

# INTERNATIONAL METHODOLOGIES FOR CALCULATION & MONITORING OF METHANE VENTING AND FUGITIVES.

## METHODOLOGIES` APPLICATION TO THE NATIONAL OIL INDUSTRY.

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### **ABSTRACT**

Annual increase of oil production in Azerbaijan provides an economy growth of the country but along with the prosperity it brings the barest necessity to maintain the consistent quality of environment. Air emissions, and particularly methane, are one of the most significant environmental impacts associated with oil and gas extraction, processing, refinery and following transportation.

Gaseous emissions are the prioritised area of our environmental expertise and noticeable efforts have been undertaken to improve our mitigation and calculation methodologies. Methane fugitives and methane emissions from venting is a matter of some difficulty from accurate calculation and monitoring point of view and usually the data represented at best can be treated as a general approximation. Despite on relatively low percentages of methane emissions from venting and fugitives within the total volume of emissions, it is required to provide an accurate and systematic methodology for their calculations. This induces us to explore international expertise and existing techniques of methane emissions calculation methodologies.

At these days Azerbaijan is experiencing a second oil boom in its history, which is commemorated by return of international industrial leaders to our country. It is critically important to encourage continuous knowledge exchange between the industrial leaders and host countries where the companies operate. The utilization of best practises has a high importance for Azerbaijan and other post-Soviet republics, where worn-out extracting and refinery equipment together with out-dated oil and gas collection systems resulted in large losses from a methane venting. In 1996, which is considered as a revival period of national oil industry, the releases of VOC-s from oil extraction industry constituted about 200,000 tonnes, VOC-s emissions from refineries were about 45,000 tons (National Environmental Action Plan, Baku –1998. Air pollution. 29 Problems. p.22).

At these days, when our operational scales in the Caspian have expanded and our oil production grows annually, the volumes of gaseous emissions are much higher than those in 1996.

This induced us to carry out an overview of methane sources in Azerbaijan and analyse an opportunities of international experience utilization.

### **1.0 FIRST STEPS FORWARD...**

Azerbaijan inherited from its Soviet past a relatively developed command-and-control system of environmental laws, regulations and institutions, but weak

enforcement capabilities and mechanisms. This has resulted in severe environmental degradation. Since its independence the country has initiated some measures to improve the effectiveness of its environmental management system in terms of air quality improvement and the UN Framework Convention on Climate Change has been signed by Azerbaijan in 1992. The Convention has been ratified by the Azerbaijani Parliament in 1995 and the State Committee was organized with an aim to coordinate implementation of requirements imposed by the Convention.

### **1.1 FIRST NATIONAL REPORT ON CLIMATE CHANGE**

In accordance with the Convention requirements the first stage of "First national report on climate change" project was implemented during 1998-1999 and the second was completed in 2000. Local climate change trends, National Cadastre of methane emissions and the National Action Plan for methane emissions mitigation were developed at the first stage. Current quality of systematic climate change observations and its future potential were assessed at the second stage of the project (National program on sustainable socio-economic development, Baku 2002. 5.1 Climate change, p.14).

### **1.2 PARTICIPATION IN REGIONAL PROJECTS**

Azerbaijan together with other post-Soviet and Eastern Europe countries participates in "Greenhouse gases inventory and its quality enhancement" regional project. The aim of the project is to develop a national professional community for the quality enhancement and includes followings:

- statistical reporting and assessment of methane emissions and establishment of analytic - informational systems about its sources;
- encouragement of sustainable development;
- an assessment of climate change affects to health and development of relevant mitigation measures;
- adoption of progressive environmental technologies (alternative energy sources) in Azerbaijan (National program on sustainable socio-economic development, Baku 2002. 5.1 Climate change, p.14).

## **2.0 METHANE EMISSIONS IN AZERBAIJAN AND COMPLICATIONS ASSOCIATED WITH ADOPTION OF ABATEMENT TECHNOLOGIES.**

According to the article 4.b of the United Nations Framework Convention on Climate Change, as a Party to the Convention, Azerbaijan has to produce and periodically update its national programs on mitigation the impacts of climate change. In this chapter main sources of methane emissions and the work, which has implemented by Azerbaijan in accordance with the article 4.b requirements of the Convention, was analyzed.

### **2.1 SOURCES OF METHANE RELEASE TO ATMOSPHERIC AIR IN AZERBAIJAN.**

Main sources of methane emissions in Azerbaijan are power plants and industry (and its oil sector in particular). Industrial emissions in Azerbaijan are concentrated in Baku and Sumgayit. The primary source of atmospheric pollution is the release of associated gas by the oil industry. The problem is aggravated by worn-out and out-dated collection systems for the oil/gas, resulting in large losses. In the Baku area VOCs from the oil extraction were reduced to about 200 thousands tons in 1996 after

construction of a compressor station that recovers LP gas (National Environmental Action Plan, Baku –1998. Industries, including Oil extraction and Refineries. p.24).

## 2.2. FIRST NATIONAL INVENTORY OF METHANE EMISSIONS.

National inventory of greenhouse gases emissions in Azerbaijan has been conducted in 1990-1994. The year 1990 has been taken as a baseline. Methane and other emissions have been assessed based on the governmental and various ministerial statistics.

All methane emissions sources in Azerbaijan have been split up into the 3 main categories: energy, agriculture and waste.

The results of the baseline study are given in the table 1:

Category	Sources	Years				
		1990	1991	1992	1993	1994
Energy	Fugitive emissions	443.	439	297	238	201.64
	Fuel combustion	4.8	5	6	7	9.1
Agriculture	Enteric fermentation	164.	153	148	141	131.95
	Manure	30	27	30	28	26.47
	Rice cultivation	0.2	0.4	0.3	0.5	0.41
Waste	Solid domestic waste	64	65	66	66	67.04
	Industrial waste water	15	11	3.8	3	2.73
	Sewage	2	2	2.4	2.4	2.93
Total		723	703	553	485	442
Total in CO2 equivalent		15183	14763	11613	10185	9282

Table 1. Methane emissions by category of sources for 1990-1994, Gg (First National Communication to the Conference of Parties, Baku-1995. Methane Emissions. p.33).

## 2.3. INDUSTRIAL VENTING OF METHANE

One of the main sources of methane emissions in Azerbaijan is its venting during extraction, transportation and storage of oil and gas, fuel combustion and flaring. Less concentrations of methane are released during enteric fermentation and manure, rice cultivation, solid domestic wastes, municipal domestic and industrial effluents. In baseline 1990, share of methane in the “energy” category constituted 62% of total methane emissions, of which 99% was the share of fugitive emission and venting, which were formed during extraction, transportation, storage and distribution of oil and gas (First National Communication to the Conference of Parties, Baku-1995. Methane Emissions. p.33).

It has been acknowledged that associated gas is released in a rather big concentrations from onshore and offshore exploratory and production wells.

However due to lack of ministerial and governmental statistical information on volumes of associated gas volume releases no information has been available. As a result methane emissions from this source have not been included into the baseline study statistic database.

Moreover, due to anticipated production increase at existing and large-scale development of new oil and gas fields methane emissions are forecasted to increase by more than 3 times by 2025. Share of methane in total emissions will increase from current rates of 25-30% by 38-40% in 2025 and fugitive emissions will make up 80-85% of total methane emissions (First National Communication to the Conference of Parties, Baku-1995. Forecast of methane emissions, p. 57).

Table below illustrates forecasted methane emissions by the economy sectors.

Categories	Years							
	1990	1995	2000	2005	2010	2015	2020	2025
Baseline scenario								
1. Energy including	448	330	454	951	1515	1614	1704	1817
a) fuel combustion	5	2.8	2.2	3.8	5	5.4	5.9	6.1
b) fugitive emissions	443	327	452	947	1511	1609	1698	1811
2. Agriculture	194	182	186	209	225	232	242	252
3. Waste	81	75	90	93	96	100	104	108
Total	723	587	730	1253	1837	1946	2050	2177

Table 2. Methane emissions forecast by the economy sectors, Gigagram. First National Communication to the Conference of Parties, Baku-1995. Forecast of methane emissions, p. 58).

#### **2.4 EXISTING AND EXPECTED ABATEMENT PRACTICES.**

Current methane abatement technologies shall be directed to reduction of methane losses in the gas production and utilization of associated gas during oil production. This reduction must be achieved through the improvements of the main and distributive networks of the gas pipeline, increase of the quality and maintenance conditions of the pipeline. Reduction of the emissions of natural gas due to these measures may make up 63.7 – 70.7 billion m<sup>3</sup> by 2025 (First National Communication to the Conference of Parties, Baku-1995. Assessment of methane abatement, p. 50).

During the last years a few examples of such improvements in gas networks were established between local and international oil companies operating in the Caspian Sea. For example, excessive associated gas from Chirag 1 offshore platform (operated by bp) has been delivered to SOCAR`s (State Oil Company of Azerbaijan Republic) Oily Rocks offshore facility since 1998. Update of gas compressor station at Oily Rocks has enabled bp to increase volumes of gas export (bp Amoco environmental statement 2002. Impact on air. p.11).

## **2.5. METHANE MANAGEMENT AND ITS COMPLICATIONS**

Our country has experienced a serious lack of statistical data on methane emissions and therefore forecast of these emissions has not been made and the amount of assumed methane utilization has not been included in the overall abatement of GHG. The main reasons of the unavailability of methane related information were legibly pointed out during thematic workshop on greenhouse gases inventories in Baku, Azerbaijan during 7-9 April 1999:

- insufficient level of detail of national statistical data;
- different sector divisions in the IPCC Guidelines and national statistics (e.g. in our statistics, fuel consumption data by residential and commercial sectors are not divided, and data are available only in aggregated form);
- data from specific private enterprises are usually not available;
- it is necessary to use data from different sources and reporting systems;
- necessity of use for reference approach;
- calculation methods and the difference between the results;
- importance of technological aspects in inventories for further mitigation analysis;
- uncertainties of fugitive emissions calculation and reporting. (Thematic workshop on greenhouse gases inventories. Baku, Azerbaijan, 7-9 April 1999. Workshop report. Annex I: Key questions and issues. p.16)

Further improvements in institutional basis and active participation of NGOs in data collection process were actively encouraged by workshop attendees and important recommendations on further disaggregating of emission coefficients and inventory data bank development were made.

## **3.0 UTILIZATION OF INTERNATIONAL EXPERTISE BY AZERBAIJAN.**

Little environmental consideration was given to industrial and energy developments in Azerbaijan, and the consequences were disastrous. The population of major industrial cities suffered from extremely high levels of air pollution. After the collapse of the Soviet Union Azerbaijan has faced with a number of difficulties in its environmental management and these difficulties were mainly associated with lack of integration of its environmental and economic policies. From the first days of independence a significant efforts have been undertaken by Azerbaijani government to integrate national environmental policy into the international one.

In 1994 the Azerbaijani government has signed the Production Sharing Agreement (PSA) with eleven oil companies representing six countries for development of Azeri-Chirag-Gunashli oil fields in the Azerbaijani section of the Caspian Sea. Outstanding experience in environmental management systems together with up-to-date technologies and stable national economy growth has been brought to Azerbaijan by international oil companies. For example, bp Exploration (Caspian Sea) Ltd (this company operates all significant oil and gas projects in Azerbaijan), which has been certified by ISO 14001 environmental management system standard in 2000 classifies air emissions, and greenhouse gases in particular, as the one of the most significant environmental impacts associated with its current operations in Azerbaijan. Close cooperation between local authorities and international

companies is the normal practise for Azerbaijan nowadays. Quarterly environmental sessions with representatives of Ministry of Environment and Natural Resources of Azerbaijan Republic, which are organized by bp Exploration (Caspian Sea) Ltd, are good example of such partnership. Knowledge and opinions exchange on adoption of ISO 14001 standard at national enterprises and emissions abatement technologies (as a crucial part of the environmental management system) are discussed during the sessions. Risks associated with increase of methane concentrations in atmospheric air were discussed during the one of sessions. Experts and specialists from Azerbaijan have received training in the international training centres in Israel, Germany, Russia, United Kingdom and other countries .

#### **4.0 CONCLUSION**

This report summarized main sources of methane emissions in our Republic and practise shows that the methane venting and its fugitives remain to be significant source of environmental pollution. Main purpose was to address issues associated with development and application of methane abatement technologies, its calculation and monitoring methodologies. Analysis of situation shows that additional research and assessments shall be undertaken by Azerbaijan with an aim to mitigate uncertainties and lack of expertise existing in national gas management.

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