to meet specified performance requirements to address the identified risk of ignition of flammable vapors.

B. Statutory Authority

This proceeding is conducted under provisions of the Consumer Product Safety Act ("CPSA"), 15 U.S.C 2051-2084. A proceeding to promulgate a regulation establishing performance or labeling requirements as a consumer product safety standard is governed by the requirements in sections 7 and 9 of the CPSA. 15 U.S.C 2056, 2058.

To commence a rulemaking proceeding, the Commission must issue an ANPR as provided in section 9(a) of the statute. 15 U.S.C. 2058(a). If the Commission decides to continue the rulemaking proceeding after considering responses to the ANPR, the Commission must publish the text of the proposed rule, along with a preliminary regulatory analysis, in accordance with CPSA section 9(c). 15 U.S.C. 2058(c). If the Commission then wishes to issue a final rule, it must publish the text of the final rule and a final regulatory analysis that includes the elements stated in section 9(f)(2) of the CPSA. 15 U.S.C. 2058(f)(2). Before the Commission may issue a final regulation, it must make statutory findings concerning voluntary standards; the relationship of the costs and benefits of the rule; and the burden imposed by the regulation. CPSC sec. 9(f)(3), 15 U.S.C. 2058(f)(3).

C. The Product

The products that are the subject of this proceeding are gas-fired water heaters that are used in residences. The Commission estimates that there are between 40 and 50 million homes in the United States that have gas water heaters. The Commission is also interested in information on whether other

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flame-producing appliances (such as gas-fired clothes dryers, furnaces, or ovens) are potential sources of ignition for flammable vapors.

D. The Industry

Information from the American Gas Association indicates that annual sales of residential gas water heaters have increased from 2.5 million units in the early 1960's to 3.5 million units in the late 1980's. Five manufacturers dominate the gas water heater market, with 99% of production.

E. Risks of Injury and Death

An average of 316 people were injured and 17 people died each year between 1986 and 1991 in incidents involving gas water heaters and flammable vapors. Of these incidents, an average of 239 injuries and 14 deaths each year involved gasoline. Many of the injuries involved severe burns.

For the period 1986 through 1991, gasoline and other flammable vapors accounted for the following percentages of incident categories associated with gas-fired water heaters: 20% (1,944 incidents) of the fires; 54% (316 people) of the persons injured; 44% (17 people) of the deaths; and 30% ($26,339,000) of the property loss.

The societal costs from fires involving flammable vapors and gas-fired water heaters may exceed $300 million per year. Fires involving only gasoline are estimated to cause annual societal costs that may be as much as $215 million for injures, $28 million for deaths, and $20 million in property damage.

Assuming a discount rate of 5% and an average useful life of 11 years for a water heater, the estimated value of modifications that prevented virtually all incidents involving the ignition of flammable vapors by gas water heaters would be between $59 and $74 per water heater.

F. Existing Standards

The ANSI Z-21 standard, discussed above, does not contain any performance requirements intended to prevent flammable vapors from coming into contact with the flames in gas water heaters. It does contain a labeling requirement applicable to water heaters for other than recreational vehicle installation. However, CPSC has not endorsed the warning label recommended by GAMA and has commented previously that the warning label needs more concise wording to help the consumer focus on the hazard being addressed. In any event, a warning label should not be used in place of a performance standard. To achieve product safety, the most effective approach is to design the hazardous feature out of the product. If labeling is used, it should, wherever possible, be used in conjunction with product modifications that address the risk.

The National Fuel Gas Code ("NFGC") has adopted a requirement, originally in the National Electric Code, that water heaters in garages be elevated so that the burner and pilot light are at least 18 inches off the floor. However, this requirement does not apply to water heaters located elsewhere in the home. In addition, there is a requirement that "gas appliances shall not be installed in any location where flammable vapors are likely to

be present, unless the design, operation, and installation are such to eliminate the probable ignition of the flammable vapors." The Commission's staff believes that this latter provision has not been considered as routinely applicable in homes to locations other than garages. Although one report indicates that 73% of U.S. homes have a garage (Flammable Vapor Hazards Ignition Study — Task 1 Report, Arthur D. Little, Inc., GAMA 1993) ("Task 1 Report"), not all homes with garages have the water heater in that location.

In addition, the Commission's staff believes that compliance with this provision of the NFGC has been poor. This lack of conformance may improve as this provision is adopted by model building codes, such as the Southern Standard Building Code and the Council of American Building Officials ("CABO") code. However, adoption by model building codes does not guarantee that the provision will be incorporated into local building ordinances, where compliance is enforced.

Moreover, garage ignitions apparently represent only a portion of the problem. The Task 1 report referenced above assembled a database of 135 incidents involving ignition of flammable vapors by residential gas water heaters for which there were detailed incident reports; only 27 of these incidents were known to have occurred in a garage. (Thirty-one incidents did not specify the room location.) The report shows that, in the incidents where the room location was specified, the garage was involved in 10 of 27 deaths, 5 of 33 injuries, and 2 of 11 incidents in which there were both deaths and injuries.

Therefore, even if all new construction of houses and commercial replacements of existing residential water heaters followed the NFGC requirement for water heaters in garages, there is a large portion of the incidents that would not be addressed.

The Commission is not aware of any other standard for residential gas water heaters that addresses the risk of burn injuries, deaths, and property damage from gas water heaters igniting flammable vapors. Therefore, for the reasons stated above, the Commission believes that the existing standards would not eliminate or adequately reduce this risk.

G. Regulatory Alternatives Under Consideration

The Commission is considering alternatives to reduce the number of injuries and deaths related to the ignition of flammable vapors by gas-fired water heaters.

1. *Performance standard.* For the reasons discussed above, it appears that a performance standard can be developed that will reduce the risk of gas water heaters igniting flammable liquids.

2. *Labeling and instructions.* Another alternative is labeling the product to warn against this hazard and providing information on the risk in the product's instructions. The Commission believes such steps are necessary. However, as noted above, these steps alone are not likely to adequately reduce the risk and should be used in conjunction with product modifications, where possible.

3. *Voluntary standards.* For the reasons stated above, it appears that there is no voluntary standard in existence, or

likely to be developed and implemented, that would adequately reduce this risk of injury.

H. Solicitation of Information and Comments

This ANPR is the first step of a proceeding which could result in a mandatory performance or labeling standard for gas-fired water heaters that present an unreasonable risk of igniting flammable vapors in residences.

All interested persons are invited to submit to the Commission their comments on any aspect of the alternatives discussed above. Specifically, in accordance with section 9(a) of the CPSA, the Commission solicits:

(1) Written comments with respect to the risk of injury identified by the Commission, the regulatory alternatives being considered, and other possible alternatives for addressing the risk.

(2) Any existing standard or portion of a standard which could be issued as a proposed regulation.

(3) A statement of intention to modify or develop a voluntary standard to address the risk of injury discussed in this notice, along with a description of a plan (including a schedule) to do so.

Comments should be mailed, preferably in five (5) copies, to the Office of the Secretary, Consumer Product Safety Commission, Washington, D.C. 20207-0001, or delivered to the Office of the Secretary, Consumer Product Safety Commission, Room 502, 4330 East West Highway, Bethesda, Maryland 20814; telephone

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Gama

1901 North Moore Street • P.O. Box 9245 • Arlington, Virginia 22209 • 703/525-9565

June 27, 1994

The Honorable Ann Brown
Chairman
Consumer Product Safety Commission
4330 East West Highway
Bethesda, Maryland 20814

Re: Staff Option Package on
Gas-Fired Water Heaters

Dear Chairman Brown:

Thank you for agreeing to meet with us today concerning the staff's Option Package for Gas-Fired Water Heaters and Ignition of Flammable Vapors. Staff has recommended that the Commission institute a rulemaking proceeding to develop a performance standard for new gas-fired water heaters to address the risk of flammable vapors ignition. Before you vote on the staff recommendation, the Gas Appliance Manufacturers Association (GAMA) wants to be sure you are aware of ongoing water heater industry activities to address this risk. We also want you to understand that a technical solution to eliminate ignition of flammable vapors by gas-fired water heaters is not as simple as staff may have led you to believe.

In a letter dated June 14, 1994 (copy attached), we complained to the Commission's Executive Director, Bert Cottine, that the staff Options Package does not give the Commissioners an up-to-date account of what the water heater industry has been doing to address this issue. Our letter describes an ongoing joint effort to test a new burner and the planned development of a test protocol for measuring compliance with any new performance standard in this area. We asked the Executive Director to provide a copy of our letter to each Commissioner in advance of the Commission's meeting on June 22. For reasons we do not know, this was not done. We regret that the Commissioners did not have this information in time for discussion at the June 22 meeting.

The water heater industry continues to believe that the best way to reduce death and injuries from ignition of flammable vapors

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is to educate the public on the dangers of storing and using gasoline and other flammable liquids indoors. The real problem is not gas water heaters, but consumer misuse of gasoline and other flammable liquids. The Commission should recognize that a gas water heater is only one of many possible ignition sources in the home. Incident data will show ignition of flammable vapors by gas dryers, electric washers, refrigerators and other appliances in addition to gas water heaters.

Nevertheless, as reflected in our June 14 letter, the water heater industry has been investigating whether practical water heater design changes are possible to reduce the incidence of ignition of flammable vapors in the home. These efforts began before the industry became aware that the Commission staff was preparing an options package for the Commission, and they will continue whether or not the Commission commences a rulemaking proceeding in this area. Issuance of an ANPR is not needed to provide an impetus for industry action; the impetus is already there.

Considering the ongoing industry activities that may support the development of a voluntary standard, it is premature for the Commission to commence a rulemaking proceeding at this stage. The Commission has not been given adequate information to propose a practical, effective performance standard or technical solution for preventing ignition of flammable vapors by gas water heaters. The water heater industry itself does not yet have a technical solution.

In its Options Package and draft ANPR, Commission staff claims to have found a "simple" solution to prevent gas water heaters from igniting flammable vapors, i. e. encircling the water heater with a 14" high sheet metal dam that is then taped to the floor (see Options Package at pages 8, 16 and 91). In his presentation to the Commission on June 22, the staff project manager, Joseph Fandey, seemed less confident about this supposed solution, calling it merely "a demonstration of principle," and conceding that Commission staff "have not done the live fire work that would be necessary to say this is definitely a way to go." What happened to make Mr. Fandey become less certain of this solution? The morning of the June 22 briefing, Mr. Fandey learned that, in two "live fire" tests of the proposed 14" high dam by International Approval Services, gasoline vapors were ignited by the water heater in 30 seconds in one test and in $3^1/_2$ minutes in the other test.

The 14" high dam proposed by Commission staff is not the "simple" solution that the Options Package may have led the Commission to believe. Moreover, Commission staff appears not to have considered the possibility that the dam could increase

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the risk of carbon monoxide production, a potential hazard to consumers the Commission certainly would want to avoid.

The staff Options Package discusses elevation of gas-fired water heaters 18 inches off the floor as another effective way to prevent ignition of flammable vapors. At the June 22 briefing, Mr. Fandey cited a decreasing incidence of fires caused by water heaters in garages in California and Oregon in the years since 18" elevation of water heaters in garages has been mandated in these states as evidence that elevation of water heaters is an effective way to prevent ignition of flammable vapors. However, fire incidence data for California and Oregon shows a declining incidence of flammable vapors ignition by water heaters in all areas of the home, including areas where there is no requirement to elevate the water heater. Thus, the data is at best inconclusive about the effects of the requirement to elevate water heaters in garages.

In tests conducted by Arthur D. Little, Inc. elevation of the water heater 18 inches often did not prevent ignition of gasoline vapors under a variety of test conditions. A copy of the Arthur D. Little study is being provided to you.

In its draft ANPR, Commission staff disparages the Arthur D. Little study as not particularly useful, and at the June 22 briefing, Mr. Fandey dismissed the study as "really done in contemplation of litigation rather than in an attempt to find a solution." To us, this shows an unreasonable bias on the part of Commission staff. The Arthur D. Little study is the most methodical, fully documented testing of the effects of water heater elevation on flammable vapor ignition ever conducted. Neither Commission staff nor Ed Downing, the Louisiana attorney on whom Commission staff relies so much, has produced any study nearly as thorough and substantiated as the Arthur D. Little study. For example, Commission staff's own testing in this area consisted of apparently only two tests using instrumentation to simulate actual water heater operation. The Arthur D. Little study involved 40 "live fire" tests.

In its draft ANPR, Commission staff condemns the Arthur D. Little study for using 2-gallon gasoline spills and unreasonably high floor temperatures up to 123°F (allegedly to increase the rate of gasoline vaporization). During his June 22 presentation to the Commission, Mr. Fandey also criticized Arthur D. Little for moving a dummy figure in the room so fast that it created unrealistic turbulence of the gasoline vapors. These comments ignore the variety of conditions under which water heaters ignited gasoline vapors in the Arthur D. Little study, and again demonstrate an unreasonable bias on the part of Commission staff.

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In the Arthur D. Little tests of water heaters installed on an 18" stand, fires did occur with gasoline spills of 2 gallons, but fires also occurred with gasoline spills of $^1/_2$ gallon, 1 gallon, and $1^1/_2$ gallons when there was movement in the room. The movement in the room was not exaggerated, as Mr. Fandey contended at the June 22 briefing. The human cutout used on the moving sled was a child size flat board having no arms or moving parts. We believe that the more complex movements of real people would produce greater vapor dispersion than the dispersion created by the dummy form used in the tests.

Also, in the testing of water heaters installed on an 18" stand, the occurrence of fires was not dependent on the floor temperature. Fires occurred with floor temperatures of 45°F, 54°F, 60°F, 72°F, 81°F, 87°F, and 114°F, for example. This refutes Commission staff's assertion that overheated floors were used in the Arthur D. Little tests to enhance gasoline evaporation. For a concise summary of the results of the tests, we refer the Commission to amended Tables 9 and 10 in the Arthur D. Little report we are providing.

Finally, GAMA takes very seriously statements made by Mr. Fandey at the June 22 briefing that GAMA has not shown a willingness to cooperate with Commission staff and has not exhibited good faith in dealing with Commission staff. We do not believe that these claims are supported by the record. In October 1992, at the very beginning of Arthur D. Little's work for GAMA in this area, GAMA and Arthur D. Little representatives met with Mr. Fandey, William Rowe and Elizabeth Leland and briefed them on our plans for incident data collection and analysis. We asked for Commission staff support of this effort. In February 1993, Arthur D. Little presented the results of its incident data collection and analysis in a meeting with Mr. Fandey and Al Martin of Commission staff at GAMA's offices. At this same meeting, the Arthur D. Little representatives presented a draft of the methodology they planned to use to test the potential of water heater elevation to prevent ignition of flammable vapors. In May 1993, Mr. Martin observed a full day of testing by Arthur D. Little at International Approval Services laboratories in Cleveland. In December 1993, Larry Mulligan of Commission staff spent two days at Arthur D. Little in Cambridge learning to use Arthur D. Little's vapor dispersion model so that it could be applied to Commission staff's own testing. On all of these occasions, constructive suggestions from Commission staff were welcome.

In conclusion, we do not believe that the staff has made a persuasive case that a rulemaking proceeding is needed to force the water heater industry to examine possible technical solutions to prevent ignition of flammable vapors by gas-fired

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mention of planned water heater test method development either in the text of the agenda item, or in the discussion. GAMA and the chairman of the water heater subcommittee had opportunity to inform staff of planned work and did not. Neither did they inform the Project Manager of any planned work, although they knew that an ANPR would be presented as an option to the Commission.

2 The letter to Bert Cottine does not "describe" the testing or activities that are underway. It mentions that work is underway, but does not provide specifics. Had staff known of the ongoing work, staff would certainly have attempted to gather additional information and would have factored it into our recommendations to the Commission. As it is, industry held this information private and submitted it at the last moment (without detail) to the Commission.

3 Mr. George Sweet of the Division of Human Factors responds: "It is a basic human factors principle that the best way to improve product safety is to design the hazardous feature out of the product. Educating the public does not reduce the hazard unless the people are motivated to comply with the message. More effective safety protection is offered through passive interventions (which have built-in safety features that do not require any action from the consumer) as opposed to warnings (which require the consumer to do something). As stated in the Commission briefing, most consumers do not think about their water heaters on a regular basis, some may not even realize it has a pilot light. An education program could be effective in making some people aware of the hazard of flammable vapors being ignited by water heaters, however, it will not prevent the hazard from occurring. For these reasons, the staff recommended an ANPR to find out if a design fix is possible."

4 Staff certainly recognizes that there are other sources of vapor ignition in the home. However, the data indicate that water heaters are by far the largest contributor to this type of accident. Figure 1, *Top Twenty Appliances Igniting Gasoline Vapors in Dwellings - 1991* indicates that water heaters account for more than 65% of the incidents, followed by gas cooking surfaces with about 7%, followed by four other gas appliances. These 6 products account for over 85% of the gasoline vapor ignition incidents. Staff intends to investigate possible ways to eliminate the other gas-fired appliances as possible ignition sources.

5 The staff does not believe it can propose a "practical, effective performance standard or technical solution for preventing ignition of flammable vapors by gas water heaters" at this time. Staff does, however, believe that performance standard provisions must be developed to address

this hazard. Without a standard development activity to develop necessary coverage, the state of the art for water heaters vis-a-vis vapor ignition, will not change.

6 The staff does not intend for the 14-inch sheet metal dam to be considered "the solution" to flammable vapor ignition by water heaters. None of the citations referred to in the Autery letter (pages 8, 16, and 91 of the briefing package) characterize the dam as a "simple" solution. The dam does, however, demonstrate that a significant reduction in the potential for accidents could be achieved by taking combustion air from above the level of flammable vapors. Prior to the June 22, 1994 briefing, staff discussed at length the need to characterize the dam concept as just that, a concept that holds potential. The information on the 2 tests performed by International Approval Services did not cause the staff to "become less certain of this solution" because staff never considered the dam to be the solution. Finally, staff was well aware of the need for "live fire" testing long before the communication concerning the IAS testing. Staff had begun to examine resource implications for this type of testing in advance of the June 22, 1994, briefing.

7 Staff did consider the possibility that the dam could increase the risk of carbon monoxide poisoning. Appendix B of the ESEL test report (page 66 of B.P.) examined the possibility of excess CO production caused by installation of the dam. Tests were run both with and without the dam in place. There was no significant difference in CO production between when the dam was installed and when it was not. ESEL also performed additional testing where a rolled up cotton sheet was placed in the annulus between the water heater and the dam to determine the effect of restricting combustion air flow by draping clothes over the dam. Once again the CO production was not significant.

8 The data for the State of California is presented graphically as Figure 2. It shows an apparent decline in the number of garage fires in relation to the number of non-garage fires.

9 Mr. Autery has taken this comment out of context. The ADL work is of little use for standards development. Staff had requested that the subcommittee develop performance requirements to address this issue and expected that the work undertaken would be for that purpose. The work performed by ADL is not standards development work. Standards development consists of carefully identifying environmental conditions that are encountered in the field, and developing a standardized, reproducible methodology to address the hazard, and then performing extensive testing to verify that the conditions established in the laboratory produce consistent results. By varying multiple test

parameters, the ADL testing did not establish reproducible test conditions. Quoting from page 1 of the Phase 2 report, "The overall goal of the project is to develop a comprehensive understanding of the extent of the hazard identified, and the effectiveness of current mitigating measures." This is not the scope of a standards development program.

10 Mr. Autery is incorrect in asserting the testing performed by the Commission staff "consisted of apparently only two tests using instrumentation to simulate actual water heater operation". In actually, ESEL performed twenty-five tests, as detailed on pages 41-45 of the briefing package.

11 The large number of test conditions investigated in the ADL report is precisely the reason the staff "disparages" the ADL work as standards development.

12 A major issue is CPSC's participation in developing the test program. Staff believes that in order to effectively participate in any type of testing program, one ought to be involved in developing the goals, protocol, and methodology of the program. It is also critical to be involved in the analysis of resulting data, and development of conclusions based on the data. At the February, 1993, meeting where ADL staff presented the results of the Phase 1 Epidemiological study, CPSC staff requested to be included in further development of the Phase 2 test protocol. This request was not honored by ADL or GAMA. In fact, staff was not provided with a copy of the ADL report in draft form for comment. Staff finally received copies of the reports after it had been distributed in final form to the industry.

With regard to Mr. Martin's participation in the testing at International Approval Services in May, 1993, Mr. Martin was on site as an observer. The test protocol and methods had already been established, and testing was nearly completed. Mr. Mulligan's trip took place after the Phase 2 testing was complete and is not relevant to a discussion of staff's participation in test program.

Attachments