chemical core (1/2") was Glauber salt, fumed silica, borax and sodium chloride, wrapped in waterproof membrane. The core was bounded by two layers of polymer concrete, which have functioned as the containers for the PCM.

The phase transition temperature of this PCM is 73 °F (23 °C). The tile weighs 11 lb/sqft and stores about 220 Btu/sqft (600 Kcal/sqm or 690 Wh/sqm) over a 10 °F, (5.5 °C) swing (latent and sensible heat). This is about ten times the sensible heat capacity of a concrete tile of the same thickness with the same temperature swing (.025*2000*.22*5.5).

Johnson mentions that aging problems were overcome by packaging the thickened salts in two adjacent 1/4" layers,thin enough to approximate the long dimension of Glauber salt crystals. After 2400 freeze-thaw cycles no signs of aging were observed.

The solar system was a Direct Gain. Incoming insolation was reflected toward the dark colored ceiling tiles by movable reflecting louvers. The temperature swing of the PCM ceiling on sunny days was from 82 to 70 °F. The indoor air temperature was about 10 oF below the ceiling temperature. The indoor temperatur swing was about 10 oF., even in very sunny days.

According to Johnson (personal communication), the PCM tiles were used not only as ceiling but also as floor tiles in many buildings. Their cost was about $ 13/sf, out of which only $ 3 was for the PCM and its pouch and the rest for the containerization. The manufacturing of the tiles in the USA ceased about a year ago although they are still manufactured in Japan and in Sweden.

A Building In Annot, France.

Jaffrin (1986) of the CNRS has measured the performance of an 80 sqm (about 900 sqft) solar house with PCM and concrete floor thermal storage in a cold region of France, Annot, (minus 10 °C average minimum in January).

Southern windows provided direct gain, but during periods when the house was not occupied the windows were converted into solar air heating collectors by installing insulation panels behind them.

The thermal storage consisted of a 20 cm (8") concrete floor in which 80 PVC tubes (10 cm. diameter and 2 m. long), filled with CaCl PCM, were embedded.

Solar heated air from the vertical collectors was blown by a 300 watts fan through small PVC tubes (5 cm) inside the PCM tubes. Electric wires in the concrete floor provided the auxiliary heating, which was operating only during the night hours.

The performance of the house was monitored during two winters (1985 and 1986). The average efficiency of the "window air collectors" in January was about 30%. The stored solar energy by itself was able to keep indoor stable temperature about 10 OC above the outdoors average even during a cloudy period of 10 days.