MEETING LOG
DIRECTORATE FOR ENGINEERING SCIENCES

SUBJECT: Industry Activities to Address Water Heater Ignition of Flammable Vapors

PLACE: CPSC Headquarters, Bethesda, MD

MEETING DATE: March 2, 1995

LOG ENTRY SOURCE: Donald W. Switzer, ESEE DWS

ENTRY DATE: March 6, 1995

COMMISSION ATTENDEES:

Don Switzer	ES
Terry Kissinger	EPI
Bill Rowe	EPI
Bob Franklin	ECO
Lori Saltzman	HS
Jim Bertoch	ES
Ron Jordan	ES
Tim Johnson	ES

NON-COMMISSION ATTENDEES:

Bob Hemphill	GRI
Tom Doerfler	ADL

MEETING SUMMARY

Arthur D. Little, Inc. (ADL) has been contracted by the Gas Research Institute (GRI) to develop a test protocol to screen water heater resistance to igniting flammable vapors. The protocol will be provided to the ANSI Z21 water heater subcommittee to be used as the basis for a standard test method in the ANSI Z21 residential water heater standard. The purpose of this meeting was to discuss the statistical aspects of the experimental design of the test program.

Various aspects of the experimental design of the study currently being done by ADL were discussed, as well as key aspects of the data analysis to follow. It was mentioned that a full factorial design with replication would take many runs and a very long time to complete. For this reason, a fractional factorial design with orthogonal main effects was chosen, so that the effects of the eight main effects could be estimated independently. Dr. Doerfler said this type of design is often used for screening studies in industrial research.

Some limitations of the chosen design were also discussed. Due to the sample size of 16 runs, there will be low power for

detecting main effects. Also, interactions cannot be tested for, and it is unknown how reasonable it is to assume no interactions are present. It was commented that additional research may be conducted, if needed to insure the statistical validity of the study.

The test program has three dependent variables. It is believed that time to the lower flammability level is the most important dependent variable, in terms of being a good indicator of risk. However, because the test design has three dependent variables, conflicting results are possible. Again, further research may be conducted if conflicting results are obtained.

In the experiment, measurements are taken at ten different locations in the room, and in the analysis there will be a need to decide how to use the information obtained, perhaps defining a function of the ten sensors. Dr. Doerfler said the most important sensors were the three sensors that were three inches above the floor. As an example, he said one way of dealing with it would be to define time to reach the lower flammability level as the minimum time obtained at those three sensors.

Dr. Doerfler also said the time for which measurements are taken in a given run is about 60 minutes, and Dr. Kissinger mentioned the need to standardize the time in the analysis.

Regarding spill size, Dr. Kissinger pointed out that if one gallon appears to lead to significantly greater risk than half a gallon, it is unknown if an even larger spill size would lead to even greater risk. Dr. Doerfler mentioned that spill sizes tend to be in relatively discrete amounts related to storage quantities, and beyond a certain amount there would not be increased risk. Mr. Switzer said that no matter what conditions are used to define a "worst case" scenario, there probably would be other conceivable conditions that would define a scenario with even greater risk.

Mr. Switzer expressed interest in how the results and analysis of the study would be used to write a test method, and said that consultation between ADL and CPSC staff on this portion of the work would be beneficial. Dr. Kissinger mentioned the importance of a round-robin study to determine the reproducibility of the test method, and Dr. Doerfler agreed that at least two laboratories should be involved in such a study. Mr. Bob Hemphill said that at most four laboratories would have the capability of participating in such a study.

Mr. Switzer asked if having one independent variable at three levels, with all others at two levels, would present any problems in the analysis. Dr. Doerfler said it wouldn't, but it did make the design of the study a little more complex. Mr. Switzer suggested that ADL staff consult with CPSC staff at critical junctures and decision points in the data analysis. Dr. Doerfler responded he would do that.

The timetable for the work was also discussed. Mr. Switzer said that rapid completion of the test protocol is critical. He also said that the adequacy of the protocol is more important, and that the timetable could be modified if sufficient technical justification for doing so were provided. However, he noted that he would be a severe judge of whether the justification were adequate.