



Design of an innovative seismic valve for automatic blocking of the natural gas and dangerous liquids leakage in case of strong earthquake

Daniela Ghica, Dan Corneliu Rau, and Constantin Ionescu

National Institute for Earth Physics, National Data Center, Bucharest, Romania (daniela@infp.ro, +40214050664)

In case of a strong earthquake (M_s greater than 7.0), one of the most important risk factors for the densely populated areas is represented by the gas-leakage fires or explosions that may immediately occur, causing up to 60% of the material damages and casualties. Romania is a country with significant seismicity, and the main source of the seismic risk is the Vrancea seismogenic zone. During the last 80 years, four strong Vrancea earthquakes with magnitude between 6.9 and 7.7 affected Romania. So far, the 4 March 1977 event ($M_w = 7.5$, 100 km depth) produced the most catastrophic consequences: 1570 casualties and 11,300 injured, 33,000 residences totally destroyed or partially deteriorated, 61 natural-gas pipelines damaged causing destructive fires.

The paper presents an innovative seismic valve for automatic blocking of the natural gas and dangerous liquids leakage in case of strong earthquake, designed at the National Institute for Earth Physics (NIEP). The designing procedure followed the 12 criteria enforced by the US regulations for seismic valves, aimed to eliminate the critical situations as fluids and under pressure gases leakage caused by the seismic shocks. The system is based on a seismically actuated gas shut-off valve, which is automatically shut down in case of a seismic shock. The device is intended to be mounted on the natural-gas supply lines, outside of the buildings, after the regulator and gas meter, and before the consumer (user) and is called "Robinet Seismic RS" (Seismic Tap).

The innovative seismic valve does not use any source of internal or external electrical power, operating strictly by motion caused by an earthquake. The system is designed to remain closed until manually reset. The energy accumulation element of the RS is a coil spring, while the blocking system for shut-off of the installation is a latch operated by a lever, developing a small force for blocking a large amount of energy.

The innovative valve is designed to assure a very stable operation for more than 30 years. Since the fluid is not flowing through the blocking mechanism, the system can be successfully used for: natural gases installations, protection of GPL tanks, corrosive poisonous substances, polluting agents etc. Presently, in Romania, safe and efficient accepted solutions for antiseismic protection of the dangerous installations as natural-gas pipelines are not compulsory, and, therefore not widely used.