CBRN THREATS FOR INFRASTRUCTURE OF GAS DISTRIBUTION AND ITS POTENTIAL INFLUENCES ON THE NATIONAL SYSTEM OF CRITICAL INFRASTRUCTURE

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ABSTRACT
The problem of gas infrastructure as a critical infrastructure and its threats by weapon of mass destruction using was presented. The authors describe system of critical infrastructure and natural gas production and distribution. The characteristic of weapon of mass destruction (nuclear, radiological, chemical and biological) and its factors or damage was underlined. In the end of article the risk of using WMD for natural gas system was presented.

Key words:
critical infrastructure, natural gas system, weapon of mass destruction

ABSTRAKT
W artykule przedstawiono problematykę zagrożenia bronią masowego rażenia infrastruktury gazowej jako elementu infrastruktury krytycznej. Autorzy opisali system infrastruktury krytycznej w tym szczególnie znaczenie systemu zaopatrzenia w gaz ziemny. Scharakteryzowano zagrożenia ze strony broni masowego rażenia (chemicznej, biologicznej, radiologicznej i jądrowej) oraz wpływ jej czynników rażenia na funkcjonowanie infrastruktury gazowej. W podsumowaniu podjęto próbę skwantyfikowania ryzyka użycia BMR oraz jej wpływu na system dystrybucji gazu ziemnego.

Słowa kluczowe:
Infrastruktura krytyczna, system dystrybucji gazu, broń masowego rażenia

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1 GAS INFRASTRUCTURE AS A CRITICAL INFRASTRUCTURE

The infrastructure of a facility, a company, or an economic sector, consists of an array of assets which are necessary for the production and delivery of a good or service. Similarly, the infrastructure of a city, state, or nation consists of an array of assets necessary for the economic and social activity of the city and region, and the public health and welfare of its citizens.

Among of the elements of infrastructure we can find systems, which play important role in the general system of defense and security well known as a critical infrastructure.

According to the Polish regulation critical infrastructure is defined as "*systems and being their composition related with each other functional objects, including the building objects, devices, installations, key services for the safety of state and his citizens and serving the assurance of efficient functioning the organs of the public administration, and also institution and businessmen*" [1].

After identifying what may be considered a critical infrastructure, a protection strategy must identify which elements of the infrastructure are critical to its function or pose the most significant danger to life and property. Not all assets may be critical, and some may be more so than others. However, the size and complexity of these infrastructures can make identifying which assets of an infrastructure are critical a daunting task.

According to the regulation these critical infrastructures included [1]:

- **energy, energetic resources and fuels supply system;**
- communication;
- data communication network;
- finance;
- food supply systems;
- water supply systems;
- health protection;
- transportation;
- rescue services;
- continuity of public administration;
- production, storage and applying chemical and radioactive substances, including the pipelines of dangerous substances.

Gas and Oil Production Storage and Transportation is a part of the system of energy, energetic resources and fuels supply. The production and holding facilities for natural gas, crude and refined petroleum, and petroleum-derived fuels, the refining and processing facilities for these fuels and the pipelines, ships, trucks, and rail systems that transport these commodities from their source to systems that are dependent upon gas and oil in one of their useful forms.

2 NATURAL GAS PRODUCTION AND DISTRIBUTION SYSTEM

Natural gas is one of the most abundant energy sources in the world. Like oil, it is created by the decomposition of organic matter. The lightest of all hydrocarbons, natural gas is commonly found in underground formations either by itself; associated with or lying atop oil deposits; or dissolved in crude oil.

The natural gas portion of the Energy Sector includes the production, processing, transportation, distribution, and storage of natural gas; liquefied natural gas (LNG) facilities; and gas control systems.

Natural gas production includes: exploration, field development, on- and offshore production, field collection systems, and their supporting infrastructures. Natural gas transport includes pipelines, storage terminals, ports, and ships.

The natural gas industry consists of three major components: exploration and production, transmission, and local distribution.

Distribution includes storage facilities, gas processing, liquid natural gas facilities, pipelines, city gates, and liquefied petroleum gas storage facilities. City gates are distribution pipeline nodes through which gas passes from interstate pipelines to a local distribution system. Natural gas storage refers to underground aquifers, depleted oil and gas fields, and salt caverns. At the Fig. 1 the example of production, transmission and distribution system of natural gas is presented.

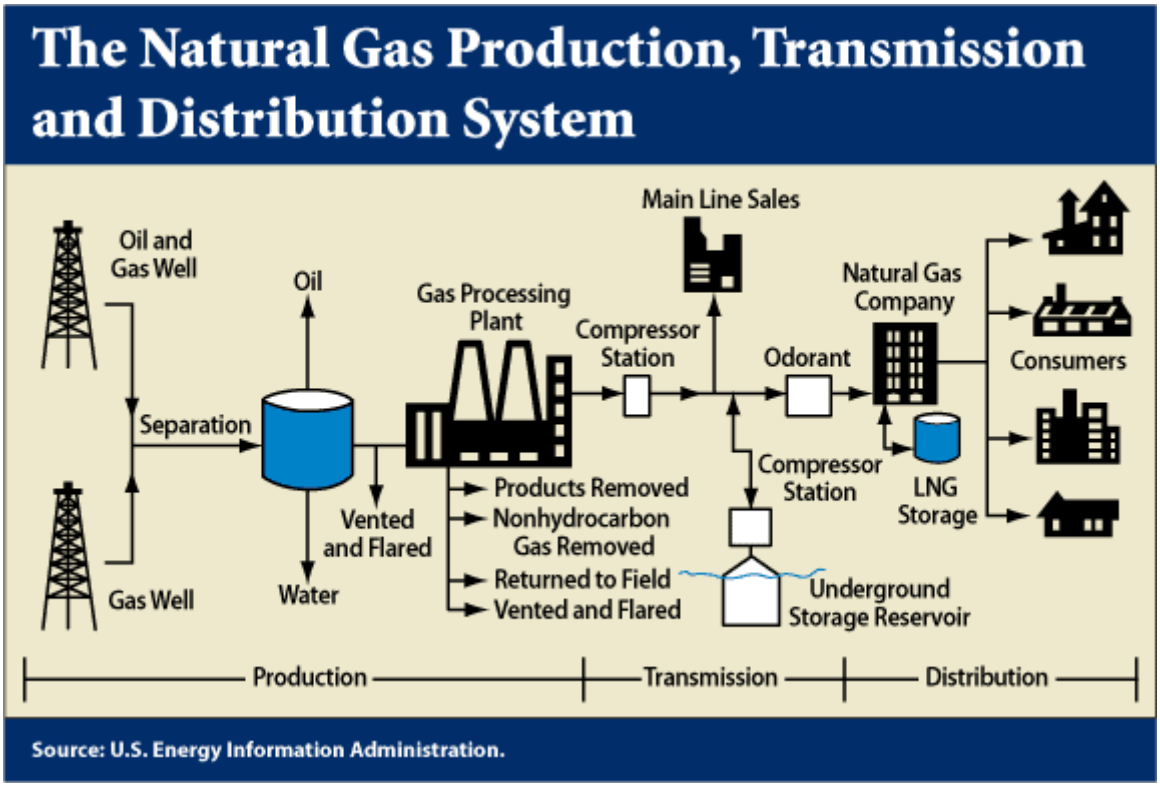

Figure 1 The Natural Gas Production, Transmission and Distribution System.
Source: http://www.window.state.tx.us/specialrpt/energy/nonrenewable/gas.php

3 THREATS OF CBRN WEAPON USING BY TERRORISTS

A terrorist attack using a weapon of mass destruction is one of the most acute threats to international security [2]. Terrorist attacks have become increasingly sophisticated and designed to achieve mass casualties. It is one of the reason of possibility to use nuclear, radiological, chemical and biological (CBRN) weapons of mass destruction (WMD). With a single act, terrorists using a weapon of mass destruction can cause the deaths of thousands, even millions [3].

The consequences of the major CBRN attack would not be immediate. The first effect would be physical damage, but in the wider perspectives it would also have broad repercussions for the economy, for the nation's strategic position in world affairs. These effects would be compounded by an organized campaign of multiple attacks, or if more than one weapon type were used. The severity of the effects would vary greatly with the type and scale of the attack.

There are seven general types of consequences are likely [4]:

- massive casualties,
- contamination,
- panic,
- degraded response capabilities,
- economic damage,
- loss of strategic position,
- social-psychological damage and political change.

The most important consequences of using WMD by terrorists connected with functioning of natural gas production, transportation and distribution systems are:

- casualties in the staff,
- devastation and contamination of the equipment and installations.

The consequences of CBRN using are specific for different kinds of weapon (devices and techniques). Some of them are predictable but basically every new act of terror characterized by new (unexpected) "innovations".

3.1 NUCLEAR WEAPON

A nuclear attack is the use of a device that produces a nuclear explosion. A nuclear explosion is caused by an uncontrolled chain reaction that splits atomic nuclei (fission) to produce an intense wave of heat, light, air pressure, and radiation, followed by the production and release of radioactive particles. For ground blasts, these radioactive particles are drawn up into a "mushroom cloud" with dust and debris, producing fallout that can expose people at great distances to radiation [2].

A nuclear attack could causes substantial fatalities, injuries, and infrastructure damage from the heat and blast of the explosion, and significant radiological consequences from both the initial nuclear radiation and the radioactive fallout that

settles after the initial event. An electromagnetic pulse from the explosion could also disrupt telecommunications and power distribution.

In the natural gas production and distribution system nuclear explosion could destroy (shock wave) the pipelines, equipment and control system which are the key structure in the gas system supply.

Radioactive fallout would contaminate area where the plant is located the authorities will be forced to stop production and close it's to the moment when decontamination will be finished.

3.2 RADIOLOGICAL WEAPON

Radiological weapon, well known as a "dirty bomb" is new type of the weapon which can be used in terrorist attacks. It means radioactive material mixed with conventional explosives. A detonation could release radiation over large areas. The radioactive substances are used in legitimate biological and medical work. Others are unwelcome by-products of nuclear power reactors. It could be real source of radioactive materials for terrorists [2].

After radiological attack, contamination will be the main factor which will decide about possibility of gas production continuation when explosion would spread radioactive materials. The break of production will be connected with range of contamination and big amounts of radioactive substances.

3.3 CHEMICAL WEAPON

A chemical attack is the spreading of toxic chemicals with the intent to do harm. A wide variety of chemicals could be made, stolen, or otherwise acquired for use in an attack. Industrial chemical plants or the vehicles used to transport chemicals could also be sabotaged. Harmful chemicals that could be used in an attack include [5]:

- Chemical weapons (warfare agents) developed for military use.
- Toxic industrial and commercial chemicals that are produced, transported, and stored in the making of petroleum, textiles, plastics, fertilizers, paper, foods, pesticides, household cleaners, and other products.
- Chemical toxins of biological origin such as ricin.

Acutely toxic chemicals can cause injury or fatalities if they are inhaled or absorbed by the skin. The harm that chemicals can cause depends on:

- their degree of toxicity,
- the concentration of the chemical,
- the route of exposure,
- the duration of the exposure.

The symptoms of exposure to most toxic chemicals would appear in minutes to hours.

In the natural gas production and distribution system chemical toxic compounds would contaminate area where the plant is located. The authorities will be forced to stop production and close its to the moment when decontamination will be finished.

3.4 BIOLOGICAL WEAPON

A biological attack is the intentional release of a pathogen (disease causing agent) or biotoxin (poisonous substance produced by a living organism) against humans, plants, or animals. An attack against people could be used to cause illness, death, fear, societal disruption, and economic damage [6].

For an attack on people, biological agents could be disseminated in the dispersal of an agent in air from sprayers or other devices. The agent must be cultured and processed to the proper size to maximize human infections, while maintaining the agent's stability and pathogenicity (ability to produce illness). An aerosol attack might take place outdoors in a populated area or indoors, e.g., in the ventilation system of a building, in the subway, on planes. It takes expertise to process biological agents to maximize the effect of aerosol dissemination, but even relatively crude devices could have an impact.

In the natural gas production and distribution system biological weapon would contaminate area where the plant is located. As in the case of chemical weapon, the authorities will be forced to stop production and close it's to the moment when decontamination will be finished.

4 NATURAL GAS SECTOR PROTECTION

Natural Gas Sector Challenges Protection of critical assets requires both heightened security awareness and investment in protective equipment and systems. One serious issue is the lack of metrics to determine and justify corporate security expenditures. In the case of natural disasters or accidents, there are well-established methods for determining risks and cost-effective levels of investments in protective equipment, systems, and methods for managing risk (e.g., insurance). It is not clear what levels of security and protection are appropriate and cost effective to meet the risks of terrorist attack. The first government responders to a terrorist attack on most natural gas sector facilities will be local police and fire departments. In general, these responders need to improve their capabilities and preparedness to confront well-planned, sophisticated attacks, particularly those involving CNBR weapons.

Fortunately, because of public-safety requirements related to their operations and facilities, the natural gas industries have substantial protection programs already in place. Quick action to repair damaged infrastructure in an emergency can be impeded by a number of hurdles, including the long lead time needed to obtain local or national construction permits or waivers; requirements for environmental reviews and impact

statements; and lengthy processes for obtaining construction rights-of-way for the placement of pipelines on adjoining properties if a new path becomes necessary. The availability of necessary materials and equipment, and the uniqueness of such equipment are also impediments to rapid reconstitution of damaged infrastructure. The current system for locating and distributing replacement parts needs to be enhanced significantly. While newer systems are standardized, many of the older components are unique and must be custom-manufactured.

Moreover, there is extensive variation in size, ownership, and security across natural gas facilities. There are also large numbers of natural gas facilities scattered over broad geographical areas - a fact that complicates protection.

5 CONCLUSION

Using of weapon of mass destruction by terrorists is theoretically possible, and constitutes potential threat for many systems of critical infrastructure. Natural gas production and distribution system is a part of critical infrastructure, sector energy of many countries, which industry is connected with gas using to energy production and in the households.

CBRN threats are potentially dangerous for natural gas industry especially for its technical infrastructure. It will be connected with huge damages of the system elements and significantly influence on the correct functioning of the energetistic system.

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Článok recenzovali dvaja nezávislí recenzenti.