Proceedings of Plastics Pipes XI
Munich, Germany, 3rd - 6th September 2001

Gas Pipes - Qualification of Plastic Pipes for 10 Bar

LARS SYNNERHOLM
National Inspectorate of Explosives and Flammables, Sweden

ABSTRACT

PE 100 pipes were introduced as a possibility for use for natural gas in Sweden and Norway. The authorities had no doubts that the pipes were suitable for what they were designed. The main issue was whether the pipes were suitable for the same proximity distances or if they had to be altered. This paper explains the philosophy behind the Swedish - Norwegian distance requirements and why the authorities accept that the PE 100 pipes may have the proximity distances already used for steel pipes.

PE 100 PIPES

When the PE 100 pipes were introduced as a possibility for use in Sweden and Norway the authorities in both countries wanted to come to a mutual decision. The technical requirements are almost exactly the same in Sweden and Norway. Sweden has been leading the legislation work for pipelines on shore and Norway has been leading the work off shore then sharing each other's requirements.

When starting the work we found that other countries had accepted the PE 100 pipes. The manufacturing, handling, weldability, ageing and quality assurance were accepted. We had no doubts that these questions were seriously treated and passed by the countries where PE 100 pipes previously were accepted.

However the PE 100 pipes were accepted to lower pressures than the one they were designed for. Strangely enough U.K. had accepted the pipes for 7 bar only, NL for 8 bar, D for 10 bar and so on. A study showed that the U.K. requirement was set by the fact that 7 bar is the limit for a tax not having any technical background at all. Other countries had followed step by step up to the pressure for which the pipeline is designed. We had no doubts that the pipes were suitable for the working pressure for which they were designed and the D experiences verified it. In Sweden and Norway we use the pipes to the pressure for which they are designed.

The main issue was whether the pipes were suitable for the same proximity distances or if they had to be altered. To understand the question we must explain the philosophy behind the Swedish – Norwegian distance requirements based upon steel pipe experiences:

LEGISLATIVE BACKGROUND FOR STEEL PIPELINES FREQUENCY OF BEING HIT

A pipeline designed according to the technical requirements and maintained according to the requirements is considered safe as long as it is not hit by an outer force, usually an excavator.

Fortunately excavators are not evenly spread over the Scandinavian peninsula, they are located to certain areas:

1. True excavating areas such as sand pits,
2. Areas that a lot of people use at the same time, e.g. golf courses
3. Rural buildings, built or planned.

Do please observe that there is no limit to how often people use the area above and it's of no interest whether people use the buildings or not. Housing and stores are equal.

Excavating work is most frequent at the area or rural house lowering as the distance increases. There is no distance that can be considered as a threshold, therefore it can be chosen longer for countries with low population density. Sweden and Norway have chosen 25 m.

Do please observe that the pressure has nothing to do with the frequency of excavation damages since the excavator will hit the pipeline regardless of its pressure. Do please also observe that the diameter of the pipeline has nothing to do with the frequency of excavation damages since the excavator will hit the pipeline regardless of its diameter (**Figure 1**).

SIZE OF HOLE IF BEING HIT

A pipeline designed according to the technical requirements and maintained according to the requirements is considered safe as long as it is not hit by an outer force, usually an excavator. Fortunately excavators are not cutting pipelines as a guillotine, they make a scratch or a hole.

If a pipeline is hit experience shows that > 99% of the holes are < 1 cm^2.

Do please observe that the diameter of the pipeline has nothing to do with the size of the hole since the excavator will make the same hole regardless of the pipeline diameter (**Figure 2**).

If the pipeline has got a hole the leak is a product of the size of the hole and the working pressure. If taken fire the fire will spread longer with increasing size of hole or working pressure.

When a pipeline is placed > 25 m from a building, populated or not, the frequency of excavation damages are considered acceptably low regardless of pressure or diameter.

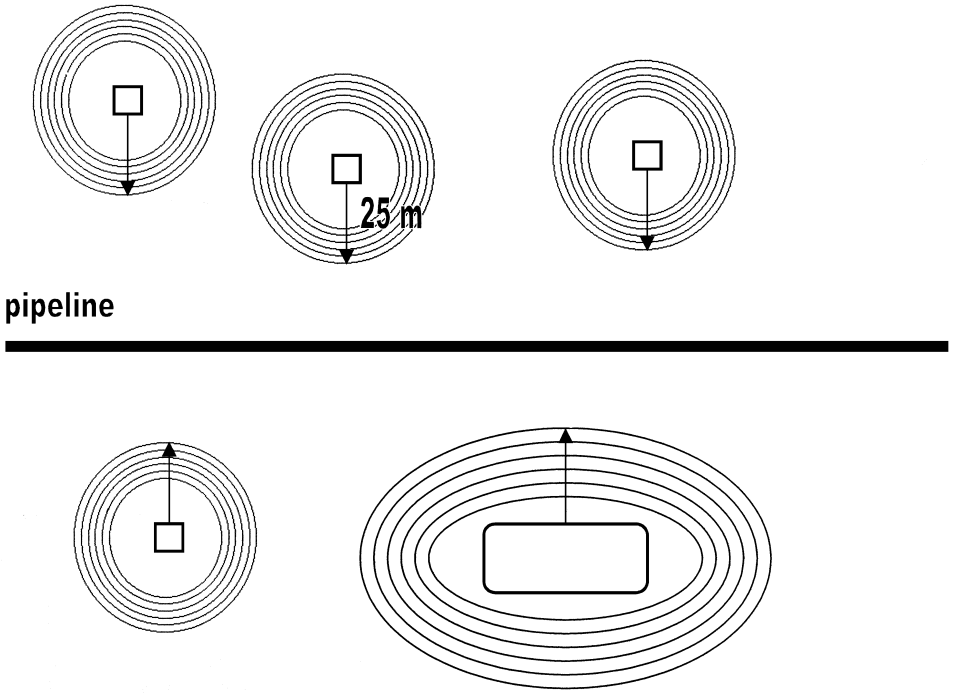

Fig. 1 Frequency of excavation work.

COMPARISON BETWEEN STEEL AND PE 100

The question was how would the PE-pipes coop with these experiences from the steel pipelines. To get the answer we had to compare a steel pipe with a PE 100 pipe.

First of all, the frequency of being hit by an excavator is regardless of the material. So the distances according to frequency are the same. But how big will the hole be if an excavator hits a PE 100 pipe in stead of a steel pipe? Will it be larger causing worse leaks and thereby damages? If so how much larger? Which precautions could be made to get PE 100 pipes as resistant as steel?

To check this out Sydgas made a test at the Kockum's wharf in Malmö this year (**Figure 3**). A test programme compared the resistance to outer force for a

When a pipeline is placed > 25 m from a building, populated or not, the distance will protect from fire spread in 99% of all cases of a pipeline < 80 bar being hit.

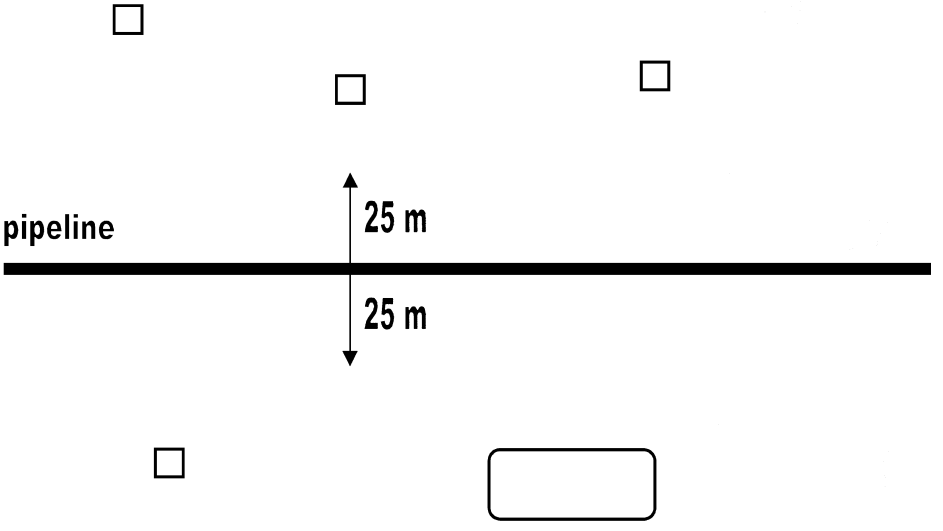

Fig. 2 Size of hole if being hit.

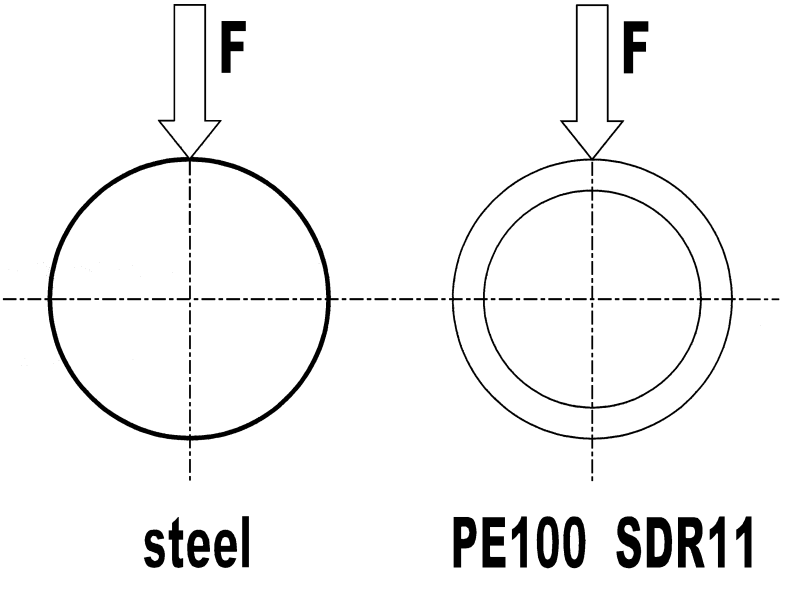

Fig. 3 Resistance against outer forces.

- Steel pipe DN 400 design factor 0.5 (= zone C) t = 2 mm and a
- PE 100 pipe D_e 400 SDR 11 t = 36.4 mm.

The test programme showed that a PE 100 pipe has

- A lager resistance to outer force than a steel pipe and
- A smaller hole after the piercing tool has been removed.

The Swedish and Norwegian authorities have drawn the conclusion that the PE 100 pipes are suitable to usage according to the proximity distances already used for steel.