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Our Reference: FIR/74 80/37/25

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To all Chief Officers

FIRE SERVICE
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45621

19 May 1976

Dear Chief Officer

30/1976

SMOULDERING IN FOAM RUBBER
EXPLOSION HAZARDS IN SMOULDERING FIRES

1. I wrote to you on 24 January 1975 about a fire at Chatham Dockyard involving foamed rubber mattresses (letter No. 4/75) and again on 17 October 1975 (letter No. 57/75) about Building Research Establishment, Current Paper CP/36/75 entitled "The explosion risk of stored foamed rubber". The Current Paper described research which indicated that a serious explosion risk exists when the flammable smoke and vapours from the smouldering of foamed rubber are allowed to collect in an enclosed space.
2. A further development occurred in the latter part of 1975 when a report was received from the West Yorkshire Brigade on a fire in a dwelling-house, at which it was believed the same phenomenon or one similar to that at Chatham was responsible for what may be called an explosion, or perhaps more accurately a deflagration, ie a sudden ignition of unburned gas and air mixture resulting in a rise in pressure resembling a blast wave. On that occasion the lives of 2 firemen were hazarded and both were injured, though fortunately not fatally.
3. In the light of the incidents at Chatham and West Yorkshire, the following guidance has been drawn up in consultation with the Fire Research Station. The guidance has been agreed by the Joint Committee on Fire Brigade Operations, which has recommended that it should be issued to the service.
4. The fire service is already familiar with explosion hazards which may exist in the course of fire fighting operations, and which arise from the existence of vapour and air mixtures from flammable liquids; and with the phenomenon of "flash-over" defined in BS 4422 as "a stage in the development of a contained fire at which fire spreads rapidly to give large merged flames throughout the space". It has been the usual understanding that flash-over is to be expected only in circumstances of very high temperature more or less throughout the space concerned.
5. BRE Current Paper CP 36/75 indicates that there is at least one substance, foamed rubber, which is capable of sustaining a small fire insufficient to raise the temperature of a room to intolerable levels but which can release unburned vapours whose ignition when mixed with air can produce explosive results. This appears to have taken place in the 2 fires to which reference has already been made, in which the vapours deflagrated without the need for admixture of any air from outside the enclosed space. Of course, many materials, both synthetic and natural, may produce hazardous situations when a fire develops normally in its early stages and then becomes oxygen-vitiated and hence subdued. Vapours from this may migrate and ignite when mixed with

additional air. It is important to identify the conditions in which the special risk from smouldering fires may apply, so that special precautions may be taken during the course of fire fighting to avoid unnecessary danger to firemen.

6. In broad terms, the deflagration of accumulated flammable vapours is unlikely to take place except in a closed compartment of relatively small size. A bedroom, a living room or a small storeroom, whose door and windows were neither open or broken, might lead to the hazardous condition, which is unlikely to exist in a small area of a large warehouse or factory compartment. The hazardous condition is likely to be accompanied by the presence of smoke, perhaps dense, but relatively cool. Indeed, the products of smouldering may cool to near room temperature if they have been given off over a long period of time and still present a potential hazard. Moreover, it is unlikely that unburned flammable vapours can exist while free flaming is in progress in any part of the enclosed space: so far as has been revealed up to now, the hazard referred to is associated with a smouldering fire which does not produce flames at the same time. The ignition of the unburned gases will normally occur not from the heat of the smouldering process but from circumstances which cause the smouldering to give way, even if only momentarily, to a flame or flaming. It is accepted that these circumstances will be difficult to identify positively, for instances from outside a room before entry has been made. Nevertheless, a general rule can be stated that wherever dense cool smoke is encountered, with no evidence of flaming, a risk of deflagration could exist; no deep entry should be made into a room under these conditions until every effort has been made to disperse the smoke by increasing the ventilation, for instance, by opening outside doors and windows, particularly high level ones.

7. Until the hazardous conditions have been removed by ventilation, firemen will be to some extent at hazard from the risk of a wave or pressure from the ignition of free vapour. Care should always be taken not to stand or remain in front of openings, whether doors or windows, and firemen should keep as near the floor as practicable so as to avoid being unduly exposed to the effect of a sharp movement of air. Subject to what appears to be the urgency of the job to be done, fire-fighting equipment should be ready to hand before a deep entry is made into this type of situation.

8. Notwithstanding the above guidance it is important that explosion hazards in smouldering fires should be kept under review. In this connection it would be useful if you would let me have details of any similar incident which occurs in your area.

Yours sincerely



No 30/1976

The Fire Service
College



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