EMERGENCY PLANNING FOR HIGH PRESSURE GAS PIPELINES

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Abstract

The operation of pipelines conveying hazardous fluids in the UK is controlled by the Pipelines Safety Regulations 1996 (PSR 96). PSR 96 replaces earlier, prescriptive legislation with a more goal setting, risk based approach. The Regulations are applied as general duties to all pipelines and additional duties to pipelines classed as major accident hazard pipelines (MAHPs). High pressure gas transmission pipelines are classed as MAHPs, and so the additional duties apply to the 18000 kms of UK gas transmission pipelines operated by Transco. One of the additional duties involves the preparation of plans for emergency response to a major accident. Proposed amendments to PSR 96 extend these duties to include the testing of emergency plans every three years. The impact of this requirement on Transco has been assessed, and the benefits are considered with respect to the industry safety record and risks as well as the costs incurred. Recommendations for the development of a more equitable regime for the preparation and testing of emergency plans are made.

1. Introduction

The Pipelines Safety Regulations 1996 (PSR 96) were introduced to provide a consistent legislative framework for the control of onshore and offshore pipeline safety management in the UK. PSR 96 are structured in terms of general and additional duties. General duties apply to all pipelines conveying hazardous fluids, and additional duties apply to pipelines classed as major accident hazard pipelines (MAHPs). The approach taken to the regulation of major accident hazard assets is based around identifying hazards through notification, controlling risks associated with the hazards through the implementation of a safety management system, and mitigating consequences if they occur through emergency planning and land use planning.

The additional duties placed by PSR 96 include the preparation of emergency procedures by the pipeline operator, and the preparation of emergency plans by the Local Authority. Currently, PSR 96 cover the identification of hazards and control of risks, but the Health and Safety Commission (HSC) consider the scope of the Regulations must be extended with respect to mitigation of consequences. The Health and Safety Executive (HSE) have therefore been actioned to draft amendments to the Regulations which extend the scope to include testing of emergency plans.

The original objective was to align the timing of the implementation of the amendments to PSR 96 with the implementation of COMAH, so that the principles established in the development of the COMAH emergency plan testing requirements could be applied to pipelines. The current requirements of and proposed amendments to PSR 96 are compared with COMAH requirements in Table 1.

Table 1
Comparison of PSR 96 and COMAH Requirements for Emergency Planning

	Operator Procedures		LA Plans		
	Preparation	Testing	Preparation	Testing	Charging
COMAH	Yes	3 yearly	Yes	3 yearly	Preparation and Testing
PSR	Yes	Frequency not specified	Yes	No	Preparation only
Proposed PSR 96 Amendment	Yes	3 yearly	Yes	3 yearly	Preparation and Testing

As a result of the complexity and difficulty of the issues identified through informal consultation, the programme for amendment has been delayed. The consultation process has identified the difficulties associated with the application of emergency planning and testing requirements to distributed assets such as pipelines, which are in general laid in remote locations on 3rd party land, and are remotely operated. The duties for the preparation and testing of emergency plans are placed on Local Authorities, of which there are over 150. Local Authorities differ considerably in their arrangements for the provision of emergency response. There is no central strategy or co-ordination of emergency response responsibilities, as the legislative framework for control of such activities is very limited. In addition, PSR 96 do not define the scale or scope of the required emergency plans, so the potential for varying interpretation is considerable.

During the consultation exercise, pipeline operators have clearly identified the following issues:

i) **Why pipelines?** - legislation requiring the testing of and charging for emergency plans is not planned for other higher risk distributed asset groups.

ii) **How will it work?** - there is no central strategy for the co-ordination or management of emergency response in the UK.

iii) **What controls will apply?** - the wording of the proposed amendments is not clear on the requirements. The scope for variation in interpretation undermines the credibility for the requirements.

High pressure gas transmission pipelines operating above 7 bar are classed as MAHPs, and so are subject to additional duties under PSR 96. The UK gas transmission pipeline network operated by Transco, shown in Figure 1, is

Figure 1

comprised of over 18000 kms of pipelines.

This network represents over 86% of MAHPs in the UK, and crosses the majority of Local Authority areas. Transco is therefore the operator most significantly affected by the proposed amendments.

Consideration of the issues involved indicates that the legal requirement for preparation and testing of emergency response plans is unlikely to affect the industry safety record or risk levels, but will impose onerous resource requirements and costs. This paper examines the impact of the testing of emergency plans on the operation and safety of pipelines, draws conclusions and recommends the development of a wider, more effective regime for the preparation and testing of emergency plans to ensure and improve public safety.

2. The Pipelines Safety Regulations 1996

The introduction of PSR implemented a new statutory regime to coincide with the privatisation of the gas supply market in the UK. PSR 96 were introduced to provide a consistent legislative framework for the control of onshore and offshore pipeline safety management in the UK. The introduction to the Regulations states that they replace prescriptive legislation with an integrated, goal setting risk-based approach encompassing both onshore and offshore pipelines. PSR 96 are structured in terms of general and additional duties. General duties apply to all pipelines conveying hazardous fluids, and additional duties apply to pipelines classed as major accident hazard pipelines (MAHPs).

Additional Duties for MAHPs

The regulation of major accident hazards is based on identifying assets which have the potential to cause a major accident, identifying the hazards specific to the asset, evaluating the risks associated with the identified hazards, controlling the risks through an adequate safety management system and mitigating the consequences of a major accident through emergency planning and land use planning.

The additional duties placed by PSR 96 include the notification of MAHPs, the preparation of a major accident prevention document (MAPD) which describes the pipeline operators safety management system, and the preparation of emergency procedures (by the pipeline operator) and emergency plans (by the Local Authority).

Requirement for Emergency Planning

PSR 96 place a duty on Local Authorities at county or equivalent level, once notified of the presence of an MAHP by HSE, to prepare an emergency plan which relates to the protection of the health and safety of people. The plan should be drawn up and amended following consultation with bodies able to contribute information or advice, including the emergency services, hospitals, the pipeline operator and HSE. The Guidance to the Regulations states that full liaison and effective two-way flow of information is required between the pipeline operator and the Local Authority. The pipeline operator is required to provide information about the type and consequences of possible major accidents and the likely effects. In addition, the operator is required to supply details of the pipeline route, the fluid conveyed, the operating conditions, location of shut-off valves and emergency control arrangements are required. The Regulations enable Local Authorities to charge pipeline operators for the preparation of emergency plans.

Proposed amendments to PSR 96 would extend these requirements to cover testing and charging for testing. The proposed amendments to the Regulations are not clear on the scope of the plan or the test required, or the aspects which must be tested for pipelines in order to meet the requirements of the Regulations.

Relationship with European Legislation

It is European policy to promote the greater use of pipelines, including the development of European pipeline networks. The European Union has taken the view that, as pipeline accidents have occurred in Europe and world wide, pipelines should be included within the scope of legislation dealing with major accident hazards (Ref. 1). Work has been undertaken to identify the requirements which apply to pipelines, in order to develop a European Pipeline Safety Instrument (PSI) which applies the requirements. This work identified that the form of the PSI should be goal setting, and should enable the application of existing best practice. This would be encompassed through the requirement for a safety management system, and performance measures to be agreed between pipeline operators and relevant authorities.

The development of the European PSI has been delayed, and as yet, the requirements which must be met by the legislation of individual member states have not been set. The Better Regulation Task Force headed by Lord Haskins is currently considering the costs and benefits of regulation, and has recently warned against prescriptive interpretation of European Parliament proposals, which do not sufficiently take account of British interests (Ref. 2). Noting this, the overall requirements of the European PSI should be understood before existing UK legislation is amended.

3. Engineering Standards and Safety in Gas Transmission

The Transco transmission network is managed according to policies and procedures, which are based on the IGE/TD/1 Recommendations on Transmission and Distribution Practice - Steel Pipelines for High Pressure Gas Transmission.

The approach is summarised as:

a) The pipeline route is classified as Rural (R) or Suburban (S) where the maximum population density in R type areas is 2.5 persons per hectare.
b) The maximum operating stress in pipelines operating in R areas is 72% SMYS, whereas the maximum operating stress in S type areas is restricted to 30% SMYS. This means that the most likely failure mode in S areas is a leak, but in R type areas rupture is a possible failure mode.
c) The consequences of thermal radiation resulting from a pipeline failure are defined in terms of the building proximity distance (BPD), which is the minimum separation distance between the pipeline and the surrounding population.

The philosophy applied in IGE/TD/1 is one of ensuring safety through recognition and control of pipeline failure modes and consequences, and minimisation of frequency and effects. The IGE/TD/1 recommendations have been applied by the gas industry in more than 30 years of operation. The operating experience and learning gained by the industry has influenced the development of the recommendations, and their application has resulted in an excellent safety record.

Safety of UK Gas Transmission Pipelines

The UK gas transmission system has operated for over 30 years, and has accumulated over 500,000 km years of operational experience. There have been no casualties or fatalities as a result of the operation of the system during this period. The same cannot be said of other distributed assets/industries, including railways, aircraft, road haulage etc, where fatalities have occurred.

The safety of UK gas transmission pipelines can be considered by defining the relevant failure modes, reviewing the failure statistics and comparing the trend

with other relevant international data, determining the risks and classifying these risks against risk tolerability criteria. The safety record is demonstrated by the comparison of UK and international pipeline failure data given in Table 2.

Table 2 Pipeline Failure Data

Incident	Bench-mark (1)	European (2)	HP Gas Pipelines UK (3)
Repair	4		0.75
Leaks Major Total	0.6	0.48	0.045 0.33
Ruptures		0.046	0.011
- Failure with Casual-ties	0.16	0.0	0.0

Notes:
(1) Derived from Western European and North American data.
(2) European Gas Incident Group data (includes UK).
(3) Transco data.
(4) Incident frequency quoted per 1000 km years of operation.

Failure History

There have been three major UK gas transmission pipeline failures in the last 29 years. The first was a rupture, which occurred at Yarm during the commissioning of a 760mm dia 70 bar pipeline in 1971. The pipeline had been subject to external interference caused by earth moving machinery between testing and commissioning. It failed during commissioning at approximately 50 bar, when the defect propagated to approximately 10 meters. The second was a full bore break and separation of a 450mm dia pipeline which occurred at Bushey Heath in 1984. The pipeline, operating at approximately 10 bar, failed due to slip of unstable soil over the pipeline which caused excessive load. The third was a partial break of a 914mm dia pipeline which occurred at Palaceknowe in 1993. Part of the pipeline had been replaced and reinstated to accommodate the construction of the M74. This dictated a change in position and alignment, which resulted in the new section of pipeline being laid on disturbed ground made up of soil and infill materials. Excessive settlement occurred, resulting in a high bending stress at the connection weld. The pipeline was operating at approximately 50 bar when the failure occurred. None of these failures ignited, and there have been no casualties as a result of any gas transmission pipeline incident in the UK.

4. Pipeline Risk Assessment

Favourable comparison of UK pipeline failure data with international statistics is significant, but does not provide a ready indication of the risks to people, which are dependant upon the frequency with which failure occurs and the associated consequences. A more sophisticated approach involving quantified risk analysis is required to produce the information needed to do this.

Pipeline risk is a function of the frequency of failure and the consequences in terms of death or serious injury. Operational data to determine the cause and frequency of damage which could lead to pipeline failure, and a measure of physical consequences which can be related to injury or death is needed. The excellent safety record of the UK gas transmission system means there is insufficient data available to reliably determine anything other than average failure frequencies for large groups of pipelines. The methodology based upon fracture mechanics failure analysis and operational data encompassed in PIPESAFE (Ref. 3), which is applied to the UK gas transmission system, enables the failure frequency for individual pipelines to be predicted taking into account pipeline diameter, wall thickness, material properties and operating conditions.

When a high pressure gas pipeline fails, a ground crater is formed by the sudden release of gas. The primary consequences are the release of stored energy in the escaping gas and the fire, which could result if the escaping gas ignites. If ignition occurs, the thermal radiation produced by a fire could lead to death or serious injury. The calculation of consequences depends upon the type of failure (rupture or leak), the release rate, the orientation of the failed pipeline, the crater geometry, wind speed and direction, location, surrounding infrastructure and population density. The methodologies used in PIPESAFE are validated against large and full scale experimental data and real failures.

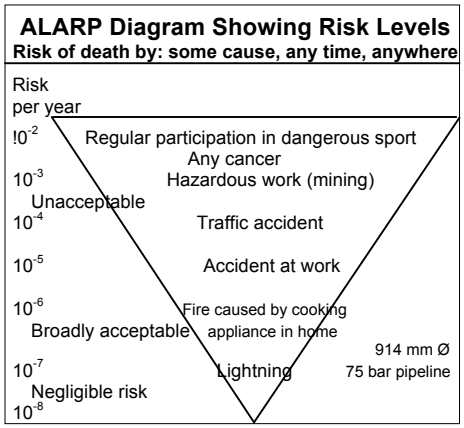
Risk to People

Most people understand safety in terms of a risk to their own lives that they can put in context. A good way of visualising risk is to use the HSE's risk diagram, shown in Figure 2 (Ref. 4), which is constructed in three regions, each of which relates to the risk of becoming a fatality per year:

i) the unacceptable region, at individual risks above 1 in 10,000,
ii) the broadly acceptable region, at individual risks below around 1 in 1,000,000,
iii) the tolerable region, between these limits in which the risk is tolerable only if further reduction is impracticable or requires action which is grossly disproportionate in time, trouble, effort and cost to the reduction in risk achieved. In this case, the risk is deemed to be 'as low as reasonably practicable', or ALARP.

For people living near a major accident hazard pipeline, the risk is generally perceived as one which is essentially unavoidable and from which they do not receive a benefit. It is therefore reasonable to expect that the risk should be sufficiently low (through design, construction and operation standards and codes of practice) that it is broadly acceptable. This is the case for major accident hazard pipelines, and the risk associated with a high pressure large diameter gas transmission pipeline is shown explicitly on Figure 2.

Figure 2



Risk Criteria

A Royal Society Study Group has studied risk levels in the UK, and the HSE have adopted their recommendations in preparing land use planning guidelines for developments adjacent to major industrial hazards (Ref. 5). The HSE have also developed criteria for the quantification of risk associated with pipelines. Three risk levels are used to define a zoning system:

i) 10 chances per million (CPM) per year of receiving a dangerous dose for small developments,
ii) 1 CPM per year chance of receiving a dangerous dose for medium and large developments,
iii) 0.3 CPM per year chance of receiving a dangerous dose. This is considered to be a negligible level, and should not be exceeded where there are sensitive developments such as schools, hospitals, homes for the elderly etc.

The above criteria are applied to the assessment of risks posed by fixed installations and, in terms of risk level, are equally applicable to pipelines. The 1 and 0.3 CPM per year risk levels, as calculated using PIPESAFE, are used to define the emergency planning distances for R and S area pipelines respectively. This information, given in Appendix 1, is provided by Transco to all Local Authorities.

5. Emergency Planning for Pipelines - Purpose and Benefits

Purpose

The purpose of a plan for response to any emergency is to detail the action to be taken to minimise the consequences to the health and safety of people in the event of an emergency involving a major accident hazard pipeline.

Benefits

The benefits are to minimise the consequences of a failure and any secondary consequences, maintain public order and reduce disruption and to be seen to act positively.

Application to Gas Pipelines

A gas pipeline failure which would lead to significant consequences is a rupture in a rural area. The hazard which would result in numbers of casualties is the thermal radiation dose resulting if the released gas ignited. Immediate ignition of the released product would lead to a transient fireball, which would burn out to a quasi steady state plume. This would reduce as the pipeline depressurised to a steady state condition after about 15-20 minutes for large diameter high pressure pipelines. Following isolation of the pipeline, the plume would reduce to zero.

The consequences of the event would be the cumulative thermal radiation dose from the pipeline fire and any secondary fires which would result. The risk assessment methodology assumes that the secondary fire spread will provide the source of ignition to properties. This is based upon light, combustible materials such as vegetation being available to act as pilots to ignite wooden buildings. The cut-off time assumed for the ignition of buildings for an event due to a large diameter high pressure rural pipeline is 15 minutes. Although the PIPESAFE methodology considers a 15 minute event, modelling and information from incidents indicates that in almost all cases the event, in terms of producing casualties, will occur in less than 5 minutes. The effects of the failure will therefore have occurred before the emergency services would be expected to respond. Sensitivity studies carried out using PIPESAFE have confirmed that in almost all cases, rapid emergency response would not provide any benefit.

A review commissioned by Transco of international data relating to ignited gas releases, has confirmed that out of 55 known incidents, a delay in ignition occurred in 29 of the incidents. The average delay (including the assumed 30 second delay for all ignition incidents termed 'rapid') is approximately 3 minutes. This shows that in the (low probability) event of a pipeline failure occurring, there is only a one in 29 chance that planned emergency response would have any mitigating impact on the failure in terms of reducing the number of casualties.

The benefits of emergency planning to gas pipelines therefore relate only to the maintenance of public order, reduction of disruption and being seen to act positively. However, there may be specific locations where a) significant numbers of people may be affected and b) a rapid response is achievable, where emergency plans may offer additional benefits.

Reviewing benefits in the context of the consequences of pipeline failures:-

i) Minimise the consequences of pipeline failures: This is limited to a small number of locations involving significant numbers of people where a rapid response is feasible.
ii) Minimise secondary consequences of pipeline failures: As above.
iii) Maintain public order and reduce disruption: This relates to procedures which are not site or event specific.
iv) Positive response: This relates to the readiness to respond, and so covers pipeline specific information and access to specialists.

In summary, the above assessment demonstrates that with the exception of a small number of specific locations, the benefits are limited to those provided by the generic emergency response capability, and therefore in terms of pipelines, negligible.

6. The Impact of Emergency Planning on the UK Gas Pipeline Network

PSR 96 represented a new regulatory regime for pipelines. The consultative document which preceded the implementation of the regulations specifically highlighted the Government's proposals to open the domestic gas market to competition as a prime reason for legislative reform for onshore pipelines. It is therefore reasonable to assume the regulations are aimed at securing the safety and risk levels associated with the onshore gas transmission network.

The UK Gas Transmission Pipeline Network

The Transco transmission pipeline network is comprised of the National and Local Transmission Systems. The National Transmission System (NTS) is comprised of 6000 kms of steel pipeline which operates at pressures up to 85 bar, and provides bulk supply of gas to the NTS connections and the Local Transmission Systems (LTSs). The 13 LTSs in total comprise 12500 kms of steel pipelines, which receive gas generally at around 40 bar, but in some cases up to 70 bar. The NTS and LTS systems are shown schematically on Figure 1.

There are approximately 21500 kms of MAHPs in the UK, so the gas transmission network represents 86% of the total UK population of MAHPs. As the largest national pipeline operator, Transco is in a unique position to understand the purpose and benefits of safety legislation, and also to identify and quantify the impact of such legislation on operations.

Interface with Local Authorities

The scale and extent of the Transco gas transmission pipeline network is such that it crosses most Local Authority areas. This means that as a single operator, Transco is subject to the requirements of approximately 150 Local Authorities together with the cross boundary issues that exist, and must manage and respond to the variations in interpretation of the legislation which are currently evident. As required by PSR 96, Transco has supplied a consistent set of information to all Local Authorities. However, the plans prepared by Local Authorities using this information range from simple factual additions of pipeline route details as an addendum to an existing emergency response plan, to the development of separate emergency response plans for individual pipelines within a Local Authority area. Information provided by Transco shows that the charges made by Local Authorities varied by over an order of magnitude, ranging from costs to cover administration, to costs for the development of a full area pipeline emergency response plan.

The proposed amendments to PSR 96 are not clear on issues relating to the type, scope and scale of test required to demonstrate adequacy of the emergency plan. Discussions with Local Authorities in different parts of the UK indicate wide variations in their interpretation of testing requirements, in terms of the type (ie full-scale vs live play vs desk-top) and scope (ie full emergency response vs interface with pipeline operator vs communications only) of test. This variation in interpretation will affect the charges made for carrying out the test significantly.

Impact of Testing on Pipeline Operations

The potential impact of testing of emergency plans on pipeline operations has been assessed using information and data provided by Transco. As previously stated, Transco interfaces with approximately 150 Local Authorities, but has no influence on the programme and schedule of tests as there is no central co-ordination of emergency plan testing in the UK. In terms of the number of tests which Transco may be required to participate in, this will be 150 plus additional tests required to address changes in responsibilities across boundaries.

The number of additional tests required to address cross-boundary issues could be significant, as it is a recognised area of difficulty in the management of emergency response. Emergency response is generally co-ordinated in accordance with Police Authority Areas, of which there are over 50 in the UK. Taking into account the 150 Local Authorities and 12 Transco LDZ boundaries, Transco could be involved in over 200 Local Authority emergency plan tests over a three year period. This could mean a minimum of one test per week,

Table 3
Impact of Emergency Plan Testing
Estimates per Test

	Desk Top	Full Scale
Resources (m hrs)	208	550
Internal Costs (£k)	12	33
Recharges (£k)	16.3	86
Total Cost	28.3	119

but in reality the picture is more complex. The duty to define and schedule the test is placed on the Local Authority, so a number of tests may occur concurrently, and the type of test defined by the Local Authority may involve differing levels of resources. Taking these factors into account, resources, costs and recharges have been estimated for both desk top and full scale tests. These estimates are given in Table 3.

In considering the estimates given in Table 3, it is clear that the potential impact on resources is significant. Assuming that test programme involves 200 tests over three years, the likely annual resources Transco will need to dedicate to supporting/participating in emergency plan tests is 14000 man hours for desk top testing, 37000 man hours for full scale testing. The level of additional resources required is such that recruitment will be essential if disruption of operational duties is to be avoided. Equally, this level of testing must impact on the operational resourcing of the emergency services, in particular their readiness at all times to respond to a real emergency.

The formal legal requirement for the preparation and the proposed requirement testing of emergency plans is new. There is no similar existing or planned requirement for other asset groups or industries. Pipelines have an excellent safety record, and operate at risk levels below other industry assets such as railways, aircraft and road haulage. There is no obvious deliverable benefit in terms of increased pipeline safety, particularly as the regulations themselves are not specific in terms of compliance requirements. This has already been demonstrated in the varying Local Authority interpretation of emergency plan preparation requirements. It is particularly relevant to the proposed amendments for testing of emergency plans, which are not clear on the scope of the test required and the aspects which must be tested for pipelines in order to comply with the Regulations. The requirements of the Regulations can and will be interpreted in a number of ways. In fact the overall impact in terms of the disruption to operations caused by the reallocation of resources required to support/participate, the internal costs accrued and the external charges made by Local Authorities, requires careful evaluation.

The proposed amendments to PSR emergency planning duties will enable Local Authorities to charge pipeline operators for the testing of plans. Within the UK, pipeline operators represent a much smaller stakeholder group than Local Authorities. As such, they may be subject to various and inconsistent testing requirements and potentially onerous costs associated with specific Local Authority interpretations of the Regulations. Particular concerns relate to a worst case interpretation involving the testing of each plan for each pipeline and the individual testing of each plan.

7. Consultation - Review and Status

HSE initiated informal consultation on the proposed amendments to PSR in April 1997. The Pipeline Emergency Planning Forum (PEPF), which includes key stakeholder representatives, was formed to progress this consultation. Discussions on the requirements for and value of testing and test requirements were actively progressed. These centred specifically on the type, scope and scale of test, but convergence of opinion has not been achieved.

Transco has worked actively with other pipeline operators through UKOPA (United Kingdom Onshore Pipeline Operators' Association) to influence the development of the proposed amendments. The influencing strategy involved the development of specific proposals which were investigated through a pilot test exercise.

7.1 Pilot Test

In order to provide a common basis for agreement of principles and identification of issues for resolution, a pilot exercise to test a local authority emergency plan was carried out by Transco on behalf of UKOPA (Ref. 6). The objectives were to:

i) demonstrate that desk top testing is adequate,
ii) demonstrate that one test of a plan can test all pipelines within a plan,
iii) demonstrate that one test of a plan can cover more than one plan and that a regional approach is feasible,
iv) identify issues, which should be addressed before legislation is progressed.

The pilot test was carried out by Transco on behalf of UKOPA. Transco responsibilities were managed and carried out by North West LDZ, Cheshire Local Authority led and ran the desk top test exercise using Transco training facilities at the Hollinwood Training Centre. Representatives from Transco and the Cheshire County Council Civil Protection

Unit worked together to stage the exercise on the 1st July 1999, observed by other Local Authorities, Pipeline Operators (representing UKOPA) and HSE. The purpose was to provide evidence for and to inform discussions relating to the proposed amendments.

Immediately following the exercise a debrief session was held, during which all participants, observers, exercise assistants and the directing team were involved. This was followed the next day by a workshop involving key stakeholder representatives to establish principles of agreement and issues for resolution to be presented to the Pipeline Emergency Planning Forum (PEPF).

Principles of Agreement

The principles of agreement relating to the interpretation of requirements for the current regulations and the proposed amendments and taking into account the issues raised, were confirmed as follows:-

i) Desktop testing is the recommended approach.
ii) One Local Authority Test can cover all pipelines/pipeline operators.
iii) Testing of pipeline specific issues relates to:
   - the diagnostic period
   - communications between all agencies

   These can only be tested against a specific scenario.
iv) The scope of the desk top test is to cover pipeline specific issues.
v) Standardisation of the pipeline operator input to the local authority test is required to enable the plan to be tested.
vi) The scope of the test must concentrate on response/ management systems.

7.2 Follow-Up Actions

Following the pilot exercise, UKOPA with Transco's assistance sought to test the principles of agreement through direct correspondence with each Local Authority. Transco LDZs requested Local Authorities confirm agreement with a) desktop testing and b) a single geographic test based on the LDZ area. UKOPA wrote to all Local Authorities referencing the Transco correspondence, and requested confirmation of support for c) desk top testing over a geographic area, and d) a national schedule of tests. The results of this exercise are still being collated. To date, responses from approximately 50% of Local Authorities have been received. Analysis is not straight forward, as in most cases direct responses to the queries are not given, However, the analysis indicates that out of the responses received,

a) over 75% support desk top testing as a principle
b) less than 5% support geographic testing on a Transco LDZ basis
c) over 80% support geographic testing, but on a much smaller area
d) less than 40% support a national schedule of tests

The responses indicate that significantly more work is needed to achieve a common understanding and approach.

7.3 Pipeline Industry Conclusions

Based on the consultation to date and the results of the pilot exercise, a number of industry specific conclusions have been drawn by pipeline operators. The key conclusions are:

i) Robust and reliable emergency response is an essential in ensuring and protecting public safety. However, there are no national legislative controls or centralised co-ordination for its provision in the UK. A nationally co-ordinated regional approach for the preparation and testing of emergency response plans is required.
ii) There is no existing or planned requirement for the testing of emergency plans for distributed assets

other than for pipelines. Pipelines have an excellent safety record, so the imposition of this requirement to pipelines in isolation must be carefully evaluated.

iii) Following the identification of the cause of the emergency, emergency response to any incident is generic. Any testing requirement relating to plans for pipelines should apply to pipeline specific issues only. Pipeline operators should not be expected to fund aspects of testing which are generic to any emergency**.**

iv) Pipeline specific issues should be clearly defined. Pipeline operators consider these are restricted to communication, provision of pipeline specific information and the availability of trained operators to attend site.

v) A cost benefit analysis which confirms the requirement for emergency plans validated by testing while demonstrating justification in terms of cost per life saved to central Government is essential.

vii) The proposed amendments to PSR 96 do not specify the scope of the testing requirements, and a wide range of interpretations are possible. An ACOP covering the issues is needed to ensure the application of best practice and minimisation of disruption.

8. Recommendations

8.1 An equitable and comprehensive regime for the testing of emergency response plans covering all fixed and distributed assets in the UK is required. The regime should be centrally co-ordinated, funded by all asset groups/industries, and tests should be scheduled locally in accordance with a national programme.

8.2 Legislation requiring the testing of emergency plans for pipelines should be postponed in the first instance until the requirements of a European Safety Instrument are clear, and secondly until the national requirements are established.

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APPENDIX 1

SUMMARY OF POSSIBLE INCIDENTS
R Area design pipelines operating up to 75 bar

Type of Event	Pipeline Diameter (mm)	Emergency Planning Distances					Thermal Hazard Range (m) (6)
		Noise (m) (1)	Debris (m) (2)	Over-pressure (m) (3)	Thermal Radiation		
					Normal (m) (4)	Sensitive (m) (5)	
0 – 25 mm leak	All	3	5	5	4	5	5
25–75 mm leak	All	5	12	6	23	26	29
75–150 mm leak	All	18	20	10	72	81	90
Rupture	168	40	20	10	75	85	140
	324	64	33	17	75	105	230
	457	64	37	21	108	117	290
	610	64	53	26	150	170	365
	762	64	64	33	195	260	455
	914	64	80	40	220	265	560
	1067	64	95	48	230	275	665
	1219	64	117	58	250	340	812

Notes:
1. Distance to the threshold of pain determined in accordance with methods in IGE/SR/23 (Venting of Natural Gas) guidelines.
2. Distance equal to 1 BPD based on data relating to actual events. Most debris will be contained within this distance. BPD, building proximity distance, is the distance from the pipeline within which IGE/TD/1 recommends that there are no occupied buildings.
3. Estimates based on a high likelihood of window breakage but little structural damage.
4. Distance to an individual risk of 1 cpm in a pipeline designed to the minimum IGE/TD/1 conditions.
5. Distance to an individual risk of 0.3 cpm in a pipeline designed to the minimum IGE/TD/1 conditions.
6. Thermal hazard range equal to 7 BPD for ruptures and escape distance for leaks.

SUMMARY OF POSSIBLE INCIDENTS
S Area design pipelines operating up to 75 bar

Type of Event	Pipeline Diameter (mm)	Pipeline Pressure (bar)	Emergency Planning Distances				Thermal Hazard Range (m) (5)
			Noise (m) (1)	Debris (m) (2)	Over-pressure (m) (3)	Thermal Radiation (m) (4)	
0 – 25 mm leak	All	75	3	5	5	5	5
		40	2	5		5	5
25–75 mm leak	All	75	5	12	6	24	29
		40	3	8		15	18
75–150 mm leak	All	75	18	20	10	35	60
		40	13	15		20	33
Rupture	168	75	40	20	10	60	80
		40	26	15		48	55
	324	75	64	33	17	60	90
		40	40	22		60	70
	457	75	64	37	21	60	126
		40	40	28		60	90
	610	75	64	53	26	60	165
		40	40	36		60	130
	762	75	64	64	33	60	230
		40	40	45		66	190
	914	75	64	80	40	60	250
		40	40	57		60	205
	1067	75	64	95	48	60	250
		40	40	70		60	215
	1219	75	64	117	58	60	315
		40	40	90		60	225

Notes:
1. Distance to the threshold of pain determined in accordance with methods in IGE/SR/23 (Venting of Natural Gas) guidelines.
2. Distance equal to 1BPD based on data relating to actual events. Most debris will be contained within this distance but pipe fragments may travel further. BPD, building proximity distance, is the distance from the pipeline within which IGE/TD/1 recommends that there are no occupied buildings.
3. Estimates based on a high likelihood of window breakage but little structural damage.
4. Distance to an individual risk of 0.3 cpm in a pipeline designed to the minimum IGE/TD/1 conditions or the hazard range for a 75 – 150mm leak if rupture does not reach this level.
5. Distance at which risk assessment techniques indicate zero casualty probability.

Note that the hazard range is less than that for rural areas due to the increased shelter provided by housing in the more densely populated areas.