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Letter to the Editor

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Sir,

I write in response to the above article and its implications to the 'root' cause of the Flixbourgh Disaster of 1974.

The significant conclusions of this contribution are that the determinations of Gugan are vindicated (i.e. over-pressures perhaps greater than 16 bar and possibly indicative of detonation) and that 'visual' inspection determinations of blast over-pressure are inferior to those based upon calculation.

To the first I would say that it is about time for Gugan's contribution to this investigation to be recognized.

To the second I would caution that this conclusion is very much based upon the assumption as to the size, shape, distribution, and location of ignition and/or 'trigger' to the explosion despite the author's statistical examination of the variation of ignition within one location only, the Hydrogen Plant.

The authors have chosen to assume the size and distribution as well as location of 'ignition' of Sadee et al. A significant result from this is that the over-pressures predicted at the upstream reactors (R1–R4) in Section 25A should also have caused them to have had their skirts crushed like that of R6 (location P3) and reactor R5 (location P2), they did not however! (Plates 7 and 8 of the Official Report show this clearly for R4 and R6 as well as R5), thus indicating, perhaps, that some significant uncertainty should be attributed to the location of the boundary of the flammable cloud chosen for the simulation?

Additionally the fact that the upper bodies of R5 and R6 WERE NOT crushed (both vessels had similar wall thickness to the skirts, but with greater length–diameter ratio [1] (therefore LESS resistance to blast crushing) indicates, in the case of R5, that the flammable cloud was ONLY at ground level near this location, and in the case of R6, that this vessel was STILL UNDER PRESSURE at the time of the explosion! It further indicates that the

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cloud did NOT extend much further north than the base of R6 and not as assumed by Sadee et al. and the authors.

These points thus, question the assumption of the size, shape and vertical distribution (of which we are not given information in the article) as well as the presumed location of ignition.

Studies by ourselves, based upon an extensive review of the literature, the Minutes of the Court of Inquiry, eyewitness reports to the police, the Factory Inspectorate, and the Court (as well as one to me personally), FEA analysis of the bellows and by-pass pipe bridge and its possible mechanism of failure [2], the flow within the by-pass between the two reactors, R4 and R6 [3], CFD simulations of the possible releases (that accepted by the Court and the one arising from [2,4]) indicate that the release, BEFORE THE EXPLOSION, could only have occurred in a two-step manner. From only R4 initially and may have been limited to only 10–15 t of Cyclohexane not the 30 t assumed for the simulation.

These facts, coupled with the evidence of the high temperature carbides found only on the bellows remnants of R4 and not R6 [5], the eyewitnesses and the points earlier raised and in our cited papers indicates that release was from R4 only before the explosion and thus the cloud very much different from that assumed.

Further if ignition, or more likely a ‘trigger’, to the explosion was as a result of an internal gas explosion in either the Main Office building or the Project or Works Office then the ‘visual’ observations of both Sadee et al. and Marshall can be reconciled with the results.

It would be interesting to perform a complementary study using the very much smaller release suggested here and the size and distribution indicated in [4].

References

[1] G. Artingstall, Appraisal of the damage in the reactor vessels in Section 25A, Report No. 4, Part I, Safety in Mines Research Establishment (SMRE), 11 September, 1974.
[2] J.E.S. Venart, D.M. Tan, in: Proceedings of ICPVT-9 on Flixbourgh; Twenty-Five Years After, the Final Resolution? Sydney, 9–14 April, Vol. 2, 2000, pp. 525–539.
[3] R. Teng-yang, K.F. Sollows, J.E.S. Venart, in: Proceedings of the IChemE Symposium on Froude Modeling of the Flixbourgh By-Pass Pipe, Hazards XV, Series No. 147, Rugby, 2000, pp. 139–154.
[4] J.E.S. Venart, in: S. Grayson (Ed.), Flixbourgh a Final Resolution? INTERFLAM’99, Vol. 1, 1999, pp. 257–272.
[5] J.H. Foley, Metallurgical examination of the damaged pipes from Section 25A, Report No. 1, Part I, Safety in Mines Research Establishment (SMRE), 10 September, 1974.