SCIENTIFIC ISRAEL
Technological Advantages

INTRODUCTION

Pipelines are one of the ways to transfer the substance from the manufacturer to the general public. Sometimes it seems to be almost the only practical means of transporting large volumes of substances which could not be transported by road or rail. Also be considered as one of the most safe and economical method of transporting hazardous substances.

The use of pipelines for the transport of large quantities of natural gas to industry and to commercial and domestic consumers represents a safe mode of transport in terms of the impact on the environment and human health. The safe transportation of product by pipeline is vital to meeting the energy needs in the future. As a general policy the natural gas industry strives to design, construct and maintain pipelines in a safe manor to prevent any damage in order to protect the public, public health and the environment and to assure an undisturbed supply of natural gas to customers. This business principle aims to secure the confidence of authorities and of consumers as well as continuity of supply.

The world's major span a total distance in excess 2.5 million kilometers.

The vast majority of the pipeline runs underground or under water, and consequently is exposed to accidental damage or erosion. Most people are unaware of both the existence and extent of the existing pipeline network, and the volume of the substance flowing through these networks. In many cases, pipelines are used for transporting substances over long distances and across borders of different countries. Trails run, where possible, through the countryside, but in their sources and target points are close to urban areas. In addition, as a result of increasing urbanization, it is difficult to keep piping away from settlements.

In general, pipelines are a practical, economic and safe means of transport of large volumes of hazardous substances from their producer to a wide range of customers over long distances. Among these hazardous substances, crude oil and its derivatives and natural gas dominate

Pipelines transporting hazardous substances could potentially create a serious risk. Release of flammable and toxic materials may initiate a catastrophic emergency event effects. The frequency and type of accident and the size of the effects of a substance depends on the move, the network type, etc. The analysis shows how the accident occurred very systematic control is important for the further protection against failures. Experience gained should lead to relevant legislation.

Like fixed installations handling hazardous substances, pipelines may be a threat to our health and our environment have a devastating effect on the soil and water.

Pipeline accidents unfortunately take place, those involving gas often have an effect on human health, while those involving oil or petroleum products often have a devastating effect on the soil and water. The effects of pipeline accidents are often transboundary in nature and require an efficient, coordinated emergency response from two or more countries.

Critical failures of pipelines create enormous economic losses in the pipeline transfer system itself and well beyond its limits.

Only North Sea alone now has thousands of miles seabed pipelines. The early pipelines were installed by flat bottom barges in relatively shallow areas. Then evolution of pipeline techniques allow perform installation pipes with higher diameter from ships and in deeper water (1500 plus feet). Unfortunately, this time technique for repair damaged pipes or necessitates replacement was not developed in accordance with future necessities. Residual overstresses, seabed instability, dynamic overstresses, regular and irregular wave's condition, and other factors were not taken in consideration. As result, 59 serious accidence were happened for the period 1995-1997 years, 149 people were killed, 263 were injured, estimated US Petroleum Industry Environmental Expenditures were about US$ 20.000 billion. More than 100 gas line emergencies and accidents occurred in the 1989 alone costing 25 millions US $ per 1000 m^3 gas.

Taking all the above into account, it is possible to conclude that despite improved construction procedures and the high quality of materials used, accidents, damage and failures offshore platforms and piping have increased significantly during the second half of the twentieth century. The result has been a grave expansion in the number of injuries, deaths, ecological disasters, and their social and economic consequences. These have increased the interest to creating rational NDI methods for revealing typifying and assessing condition of offshore platforms and piping during construction and operation

The diagnostic problem is especially crucial in regard to pipelines in service for more 20-30 years. Breaks in insulation set the stage for the development of general corrosion process and corrosion cracking. Internal corrosion damages pipelines transporting a product with a high hydrogen sulfide content. Large static stresses and their concentration in combination with random loading from pressure fluctuations, seasonal temperature drops, additional loading from wet soils, pulsation of the working media, and vibration of industrial equipment lead to the development of planar defects in straight sections of pipeline and the formulation of fatigue cracks in the piping of transfer stations.

Growing planar defects, fatigue cracks formed in zones of structural stress concentrators and volume flaws in welds, and corrosion damage are potential causes of breaks in pipelines.

The large statistics of accidents and major disasters in pipelines under construction and in service, together with their detrimental economic and social consequences, escalate She importance of diagnostic monitoring of the state of these large-scale structures. Research efforts have been aimed at the development of methods and facilities that can be used to detect flaws in a stage when the development of irreversible damage can be prevented by focalizing the potential high-risk zones and implementing preventive measures. However, the solution of this problem is complicated by the fact that conventional scanning ultrasonic inspection and X-ray flaw detection techniques are often ineffectual under the conditions of prestartup testing, actual operation, or similar situations. The diagnostic monitoring of surface flaws inside pipe, specifically in corroding elements, must be performed “blindly” in some cases, because visual access may be denied to metal parts of the structure or is it difficult, or visual inspection may fail to disclose dangerous cracks, for example, in the case of corrosion of gas-line structures under loading.

The development of efficient acoustic emission diagnostic procedures is particularly timely in regard to the solution of problems in flaw detection and monitoring of the serviceability of welded joints in gas and petroleum pipelines, transfer compressor and pumping stations, and other, highly critical conduits used in various branches of industry.

Many researchers are intrigued by the possibility of using acoustic emission (AE) for the detection of growing cracks and corrosion damage. Definite results have been obtained thus far. On the other hand, the principles of identification of the type of flaw or damage from AE criteria have not been adequately developed to date for diagnosis of the emergence of a potential crisis situation.

Research performed by Quantitative Acoustic Emission Non-Destructive Inspection (QAE NDI) and by photo-elastic methods reveal and determine quantitative statistical Acoustic Emission (AE) indications that would enable the recognition of individual and interacting flaw development and assess flaw danger levels according to fracture mechanics criteria. Elaborated techniques allow:

- Reveling and determining quantitative statistical AE indications that would enable the recognition of individual and interacting flaw development (pitting and cracking) and assess flaw danger level in accordance with fracture mechanics criteria.
- Establishing acceptable and critical danger levels of flaws in industrial equipment.

- Guarantee of reliable diagnosis of the integrity of the entire structure, and evaluating of kinetics of flaw development within specified time intervals.
- Estimating of remaining lifetime of equipment with interacting flaws using theoretical calculations, based on results of QAE NDI.

Carried out researches have shown, that Quantitative Statistical Acoustic Emission (AE) method provide a means for recognition of individual and interacting flaw development and assess flaw danger level according to physical criteria of composite material fracturing. Elaborated techniques allow quantify criterion of acceptable and critical danger level of flaw in industrial equipment. The verification of theoretical results by photo-elastic, AE methods and metallurgical investigation confirmed predicted peculiarities of cracks interaction.

In the present work the condition and prospects of development of pipeline transport in the countries of the Europe and the USA are considered, the statistical analysis of destructions of gas and oil pipes is given. Methods of not destroying control of pipelines during their installation and operation are discussed.

The second part of work is devoted to generalization of experience of application of qualitatively new method of not destroying control – to the quantitative acoustic issue, allowing to reveal defects of pipelines which cannot be found out by other methods

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