

Title	Research Report: 369 Research to improve guidance on separation distance for the multi-energy method (RIGOS)
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Executive Summary	<p>This report describes the results of a research project with the primary objective to develop practical guidance with respect to the Critical Separation Distance. The Critical Separation Distance is a basic element in the application of the TNO Multi-Energy Method. The TNO Multi-Energy Method is a simple method for vapour cloud explosion blast modelling, which is based on the Multi-Energy concept. The Multi-Energy concept is the basic feature of vapour cloud deflagration that overpressure/blast develops only in parts of the cloud that are located in partially confined or congested areas. An important consequence of the Multi-Energy concept is that if one single extended vapour cloud of flammable composition comprises more than one partially confined or congested areas that are separated by open spaces of sufficient extent, the vapour cloud explosion on ignition develops the same number of separate blasts. If, on the other hand, open spaces between partially confined or congested areas are insufficient, the blast of the vapour cloud explosion should be modelled as one single blast of summed energy content. The blasts are modelled by the application of blast charts compiled for an equivalent hemispherical fuel-air charge.</p> <p>The Critical Separation Distance between partially confined/congested areas is the criterion that enables to discriminate between the modelling by one single blast or more than one blast, i.e. to be able to discriminate between open spaces of sufficient or insufficient extent. The critical separation distance is, therefore, a basic element in the Multi-Energy method and of paramount importance for its application.</p> <p>This report describes an experimental program to develop quantitative guidance with regard to the Critical Separation Distance. To this end, explosions of small scale vapour clouds containing two separate configurations of obstacles (representing separate process units on a chemical plant) were produced. Blast effects at various distances were recorded while the separation distance between the configurations of obstacles was varied. The critical separation distance is defined as the minimum separation distance between two congested areas still resulting in two separate blast waves. In addition to the separation distance, the size and obstacle density of the donor as well as the fuel in the gas cloud were varied. These series of experiments constituted the bulk of the research program.</p> <p>In addition, it was investigated through a limited number of tests if the critical separation distance is also dependent on the obstacle diameter in the donor. Also, it was studied whether the critical separation distance would possibly be influenced by a connection of limited cross-sectional area between donor and acceptor, representing for instance a pipe rack between two process units. This research program resulted in a substantial body of experimental data on donor-acceptor explosions. This data set offered the opportunity to validate the methodologies for simple vapour cloud explosion blast modelling on gas explosions substantially different from those these methods were derived from. This report describes the research program. After a brief introduction in Chapter 1, Chapter 2 describes the background of the Multi-Energy blast modelling as well as the guidance for its application, developed over the years in the multi-sponsor research programs GAME and GAMES. The Chapters 3 and 4 describe the objectives, the general approach in this research program as well as a detailed definition of the various</p>

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Table of Contents	1 Introduction.....	1
	2 Background.....	3
	2.1 History	3
	2.2 The Critical Separation Distance	4
	3 Research program	7
	3.1 Objectives	7
	3.2 Approach.....	7
	3.3 Test location.....	8
	3.4 The obstacle configurations	8
	3.5 The test set-up.....	9
	4 Test program	12
	4.1 Variation of Separation Distance (SD)	12
	4.2 Tests with a connection between donor and acceptor representing a pipe rack.....	15
	4.3 Combination of large and small obstacles	16
	5 Results and Analysis	18
	5.1 Donor-acceptor explosion behaviour.....	18
	5.2 The Critical Separation Distance	25
	5.3 Influence of a Connecting Obstacle Configuration	30
	5.4 Influence of the Obstacle Diameter	37
	5.5 Practical Guidance on the critical separation distance.....	39
	6 Additional information from experiments	42
	6.1 Donor-acceptor explosion behaviour.....	42
	6.2 Validation of blast modelling methods	46
	7 Conclusions.....	67
	8 References.....	69
	9 Authentication.....	72