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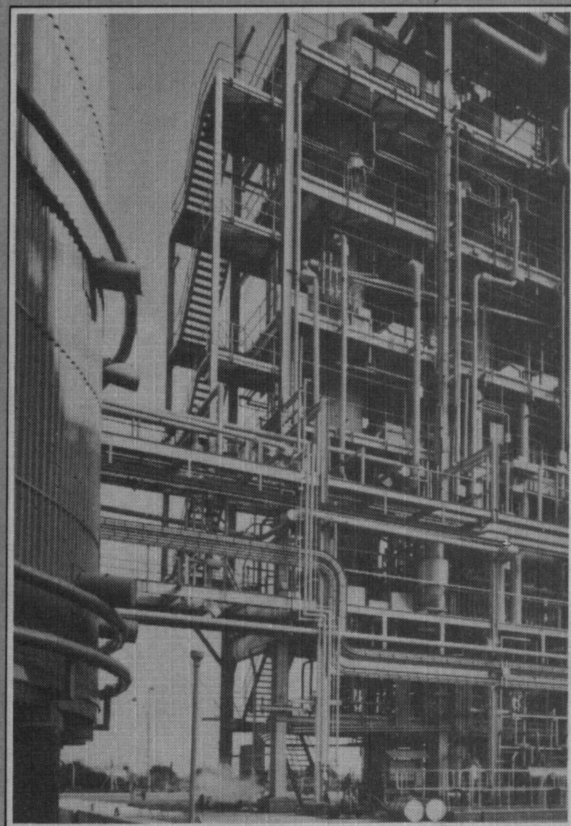

THE ASSESSMENT OF MAJOR HAZARDS

Manchester 14/16 April 1982
Event No. 272 of the EFCE

The Institution of Chemical Engineers
North Western Branch

1982

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THE ASSESSMENT OF MAJOR HAZARDS

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A REVIEW OF MATHEMATICAL MODELS FOR PREDICTION OF HEAVY GAS ATMOSPHERIC DISPERSION

J. A. Havens*

Mathematical models for atmospheric dispersion of heavy gases are reviewed. Treatment of gravity spreading of heavy gas clouds and air entrainment are emphasized. Considerable variation in the methods of treatment of air entrainment is identified. The importance of gravity spreading compared to atmospheric turbulence-generated lateral spreading is considered, and a criterion is suggested for evaluation of their relative importance. Several heavy gas dispersion tests which have been conducted appear to have been dominated by atmospheric turbulence and hence provide little basis for extrapolation to catastrophic releases where gravity-driven flows are expected to dominate.

INTRODUCTION

Risk of accidental release of heavier-than-air gases accompanies many manufacturing, storage and transportation operations. Although increased public attention to such risks reflects, in large part, extensive debate on the risks associated with marine transport of very large quantities of flammable liquefied gases (1,2,3), many other potentially hazardous chemicals can produce heavy gas or aerosol "clouds" when released into the atmosphere (4,5). Assessment of risk attending such operations invariably involves estimation of the probability of release and the ensuing atmospheric dispersion, since such dispersion eventually results in dilution of the gas with air to concentrations which are non-flammable (or non-explosive) or within acceptable toxicity limits. Therefore, a prediction of the location of the "boundary" of such clouds (defined, for example, as containing gas concentrations above a prescribed lower concentration limit) with respect to time is required for rational risk assessment.

Considerable effort has been directed to the understanding of heavy gas atmospheric dispersion in the last ten years. The purpose of this paper is to summarize these developments in some historical perspective and to present a view of the state of our understanding of the problem.

BACKGROUND

The recognition of the need for a more quantitative understanding of heavy gas dispersion processes was in part a result of extensive debate regarding the risks associated with marine transport of liquefied natural gas (LNG).

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