

Alerting Gas Explosions in Buildings: LPG as Fuel or for Air-Conditioner?

W.K. Chow JP FHKEng and Y. Huo

Research Centre for Fire Engineering, Department of Building Services Engineering
The Hong Kong Polytechnic University, Hong Kong, China

1. Introduction

A note was raised early this year [1] consequent to the occurrence of several gas explosions in residential buildings in big cities in the Asia-Oceania areas, including a very big one which killed several firemen [2] in Hong Kong in 2014. Another gas explosion occurred [3] in a garage of about 200 m² for repairing liquefied petroleum gas (LPG) taxis also in Hong Kong in April 2015 !

This gas explosion in buildings not only damaged the building structures, but also killed the owners [3] staying inside. Hazardous consequences were even brought to the neighbours as reported before in Hong Kong [1,4-6].

The transient gas explosion pressure has to be better understood for protecting firemen during operation. The explosion pressure should not exceed 21 kPa or about 0.21 bar to avoid serious damages to the building as suggested [7]. Approximate amount of LPG involved in that explosion in a garage was estimated using empirical equations reported in the literature [8-10].

2. The Case Concerned

Information on the case of explosion in that garage is taken out from government website [3,8] and shown in Fig. 1. There are many methods [e.g. 9,10] available for calculating pressure rise in a chamber for different scenarios.

Two methods A and B were used:

- Method A: Perlee, Fuller, and Saul model [9]
- Method B: Morton and Nettleton model [10]

Results on the amount of LPG required to generate 21 kPa in that 200 m³ garage are shown in Table 1. A reasonable estimation will be having 3 kg or 3.9 kg of LPG involved in the explosion to give adequate high pressure rise. This is just a very rough estimation and further experimental studies must be carried out to confirm that using a small amount of LPG can lead to serious consequences.

From the data on LPG cylinders for different types of taxis in Hong Kong [11], the maximum storage of LPG allowed is from 22 kg to 50 kg. However, only 3 kg of LPG can give an explosion pressure of 21 kPa, though LPG is claimed to be not leaked out easily from the storage tank.

There is another possibility of having explosion due to flammable clean refrigerants [12] including LPG. A taxi might have 0.5 kg of refrigerant HFC134a (R134a) stored in the air-conditioning unit. Explosion can result from such a small amount of flammable gas.

3. The Way Forward

With so many explosions [1-3,12] due to fuel or even clean refrigerant gas leakages reported in buildings in this part of the world, there is a need to control the activities for repairing LPG cars which might have the explosion risk. Before putting the scheme into practice, a longer-term study on explosion control of LPG and other flammable gases such as clean refrigerants commonly used as domestic fuels in Hong Kong should be carried out. An explosion hazard protection framework must be recommended.

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Table 1: Results

Space volume	Method used	LPG volume / m ³	LPG mass / kg
200 m ³	A	1.4	3
	B	1.7	3.9

Total area of No. 65 to No. 67 is about 95 m².
The garage is in No. 65, and the area is about 47 m².



Fig. 1: The garage

Source of map: <http://www1.map.gov.hk/gih3/view/index.jsp> from Lands Department