

## Molten salt baths cited as lab hazards



1982: Berkeley lab was demolished when a heated nitrite/thiocyanate mixture exploded

A University of California, Berkeley, lab has been rebuilt and is ready for use again after being demolished in late July by the explosion of a molten salt bath. Berkeley chemistry and chemical engineering faculty members are concerned that many researchers are unaware of the potential dangers of these commonly used heat-transfer media.

The explosion involved a glass polymer-synthesis apparatus immersed in a fused salt bath containing 3 lb of sodium nitrite and 1 lb of potassium thiocyanate. The bath had been heated above 270 °C using a hot plate. The experiment was being conducted in a closed fume hood.

The explosion, which Berkeley faculty members estimate had the force of about 1 lb of dynamite, caused more than \$200,000 damage to the new lab. The doors of the fume hood were imbedded in a wall 20 feet from the point of explosion and the interior walls of the lab were bulged outward. The chemical engineering graduate student conducting the experiment escaped probable death only because he was bending over to work on a floor vacuum pump at the time of the explosion.

Book references to molten salts imply that they may be used freely, according to C. Judson King, dean of Berkeley's College of Chemistry. "Molten salts are safe – that's the message," he says.

Some may be, but others clearly are not. Mixtures of salts for heat transfer are common and are marketed commercially. Such commercial mixtures contain, for example, potassium nitrate, sodium nitrate, and sodium nitrite.

King points out that, in the commercial mixtures, all of the components are oxidizers. In the mixture that exploded at Berkeley, thiocyanate, a reducer, was included and seems to have triggered the explosion. Mixtures that contain only nitrate and thiocyanate do not seem to explode. The explosive reaction involved nitrite and thiocyanate.

The literature is not of much help in elucidating the problem. The dangers of the mixture are not mentioned in the molten salt safety review in the Journal of Hazardous Materials, King says. An extensive literature review carried out by King unearthed a 1945 Soviet publication that reported that some mixtures of potassium nitrite and potassium thiocyanate exploded when heated above 370 °C.

“A small community of industrial chemists is aware of the dangers of molten salt baths,” King says. “However, the information does not seem to have filtered down to the rest of the chemical community.”