WORKSHOP

Modern Technologies of Detection and Elimination of Methane Leakages from Natural Gas Systems

September 14-16, 2005

Tomsk, Russia

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Methane to Markets

Institute Coal and Coal Chemistry
SB RAS

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NaturalGas
EPA POLLUTION PREVENTER

INSTITUTE OF ATMOSPHERIC OPTICS
Siberian Branch of Russian Academy of Sciences

WORKSHOP PROGRAM

September 14, 2005

17:00 – 21:00 Registration, Rubin hotel

September 15, 2005

09:00 – 09:30 Registration
09:30 – 10:00 Workshop opening

10:00 – 10:25 *On Creating a Gazprom Cadastre of Green-House Gas Emissions*
Natalia Gladkaya, Natalia Kruglova
VNIIGAZ (Russia)

10:25 – 10:50 *Development of a Best Management Practice in Canada for Controlling Fugitive Emissions at Upstream Oil and Gas Facilities*
Michael Layer
Environment Canada
David Picard
Clearstone Engineering, Ltd. (Canada)

10:50 – 11:20 Coffee

11:20 – 11:45 *Detection and Elimination of Methane Leakages in Gas Transportation Systems*
Gretta Akopova, Natalia Gladkaya, Yelena Dorokhova
VNIIGAZ (Russia)

11:45 – 12:10 *Methane in the Atmosphere over Russia: TROICA Experiments*
Nikolay Elansky
Obukhov Institute of Atmospheric Physics RAS (Russia)

12:10 – 12:35 *GHG-emissions of Russian Long Distance Gas Transport Pipelines and Options for Mitigation - Based on Results of New Measurements*
Stefan Lechtenböhmer
Wuppertal Instiute for Climate Environment and Energy (Germany)

12:35 – 14:00 Lunch

14:00 – 14:25 *Directed and Inspection Maintenance Programs for Reducing Methane Emissions*
David Picard
Clearstone Engineering, Ltd. (Canada)

14:25 – 14:50 *Cost-Effective Opportunities to Reduce Methane Emissions and Losses at Upstream Oil and Gas Facilities*
David Picard
Clearstone Engineering, Ltd. (Canada)

14:50 – 15:15 *Vapor Recovery Defined*
Larry Richards
Hy Bon Engineering (USA)

15:15 – 15:45 Coffee

15:45 – 16:10 *Evaluation of Methane Flux from Natural Gas Transportation System*
Gen Inoue, H. Suto, K. Ohashi
National Institute for Environment Studies (Japan)

16:10 – 16:35 *Methane Emissions Accounting in GHG Emission Inventory of Power Generating Companies*
Inna Gritsevich
Center for Energy Efficiency (Russia)

16:35 – 17:00 *Re-measurement of the Emissions Reduction*
Bruce Chisholm
(Canada)

17:30 – 19:30 Tomsk sightseeing

September 16, 2005

09:00 – 09:25 *Assessment of Motivations for Saving Methane Emissions in International Oil and Gas Operations*
Don Robison
ICF Consulting (USA)

09:25 – 09:50 *Reducing Methane Emissions Provides Operating Benefits for International Oil and Gas Companies: A Case Study*
Don Robison
ICF Consulting (USA)

09:50 – 10:15 *Discussion of Projects that Achieve Large Methane Emissions Reductions in Oil and Gas Operations*
Don Robison
ICF Consulting (USA)

10:15 – 10:45 Coffee

10:45 – 11:10 *Methane Emission Reduction Techniques at TransCanada PipeLines*
Hasan Imran
TransCanada PipeLines, Ltd

11:10 – 11:35 *The Inventory and Natural Gas Leakage Removals at the Compressor Stations and Line Valves at the Management of Main Gas Pipelines of CherkassyTransGaz*
Elena Mandra, Natalia Novakovskaya
CherkassyTransGaz (Ukraine)

11:35 – 12:00 *Detection of the methane emissions throng the water and soil surfaces*
V. Kapitanov, N. Krivolutsky, Yu. Pomomarev, I. Tyryshkin
Institute of Atmosphere Optics SB RAS (Russia)

12:00 – 12:25 *Laser Leak Detectors*
A. Karapuzikov, I. Shestov, K.V. Bychkov, V.A.Vasiliev
Institute of Laser Physics SB RAS (Russia)
V. Kapitanov, Yu. Ponomarev, B.G.Ageev
Institute of Atmoshphere Optics (Russia)

12:25 – 14:00 Lunch

14:00 – 14:25 *Greenhouse Gas Emission Assessment Methodology at Gazprom Units*
Gretta Akopova, Natalia Gladkaya
VNIIGAZ (Russia)

14:25 – 14:50 *Diode Laser Methanometers*
A. Nadezhdensky, A. Berezin
Instrument Design Center, General Physics Institute RAS (Russia)

14:50 – 15:15 *Opportunities for Project Finance Through the International Carbon Market*
Stanislav Potapenko
QualutyTonnes (USA)

15:15 – 15:40 *Influence of the Spectroscopic Information Accuracy in Tasks of Methane Monitoring*
M.Yu. Kataev, A.V. Nikitin
Institute of Atmoshphere Optics SB RAS (Russia)

15:40 – 16:10 Coffee

16:10 – 16:35 *Using GIS Technoligies for Assessment of Methane Emissions from Antropogenic Sources*
Vadim Potapov
Institute of Coal and Coal Chemistry SB RAS (Russia)

16:35 – 17:00 *ICF Consulting's GHG Emissions Management System (GEMS™)*
D.R. Robinson, V.V. Aggarwal, B.W. Gillis, A.G. Sankovsky
ICF Consulting (USA)

17:00 – 17:25 *Development of JI Projects Design Documents*
Oleg Tailakov
NPO Uglemetan (Russia)
Vladimir Berdin
UNDP (Russia)

18:00 – 20:00 Workshop dinner

ABSTRACTS

On Creating a Gazprom Cadastre of Green-House Gas Emissions
Natalia Gladkaya, Natalia Kruglova
VNIIGAZ (Russia)

О создании «Кадастра выбросов парниковых газов» ОАО «Газпром»
Н.Г. Гладкая, Н. Ю. Круглова
ООО «ВНИИГАЗ» (Россия)

According to expert appraisals, the national gas sector shares over 10% of all emissions of greenhouse gases in equivalent of CO_2. The Federal Law of 4 November 2004, No. 128-F3, "Ratification of the Kyoto Protocol to the UNO Framework Convention on climate change" necessitates Russia to create a state system of evaluating man-caused emissions of greenhouse gases till 2007. The preparation of national cadastre of man-caused greenhouse gases emissions is of the first priority. It should be noted that national cadastres must be based not on national statistical data but on summary data on emissions for different economy sectors on corporative level.

In Gazprom's daughter companies and organizations the inventory of greenhouse gases and research of this problem have been carried out since 1992. In 2004, by request of GAZPROM, specialists from VNIIGAZ developed a standard of the company, namely Gazprom's corporative Cadastre of greenhouse gases emissions. This standard is the first document of a complex of standards of GAZPROM in the field of formation and conduction of the Cadastre. The document is directed to the increase in confidence and simplification of processing data on emissions of greenhouse gasses formed during production, transportation, storage, processing and distribution of natural gases. The paper details the standard and includes the description of methods and methodology, which were used for drawing up the standard. The main targets and ideas of this document and plans directed to its further development and improvement are also described.

Development of a Best Management Practice in Canada for Controlling Fugitive Emissions at Upstream Oil and Gas Facilities

Michael Layer
Environment Canada
David Picard
Clearstone Engineering, Ltd. (Canada)

Разработка оптимальных методик управления в Канаде для контроля утечек на нефтегазовых объектах

Майкл Лэйер
Энвайронмент Канада
Дэвид Пикард
Клирстоун Инжиниринг Лтд. (Канада)

The Canadian Association of Petroleum Producers (CAPP) and the Small Explorers and Producers Association of Canada (SEPAC), with support from Environment Canada and Alberta Energy Utilities Board (EUB), are developing a Best Management Practices (BMP) document to assist the Upstream Oil and Gas industry in managing fugitive emissions. The BMP is due by December 31, 2005 and will target sources that are most likely to contribute significantly to fugitive emissions and which would be most cost effective to address. Once a BMP document has been developed by CAPP and SEPAC, the EUB will reference the BMP in Directive 60 which will likely require licensees to develop and implement a leak detection and repair program for the UOG industry to minimize fugitive emissions from UOG facilities. Follow-on studies are planned in 2006 and 2007 to validate and refine the BMP.

The requirement for fugitive emission management programs is becoming a common condition of operating approvals and reflects the importance of controlling these emissions from the perspective of resource conservation, local air quality control and climate change. Key elements of the BMP project will include delineating the sources of fugitive emissions and their relative contributions, highlighting strategies for achieving significant cost-effective emission reductions (e.g., through improved designs, directed inspection and maintenance practices, improved operating practices and the application of new and retrofit technologies), and summarizing key considerations and constraints.

Detection and Elimination of Methane Leakages in Gas Transportation Systems
Gretta Akopova, Natalia Gladkaya, Yelena Dorokhova
VNIIGAZ (Russia)

Обнаружение и устранение утечек метана при транспортировке природного газа
Г.С. Акопова, Н.Г. Гладкая, Е.В. Дорохова
ООО «ВНИИГАЗ» (Россия)

Development and introduction of a monitoring and accounting system of gas leakage volumes at the gas industry facilities and also development of mechanisms to reduce such gas leakage based on energy-saving and energy-efficient processes is one of the primary tasks facing Gazprom in the framework of the Kyoto protocol provisions.

Gazprom's specialists jointly with foreign partners have carried out experimental investigations at six facilities (compressor stations and adjoining linear trunk gas pipeline portions) of four gas-transport enterprises. Investigation tasks included acquisition of extensive and reliable data on Russia's gas-transport system on methane leakage and natural gas consumption for own needs and reliable assessment of specific and absolute methane emissions from organized sources and leakage from Gazprom's representative facilities. In-situ measurements to assess methane emission were performed using up-to-date experimental methods for measuring natural gas leakage (remote and contact), methodical recommendations and techniques.

Greenhouse gas emission from compressor stations and linear trunk gas pipeline portion may be divided into emission related to process blowouts and unplanned methane emission due to possible technical failures. In the course of investigations, estimated were the methane blowout volumes during process blowing and leakage from various process equipment at Gazprom's facilities. The measurements showed that the fuel gas consumption at the facilities under investigation amounts to 90-99% of the total gas consumption for own needs. Gas consumption for process needs (blowing) at the facilities being investigated is 1.5-10%; compressor stations account for a third of this quantity. It was determined through direct methane leakage measurements that approximately 72-97% of the total leakage volume are bleeder valve leaks, and majority of them are related to compressor stations.

The results of experimental investigations and extrapolation calculations made possible to assess the total methane emission from Gazprom's gas transmission facilities with high degree of reliability. It was established based on the results of the performed investigations that methane emission may be reduced through utilization of gas consumed for the compressor station process needs, and also by promptly detecting and eliminating methane leaks.

On the whole, the measurements and calculations have proved, that, above all, leakage and blowouts from the compressor station equipment due to technical failures, and, to a lesser extent, because of gas pipeline valve leakage are the main emission sources. Methane emission in case of planned blowouts and repairs is insignificant. The investigations demonstrated that the total methane emission, as a whole, for Russia's Unified gas-supply system does not exceed 1% of the transported gas volume. This value is at the level of the leading world gas transmission systems.

Methane in the Atmosphere over Russia: TROICA Experiments
Nikolay Elansky
Obukhov Institute of Atmospheric Physics RAS (Russia)

Метан в атмосфере над Россией: эксперименты «TROICA»
Н.Ф. Еланский
Институт физики атмосферы им. А.М. Обухова РАН (Россия)

The "Transcontinental Observations Into the Chemistry of the Atmosphere (TROICA)" experiments started in 1995. The mobile railroad laboratory was used for the atmospheric gases, including methane, aerosols, solar radiation and meteorological parameters measurements. It was coupled to a passenger trains just after an electrical locomotive and went along electrified railroads of Russia. Eight experiments were done between 1995 and 2004: seven along the Trans-Siberian railroad from Moscow to Khabarovsk (on of them to Vladivostok) and one in meridional direction between Murmansk and Kislovodsk (three trips). Into the frame of TROICA-5 the boarding down the Ob river with reactive gases measurements and air sampling for methane the stationary measurements in the transition period (spring) were conducted at the stations located at different levels in the Northern Caucasus, in the Central European Russia and in Cola Peninsula. In 2004 the new railroad observatory for the atmospheric chemical composition and environment pollution was constructed. In March-April 2004 it was tested at Trans-Siberian Railroad between Moscow and Khabarovsk. The mobile observatory is being planned to be the one of the components of the Russian Atmospheric Watch system, which should be developed in the country in near future. The main technical means of the mobile platform are presented.

The review of the most important results on the CH_4 distribution over continental Russia experiment is given. The main feature is the enhanced CH_4 concentration over Western Siberia. At the Southern part of that region the whole excess is formed is formed by biogenic emissions from swamps and wet land. To the center of the West Siberia the input of anthropogenic sources is grows and reach 50% of the excess.

The local increasing of CH_4 concentrations is connected with industrial objects and towns, forest fires and links from gas-pipelines.

The CH_4 emissions from soils were estimated for different seasons and regions using ^{292}Rn data.

In the report the future programme of TROICA experiments with use of new observatory is presented. It includes the observatory to be used for ecological education purpose as well.

GHG-emissions of Russian Long Distance Gas Transport Pipelines and Options for Mitigation - Based on Results of New Measurements

Stefan Lechtenböhmer
Wuppertal Instiute for Climate Environment and Energy (Germany)

Устранение эмиссии парниковых газов на российских газопроводах на основе результатов новых измерений

Стефан Лехтенбёмер
Вуппертальский институт климата, окружающей среды и энергии (Германия)

Russia is the worlds largest producer of natural gas and also maintains one of the worlds largest long distance pipeline systems (153,000 km of gas mains) in order to transport the gas from the fields in Western Siberia to the consumers in Central and Western Europe.

In the last decade the role of natural gas in the European energy market is increasing. In particular regarding the GHG emissions, natural gas is seen as an appropriate means to supplement the climate change policy of increasing energy efficiency and switching to renewable energy sources. The direct GHG emissions are far below the ones of other fossil fuels like coal and oil. However the indirect upstream emissions of the imported energy can have significant impact on the GHG-ranking of energy carriers.

This is why the question of the emissions of the upstream gas process chain was and is still under discussion. In particular it's focussed on the role of imported Russian gas, which is 40% of the gas used in the European Union. A distance of more than 5000 km has to be covered from the production in West-Siberia to the user in Mid-Europe.

Therefore a comprehensive measurement campaign at the Russian Northern and Central export pipelines was carried out by Wuppertal Institute in cooperation with Max-Planck Institute for Chemistry in 2003/2004. Aim of the campaign was the closing of the existing gaps in available data and to improve the knowledge of the situation in the gas export grid in Russia.

We investigated 5 compressor stations in 4 different regions, including around 50 machines of different types and ages, hundreds of valves and adjoining pipelines. Therefore, the obtained data was representative and was extrapolated for the whole gas-export system to Europe. The extrapolation was done by using Monte Carlo method for uncertainty analysis.

Subsequently, using the comprehensive Gazprom-data-set on planned emissions (operation, maintenance, repairs and accidental losses) and energy use for compressor drives, a complete GHG-inventory of the gas-export system was established.

Overall, the new measurements confirmed that the CH_4 emissions from the Russian natural gas export network are below 1% of throughput. They emit during production, processing, transport and storage and are somewhat below the level found by previous measurements. In fact around 2/3 of the total GHG-emissions (CO_2 equivalent) are CO_2 emissions from the compressor drives. The emissions from leakages derive mostly from compressor machines and only little from pipelines.

Due to technical and organisational measures the emissions have decreased since the mid-nineties, but there's still a huge potential and options for mitigation. Especially the improvement of the efficiency of the compressor drives and the implementing of regularly emission-monitoring are possible options – also for JI projects – in the future.

Directed and Inspection Maintenance Programs for Reducing Methane Emissions
David Picard
Clearstone Engineering, Ltd. (Canada)

Механизмы получения прибыли за счет снижения утечек метана на нефтегазовых объектах
Дэвид Пикард
Клирстоун Инжиниринг Лтд. (Канада)

Extensive measurement work has been done in the United States and Canada to quantify the benefits of conducting directed inspection and maintenance programs at oil and gas facilities. Some of this work has evolved into a more holistic approach aimed at maximizing the impact and cost-effectiveness of control efforts by also considering energy efficiency improvements and flare/waste gas reduction. Preliminary findings of this work are presented.

Cost-Effective Opportunities to Reduce Methane Emissions and Losses at Upstream Oil and Gas Facilities

David Picard
Clearstone Engineering, Ltd. (Canada)

Экологически эффективные возможности снижения эмиссии и потерь метана на нефтяных и объектах

Дэвид Пикард
Клирстоун Инжиниринг Лтд. (Канада)

The results of recent emission and energy management audits conducted at upstream oil and gas (UOG) facilities in North America show a variety of different cost-effective opportunities to reduce methane losses and GHG emissions in this sector. The types of control opportunities evaluated include management of fugitive equipment leaks, vent and flare gas recovery or reduction, controlling avoidable inefficiencies in compressors, optimizing the optimizing the performance of natural gas fueled process equipment (i.e., engines, heaters, boilers and incinerators), and overall process optimization. Preliminary results of this work and recommendations for a optimal holistic approach are presented.

Vapor Recovery Defined
Larry Richards
Hy Bon Engineering (USA)

Проблемы конденсации газов
Ларри Ричардс
Хай-бон Инжиниринг (США)

A trip through any of the oil producing areas in North America, or throughout the world, illustrates that the majority of the produced oil finds its way into bulk storage tanks at some point in time. What many producers do not know is that the gas which flashes off these tanks is some of the most valuable natural gas produced on the lease. Besides being an environmental hazard and regulatory concern, these "fugitive" emissions usually average 2,500 BTU content, compared to typical pipeline gas at 1,000 BTU. On a MMBTU contract, that makes this gas worth 2.5 times the value of normal produced gas. Additionally, these vapors contain varying amounts of methane, ethane, isopentane, propane and butane which contribute to the API gravity of the crude. Dissipation of these products to the atmosphere on a conventional tank battery means a reduction in gravity of the liquid in the tank, thereby decreasing its value.

The volume of natural gas produced depends on the volume of oil cycling through the tanks, the composition of the crude stream, the operating pressure of the separators dumping to the tank, the tank configuration, and seasonal daily temperatures. Vapor recovery units (VRUs) are designed to capture these vapors and turn them into an additional income stream while minimizing regulatory and liability exposure. These units are designed to comply with EPA standards, provide additional profits to the oil producer and eliminate the emission of stock tank vapors to the atmosphere. Many operators haven't reviewed VRU payback economics since gas pricing was at $1.50 per mcf and internal company economics were based on $.75 per mcf gas. The combination of technological advancements in vapor recovery – coupled with $6 per mcf gas prices – have many producers across the country scrambling to capture this unrealized revenue stream.

Evaluation of Methane Flux from Natural Gas Transportation System
Gen Inoue, H. Suto and K. Ohashi
National Institute for Environment Studies (Japan)

Оценка выбросов метана при транспортировке природного газа
Ген Иноуэ, Х. Суто, К. Охаши
Национальный институт экологических исследований (Япония)

The Greenhouse-gases observing satellite (GOSAT) is shceduled to be launched in 2008 as the joint project among Ministry of Environment, National Insitutite for Environmental Studies and Japan Aerospace Exploration Agency). The sensing method is a nadir looking near-infrared Fourier transform spectrometer observing the surface scattered solar radiation. And both carbon dioxide and methane are the target species.

The spectrometer has three bands, 0.76 mμ for O_2, 1.6 μm for CO_2 and CH_4, and 2.0 μm for CO_2. The field of view is 10.3 km. The spectral resolution is 0.2 cm-1 and SNR is expected to be 200 at one spectromter scan. The column concentration is expected to be retrieved from a spectrum with the precision of 0.3% in a clear sky condition, which means that the aerosol and/or cloud disturbances are small.

The orbit type of this satellite is polar orbit synchronizing with the sun, and the local time of observation is set at 1 p.m. The recurrent rate is three days, and the spacing of tracks is evry 10 degrees in longitude. The orbit altitude is 666 km.

There is a pointing mirror system to make the cross the truck scanning or the sun-glint observation depending on the mission. The operations pointing at a spot or scanning around a spot are possible as well.

The precision of 0.3% for the atmospheric methane column concentration corresponds to the 5 ppb in full column. The minimun detectable concentration difference within the boundary layer of 1,000 m will be 50 ppb if the concentration above is assumed to be homogeneous.

It is interesting to evaluate the possiblity of methane leakage detection by this satellite. If the methane plume spreads to the size of 10 km in width under the horizontal wind velocity of 100 m/day, the methane leakage from natural pipeline at the rate of about 25t CH_4/day will be detactable with a fair precision in the targetting mode. This amount is the more than the leakage from one compressor station reported in Russia.

Methane Emissions Accounting in GHG Emission Inventory of Power Generating Companies
Inna Gritsevich
Center for Energy Efficiency (Russia)

Проблемы учета выбросов метана при инвентаризации источников выбросов ПГ в энергетике
И.Г. Грицевич
ЦЭНЭФ (Россия)

Methane is a component, though not very substantial, of greenhouse gases emitted in course of various hydrocarbon organic or non-organic fuels (coal, natural gas, petroleum products, biomass, etc.) combustion in power and heat generation. Methane emissions result from partial carbon oxidization while combusting hydrocarbon fuels, but no direct metering of methane content in waste gases exists in Russia and its' emissions should be calculated. So the main problems of correct methane accounting related to fuel combustion are connected to assessment of a percentage of non-oxidized carbon, inclusion or non-inclusion it in accounting of CO_2 emissions. Meanwhile there is no full agreement among experts about scale of carbon non-oxidization in particular cases/technologies/facilities.

When a standard IPCC methodology (Tier 1) and software with default emission factors are used no risk of double counting occur. Spreadsheets for calculation of CO_2 emissions provide numbers for a percent of non-oxidized carbon for each fuel and source category. Default emission factor for methane emissions calculations takes these percentage into account.

When specialized methodologies for CO_2 and methane emissions calculations for companies and concrete facilities are developed an attention should be paid to double counting of carbon emitted with CO_2 and methane. These methods are based usually on data for chemical and specifically carbon content from direct measurements or from detailed reference manuals, from calorimetric measurements of energy content and technological parameters of boilers, etc. They combine those data and correspondent calculations with the IPCC approach for non-CO_2 emissions in various ways. As a result there is a chance for overestimating of methane emissions.

Some examples and recommendations to minimize risk of double counting in case of natural gas and mazut are given and discussed in the presentation.

Re-measurement of the Emissions Reduction
Bruce Chisholm
(Canada)

Повторные измерения объемов снижения эмиссии метана
Брюс Кисхольм
(Канада)

Using Commercial Off-the-Shelf Technology for Monitoring and Verification Abstract Monitoring and verifying the steps taken to reduce emissions of greenhouse gases will become an ever-increasing requirement in the industry, especially as carbon taxes and emissions trading programmes have begun.

The author's discuss the use of commercially availabie software to automatically monitor using sensors, the actual production and loss of greenhouse gases from pipeline and processing systems. In some cases, monitoring of actual release is difficult due to the expense of sensing and monitoring equipment.

In these cases, operating and maintenance practices must be employed.

Adherence to standard operating practices is notoriously difficult to monitor and verify. The author's discuss use of commercially available software and hardware that has been successfully used for many years to assist in the collection of such information and its use by the industry to demonstrate compliance to OSHA and FDA regulations and other international regulations,

This paper also discusses the software technologies developed by Honeywell to "merge" and integrate the automatically collected data with the manually collected data and make accessible over the Internet, new metering systems that measure vent and flare line flows and how the combined systems can be used to detect, measure and record valve related and other leak sources.

Assessment of Motivations for Saving Methane Emissions in International Oil and Gas Operations

Don Robison
ICF Consulting (USA)

Анализ стимулов снижения эмиссии метана в международной нефтегазовой промышленности

Дон Робинсон
Ай-Си-Эф Консалтинг (США)

The Methane to Markets Partnership has identified numerous solutions to reduce methane emissions from crude oil and natural gas systems. Many, but not all, of these solutions depend on revenue from selling the saved gas to pay back the investment. The present business climate for the oil and gas industries in countries transitioning to market economies, such as Russia, Ukraine, and Poland, dictates that a specific subset of solutions is potentially more attractive. These countries qualify for the Kyoto Protocol Joint Implementation mechanism, which provides a means of attracting investments of capital and technology from developed nations in exchange for Emission Reduction Units (ERUs, or carbon credits). This paper identifies and assesses the benefits which may motivate projects to reduce methane emissions in such countries, using Russia as a particular example.

Reducing Methane Emissions Provides Operating Benefits for International Oil and Gas Companies: A Case Study

Don Robison
ICF Consulting (USA)

Уменьшение эксплутационных издержек путем снижения эмиссии метана на примере международных нефтяных и газовых компаний

Дон Робинсон
Ай-Си-Эф Консалтинг (США)

Methane to Markets programs have identified a broad range of solutions to reduce methane losses from oil and natural gas systems. Many of these solutions have economic benefits beyond the increased revenues of selling the gas saved. This paper shows how project economics can be evaluated in various scenarios that do not provide gas sales revenues. Specific projects are presented which have decreased operating costs, reduced labor requirements, less capital cost when replacing equipment, increased safety, or increased reliability.

The business environment of the oil and gas industries in Russia provides a good basis for illustrating the alternative economics of the selected projects. For example, taking advantage of widely distributed electric power can realize operating savings. New compressor seal technology can reduce maintenance and downtime, increasing throughput in existing systems. State-of-the-art gas treatment processes can decrease capital and operating expenses. New pipeline repair tools and practices can minimize repair times, increase safety, and reduce skill level of labor.

Disscussion of Projects that Achieve Large Methane Emissions Reductions in Oil and Gas Operations

Don Robison
ICF Consulting (USA)

Обсуждение успешных проектов снижения эмиссии метана в больших объемах в нефтегазовой промышленности

Дон Робинсон
Ай-Си-Эф Консалтинг (США)

Globally, many oil and natural gas operators employ a number of technologies and practices ьwhere saved gas can be sold in markets instead of vented or leaked to the atmosphere. Even where markets are fixed, operators can economically install new equipment and initiate new practices when existing equipment wears out and when new operations come online.

New installations or upgrades to pneumatic devices, and other equipment result in less methane venting and reduced operating expenses. Operators from a variety of countries also see benefits from periodic leak inspections, which can be performed using technology ranging from simple soap solutions to infrared leak imaging cameras.

Many operators have found that a vapor recovery unit installed on liquid storage tanks can be the centerpiece for recovering a broad range methane emission sources. A host of process vents can be routed to the vapor recovery compressor rather than vented to the atmosphere – including natural gas powered pneumatic devices, dehydrator vents, compressor seals and pig receivers.

Methane Emission Reduction Techniques at TransCanada PipeLines

Hasan Imran
TransCanada PipeLines, Ltd.

Технологии снижения эмиссии метана компании Трансканада Пайплайнс

Хасан Имран
Трансканада Пайплайнс Лтд. (Канада)

TransCanada is a leading North American Energy Company focused on natural gas transmission and power generation services. Climate change continued to be a key environmental and business issue for TransCanada. TransCanada has spent considerable effort and resources in identifying and controlling GHG emission. TransCanada emits as a result of its operations three GHG emissions, CO_2 & N_2O from the combustion of fuel and methane as a result of venting and fugitive losses. This paper outlines TransCanada's Methane Emissions Management Program.

There are mainly two types of emissions from the transmission of natural gas, Fugitive Emissions and Blowdown Emissions. Fugitive Emissions are small methane leaks from pipeline equipment, such as flanges, valve stems, leaking tube fittings as well as engineered releases like compressor seals, analyzers etc., related to pipeline operations. Emissions of this type are continuos and account for about 76 percent of TransCanada's total methane emissions, or 8% of the company's total GHG emissions. Blowdown Emissions account for 23% of total company's methane emissions. In 2004, TransCanada's Fugitive Emissions Management Program consisting of LDAR (leak detection & repair) and HFS (high flow sampler for leak quantification program) resulted in GHG emission savings of 137,000 tonnes (equivalent to 325 mmcf natural gas) for our Canadian pipeline system. Total of 725,000 tones of carbon dioxide equivalent emissions savings made through blowdown emission management.

Other emission reduction programs at TransCanada Pipeline includes special techniques of repairing pipeline while gas is flowing are i) Buttering and Hot Tapping ii) Stopple Plugs and Valves iii) Repair Sleeves. Some of these are pioneered at TransCanada through our R&D projects.

Research & Development projects underway for reducing emissions includes Biofiltration for methane oxidation, use of Gas-gas ejector for Dry gas seal methane emissions from Centrifugal compressors and Fuel cells for remote facilities power supply are some of the area TransCanada is investigating.

The Inventory and Natural Gas Leakage Removals at the Compressor Stations and Line Valves at the Management of Main Gas Pipelines of CherkassyTransGaz

Elena Mandra, Natalia Novakovskaya
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Инвентаризация и устранение утечек природного газа на компрессорных станциях и линейных кранах УМГ «Черкассытрансгаз»

Елена Мандра, Н.Ф. Новаковская
Черкассытрансгаз (Украина)

Project "Program on energy saving and environment protection", which won the grant "Ecolinks" in 2001 provides natural gas leak detection, instrumental measurement of their volumes, leakage removals and second instrumental measurement at 2 compressor stations.

The works concerning the project were performed in 2002. Reducing leakages at 2 compressor stations compiled 1954 thousand m^3 per year, which is approximately $101,300 (at $51,7 per 1 m^3).

Detection of the methane emissions throng the water and soil surfaces
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Выявление эмиссий метана через водную поверхность и почву
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The goal of this work is the development of the method and techniques for measuring of the methane fluxes throng the water and soil surfaces.

An improved version of the methane worked out at the Institute of General Physics RAS, based on a near IR diode laser and a multi-path cell, was used. Main specifications of the detector were identified just at the place of measurements. The discretization period was 12 s, which at the vessel's average speed of 16 km/h corresponded to spatial distribution of about 50 m. The device calibration was made using the nitrogen-methane mixture with the methane concentration of 2 ppm. Zero was determined via blowing the analytical cell by pure nitrogen. A long-term stability, stipulated by the zero drift, was significant and made a value of the order of ± 0.5 ppm for 5 hours. To take it into account, an hourly zero correction has been conducted. The threshold sensitivity (mean deviation for 1 hour) made 0.037 ppm; the time of the air total change inside the analytical cell (accounting for the pump capacity and the cell volume) was 99 s.

The results of the testing of this methane detector on the Baikal lake and in Kemerovo region are presented and discussed.

The authors are very grateful to Dr. A. Nadezhdinskii for his constant support of this activity.

Laser Leak Detectors

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Лазерные течеискатели

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The monitoring of gases leakages in real time mode remains by an actual problem despite of an abundance of semiconducting and other sensors for various gases. The photo-acoustic detectors (PAD) can register an absorption in gases at a level 10^{-8} – 10^{-9} cm^{-1} and have high speed characteristic for optical methods. These qualities allow to create laser devices for highly local detecting and identification of impurities in the atmosphere, monitoring of gas outflow, leak check of gas and vacuum system.

The design features and outcomes of researches of a number of detectors for monitoring of gases leakages and realization of local gas analysis of the atmosphere are represented in the report. The devices are created because of original resonance differential PAD capable operate at air test flow rate up to 0.8 LPM. As a light source tunable waveguide RF excited CO_2 laser operated on 60 – 70 generation lines with output power of 0.5 – 3 W or its modifications are used.

The limit sensitivity of developed PAD has made (2 – 5) x 10^{-9} cm^{-1}. The measurements were carried out using N_2 + 0.1% SF_6 gas mixture at atmospheric pressure on 10.492 μm wavelength (P10 line).

For leak monitoring of various gases and check of volumes on tightness it is offered to use the impurities of tracer gases that have a strong absorption lines on wavelength of laser source radiation. The authors added 0.1% SF_6 to nitrogen or hydrogen for places and intensity of leakage from vessels and pipelines under increased pressure of these gases. The limit sensitivity of an experimental sample of Laser leak Detector has made ~ 2 x 10^{-9} Pa · m^3/sec (~ 2 x 10^{-8} cm^3/s) with pure SF_6, what exceeds similar magnitude of serial Halogen Leak Detector (~ 1 x 10^{-7} Pa · m^3/s) also comparable with sensitivity of Helium Leak Detector (~ 1 x 10^{-9} Pa · m^3/s) operated in reverse stream mode. The device is ready for operation in some seconds after switch on that favorably distinguishes it from Halogen and Helium Leak Detectors.

Greenhouse Gas Emission Assessment Methodology at Gazprom Units
Gretta Akopova, Natalia Gladkaya
VNIIGAZ (Russia)

Методология оценки объемов эмиссий парниковых газов от объектов ОАО «Газпром»
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After ratification of the UNO Framework Convention on Climate Change and the Kyoto Protocol (Federal laws Nos. 34-F3 and 128-F3) Russia assumed some obligations and opened new market opportunities that can be transferred into the area of responsibility and used in the interest of economy sectors being suppliers of emissions of greenhouse gases, including Gazprom.

Indispensable condition of nature conservation activity under the UNO Framework Convention and the Kyoto Protocol is inventory of emissions of greenhouse gases the methodical base of which are recommendations of intergovernmental group of experts on climate change.

The inventory of emissions of greenhouse gases from Gazprom's facilities started in 1992. This process is being carried out step-by-step in two directions of emission formation:

- As a result of HC fuel usage
- In the process of manufacturing operations and due to leakage

The inventory is performed with the help of emission coefficients and three-level evaluation of emission volumes.

The first and second levels were performed for Gazprom during the period between 1996 and 2004 on the basis of data on gross volumes of products output and volumes of fuel consumed.

The third level ("bottom-up" disaggregated inventory) is the estimation of emission volumes based on actual data of each enterprise, process, type of equipment, etc.

To provide a required degree of reliability of the disaggregated inventory coefficients of greenhouse gases emissions are been developing on the basis of data of instrumental measurements carried out at representative facilities.

The disaggregated inventory of methane emissions resulted from technological purging and leakages has been carried out at some representative facilities of Tyumengazprom, Severgazprom, Mostransgaz and Permtransgaz

Diode Laser Methanometers
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Лазерные метанометры на диодных лазерах
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Opportunities for Project Finance Through the International Carbon Market
Stanislav Potapenko
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Возможности финансирования проектов через международный углеродный рынок
С.А. Потапенко
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Mr. Potapenko would like to give a presentation on the status of the international carbon trading market, particularly as it relates the Joint Implementation program in Russia and other countries. Mr. Potapenko will discuss the work of the World Bank and other major buyers of carbon emission reductions in Russia and what opportunities may exist for gas companies in Russia that could potentially sell the credits generated from lower greenhouse gas emissions. In addition, Mr. Potapenko will review some of the requirements of selling such credits, such as developing a credible baseline, outlining a strong additionality argument and designing an accurate and precise monitoring plan. Mr. Potapenko will describe some of the baseline/monitoring methodology efforts for projects under the Clean Development Mechanism related to natural gas. For example, QT developed a CDM methodology (which some JI buyers prefer to use because of the credibility afforded by the rigorous CDM approval process) for reducing leaks in gas pipeline compressor and gate stations. This methodology, now approved by the CDM Executive Board, provides the outline for determining an accurate baseline (including filtering out leaks that might have been fixed anyway and would thus not be considered "additional") as well as a credible monitoring protocol. This method may be a model for gas companies in Russia, again because many JI buyers like to see an approved CDM methodology applied to JI projects. In addition, QT will describe another methodology approach currently underway for a project in Georgia. This project will rehabilitate a pipeline itself (not just compressor stations). The objective of the presentation will be to show the audience how to develop a GHG-reduction project and how to "bring those credits to the market" thus creating a "carbon asset" that can generate revenues each year until the end of the first Kyoto period.

Influence of the Spectroscopic Information Accuracy in Tasks of Methane Monitoring
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Влияние точности спектроскопической информации в задачах мониторинга метана
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Atmospheric Methane (CH_4) is a very important molecule for a variety of applications, from its role in global warming in the earth's atmosphere, to the industry. Spectral windows from NIR to IR at 1.6 μm, 2.0 μm, 3.3 μm and 10 μm are of particular interest for the remote monitoring of Methane from Earth, satellites, balloon or airborne platforms in vertical and horizontal atmospheric paths using absorption spectroscopy. A precise knowledge of the absorption line parameters (line center, strength and halfwidth) are need for an accurate gas concentration retrieval. Absolute accuracy of the CH_4 concentration determination depends on the accuracy of spectral parameters taken from the HITRAN spectral database or other type of spectral databases (for example, GEISA). Besides on accuracy is influenced the absorption bands of isotopes and weak absorption lines. All these factors are determine the spectroscopic accuracy of gas concentration retrieving by any absorption methods.

There has been a great number of spectroscopic experimental work for the Methane, but analysis of the measurement spectrum is difficult by it complexity. It is on of the reasons why in spectroscopic databases present absorption lines with the great error (up to 50% in worst case) in parameters. In the report, on the example of an atmospheric transmittance calculation on various atmospheric paths, influence of the spectroscopic information on monitoring of Methane by various methods of measurement (for example, diode-laser and CO_2-laser gasanalyzers, the satellite) is shown.

Using GIS Technoligies for Assessment of Methane Emissions from Anthropogenic Sources
Vadim Potapov
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Применение ГИС-технологий для оценки эмиссии метана из пространственно-распределенных антропогенных источников
В.П. Потапов
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ICF Consulting's GHG Emissions Management System (GEMS™)
D.R. Robinson, V.V. Aggarwal, B.W. Gillis, A.G. Sankovsky
ICF Consulting (USA)

Оценка выбросов метана на основе применения компьютерной программы GEMS™
Д.Р. Робинсон, В.В. Аггарвал, Б.В. Гиллис, А.Г. Санковский
Ай-Си-Эф Консалтинг (США)

The natural gas industry is a major source of methane emissions – a significant greenhouse gas (GHG). General approaches used today to estimate emissions from natural gas systems (including those used in IPCC guidelines) are based on EPA/GRI's 1996 study: "Methane Emissions from the Natural Gas Industry." This study developed emissions factors for natural gas system operations, e.g. dehydration, compression etc., that bundled different technologies and processes. These bundled factors – adequate for estimating total emissions – are less useful if companies intend to design an emissions reduction management program.

ICF Consulting's "GHG Emissions Management System" (GEMS) allows users to build GHG emissions inventories in a way that users can plan economic reductions. GEMS structures methane emissions inventories by source and technology. Users can estimate emissions reductions, costs, and economics of alternative technologies and evaluate benefits of trading carbon reductions. GEMS presents outputs at facility, business unit and corporate levels. One of the U.S.-based international gas company currently uses GEMS.

Development of JI Projects Design Documents
Oleg Tailakov
NPO Uglemetan (Russia)
Vladimir Berdin
UNDP (Russia)

Опыт разработки проектно-технической документации для выполнения проектов совместного осуществления
О.В. Тайлаков
АНО «Углеметан» (Россия)
В.Х. Бердин
ПРООН (Россия)

Growing market of emission trading provides additional opportunities for improving efficiency of different Russian industry sectors. Development of JI projects could also provide social, ecological and economical benefits for all parties participating in the projects. In the presentation, the authors are discussing different procedures of JI projects registration in Russian Federation and provide comprehensive analyses of existing barriers for development of methane emission reduction projects.

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