REASSESSMENT OF SAFETY DISTANCES FOR EOD OPERATIONS: SMALL AMMUNITION AND AIRCRAFT BOMB FRAGMENTATION TRIALS AND EVALUATION OF EFFECTIVENESS OF MITIGATION TECHNIQUES

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In the Netherlands old World War II ammunitions, like dropped GP aircraft bombs and dumped ammunition, still pose a great problem to the Dutch community. Particularly, since the Netherlands is so densely populated that every square metre has to be used and has high economic value. Currently, large infra-structural projects are ongoing, like the construction of the new railways for the high-speed train and the building of large domestic areas. Consequently, the Ordnance Disposal Unit (EOD) of the Royal Netherlands Army has to clear old WWII-munitions on an almost daily basis.

The military field manual VGVK 19 is used when performing EOD operations in the Netherlands. This manual describes different safety aspects that must be considered during ordnance disposal operations. In the manual, safety distances like evacuation distances and fragment zones are given for different ammunition articles, varying from small ammunition-articles, e.g. hand grenades and land mines, up to large aircraft bombs. Within the EOD-organisation, doubts have arisen concerning the validity of the safety distances given in VGVK-19. Consequently, TNO Prins Maurits Laboratory (TNO-PML) was tasked to evaluate and if need be, alter these. Using safety distances that are either too small can be dangerous, to the local population and EOD personnel, or when too large lead to unnecessary cost involved in the evacuation operation. Besides data for the disposal of WW-II bombs still present in the Netherlands, there is also a need for data in relation to modern NATO bombs as used in more recent war areas (e.g. Afghanistan, Kosovo, Bosnia, Iraq), where the RNLA EOD operates.

Most of the safety distances given in the VGVK-19 field manual, as holds for most of the EOD manuals used world-wide, are based on observations made during the Second World War. Since then, however, ammunition-articles have been changed, making alterations to those distances preferable. In addition, the RNLA EOD currently utilises protective measures/ structures, e.g. sand-filled 20- and 40-ft freight/ISO containers, in many of their operations to minimise the effects of an (accidental) explosion. The mitigating effect of these containers against blast and fragmentation are not precisely known and how this affects the safety distances.

To this end, TNO-PML first conducted a series of arena tests with different small NEQ ammunition articles, with charge weights less than 25 kg, varying from hand grenades up to 155 mm calibre mortar rounds. For a fragment safety distance of 190 m given in VGVK-19, it

turned out that the real fragment safety distance varied from 74 – 723 m, depending on the calibre of the shell and high explosive (HE) charge weight.

Next, a series of trials was conducted in Hjerkinn Norway to determine fragment safety distances of large GP bombs with and without the use of mitigation techniques. The performed trials consisted of arena test trials with Mk 82 (500 lbs) GP bombs: in the open at ground level (for reference); in an open pit, 5 m deep, with reinforced sides; in a 5 m deep pit with a protective structure on top; and trials with Mk 82 bombs covered with either 10 or 15 calibres of sand. For each test, blast measurements were performed and the fragments were collected in a designated target area, weighed and the throw-out distance was recorded using GPS. In the paper, the findings of this extensive and unique test programme will be described and new safety distances for EOD operations will be presented.