SCALDING ACCIDENTS

MDE has investigated several recent cases involving accidental scalding from contact with hot liquids from appliances and beverage container spills. According to Pediatrics journal, 140 degree F. water can cause full-thickness (3rd degree) burns to adult skin in 6 seconds. At 150 degrees F., skin is scalded in just 2 seconds. A child's skin is subject to scalding in less time than an adult's. In accidental scalding where hot liquids spill from a beverage container, additional parameters must be considered. For instance, what was the viscosity of the liquid, the type of fabric against the skin, the rate at which the spill occurred, and did the liquid run off or collect against the skin? In order to conduct laboratory tests to determine the effects of accidental exposure to scalding liquids, the original conditions must be understood.

A CASE HISTORY

Dennis Martin was retained to set up a laboratory test to determine skin temperatures as hot liquid is spilled (not dumped) from a beverage cup, both with and without a drinking lid attached, with the thought that a more slowly poured liquid may result in a lower scald potential than a faster spill. The case in question involved a child sitting in a car's seat, holding a cup of hot chocolate. The child was wearing cotton tights under sweat pants.

To simulate the actual conditions from the case, our technician, Paul Josten, obtained a passenger seat from the same make, model, and year of the car in which the spill occurred. The seat was positioned on a test bench at the same angle as it was in the car. This identical seat also assured that the seat's contours would be the same, as this could affect retention or pooling of the spilled liquid. A life-size doll, 38" tall, was dressed in similar clothing and placed on the seat.

Because we wanted to do numerous tests and not soak the passenger seat for subsequent tests, Mr. Josten wrapped the seat in plastic and placed a foam rubber sheet covered with a towel on the seat. This provided a removable, yet absorbent, surface to simulate the passenger seat.

The test setup was ready except for a way to take measurements that replicate hot liquids contacting human skin. In documented laboratory experiments in the post, it was found that the epidermis of a pig approximates human skin thickness and irregularities in contour, A microscopic examination of human and pig epidermis shows these similarities through several layers of skin. Tests using live human and pig skin were actually conducted in 1946 to verify the accuracy of results of testing on pig skin as compared to human skin. Results of this testing proved that there is no significant measurable difference in susceptibility to burns between pig and human flesh, Mr. Josten obtained a pig leg and shaped it to be proportional to a child's thigh. It was then heated throughout to body temperature in MDE's environmental chamber. Temperature probes were inserted through the flesh from the far side with a hypodermic needle so that the probes' tips could be adjusted to be at the skin surface in the scald area, thereby insuring measurement of skin surface temperature. The warmed leg then was wrapped in clothing similar to the victim's and placed on the car seat, substituting for one of the doll's legs.

The hot chocolate was mixed in 190 degree water and spilled (poured) onto the test area both with and without a lid attached to the cup. The thermocouples were connected to MDE's data acquisition system consisting of a 486 computer using a National Instruments SCXI-1000 data acquisition system. Temperatures were logged for all the experimental tests, and the results were plotted. Test results revealed little difference in scalding potential whether the spilling beverage cup was uncovered or covered with a drinking lid having a large straw hole.