The Swedish Rescue Services Board carried through a series of tests on a scale model of a RC-90 during June - August 1993. The tests were made att White Sands Missile Range NM.

The purpose of the test was to validate design criteria and to test components and installations of RC-90 rescue centres.

The tests were made in two test series. The test object was during the first test exposed to a long duration blast wave, giving a side on pressure of about 2,8 bar. Only minor damages were noticed.

The second test series consisted of 5 different tests using, three MK 82,218 kg GP bombs, and two 125 TNT bare charges.

The combined effect of blast and fragments from the MK82 bombs had a decisive effect on both the concrete structure and the components. It can be noticed that the stand off distance for a 0,35 m thick concrete wall, that is used in a RC-90 type 3, is 7 m if limited spalling is accepted.

The front wall was on the inside partly covered with tiles. During the last test with a MK82 bomb some very limited spalling occurred. Otherwise unexpectedly little happened with the tiles.

The 40 mm thick fragment shields in front of the valves were not thick enough to prevent damages of the valves.

The RC-90 door got a penetrated outer door leaf and the door frame partly torn away from the concrete. Modifications shall be made and further tests are necessary to validate the design.

The shelter door was penetrated completely at several spots with the bomb at 7 m distance. When it was exposed to a blast load near the design level, it lost a part of its closing mechanism and was wide open after the test. The gastight seal was completely torn to pieces. A general conclusion for the RC-90 type 3 is that with a modern bomb like the MK 82 it is advisable to calculate with a stand off distance of about 7 m, and to choose the demand on fagment protection for various components accordingly. This means that the fragment protection capacity of the door should be increased to get a better balance between the protection level of walls and doors. The demand for serviceability of rescue centre door is higher than for a shelter door, but it must be discussed if the door has enough protection capacity even for a shelter. For rescue centres it is not possible to use the door if it is not improved. Improvements can be made by installing extra steel sheets in the door. Experiences of such measures can be found in the report from the 1991 test. Improvements could be done with reasonable costs and it is recommended that an improved door is tested again in order to get a better balance in the protection of standard shelters.

Several types of rapid closing valves and over pressure valves were tested. The large rapid closing valves gave on the whole the expected protection level. The shelter blast valves (SVV) and the over pressure valves failed during some tests as they got higher loads than their design loads. Exceptions were two of the SVV valves, the valves from SkrSyd and Temet. They were still functioning after the high load test although they could not be closed gas tight. The overpressure valve from Temet was also functioning after the high load test but with limited performance.

With regard to the functions in a RC-90 it is possible to use these valves without modifications. Until that is accomplished it is necessary to use other solutions giving a better blast protection. One way of doing it is to use for example the M1000 valve in combination with a damper in the air intake and a over pressure valve in the air outlet.

For standard shelters it has to be discussed, if there is a too large difference in blast protection between i e doors and valves, to get a balanced protection level between different weapon effects.

The test object was equipped with installations for cooling, power supply, lighting and also raised floors. These systems performed well, with limited damages, which could be rapaired with small efforts.

The tests have given experiences and knowledge, that can be used in the running production of rescue centres.

There is still a need for some tests of RC-90 components. As there is a need for more knowledge about the fragment effects on structures and components in general, future tests should cover both areas of interest.

It would be advisable to make the future tests with the same type of bomb, the MK 82, to get increased knowledge of its characteristics and enable comparison with earlier tests. The future tests would be somewhat limited to its extent and could perhaps be made as a part of larger tests, performed with conventional weapons, by for example DNA if it is possible. That could give cost-effective tests.

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Sammanfattning

Räddningsverket genomförde under juni - augusti 1993 en serie vapenverkansförsök med en till storleken nedskalad räddningscentral, RC-90. Syftet var att testa byggnadskonstruktionen, (väggar, tak, golv, betong, ventilation etc), tekniska system, (kraftförsörjning, belysning, radio, tele etc), och komponenter.

Försöken genomfördes i två försöksserier. Under det första försöket utsattes anläggningen för en långvarig stötvåg av ca 2,8 bar, vilken kunde åtgärdas med smärre insatser.

Den andra försöksserien omfattade 5 olika tester med tre MK 82-bomber, 218 kg GP bomber, och två 125 TNT laddningar.

Den sammanlagda verkan av splitter och stötvåg hade en avgörande inverkan på både betongkonstruktion och komponenter.