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SPACE TECHNOLOGY APPLICATION TO STRENGTHEN DISASTER PREPAREDNESS IN EFFECTIVE EARLY WARNING

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Abstract. *Traversing 1,768 km of often remote and challenging terrain, the BTC pipeline will be able to transport up to one million barrels of crude oil per day from a cluster of discoveries in the Caspian Sea, known collectively as the Azeri, Chirag, deepwater Gunashli (ACG) field.*

It makes it necessary to implement the below actions for effective early warning:

- *environmental Management and Monitoring Plan and other related plans;*
- *social Impact Assessment studies;*
- *route selection;*
- *geological and geotechnical studies;*
- *geohazard studies;*
- *development of seismic design criteria;*
- *environmental studies;*
- *permits and licenses;*
- *geological Information Systems applications;*
- *general risk assessment.*

Safe pipeline laying-out and transportation of energy resources are a major concern for the public and the pipeline industry. Within the framework of implementations of these scopes the following main aspects should be taking into account:

- route selection;
- geological and geotechnical studies;
- geohazard studies;
- development of seismic design criteria;
- environmental studies;
- Geological Information Systems (GIS) applications;
- general risk assessment.
- Environmental Impact Assessment (EIA) studies including baseline surveys,
- Environmental Management and Monitoring Plan (EMMP) and other related plans;
- Social Impact Assessment (SIA) studies;

The Baku-Tbilisi-Ceyhan (BTC) project is a $3 billion investment to unlock a vast store of energy from the Caspian Sea by providing a new crude oil pipeline from Azerbaijan,

through Georgia, to Turkey for onward delivery to world markets. Traversing 1,768km of often remote and challenging terrain, the BTC pipeline will be able to transport up to one million barrels of crude oil per day from a cluster of discoveries in the Caspian Sea, known collectively as the Azeri, Chirag, deepwater Gunashli (ACG) field. By creating the first direct pipeline link between the landlocked Caspian Sea and the Mediterranean, the BTC project will bring positive economic advantage to the region and avoid increasing oil traffic through the vulnerable Turkish Straits. A programme of social and environmental investment is ensuring that the people of the three host nations also share in the benefits.

In this connection effective early warning for preparedness on natural disaster which is one of the main circumstances has to be finding out a significant place in the safety of the oil and gas pipeline.

A variety of advanced technologies are available to enhance planning, design, management, operation and maintenance of pipeline system. Aerial and satellite remote sensing integrated with GIS represents one area of rapid development that can be leveraged to assist pipeline risk assessment to assure the safety of pipeline facilities. Industrial and scientific advances in satellite remote sensing systems and data processing techniques are opening new technological opportunities to develop an increased capability to accomplish the pipeline mapping and safety needs of the industry. These technologies when combined with GIS have significant and unique potential for application to a number of cross cutting system security issues.

Research and application efforts are developing cost-effective ways to enhance pipeline integrity, inspection and monitoring, as well as new tools and techniques for managing the risk involved in pipeline operations. Some of these efforts have investigated the use of satellite-based technology for pipeline protection. It has been identified the potential for satellite imagery to detect significant slope motion and ground movements that could threaten nearby pipelines with a less expensive means.
Several projects on application of space technology were carried out in Azerbaijan related to the problem of natural disaster. Permanent monitoring of this sad events have a positive influence for forecasting, mitigation and reduction of natural disaster which are extremely important for oil and gas pipeline transportation safety issues. The most risky natural disasters in Azerbaijan are the earthquakes, landslides, floods.

Earthquake: During several years a method of using space images is being developed for studying the tectonic and geological structure of earth depth down to lithosphere bottom. As a result a map of expected earthquake risk zones of Caucasus has been designed. The last earthquake of 7.0 balls by Richter scale which occurred in Azerbaijan in June, 1999 was at the place indicated on this map and its strength was within the value limit defined for this particular region.

Mudflow: The significant part of the territory of Azerbaijan is mountains. For this reason the mudflows are one of the frequent natural disasters taking place in this area. Within studying of mudflow are using the both space and aerial borne imagery processing technologies.

Landslides: This type natural disaster is the typical for the whole territory of Azerbaijan. The sufficient area of the pipeline road to run the landslide risk. The study of the behavior of this kind natural disaster is highly important. The maps of the main areas of the region especially southern slopes of the Great Caucasus with the high degree of landslides were completed using the satellite made images.

Dynamics of the sea level, water coastal zone of the sea: The level of Caspian Sea changes with amplitudes up to several meters and with the periods of tens, hundreds and even thousand years. The behavior of these changes is not completely clear that result in necessity of realization of the various projects. Monitoring of the changing the water level of Caspian Sea and coastal zone are extremely important for oil development, producing and transportation.

Floods: The basic water supplies of the rivers with high reservoirs in Azerbaijan are snow waters and with low - rain waters. Kur and Araz is the main rivers basin of Azerbaijan. Kur is starting from the border of Azerbaijan-Georgia and crossing the whole territory of country flowing to Caspian Sea. During construction of Baku-Tbilisi-Ceyhan pipeline it was impossible pass around Kur river. This situation creates an environment for permanent controlling of condition for elimination of circumstances of natural disaster. In this connection using the remote sensing data and GIS technology can be effective instrument for prevention, forecasting and assessment of consequences of disaster.

Pipelines and their associated facilities pose potential environmental pollution risk that can also be monitored by a variety of remote sensing systems. Pipelines are required to meet all environmental pollution risk hazardous waste management standards. Hazardous wastes related to the transport process of oil and gas in pipelines is fully covered by environmental pollution risk regulations for the control of hazardous material.

Today advances in information systems, satellites imaging systems and improved software technologies have led to opportunities for a new level of information products from remote sensed data. The integration of these new products into existing response systems can provide a wide range of analysis tools and information products that were not possible before. Using the higher resolution imagery and change detection analysis pipeline situational awareness and damage assessment can be conducted rapidly and accurately. Power utility infrastructure and system wide evaluations over a broad area could also be addressed using remote sensing data sources. All of those information products can be useful in the response, recovery and rehabilitation phases of infrastructure management preparedness.