UK/AUSTRALIAN 40TE DONOR/ACCEPTOR TRIAL HOUSING DAMAGE AND QUANTITY-DISTANCE ASSESSMENT

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1. The distances currently used for the separation of domestic housing and public facilities from explosives storehouses are based mainly on the damage caused by World War 2 bombs and that measured after accidental explosions. Thus in only a few cases was the quantity of explosives greater than that contained in bombs. The measured damage was that to typical 1930s and earlier housing. Explosives are held in storage in much larger quantities and housing standards, means of construction and materials have changed over the years since the war. In the early 1980s a programme of work was proposed to provide data to reduce the need for extrapolation of damage caused by wartime bombs to that expected with the larger stored quantities of explosives. The explosion effects, most importantly those of blast and fragment/debris were to be measured for quantities up to 5.6te in typical UK brick wall, concrete roof storehouses. Later an additional test was carried out to determine the effects from the storage of 75te in a double bay igloo.

2. A series of tests was carried out at Woomera, S Australia [1-4] to determine the effects from such accidental mass explosions of ammunition in a storehouse. Ammunition with net explosives quantities (NEQ from 0.5te to 5.6te were stacked in specially constructed storehouses at the centre of a flat site at Woomera. The storehouse dimensions for each test were varied such that explosives loading densities between 16kgm $^{[-3]}$ and 57kgm $^{[3]}$ were achieved. Overpressures and debris/fragment densities as a function of range from ground zero were determined.

3. From the data gained, predictions were made of blast and debris related Inhabited Building Distance (IBD)for quantities up to 5.6te. In addition fatality vs range consequence models were developed [5] for use in risk assessment calculations. In the absence of information on quantities in excess of 5.6te (the 75te igloo test [6] pertained to that special structure), conservatively calculated extrapolation was still used to determine the consequences of the accidental initiation of NEQs of 50te or more.

4. Examination of such model calculations has led to concern over the degree of conservatism and the appropriateness of carrying out such extended extrapolations. For example it is already known that brick wall debris suffers greater pulverisation as the NEQ is increased and this is not accommodated in the models. It may well be that at these high NEQs the amount of brick debris of sufficient size to be considered potentially lethal is substantially reduced. These extended extrapolations could only be avoided by the extension of the database upon which the models are built. It was, therefore proposed that a further series of explosives storehouse tests, starting with a 40te NEQ donor event, be planned to achieve thisr71

5. Early discussion of such tests led to the conclusion that the cost would be prohibitive if the only objective were to be the extension of the debris throw database. The response of modern structures and the potential corresponding effect on IBD had not yet been addressed. It was therefore proposed that the tests be used as vehicles for the collection of other consequence data, in particular data on acceptor response.

6. In addition to the need to study explosion effects on UK housing it was acknowledged that little information existed on other potential acceptors. In other parts of the world housing stocks have never been truly represented by the UK pre-war housing. There has been little examination of the effects of blast and debris on other types of building, eg factories or offices, where, again, the construction methods and materials are different. Similarly there is a need for the ratification or update of advice on public traffic routes (the vulnerability of traffic), modern services (the vulnerability of pipelines, storage tanks etc) and others. The test discussed here, along with proposed follow-on tests offered the opportunity for add-on experiments to examine acceptor effects. Tests on industrial buildings were planned for this test but postponed due to lack of funds.

7. The test was organised under the auspices of the Anglo-Australian Memorandum of Understanding for Research (AAMOUR) and carried out by The Director of Defence Trials, Australia. However, in view of the international interest in explosives safety matters, the opportunity was offered to the international community to partake. The Netherlands, Norway, Singapore and the USA, in addition to other UK and Australian organisations contributed add-on experiments to the test making it a truly international affair.