Pipeline Integrity Maintenance and Diagnosis, with particular regard to a.c. interference

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ABSTRACT

Usually, but unfortunately not always, engineers use their experience and theoretical knowledge in order to prevent any structural decay of the designed pipeline network, taking into account the most suitable materials to be used, the environmental conditions, the soil geotechnical properties, and the updated techniques of electrical protection, but sometimes the pipelines collapse, or suffer of leakages, frequently due to corrosion phenomena.
Inspection and maintenance are therefore mandatory in order to prevent disasters that could also involve the death of innocent people.
The integrity of a pipeline during its operating lifetime is mainly referred to:

- its coating quality and integrity;
- the follow-up of the efficiency of the Cathodic Protection System during its lifetime;
- its mechanical integrity overtime, which can be hindered by events such as corrosion and mechanical damages due to operating machines or by soil movements (earthquakes, landslides, floodings etc.).

When a pipeline network is to be verified in terms of integrity, numerous parameters have to be taken into account:

- Product transported (Gas, Oil, LPG, Water, Chemical products);
- Piggability;
- Year of construction;
- Type of pipes and welding procedures;
- Coating characteristics
- Soil type and characteristics

The above said characteristics will primarily help in knowing which type of threats a given pipeline is mainly subject to suffer. According to its scope, Pipeline Integrity must be verified by using a series of techniques, more or less expensive.
Among the various techniques for verifying Pipeline Integrity, the Intelligent Pig Inspection can give very important information on the present, real status (internal and external) of the metallic material of the pipeline.
Sometimes, within the network, which can also be extended for many thousands of km, the inspection with Intelligent Pig is not feasible, unless very expensive works are previously done on the pipeline.
In these cases, Specialised Surveys are very useful means to verify the “in situ” conditions of a pipeline.
The traditional surveys have shown to be not particularly suitable for the detection of a.c. corrosion risk.
The subject of a.c. corrosion on cathodically protected pipelines, even if already known before, arose in the world of corrosion engineers only in the 80ies. Starting from the 90ies, the risk of a.c. interference due to electricity power lines has massively grown, because of the intensive use of very high electrical resistance coating of pipelines, but also due to the increasing number of parallelisms of electricity power lines and the development of high-speed trains, fed with alternating current.
The risk of a.c. corrosion has been intensively investigated by the authors, through an in deep experimentation in properly designed pipelines and in the field; the tecniques to be used in order to assess the risk are deeply and extensively described.