

# Regulating Gasoline Pipeline Safety - A Way Forward?

## 1 Introduction

1 The Steering Group on Gasoline Pipelines (part of the Advisory Committee on Dangerous Substances - Major Hazards Committee) has agreed that gasoline pipelines may need to be regulated in a way that reflects more accurately the characteristics of the fluid and the relatively low level of risk, but which takes into account the potentially high consequences of failure. This conclusion was based on an assessment of empirical evidence from around the world rather than using the more conventional methods of theoretical modelling.

2 This discussion document proposes a way of incorporating some additional regulatory requirements, over and above the General Duties of the Pipelines Safety Regulations 1996 (PSR) [Ref 1], to take account of the potentially hazardous nature of gasoline pipelines but recognising that the risks are low and the full panoply of the additional duties under Part III of PSR need not be applied.

## 2 Summary of risk studies for PSR and gasoline pipelines

3 During the development of PSR a study by A.D.Little Ltd [Ref 2] was published in 1995 which compared the risks from a variety of hazardous substances in pipelines to help HSE determine which posed a higher level of risk to the safety of people and would require specific additional regulatory controls. Gasoline pipelines were shown to present an individual risk level higher than the threshold normally applied by HSE. However, this conclusion was generally considered to be indicative only and further detailed research was requested by the Health and Safety Commission but which would not be completed before the regulations (ie PSR) came into force. This additional research, also by A.D.Little, was managed by the Steering Group on Gasoline Pipelines, comprising representatives from HSE, CBI, local authorities and TUC, and which had its first meeting in September 1995.

4 The consultative document for PSR [Ref 3] was issued in the summer of 1995 where the issue of gasoline was highlighted. However, the decision had already been taken not to include gasoline as a "dangerous fluid" until the new research had been completed. The regulations eventually came into force in April 1996 with no special requirements or arrangements (ie additional duties) for extremely flammable fluids (which include gasoline).

5 Following the completion of the A.D.Little report "Risks from gasoline pipelines in the United Kingdom" in August 1996 [Ref 4] an industry-sponsored independent review of that report was submitted to the Steering Group a month or so later which challenged

some of the assumptions used by A.D.Little and concluded it was overly conservative in its assessment of risks from gasoline pipelines.

6 The A.D.Little report was presented to the Advisory Committee on Dangerous Substances (ACDS) in November 1996 but ACDS felt that there was a need for further study. It too felt that some of the assumptions were over conservative and had doubts about the methodology used for modelling consequences of leaks. The possibility of significant costs falling upon pipeline operators due to compensation payments as a result of land use planning considerations were of concern. ACDS wanted the cause of harm to people from gasoline pipelines investigated and then for models to be developed to reflect what actually had occurred.

7 At the Steering Group meeting in January 1997 representatives from industry indicated that, in principle, they had no problems with some of the additional duties in PSR but confirmed they were very unhappy with the prospect of land-use planning (which is not covered by PSR) and emergency planning controls being applied to gasoline pipelines. These concerns were supported by a number of factors put forward by the industry at earlier meetings; for example, gasoline pipelines in the UK were very safe and that nobody had been killed yet; the public would be concerned about the sudden labelling of gasoline pipelines as "major accident hazard pipelines carrying dangerous fluids"; gasoline may only be present in multi-product pipelines for short periods; and the assumptions used in earlier studies may have been overly conservative.

8 At this meeting the Steering Group agreed to proceed with an additional study, based on evidence from actual incidents from around the world, which was awarded to W.S.Atkins Safety and Reliability in August 1997. The final report of the study was submitted to the Steering Group in July 1998 [Ref 5].

### 3 Summary of findings of the W.S.Atkins study

9 The W.S.Atkins study shows that there are potentially serious consequences as a result of gasoline pipeline incidents, including significant loss of life, large numbers of injuries, substantial property damage and severe disruption, including the evacuation of large numbers of people. However, the report also shows that the individual risk of fatality at the pipeline centreline is low in both the rural and suburban environments. The picture may be complicated by the fact that only a relatively small number of relevant events were used to derive the risk levels and that serious incidents, involving loss of life, have not yet occurred in the UK. However, there is no room for complacency - it will take only one serious accident to dramatically change the overall picture.

10 A number of factors have been identified from the incidents detailed in the report and these have been grouped under two main headings:

## **1 Pipeline integrity, operations and safety management**

11 The first group of factors are mainly associated with the pipeline operator, the way safety is managed and how pipeline integrity is established and maintained. Pipeline operators will work within the regulatory framework that exists and follow normally accepted standards - if either of these is poor or missing then problems can arise. If a sound regulatory framework had been in place, such as PSR which covers many of the identified factors, and a good standard followed such as British Standard BS 8010 [Refs 6a & 6b], then it is possible that some of the incidents may not have occurred. These factors include:

- inadequate consideration of hazards to a pipeline during the design phase;
- no requirement by regulatory authority for safety enhancements at high risk locations;
- proximity of people to the release;
- failure to use risk assessment (eg for spacing of isolation valves);
- inadequate pipeline operator procedures and training in their use;
- inadequate incident response/investigation training of operator/contractor personnel;
- failure to properly identify, and protect, a pipeline for other works;
- no requirement for leak detection or pipeline isolation/shut-down;
- lack of, or failure of, isolating valves/systems resulting in increased severity of consequences;
- failure to properly establish the integrity of a damaged pipeline prior to re-use;
- inadequate schemes for pipeline maintenance including inspection and testing; and
- the need for One-call systems.

## **2 Consequences of failure and mitigation measures**

12 These factors are mainly a function of the characteristics of gasoline and how good the emergency arrangements were following an incident and include:

- pipeline contents flowed downhill into rivers, sewers, drains and streets and can be moved over large distances when waterborne;
- gasoline vapours explode when ignited and fires can be extensive;
- people may be badly injured or killed, the environment may be adversely affected and property may be damaged;
- people may need to be evacuated;
- inadequate control of scene of accident;
- importance of regular contacts between pipeline operator and emergency services; and
- unpredictable response of people affected by an incident.

13 These factors support the view that there is a need for a sound regulatory framework to properly ensure that risks from gasoline pipelines are properly controlled, that these pipelines are adequately protected and that suitable and effective measures are in place to deal with incidents, should they occur. Any such framework should include requirements for:

- 1 proper pipeline design and routing
- 2 hazard identification and risk assessment
- 3 proper schemes of maintenance, including inspection and testing
- 4 adequate emergency arrangements and procedures
- 5 competent, trained staff to be employed
- 6 suitable emergency plans by local authorities
- 7 limited land-use planning controls
- 8 control of third party activities.

14 Some of these requirements, ie 1, 3 and part of 4, are covered by the General Duties of PSR. Items 2, part of 4 and 5 are parts of the requirement under Part III of PSR for a major accident prevention document which includes hazard identification, risk assessment and a demonstration that the safety management system is adequate. Item 6 is also covered under Part III of PSR but may not be entirely appropriate for flammable liquid pipelines, given the way that fluid can migrate from the route of the failed pipeline.

The current recommendations for local authority emergency plans [Ref 7] suggest consideration of a corridor, known as the emergency planning distance, where detailed plans are prepared for the worst credible accident but the requirement for emergency plans of this type may need to be reconsidered for gasoline pipelines.

15 Land-use planning is not covered by PSR but there is a view that limited land-use planning could be used to protect the pipeline easement and which would give pipeline operators notice of future developments.

16 The control of third party activity or development is one of the most difficult areas. Regulation 15 of PSR can help but the regulation may only be effective after an incident causing danger to persons has occurred, rather than preventing a pipeline from being damaged in the first place. The use of a One-call system to allow third parties to make contact with owners or operators of buried plant in the area of proposed works is established in parts of the USA, The Netherlands and Australia. It is currently being trialed in Cheshire for 12 months by a number of pipeline operators and HSE. There is a possibility that the proposed EU Directive for pipelines may require such systems to be introduced.

#### **4 The regulatory regime - before and after PSR**

17 Before the introduction of PSR in April 1996 the safety of gasoline pipelines was regulated through the Pipelines Act 1962 (PLA62) [Ref 8] and some pipelines were also subject to the Land Powers (Defence) Act 1958 [Ref 9]. Proposals for new pipeline construction were either notified to the Department of Trade and Industry (DTI) (if the pipeline was to be 10 miles long or less - a local pipeline) or an application was made for a Pipeline Construction Authorisation (if the pipeline was to be more than 10 miles long - a cross country pipeline). When the Pipelines Inspectorate transferred to HSE in April 1991, it was agreed that safety requirements for any of these pipelines would be specified by HSE through the established Safety Notice regime, while DTI retained the planning role through PLA62.

18 The Notification of Installations Handling Hazardous Substances Regulations 1982 (NIHHS) [Ref 10] specifically excluded flammable liquids which had a flash point of less than 21°C if they were the only hazardous substance contained in a pipeline. Effectively, what this meant was that land use planning controls were not applied to any pipeline carrying a flammable petroleum liquid product such as gasoline, kerosene and diesel - the reasoning behind this is not clear. PSR later modified NIHHS by removing all references to pipelines.

19 The introduction of PSR, and other changes to regulations in 1996, has left gasoline pipelines less well regulated than under the old regime. The most significant and important change is that gasoline pipelines, classified as non-major accident hazard pipelines, are no longer brought to the attention of HSE - the pipeline safety authority.

Pipelines still have to comply with PLA62 for planning purposes and information is forwarded to HSE by DTI, but only if a pipeline requires a Pipeline Construction Authorisation. [DTI are proposing that local pipelines should no longer be notified to them - the only purpose of such notification was to allow the Minister (originally) to issue any directions for the safe construction, operation and maintenance of the pipeline. Since the responsibility for the regulation of pipeline safety is with HSE the notification to DTI serves no useful purpose.] This means that there is no direct notification of cross country pipelines to HSE and none at all for local pipelines. The HSE will probably only become aware of gasoline pipelines if an incident occurs - ie the enforcement of the safety regime is entirely reactive.

20 Table 1 details many of the features used in the pre-PSR pipeline safety regime - ie before April 1996. It also lists comparable arrangements since the introduction of PSR and it can be seen that many features no longer apply to gasoline pipelines. Some changes are as a result of the goal-setting nature of PSR but some safety features have just been lost.

## **5 Options for the future**

21 There are three main options for the future regulation of gasoline pipeline safety:

- 1 continue with the current regime where there is no formal contact between the regulatory authority and the pipeline operator, no proactive involvement by the regulatory authority and no requirement for emergency planning or land-use planning controls
- 2 take a cautious approach and apply the full requirements of the additional duties of PSR to gasoline pipelines, which will also lead to the application of land-use planning controls
- 3 consider a more pragmatic approach which recognises the needs of the regulator and the potentially serious consequences of failure of gasoline pipelines but takes into account the relatively low risk presented by them.

### **1 Option 1**

22 This option does not fully take into account the results of the various risk studies and ignores the potentially high consequences of failure of gasoline pipelines. It has the effect of grouping these pipelines in the same category as for, say, nitrogen, diesel, "dead" crude oil, or cement slurry pipelines.

23 This option is considered unacceptable by the regulatory authority due to the loss of contact and knowledge (compared with the previous regime) and which effectively

prevents the regulator being able to assure itself that the safety of gasoline pipelines was being maintained. It is likely that the general public would become concerned if they were aware that these pipelines could be developed and operated without any intervention by the authorities, and especially during the aftermath of any serious incident.

24 Having no land-use planning controls or requirements for emergency planning maintains the status quo. The requirement for emergency procedures is basically covered because operators tend to have them as a result of the recommendation in the Institute of Petroleum Model Code of Safe Practice Part 6 [Ref 11] or if required by a Safety Notice issued under the old regime (even though these Notices no longer apply).

## **2 Option 2**

25 This was the preferred option by the regulator originally but was challenged as being too severe for the particular characteristics of, and circumstances surrounding, gasoline pipelines.

26 The results of the W.S. Atkins study shows that, in theory, the risks are low enough not to warrant application of the additional duties under Part III of PSR. However, the results of the various risk studies have all "hovered" around the threshold limits where the additional duties under PSR and land-use planning controls would be applied.

27 The strongest argument against this option has been the imposition of unreasonable additional costs on the industry as a result of land-use planning controls and the associated compensation payments that could arise. A cost-benefit analysis carried out for HSE in October 1996 [Ref 12] concluded that between £52 million and £104 million additional costs would be put onto the industry over a 40 year period. The overwhelming bulk of this was as a result of compensation payments due to land-use planning controls. Although these figures were a matter of considerable conjecture they, understandably, caused the industry great concern.

## **3 Option 3**

28 The Steering Group has indicated that some "middle ground solution" needed to be developed for gasoline pipelines.

29 As has been discussed earlier, the most important element in the additional duties under Part III of PSR is notification to HSE. Any intermediate approach will still require HSE to be notified prior to construction and use - without these basic requirements being met there is little the regulator can do. However, there is scope for lesser notification requirement for changes to a pipeline (ie regulation 22 of PSR). This could be limited to change of use only and changes to the route, if land-use planning was applied to the easement - see paragraph 35 below. Change of operatorship should be notified.

30 One of the important issues to be addressed is the term used when describing gasoline pipelines. Gasoline pipelines will have to be classified differently from major accident hazard pipelines which are subject to the full additional duties. One solution might be to call them "Other Notifiable Pipelines". This category could be used for other extremely flammable liquids and could also be applied to fluids which are damaging to the environment, if such pipelines are caught by the scope of the proposed EU Directive for pipelines. The term "dangerous fluid" could also be dropped. These changes will help in reducing public alarm if these pipelines are brought to their attention.

31 The requirement for a major accident prevention document under regulation 23 may need only a little modification - perhaps to change the title. Most gasoline pipeline operators will consider they can readily meet the requirements of this regulation by current good practice. Many operators already have a policy for ensuring the health and safety of persons who may be affected by a pipeline, carry out risk assessment, have a safety management system in place, etc.

32 As already stated in paragraph 24 emergency procedures are generally already available but if the requirement for them is subject to regulation this will ensure a more consistent approach for their preparation and testing. There is scope for considering strengthening or formalising the existing liaison between pipeline operators and the emergency services by requiring consultation and co-operation between the parties. These strengthened links could form the basis of incorporating gasoline pipelines into generic local authority emergency plans. The issue of charging for testing emergency plans is currently under review by the Pipelines Emergency Planning Forum and the implications of any recommendations by the Steering Group will also need to be considered by the Forum.

33 It may be helpful, at this stage, to review some of the requirements in the national standard for pipelines. The standard to which most gasoline pipelines (and multi-product pipelines) are designed and built is BS8010 Part 2.8 [Ref 6b], which states in clause 2.4.2, Proximity to occupied buildings - "The minimum distance between a pipeline conveying category B substances and normally occupied buildings should be determined by the designer taking into account both access requirements during construction and access requirements for maintenance and emergency services during operation." Category B substances are defined as flammable and toxic substances which are liquids at ambient temperature and atmospheric pressure conditions. Typical examples include petroleum products.

34 The standard makes no other recommendation about routing category B pipelines away from normally occupied buildings and it certainly does not set any minimum distances between buildings and these pipelines. However, clause 2.5.2 does recommend that consideration be given to providing extra protection against mechanical damage to these pipelines if they are routed in high population density areas.

35 The implication of this is that it is allowable to route gasoline pipelines as close as three metres to normally occupied buildings - ie the usual minimum distance from a



pipeline to the edge of its easement. To be consistent with this approach, land-use planning should be restricted to the pipeline easement for most developments. However, there may be a case for a wider zone of interest for sensitive developments proposed in the vicinity of a gasoline pipeline. The pipeline operator may find that these land-use planning controls could help protect the easement from un-authorised developments and give notice of future planned developments.

36 Further consideration should be given to introducing a One-call system for pipelines on a national basis and even broadening the scope to include the utilities and other operators of buried plant.

37 It is proposed that Option 3 be considered as a way forward and proposals made for incorporating these new "additional duties" into regulations - possibly by having a new schedule to PSR - eg "Additional Duties for Other Notified Pipelines".

38 The above option is summarised in Table 1 which allows a full comparison between the different regimes - past, present and proposed.

Table 1

### Comparison of safety regimes pre-/post-PSR 1996 with proposals for gasoline pipelines

Feature of safety regime	Pre-PSR 1996	PSR 1996	Proposal for future regime for gasoline pipelines [Option 3]
Description of pipeline - dependent on hazard	No descriptor - pipelines split between cross country and local - depending on length	Major Accident Hazard Pipeline (MAHP) - if conveying a "dangerous fluid" as defined in the regulations - does not apply to gasoline	"Other Notifiable Pipelines" - to apply to pipelines carrying extremely flammable liquids and could be used if environmentally damaging fluids are included in the future EU Directive
Notification of construction	Pipelines Act 1962 (PLA62) - Construction Authorisation by SoS if any pipeline > 10 miles long or pipeline notified to DTI/HSE 16 weeks prior to construction if length ≤ 10 miles long	Only MAHPs are notified to HSE - gasoline pipelines are not notified	Notification to HSE
Notification of use	PLA62 - notification to SoS after first use - all pipelines. Pressure test results reviewed by authority prior to use.  NIHHS Regs 1982 - gasoline pipelines not notifiable to HSE	Notification to HSE prior to first use - MAHPs only - not gasoline pipelines	Notification to HSE
Notification of changes	PLA62 - notification to SoS after change (eg dis-use, re-use, abandonment) - all pipelines. Also route changes for cross country pipelines	Notification to HSE of safety/risk related changes - MAHPs only - not gasoline pipelines	Notification to HSE of change of use only [change of route only if pipeline easement was subject to land use planning - see also below]
Notification of change of owner/operator	PLA62 - notification to SoS of change of owner - all pipelines	Notification of change of operator - MAHPs only - not gasoline pipelines	Notification to HSE

Hazard identification and risk assessment by owner/operator	Safety Evaluation submitted to DTI/HSE as part of application or notification under PLA62	Carried out as part of major accident prevention document (MAPD) - MAHPs only - not gasoline pipelines	Gasoline pipelines to have variant of "MAPD"
Safety management system in place	No requirement	MAHPs only - part of MAPD) - not gasoline pipelines	Gasoline pipelines to have variant of "MAPD"
Securing pipeline integrity	PLA62 - Safety Notices issued for construction or operation - all pipelines	General Duties - all pipelines  Note: PSR repealed all sections in PLA62 which dealt with Safety Notices	No change
Prohibiting use	PLA62 - all pipelines	Applies to all pipelines	No change
Protecting the pipeline route	PLA62 - powers to remove encroachments within ten feet of the pipeline - all pipelines	No powers, except duty on operators to inform persons of the pipeline's whereabouts  [Some pipelines still have protection under the Land Powers (Defence) Act]	Land use planning controls to apply to pipeline corridor (easement) only  Consideration to be given to One-call system
Deposit of maps	PLA62 - plans deposited with local authorities - all pipelines	[PLA62 - plans deposited with local authorities - all pipelines - may be affected as result of proposed changes to PLA62 by DTI]	No change
Land use planning	Notification of certain pipelines under NIHHS Regulations 1982 for advice by HSE or if notified under PLA62 (deemed notified) but did not apply to gasoline pipelines	MAHPs covered as a result of notifications - not gasoline pipelines. [NIHHS no longer applies to any pipeline]	For protection of the easement only - local authorities would have to consult pipeline operator
Emergency arrangements	PLA62 - arrangements for notification of accidents to Fire Authorities, Police, etc. Requirement for emergency procedures in Safety Notice - all pipelines	Requirement under General Duties - all pipelines [PLA62 - arrangements for notification of accidents to Fire Authorities, Police, etc. still apply]	No change
Emergency procedures	PLA62 - required for all pipelines as part of Safety Notice	MAHPs only - not gasoline pipelines	Apply to gasoline pipelines but "beefed up" to ensure consultation and co-operation with emergency services who should also be kept informed and updated

Emergency plans	No requirement but information had to be provided to Fire Authorities, Police, etc.	MAHPs only - not gasoline pipelines	Use "beefed up" emergency procedures linked to generic emergency plan - conventional emergency planning distances not applicable
Abandonment	PLA62 - powers for leaving pipeline in safe condition and to notify DTI - all pipelines	General Duties (safe decommissioning) - all pipelines. [Notification to DTI of abandonment but may be affected (for local pipelines) as result of proposed changes to PLA62 by DTI]	No change

## References

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- 3 Proposed Pipelines Safety (PSR) Regulations 199- HSE 1995
- 4 Risks from gasoline pipelines in the United Kingdom, A.D.Little report to HSE August 1996
- 5 Assessing the risk from gasoline pipelines in the UK based on a review of historical experience W.S.Atkins Safety and Reliability July 1998
- 6a British Standard Code of Practice for Pipelines Part 1. Pipelines on land: general 1989 ISBN 0-580-16783-6
- 6b British Standard Code of Practice for Pipelines Part 2. Pipelines on land: design, construction and installation Section 2.8: 1992: Steel for oil and gas ISBN 0-580-20996-2
- 7 The Pipelines Safety Regulations 1996 - Further guidance on emergency plans for major accident hazard pipelines HSE 1997 ISBN 0-7176-1393-3
- 8 The Pipe-lines Act 1962
- 9 The Land Powers (Defence) Act 1958
- 10 Notification of Installations Handling Hazardous Substances Regulations 1982 SI 1357

- 11 The Institute of Petroleum Model Code of Safe Practice Part 6 Pipeline Safety Code ISBN 0-471-26139-4
- 12 Gasoline Pipelines - Cost Benefit Assessment HSE October 1996