

### Comments on Atkins Oil & Gas assessment by HSE

1. In HSE's opinion, Atkins' assessment methodology for gasholders is not technically robust, and consequently they have significantly underestimated the risks to people at 33-37 The Oval. There is a real and recognised danger in allowing new intensive development, particularly of a multi-storey nature, close to water-sealed gasholders. This is the reason HSE sought and were granted 'call-in' of the application for the amended development even though it would have located slightly further away from the holders than the present, partly-constructed building. Whilst holders are proven storage technology, the additional measures that can be taken to prevent accidental escapes or mitigate their consequences are limited. It is for this reason that maintaining adequate separation from off-site development is crucial for this type of major accident hazard. In our opinion, the 'hardening' of the building in an attempt to reduce the risk is unacceptable where the occupants have no control over their exposure and obtain no direct benefit from it. Furthermore, comparisons of involuntary risk with generalised benchmarks such as annual risk of all deaths (including natural causes) or those where the population benefits in some way (employment) is misleading, particularly for a non-specialist audience, eg. the Council.
2. HSE considers that a gas escape when one or more of the water seals fail is also a serious major accident hazard. Such failures can occur for a number of reasons, including weather effects. There are typically 3 large gas escapes from seal failure each year in the country's holder population: on average at least one of these exceeds 30 tonnes. There were three large seal escapes last year, of which two occurred at holder stations in London. A holder at Bethnal Green suffered a large seal escape in 1986 which closed Liverpool Street Station: its cause was thought to have been vandalism.
3. Historically seal escapes have not resulted in significant harm, probably because of the reasonable separation between most holders and adjacent development, particularly of an high-rise nature. However, there have been five known seal fires (a very tall sheet of highly radiative flame around the holder's circumference) in the last 35 years. At least two of these required the evacuation of neighbouring populations. A seal fire is a potential precursor of a holder decouplement and collapse 'fireball' event.
4. If a seal escape does not ignite immediate, it can result in a flammable gas cloud which does not necessarily disperse upwards as expected. In wind speeds over 5m/s, the wake effect around the holder can cause the gas cloud to extend horizontally and downwards. This has been demonstrated in wind-tunnel and 1/3-scale practical tests. HSE knows of only one 'model' which has been satisfactorily validated for this type of dispersion. Predictions from a general purpose dispersion model such as HGSYSTEM would need very careful interpretation if they are not to mislead, particularly in view of the relatively short distance of interest (~20m).
5. The flammable cloud from a seal escape is predicted to extend out to 80m or more from the side depending on the diameter and type of holder under certain wind speeds. The cloud from a failed upper seal, if not already touching the ground, will descend as the holder empties enveloping anything in its path. There is little that can be done once a seal has failed other than to empty the holder into other available storage, but this can not be done quickly. By coincidence, one recent escape started when a technician was present on a holder station. Even though he was able to initiate prompt emergency emptying, half of the holder's contents still escaped.

6. Whilst a ground roughness length of 0.3 may be suitable for predicting long distance dispersion over an urban environment, it is unlikely to suitably represent the relatively short and 'open' distance between the two holders and 33-37 The Oval. In view of the 'knock-down' effect the holder has on gas dispersing in its wake, it is unlikely that the holder station perimeter wall will provide any significant mitigation.
7. It is HSE's understanding that the 18m exclusion distance for ignition sources (it is not claimed to be a safe separation distance) in IGEM SR4 was derived from early wind-tunnel tests which indicated a higher degree of buoyancy than was eventually found to be the case. The 2nd edition of the Safety Recommendations is now over 10 years old and when revised will no doubt more accurately reflect current knowledge.
8. Major holder failure (decouplement or collapse) has resulted in flames reaching ground level. At least one early Home Office investigation report describes people running to escape the fire as a holder collapsed.
9. Atkins has calculated the chance of safe dispersion (ie. no ignition) from a seal escape as 93% which appears unreasonably high in view of the short separation to high-rise, mainly residential nature of the 33-37 The Oval development.
10. Atkins' back analysis of the National Grid split crown explosion results is incorrect.
11. HSE disagrees with the event frequency analysis in Annex C. The information on which the analysis is based was obtained from the HSE and was not claimed to be exhaustive. The data was gathered for the specific purpose of determining whether the expected frequencies of decouplement and collapse major accidents exceeded that required to support a protection concept 'siting policy' for providing land use planning advice. When the necessary number of past events had been identified, HSE terminated its search. Other unidentified 'large scale' holder accidents have probably occurred in the past and consequently the Atkins' analysis could significantly underestimate the frequencies of these types of event.
12. As a result of Atkins' misunderstandings they have significantly underestimated the individual and case societal risks at 33-37 The Oval, possibly by more than a factor of five but probably by less than an order of magnitude. This appears to have mostly been caused by their inaccurately short seal escape dispersion distances (resulting from an unsuitable dispersion model, optimistic effect of perimeter wall, inappropriate ground roughness) and, consequently, very low ignition probabilities for this event. However, their very probable underestimation of the frequencies for larger major accident events will also have contributed.
13. The 'call-in request' SRI comparison values of 500,000 and 750,000 should only be used with individual risk values of receiving a dangerous dose or worse. HSE's unpublished comparison values for use with risk of death, as Atkins have used in their SRI calculation, are significantly lower so the comparison is inappropriate.
14. Gasholders are not used for just 6 months of the year. Holders were seen fully inflated in July this year. The current hazardous substances consent for the Bethnal Green Holder Station does not constrain storage to certain times of the year. However HSE notes that the Council, acting as Hazardous Substances Authority, has the power to modify the consent if it wishes, although we understand that compensation may be payable to the operator if they did so.
15. It is noted that Atkins advises that ideally both terraces should be removed or made inaccessible for normal use. In HSE's opinion signage is unacceptable as a way of

ensuring the absence of ignition sources. In view of their underestimated dispersion distances, Atkins' recommendation regarding the occupation of front terraces is unsound. Furthermore, openings further than 18m from the gasholder could result in gas ingress and an internal building explosion under certain weather conditions.

16. A normal construction building is unlikely to withstand the almost 1 bar overpressure predicted by Atkins. Furthermore, the application of film or the provision of shatter-proof windows may at best just result in the blast forces being transferred to the frames and adjacent wall which in turn could result in partial or complete building collapse. The adequate 'hardening' of normal buildings against heat and blast is highly specialised, requires considerable expertise and may be impossible for a partly constructed building.
17. HSE 'tolerability' framework in R2P2 was not designed to judge the incompatibility of proposed land uses close to major accident hazard establishments. Consequently, its attempted use by Atkins to justify the acceptability of the development at 33-37 The Oval is misleading. The substantial level of individual risk to occupants is the reason HSE sought and were granted 'call-in' of the application for the amended development even though it would have located slightly further away from the holders than the present, partly-constructed building.
18. The comparison of the risk to occupants with generalised benchmarks such as annual risk of all deaths (including natural causes) or those where the population benefits in some way (employment) is misleading, particularly for a 'lay' audience, eg. the Council, who are not used to making risk-based decisions.