

Pipeline Insurance – Technical Aspects Of Underwriting And Claims

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Introduction

In the last few decades there has been an explosion in the importance of pipelines as a means of transportation of oil, gas, water and other materials. Pipelines are considered safer than alternative forms of transport in many cases and their use has spread around the world into all types of terrain.

Not surprisingly, there are incidents from time to time and, after most significant incidents, there is a knock on the door of the insurance underwriter with a request for payment of a claim. To the owner/operator of a pipeline the world of insurance can appear mysterious. Insurers do, however, work within defined business parameters, which make sense when explained.

Forms of Insurance

There are several types or "classes" of insurance, that are likely to be of relevance in the pipeline field: construction; property damage; business interruption and liability. Different underwriters specialise in each type. The *excess* or *deductible* requires the first portion of any loss to be paid by the insured. This avoids many small losses, which would be time consuming to administer and lead to attrition of the premium. Insurance policies protect against a variety of specific perils and not against all causes of damage. For example, it is not possible to insure against corrosion of a pipeline, although the consequences of corrosion, such as clean up costs following leakage of materials from a corroded pipeline are insurable.

Construction insurance

Construction insurance, during the construction phase of the pipeline, may be quite wide in its coverage. It could, for example, contain provisions for advanced loss of profits (ALOP) and/or the loss of goods in transit to construction sites, as well as for physical damage at the site. Construction policies, unlike others, are often on an *all risks basis* meaning that every cause of damage, except those that are specifically excluded is covered by the policy.

Property Insurance

Property insurance will pay for the replacement of damaged pipelines and associated equipment, for example control stations, pump stations and compressor stations. Many

companies do not insure the pipeline itself, although cover may be taken out for specific assets such as river crossings, and pump/compressor stations.

Business Interruption

It is possible to insure against the loss of revenue associated with a pipeline failure and, again, a deductible will apply. As the potential claim could be large, an increased level of risk assessment is normally required.

Liability Insurance

Liability insurance is probably the most important insurance for pipeline operators. Whilst leakage from pipelines is not unusual, it is usually small-scale and the insurance costs negligible. There have, however, been cases of significant leakage from full bore ruptures of pipelines causing significant pollution, fire or explosion with serious damage and casualties.

Insurance Underwriters' Concerns

When considering whether or not to provide cover for a pipeline, insurance underwriters' concerns can be best summed up by two easy questions¹:

- How big?
- How often?

In other words, “Does the “perfume of the premium overcome the stench of the risk?” .The spectrum of potential loss sizes is very large with the bigger losses tending to be less frequent. There are a number of factors on which the insurance underwriter will base his judgement on whether or not to insure and, if so, at what price. These include²:

- The age and type of the pipeline
- Its location
- Exposure to perils
- Topographical and meteorological conditions to which the pipeline is exposed
- The way the pipeline is managed by the owner/operator
- The material that the pipeline is conveying
- The size of possible loss

Age and type of pipeline

At first glance it may seem obvious that the older a pipeline is, the more likely it is to suffer damage. However studies by CONCAWE³, suggest that in Europe pipeline age is not a factor in determining the frequency of incidents. Statistics for the rest of the world are harder to find. For an underwriter the age of a pipeline is important, together with the maintenance and inspection history.

Location

Location is important for a number of reasons. When considering liability insurance the likely cost of cleaning up a spill will depend on local wage rates, the cost of living and the size of liability payments that will have to be made. These are very dependent on the location, the highest rates being applicable to the developed world.

Political stability in the region is also important in determining the potential for terrorism or malicious damage. The underwriter will have concerns in some areas over illegal tapping,

allowing theft of refined products. Uncontrolled tapping of a pipeline can result in pollution or fires/explosion.

The proximity of centres of population to the pipeline route has an influence on the likelihood of a future loss. In some areas in the developing world, populations have built up close or even over previously existing pipelines. This can increase the risk of a problem resulting from accidental damage or impact on the pipeline and the people close by can be affected by it. Whilst most pipelines are buried, impact still remains the most common cause of pipeline damage. This generally occurs due to uncontrolled excavation, the unauthorised use of backhoe diggers or deep ploughing.

Having populations close to the pipeline is not entirely a negative factor. An operator may wish to involve the local population in pipeline monitoring and incident reporting and for this to succeed, good community relations are important.

Encroachment on the pipeline route by buildings constructed after the pipeline, or trees, which have grown back after construction needs to be controlled.

Exposure to perils

The perils that will most concern an underwriter include earthquakes, tsunamis, volcanoes, storms floods, landslides, impact damage, political risks and of course fire and explosions. Some studies have even cited lightning strikes affecting pipelines. The underwriter will consider each separately.

Most modern pipelines are designed to withstand the effects of an earthquake of known strength where a fault line is crossed. More serious problems can arise, however, if the earthquake triggers large-scale landslides and large sections of pipe have to be re-routed. Such events, though rare, can result in significant costs. Severe problems can occur during the construction phase, particularly if the event happens at a construction site with a large concentration of values such as expensive construction equipment or high numbers of stored pipe sections awaiting installation.

Case History

A 20-year-old Middle Eastern oil pipeline routed through a wadi was destabilized during a flash flood when ground cover protection along a long a length of over 10 km was washed away. The flood was thought to be of a 30 to 40 year return period. Doubts were expressed about the basis of the specification for the pipeline's resistance to scour and it was determined that basic hydrological data used in the original design was incorrect. This resulted in the claim for the damage being disputed by Underwriters on the basis of defective design, potentially leaving the pipeline owners with a substantial uninsured loss.

Pipelines can be successfully designed against high intensity earthquakes, as demonstrated by the 2002 earthquake (7.9 on the Richter scale)⁴ which did little damage to the Trans Alaska Pipeline System. This had been designed to withstand an earthquake of 8.5 on the Richter scale. The line was, however, temporarily shut down after the initial tremors as a safety measure. By comparison, there was serious damage to gas, water and sewage pipelines in the

Taichung⁵ area of Taiwan following a major earthquake in 1999. Much of this damage was related to joints in non-welded systems.

During construction severe problems from flooding can occur if there are large sections of open trench. In desert areas this can be the result of flash floods brought about by short periods of intense rainfall. In some instances the underwriter will place a restriction on the maximum length of open trench that is allowed at any one time.

Once the pipeline is operating, landslides or high water flows along rivers can lead to scouring of the riverbed, which exposes the pipeline, ultimately sometimes leading to rupture and release of the pipeline contents. Flooding may occur as a result of rainfall some distance away but transported by rivers that the pipeline crosses. Deforestation upstream of a pipeline can result in increased river flows and erosion can produce pipeline damage. Landslides can be caused by other mechanisms, such as glacial movement.

Case History

A Canadian gas pipeline in mountainous terrain was hit by a landslide travelling at an estimated 360km/hr as a result of the action of glacial melt water on a high level rock mass. The slope that the pipeline traversed was so unstable as to make the pipeline's original route untenable in the long term. Insurers and the pipeline owners were then involved in studying the most economic alternative route. Whilst this was underway temporary lines were installed including a spare line just in case a further slide of material caused another failure. Insurers covered the cost of both the replacement line and the second temporary line. The latter was considered as a valid precaution against the possible business interruption loss that might occur if the first temporary line was ruptured.

Political Risk is a blanket term covering intentional man-made damage to facilities. It includes sabotage during the construction or operational stage. This is a major concern with some oil pipelines in politically unstable areas, such as parts of South America and the former Soviet Union. Colombia in particular has been the source of many terrorist attacks on crude oil pipelines.

Direct damage to pipelines from fires and explosions is generally limited as they are buried, but leakage of oil or gas from pipelines may result in severe fires and explosions affecting third parties close to or even some distance away from the pipeline.

Other factors to be considered particularly for above ground pipelines include exposure to high wind speeds including hurricanes. Whilst wind is unlikely to cause direct damage to well designed pipelines, fallen tree trunks or collapsed walls can result in impact damage. Winds combined with high water levels can affect pipe bridges across waterways.

Topographical and meteorological conditions

Topography and meteorology influence the probability of landslides, earthquake or other natural perils. Hilly terrain increases the likelihood of landslides and may make access for repairs more difficult. It can increase the amount of leakage, depending on the distance between low points on the pipeline and the number and type of isolation valves.

Case History

Fast flowing and high level water in a river in South America which passed through an area of special scientific interest caused a pipeline on a river crossing to be lifted out of its support framework. The pipeline was then buffeted against steel columns until a hole was rubbed in the pipe wall. The oil that subsequently escaped spread over the next few days along close to 200 miles of riverbank. The oil leakage was not identified for some time owing to the remoteness of location and difficulty of access during the wet season. Eventually when the pipeline was inspected from the air a discontinued pipe on the bridge was mistaken for a completely sheared pipeline and substantial quantities of sophisticated pollution clean up equipment were mobilised from USA by air. Much of this eventually proved unsuitable and superfluous for the clean up task that was eventually undertaken by local labour using shovels and sacks.

A lengthy technical and insurance investigation was required owing to the policy requirement for the pipeline company to demonstrate that it had taken all reasonable precautions to avoid pollution. The policy also had a requirement for them to prove that the pollution was the result of a sudden unforeseen and unexpected event. This investigation took many months to undertake during which time the pipeline company had to organise and fund the clean up operation without knowing whether the costs incurred would be covered by a reinsurance contract.

The type of underlying soil and/or rock is relevant as it affects ground stability, which is important to ensure that the pipeline integrity is maintained. The underwriter must combine geological and geotechnical data with meteorological information to try to identify conditions that could cause problems. Soil chemistry can sometimes affect the rate of corrosion of pipe walls and equipment and thus the likelihood of a leak.

Case History

A pipeline failure occurred in Central America where both crude oil and LPG pipelines crossed a river at the same point. The incident was as a result of high rainfall – greatly in excess of that anticipated which resulted in erosion of the riverbed, exposing the pipeline, which subsequently ruptured. Serious fires resulted in both cases whilst in the case involving the crude oil line; there were high levels of pollution, which spread for some distance from the pipeline.

Whilst, there is no statistical evidence to confirm that rainfall is becoming more intense, the numbers of cases where high levels of rainfall are causing problems appear to be on the increase. This suggests that the frequency of this type of incident may increase if rainfall patterns change as a result of global warming.

In addition, the impact of sharing the same route for more than one pipeline at vulnerable locations such as road and river crossings needs to be carefully considered.

At road, rail and river crossings, underwriters will be looking to see the extent of increases in design standards as compared to the remainder of the pipeline route. Higher stresses at these locations will often lead to changes in such factors as wall thickness or the use of pipe sleeving.

The proximity of the pipeline to earthquake fault lines is an obvious consideration but the underwriter will also want to know what factors have been considered in the design to mitigate against the impact of earthquakes.

Climatic conditions, not only at the site but in uphill areas, are relevant to determining how likely the pipeline is to be washed out or damaged by floods or high river flows.

Pipeline Management

The ways in which the pipeline is operated and maintained are important to underwriters both in terms of developing an understanding of the quality of the pipeline as an operating risk and the ability of the owner/operator to cope after an incident occurs. An underwriter will want to see organisation charts and details of operations, maintenance, engineering, inspection and safety systems.

Methods of insuring pipeline integrity by intelligent pigging and visual inspections are important to determine how quickly damage is likely to be detected and the location identified. Instrumentation for leak detection methods is also important for the same reason, and such systems vary greatly in sophistication. Underwriters will expect to be given details of instrumentation systems for detecting large leaks and of the programme of visual inspections by routine patrolling for smaller leaks. The frequency and type of patrol (by foot, vehicle or air) will be of interest.

Underwriters will also be looking at what sort of response there will be if an incident occurs. Both in terms of stopping leakage quickly and of organising a rapid clean-up. An underwriter is seeking confidence that procedures have been developed and practised and adequate resources are available. Often pipeline operators have optimistic assumptions, on detection and repair times, particularly when an incident occurs at night in a remote location.

The material being conveyed

The pipeline contents obviously have a significant effect on the potential for damage and thus the level of risk to be insured. Water might seem a benign material but large releases of water can result in erosion and subsequent damage to the surrounding buildings, roadways, etc. Probably the most common materials conveyed over long distances by pipelines are hydrocarbon liquids and gases. These vary in hazard and polluting potential, with heavier materials such as crude oil being the hardest to clean up. Lighter materials such as gasoline may be less polluting but are hazardous from the point of view of fire or explosion. Liquefied gases, such as LPG (liquefied petroleum gas) and ethylene are considered particularly hazardous from a fire and explosion viewpoint. In some locations, toxic

materials such as chlorine or ammonia are transported by pipeline, with the obvious hazards to health if released in large quantities as a result of a leak.

A significant problem with heavier-than-air gases is their ability to hug the ground and congregate in low points, such as drains. This may be some distance from the point of release and can result in unexpected and more widespread damage than those resulting from a release of lighter than air gases.

The sizes of possible losses

Estimates of the size of future losses are made for the benefit of underwriters who need to assess how big a loss they could face in the worst case. The task will normally form part of a risk survey. Estimating losses associated with pipelines incidents is not easy and is not an exact science.

Large property damage incidents are generally but not always associated with an area of significant value, such as a pumping or compressor station or a major river crossing. The worst events will involve the replacement of a whole section of the line. A loss may result in the need to change construction methods, pipeline specification or even the route of the pipeline. This can increase costs to higher than the original pipeline construction costs. For example, after an incident it may be necessary to employ directional drilling under a river instead of simply laying the pipe on the river bed as may have been done in the first place.

Case History

A volcanic eruption in Central America deposited large quantities of ash along the route of a hydrocarbon pipeline under construction. There was also a huge lahar flow, depositing magma with large quantities of rock and vegetation up to 3 meters deep along a 2-kilometer stretch of the pipeline route. In addition to insurance cover for material damage the owners had fortunately taken out cover for costs incurred by delays in starting up the pipeline.

A vast amount of debris was deposited at the time of the eruption, leaving many thousands of tons of displaced rock, soil and other matter on the mountainside, threatening further lahar flows which could move at up to 10 meters per second in heavy rain. The rainy season almost immediately followed the eruption. Whilst there had been little construction on the most badly affected part of the route, it was necessary to remove the material deposited by the lahar flows in order to re-commence construction. It was also necessary to design additional river crossings to deal with the dramatically changed landscape created by the magma.

The incident raised questions about the meaning of “damage” and “indemnity” since on those parts of the pipeline route where construction had not started insured works had not been damaged even though costs had risen sharply. Rarely would a construction insurance policy anticipate an event of this type.

One location of critical interest is the pipeline control station. Damage here might result in limited property damage but a significant period of downtime during which pipeline operations would be difficult or impossible.

Liability costs associated with the rupture of a pipeline are even more difficult to estimate and in most cases the amount of insurance purchased is based on what can be economically purchased. It is extremely difficult to predict where a rupture might occur and how bad the consequences of the leak might be. Experience suggests that there are frequent underestimates, particularly related to the operation of pig traps.

The Risk Assessment Process

To assist underwriters in making their decisions about what to insure at what price underwriters often commission risk assessments from independent specialists. Risk assessments associated with the purchase of insurance are, however, very different from those necessary for statutory approval.

The former will consider the risks, their likelihood - in qualitative terms - and the financial consequences. Statutory risk assessments on the other hand will generally consider the likely effects on the surrounding area, including injury to people and damage to the environment. This may include a qualitative assessment based on the probability of an event. Statutory risk inspections do not consider the financial losses to the pipeline operator or construction contractor, which are of great interest to their insurers.

A typical risk survey will include:

- a full description of the pipeline
- the surrounding environment
- how exposed it is to a variety of perils
- the way it is managed and operated

the risk assessment report will also cover:

- the insured values broken down by location and type of asset
- loss estimates
- previous loss history and actions taken to prevent a reoccurrence of incidents
- recommendations for risk improvement

Often underwriters will make a judgement on pipeline risk quality by comparison with other pipelines and a consistent approach and level of detail is desirable.

Improving relationships with and learning from insurers

The operational departments of many pipeline owners/operators only make significant contact with insurers after an incident. Insurers usually have a great deal of experience of what can go wrong and why, in the kind of detail that it would be hard to find from publicly available documents. They make informed decisions and are generally very willing to share their experience with their clients, particularly if the result is to everyone's mutual advantage.

Survey inspections by insurers or their appointed risk consultants are, unfortunately, rarely seen by owners/operators as an opportunity to benchmark the pipeline operation and to gain from the experience of a surveyor who will have seen numerous pipelines in different terrains and be able to compare and contrast. He will have examined the risk improvement actions that other owners/operators have taken with the benefit of hindsight following past incidents. Many owners/operators feel they are being investigated by surveyors/insurers rather than viewing a survey visit as an opportunity to benefit from the experience of others.

Owners/operators can learn how and what is likely to go wrong, from the experience of insurers who will have received detailed reports of previous incidents on other pipelines. Good planning for post incident response depends on developing credible scenarios of what might happen. What better source of scenario information than an insurer that has examined numerous real past incidents?

Influencing the cost and terms of insurance coverage

Much of the premium for a policy is determined simply by the statistics of the pipeline - how long it is, how large it is, what it carries and the terrain through which it passes. These statistics will go some way to answering the underwriter's questions about possible losses (the "how big?" and "how often?" questions), but an underwriter will also be aware that many incidents are prevented altogether or their consequences contained by the right action being taken at the right time. The underwriter therefore has to judge how well a pipeline company is likely to behave when faced with a potential disaster. A good performance can often save the day.

Any pipeline business is bound to be dominated by operational performance and profitability. An underwriter, however, is looking to see what risk management, loss avoidance and disaster mitigation philosophies exist. How seriously are such subjects taken within the insured company? Are they seen as something to pay lip service to or does the company recognise them as a vital part of operations management? Can they see that the difference between getting these factors right and getting them wrong can mean, possibly the difference between survival and failure after an incident? Does the company look upon its insurance coverage as incidental to carefully controlled decision making or as a licence to push risks as far as possible in the quest for profits? When an insurance surveyor visits, is the company looking to be as open as possible or to paint a rosy picture and keep quiet about those areas where it is sticking its neck out? Trying to give a high-risk strategy the appearance of conservative decision-making is not easy, and if detected by insurers will produce a highly nervous response. Far better for the company to explain the risks to professional risk takers, their underwriters, and seek their advice on the most appropriate risk management.

A company's attitude to risk can make a significant difference to underwriters' attitude to insurability and therefore the price to be charged for cover.

Risk management programmes

For a pipeline conveying hazardous material a risk management programme is not an option but a necessity. It gives the underwriter the reassurance that the company that is insured has thought about the kind of incidents that may occur from time to time. It should reassure the underwriter that whatever can be economically prevented will be prevented and that when an incident does happen there will be a pre-planned response. Underwriters will expect to see that relevant hazards have been addressed in a systematic way. Where co-operation and

assistance from others would be required in an incident response, suitable pre-incident preparations have been made. Underwriters would want to see that staff have been trained to recognise the early signs of a problem and that they know how to obtain the best outcome.

The impact of losses on insurers and owners/operators.

A really major loss may be sufficient to convince certain underwriters to stop insuring pipelines altogether. If they continue, however, when the insurance programme for the company comes to be renewed the existing underwriters may decline if they are not satisfied about the way an accident has been handled. They may decline to renew anyway for other reasons. A pipeline company, which has recently suffered a major loss and is then seeking fresh insurers, is likely to face considerable difficulties obtaining cover and the cost may be substantially higher. Substantially increased insurance costs or the inability of a company to obtain cover altogether can threaten the continuing existence of a pipeline owner or operator. Such difficulties are likely to occur in addition to having to deal with the aftermath of a major incident and the seriousness of such problems should not be underestimated.

Immediate response to an incident and follow up

Whilst major pipeline incidents are rare, they can be devastating, particularly in inhabited areas and an emergency response plan is essential. In some locations, there may be several pipeline operators and there will be scope for a mutual aid scheme. In other locations, reliance will be placed on local authority fire fighters who will need special training in the risks involved in dealing with hydrocarbons, particularly natural gas, liquefied hydrocarbons and toxic materials.

The initial requirements will be first aid in fire fighting, clean up and simultaneous stopping the source of leakage. Many leaks can be repaired quickly, possibly with no downtime. In other cases, there may be significant periods of downtime whilst repairs are made and investigations performed.

Case History

More intense rainfall than anticipated falling on the San Jacinto River flood plain resulted in increased river flows and flooding. As a result a total of 8 pipelines ruptured and 29 were damaged at either river crossings or new channels created by the flooding. Hydrocarbons released from the pipeline ignited and there were over 500 casualties, mostly minor.

Most of the damage occurred in areas where high river flows caused scouring of the riverbed or a diversion of flow, "shortcutting" the bends in the meandering course of the river. Many of the pipeline designs had taken limited account of river action.

Many insurance policies require immediate notification of an incident but it is surprising how often reporting to insurers is delayed in the mistaken belief that the incident is not going to be big enough to produce a claim. Where a large loss occurs insurers may look to repudiate cover if they can establish that their interest has been prejudiced by late notification. The rule for the pipeline owner/operator must be: if in doubt notify just in case. Once notified of an incident underwriters will probably appoint adjusters supported as necessary by engineers,

pollution clean up experts, forensic investigators, accountants, lawyers and others. Insurers will expect to receive reports rapidly and repeatedly from the team they have appointed. They will want to be made aware of what pre-planning had been undertaken, how this is being followed up, that it has been regularly reviewed, that adequate resources and expertise have been engaged both in terms of action on the ground and management. Insurers will engage specialists with experience through dealing with previous incidents, whose advice can prove invaluable to the owner/operator. They can offer a detached perspective and an ability to anticipate developments over the full time span of a disaster recovery.

Anticipating how matters are likely to develop can be very difficult for operational staff. They may be in the thick of day to day concerns. Adjusters can for example warn of the consequences of a lax attitude to settling liability claims with those affected by pollution. The precedents and expectations such actions will set for other claimants often outweigh the benefits of settling early claims quickly with over generous settlements. The expectations of the sufferers of pollution need to be carefully managed if claims are to be settled by agreement rather than through a flood of litigation which in itself can overwhelm a pipeline owner/operator.

Pipeline routes pass through different countries, jurisdictions and cultures and knowledge of each is vital when facing the difficulties caused by a major incident. Expert assistance with local knowledge can make an enormous difference to the outcome. Pipeline routes also rarely change and the ongoing co-operation of local residents is vital for long-term pipeline operations after the incident has been concluded.

Insurers will expect the companies they insure to be entirely open with information and fully co-operative with appointed experts. This may be despite an insurer delaying a decision over coverage whilst a lengthy investigation into the incident is completed.

In the immediate aftermath of an incident it is easy for an owner/operator to rush to make rapid commitments with contractors just to be seen to be doing something. Care is required however to avoid paying inflated rates or mobilising unnecessarily elaborate equipment or excessive personnel. Those with experience of past incidents can help with measured analysis and decision-making avoiding exploitation of vulnerability. They can help put rapidly in place the type of project management controls that would be found in a pre-planned operation, despite the operation obviously being unexpected. Without these controls, costs can rapidly escalate and control of the incident remediation difficult. Recognition is required that in most cases there are alternative assistance providers for disaster response, if you know how to find them. They will put into context the first proposals that are received. Again insurers and their advisors are a good starting point. Obtaining their advice and agreement early on will provide experience and expertise whilst at the same time minimising the chances of a disagreement developing over costs at a later date.

Some disaster response contractors, whilst very experienced in rapidly mobilising practical assistance, are also expert in generating extensive costs. Careful and early control is vital if costs are to be kept to a minimum. Insurers and their experts will be aware of the pitfalls of failing to exercise proper control of contractors from the start.

A large release resulting in wide scale pollution or fires/explosions damaging third party property is likely to result in a large number of insurance claims from individual property owners and individuals. Dealing with claims, which can number thousands, can become a major bureaucratic problem. It is essential to co-operate fully with the appointed loss adjuster

as soon as possible. The adjuster will be able to group the individual claims into a smaller number of larger claims and often be able to arrange immediate payments, thus reducing the future workload.

As some companies will be entirely dependent on the use of the damaged pipeline, its prompt return to service will be vital. For this reason, a pre-prepared disaster recovery plan is vital.

Conclusions

The insurance world has a breadth and depth of experience in pipeline problems and solutions, which it is happy to share with operators and owners. No one wants a loss to occur so insurers are best viewed as partners in the risk management of pipelines. The wider the experience that can be brought into play, the better for all concerned. Regular dialogue and an open relationship will give owners and operators the maximum benefit from their expenditure on insurance premiums. It will also be a sound investment should a major loss occur when their insurance coverage might prove vital to their survival.

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