Mitigating the environmental impact

The LOTOS Group’s Business Strategy for 2011-2015 envisages that we will exclusively endorse environmentally friendly technologies, based on the best solutions available, with characteristically low emissions and highly efficient production processes.

In line with its strategic objectives, the LOTOS Group is especially concerned with gas emissions, which are the most critical source of environmental nuisance, both for the immediate environment of the LOTOS Group’s plants and other areas located further away. This particular focus does not only stem from legal regulations in this area or from our own wish to reduce negative impact on the Company’s immediate natural environment. An essential role is also played by the economic aspect, just as the Polish and EU laws have been designed to ensure that in the long run reduced emissions and lower emissions by industrial plants will bring measurable financial benefits. In fact, all technological changes in the LOTOS Group are planned to meet the criteria of the Best Available Techniques (BAT), which in most cases, is associated with the fulfilment of the conditions specific to the three areas mentioned earlier.

As far as emissions from industrial plants are concerned, stakeholders take the greatest interest in greenhouse gases, including carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), fluorinated hydrocarbons (HFC), perfluorinated hydrocarbons (PFCs) and sulphur hexafluoride (SF₆). It is commonly believed that the excessive emission of these gases into the atmosphere is one of the main causes of the currently observed global warming. In order to counteract global warming, a number of agreements and protocols have been established, which oblige the participating countries to reduce their emission of greenhouse gases to a specific level in a given period. The main document regulating the reduction of greenhouse gas emission is the Kyoto Protocol, the first version of which was negotiated in 1997. The document came into force in 2005 after being ratified by 141 countries.

A direct consequence of the Kyoto Protocol for the European Union is the introduction of the emissions trading system (ETS/EU ETS), in which Grupa LOTOS, LOTOS Asfalt, RCEkonergia and Energobaltic have actively participated from the very beginning, successfully meeting its requirements and abiding by its restrictions. The general idea behind the ETS is to motivate plants to reduce emissions in one of several possible ways, which involve the need to purchase fewer emission allowances, and thus bring specific economic benefits.

In order to standardise the method for determining emissions levels in the EU, the industrial plants that participate in the ETS are obliged to perform measurements and report emissions in one of the recommended ways. As far as burning of fuels and processing of feedstock (considered mainstream emissions) is concerned, Grupa LOTOS uses the calculation-based methodology. With this purpose in mind the entire refinery has been included in the system of detailed measurement of burnt fuel and processed feedstock. To determine emissions on the basis of a selected methodology we need precise data regarding the quantity of fuel and feedstock and also their properties, such as calorific value and emission factor, which are analysed on a regular basis by our accredited laboratory in the LOTOS Lab. On the other hand, we use the reference emission factors for the components of the de minimis emission source stream (for example, diesel oil from aggregates or combustion of residual gases), as required by the legal regulations, whose measurements do not have to be as highly accurate as the main components’. One of the previously mentioned greenhouse gases, released by Grupa LOTOS installations in large amounts, is carbon dioxide. In 2010-2012, carbon dioxide emissions totalled 6,681 thousand tonnes.

### Type of CO₂ emissions in Grupa LOTOS

<table>
<thead>
<tr>
<th>Emissions [thousands of tonnes per year]</th>
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</tbody>
</table>
Direct emissions are understood as all sources of greenhouse gas from the burning of fuels and feedstock processing which are controlled within an organisation’s boundaries (e.g. through chimneys), whereas indirect emissions are a consequence of activities conducted outside of organizational boundaries (e.g. using purchased electricity, heat, steam, company cars or emissions related to business trips). The only significant source of indirect emissions in Grupa LOTOS is in the purchase and use of electricity.

One of the issues frequently discussed in relation to the excessive emission of greenhouse gasses observed on the global scale is the characterisation of the emissions throughout the product’s entire life cycle, i.e. from its extraction to its final consumption by the end user. Grupa LOTOS has set up a special team to investigate this problem. Despite the lack of regulations establishing a methodology for calculating the reduction of greenhouse gas emissions in the life cycle of fuels, there are plans to try to reduce the emissions of these substances throughout the process.

A significant contribution to the refinery’s impact on the natural environment is also made by such gases and substances as nitrogen dioxide (NO₂), sulphur dioxide (SO₂), and particulate matter (PM). Attempts to control and reduce these emissions to the atmosphere are not only motivated by our care for the environment, but also by concern for the health and lives of people excessively exposed to these contaminants. In Grupa LOTOS, nitrogen dioxide, sulphur dioxide and particulate matter emissions from the CHP plant’s emitter are measured continually by on-line analysers, while emissions from the emitters at the refinery installations, are monitored based on cyclic measurements, carried out in accordance with applicable reference standards.

<table>
<thead>
<tr>
<th>Substance</th>
<th>Pollution emissions in Grupa LOTOS [tonnes per year]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2010</td>
</tr>
<tr>
<td>SO₂</td>
<td>$E_s$</td>
</tr>
<tr>
<td>NO₂</td>
<td>1,315</td>
</tr>
<tr>
<td>PM</td>
<td>260</td>
</tr>
</tbody>
</table>

$E_s$ - actual level of emissions from Grupa LOTOS installations  
$E_d$ - permissible level of emissions

The increase in the emissions of these three substances in 2010-2011 from Grupa LOTOS installations, and the fact that in 2012 carbon dioxide emissions were maintained at the same level, is a result of the intense expansion of the Gdańsk refinery, taking place since 2008. At the end of 2010 and the beginning of 2011, the last installations built under the 10+ Programme were made operational, significantly increasing the amount of crude oil processed and the depth of its processing, but also the amount of substances emitted to the atmosphere.

An increase of emissions alone cannot be treated as a determinant of the emission efficiency of industrial installations. As announced in the previous year, in 2012 we introduced a number of significant technological changes at the Grupa LOTOS refinery, which considerably reduced emissions despite growing throughput. The most important changes were:

- **Use of natural gas as fuel to produce steam** in the power plant’s boilers – natural gas is a clean, high energy fuel and allows for a significant reduction in emissions;
• **Use of natural gas to produce hydrogen** – increasing the efficiency of the process and thus reducing the amount of feedstock consumed;

• **Increased the flow of natural gas to the fuel gas network** – ensuring a constant supply of this feedstock to the technological network of the refinery allowed for an increased amount of it to be added to the fuel gas network, at the same time reducing the use of heavy fuel oil, resulting in lower emissions of SO₂ from the refinery.

The legitimacy of the introduced technological changes is confirmed by the reductions in the emission of air pollutants, as listed below:

<table>
<thead>
<tr>
<th>Emission reduction in Grupa LOTOS in 2012</th>
<th>CO₂</th>
<th>SO₂</th>
<th>PM</th>
<th>NOₓ</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>tonnes/year</td>
<td>tonnes/year</td>
<td>tonnes/year</td>
<td>tonnes/year</td>
</tr>
<tr>
<td>Replacement of fuel oil with an injection of natural gas to the fuel gas network</td>
<td>35,000</td>
<td>1,200</td>
<td>140</td>
<td>170</td>
</tr>
<tr>
<td>Replacement of fuel oil with natural gas in the CHP plant</td>
<td>20,000</td>
<td>300</td>
<td>20</td>
<td>70</td>
</tr>
<tr>
<td>Replacement of light gasoline/LPG with natural gas in the HGU</td>
<td>45,000</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100,000</strong></td>
<td><strong>1,500</strong></td>
<td><strong>160</strong></td>
<td><strong>240</strong></td>
</tr>
</tbody>
</table>
Connecting the Grupa LOTOS refinery to a high pressure natural gas network has had an important ecological and economic effect, and was also beneficial in terms of energy efficiency. Liquid fuel energy obtained from processed petroleum was partly replaced by gas fuel, and extensive replacement of liquid fuels has reduced the use of steam necessary for the preparation of liquid fuels for combustion. The ongoing optimization of the fuel distribution system is aimed at maximising the use of available gas fuel.

The Company is also undertaking initiatives aimed at supplying energy efficient products with use of solutions that reduce energy requirements. In 2012, together with control engineering specialists, the Energy Efficiency Team supervised the modernisation of the Visual MESA computer system, which provides visualisation and optimisation of energy consumption. The system continually supervises the power infrastructure of the refinery – both the gas and fuel oil systems and also the technological steam system – and on the basis of optimisation algorithms, it suggests changes in the energy system which will reduce its operating costs. Wider access to information in this system is one of the benefits of the modernisation. As gas fuel was introduced to the refinery, an updated logical model of the fuel distribution system was also introduced in the Visual MESA system.

In order to reduce indirect use of energy, the refinery’s technical services have initiated a pilot project for replacement of 15 lighting fixtures with energy-saving LED lamps. This project has been extended to the external lighting of the plant’s roads and

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**A hundred thousand tonnes of CO₂ less**

Implementation of the project to supply natural gas to the Grupa LOTOS refinery and to the CHP plant means a change from our traditional heavy fuel oil, to a solution not only economically viable but also characterised by low emissions and contributing to considerable reduction of our refinery's environmental impact. By supplying high pressure natural gas we will not only meet current, but also the future standards included in the announced changes to environmental law, which from 2016, will treat the emission of energy pollution very restrictively.

The scale of the benefits that we owe to this solution is clearly reflected in the results we managed to achieve after just the first few months of its use. The fuel gas system has been fed natural gas since May 2012, the hydrogen generating plant since June, and the two boilers of the CHP plant since September and November, while the changes in emission levels of the three basic air pollutants and carbon dioxide – greenhouse gas – are already measured, depending on the type of pollution, in hundreds and thousands of tonnes. This demonstrates the scale of our reduced impact on the environment.

Initial data shows that the most significant reduction has been noted in the case of greenhouse gases. Our estimate is that once all the investment projects being part of our programme to limit the carbon dioxide emissions are completed, we will reach emission levels typical of the best European refineries. These are the levels we took into account when determining the ‘refinery benchmark’, decisive in the process of allocation of free emission allowances for the period 2013-2020. The benchmark was calculated as the average of the best 10% of refineries, and is 29.5 kg CO₂/CWT, where CWT (Complexity Weighted Tonne) measures the production capacity of a refinery at a standard level of performance.

As far as our installations are concerned, the allocation of free allowances is most likely to cover the emission of 12,757,000 tonnes of CO₂ for the entire third trading period, or until 2020. This would necessitate purchasing additional allowances on the market, up to 200,000 a year. It is important to remember that in the current trading period of the CO₂ emissions trading system, Grupa LOTOS will be treated as one installation. A draft listing of installations with a preliminary estimate of their allocation of free emission allowances, prepared by Poland, is currently being evaluated by the European Commission.

It gives me great satisfaction to point out that in the last few months we have taken a big step closer to the benchmark for the best refineries in Europe. This is a good portent for the coming years, when we will try to use natural gas as a source of energy and as feedstock for the production of hydrogen.
lighting fixtures with energy-saving LED lamps. This project has been extended to the external lighting of the plant’s roads and yards, and also serves to accumulate experience with the reliability and servicing of energy-saving light sources.

In the next few years we are also planning other projects aimed at lowering the environmental nuisance of the refinery in Gdańsk.

One of these is the **construction of an installation to make use of flare gases**, which began towards the end of 2012. Burning hydrogen in flares is probably one of the most glaring examples of wasting raw materials. Globally, a huge amount of natural gas is wasted during the crude oil extraction process because of a lack of facilities to collect and reuse it. At Grupa LOTOS we place great importance on minimising the amount of hydrocarbons burnt in both flares and those emitted directly to the atmosphere.

<table>
<thead>
<tr>
<th>Source</th>
<th>Amount of discharge – amount of flared gas at Grupa LOTOS [thousand cubic metres per year]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2010</td>
</tr>
<tr>
<td>Flare 3500</td>
<td>35,834</td>
</tr>
<tr>
<td>Flare 3550</td>
<td>6,780</td>
</tr>
<tr>
<td>Total</td>
<td>42,614</td>
</tr>
</tbody>
</table>

The clear majority of gases sent for burning are nitrogen and hydrogen. In order to fully illustrate the actual impact of the refinery’s flares on the surrounding environment we need to list the amount of discharged gas with the resulting carbon dioxide emissions.

<table>
<thead>
<tr>
<th>Source</th>
<th>Amount of emissions in Grupa LOTOS [tonnes CO₂ per year]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2010</td>
</tr>
<tr>
<td>Flare 3500</td>
<td>29,138</td>
</tr>
<tr>
<td>Flare 3550</td>
<td>3,371</td>
</tr>
<tr>
<td>Total</td>
<td>32,509</td>
</tr>
</tbody>
</table>

The data confirms the efficiency of the introduced optimisation processes, resulting in a reduced amount of generated gases that are not successfully utilised. Once the installation for redirection of discharge gases is completed, today’s most noticeable element of the Gdańsk refinery will be much less evident; in fact, the flame will be visible very seldom and only in certain exceptional cases. Up to 80% of all gases sent to the flare collector will be compressed and redirected to the fuel gas network. The investment will also reduce the intensity of noise emitted by the installation.

Another pro-environmental investment planned for 2013 is the **replacement of process** furnaces in the light gasoline hydrefining installation, and in the furfurol extraction installation, which will considerably enhance the energy efficiency of both installations, effectively increasing their overall productivity and reducing the amount of emitted pollutants.

The last of our short-term plans is the **construction of a new, larger vapour recovery unit (VRU)** in place of the old installation which will be removed. This will finalise the process of minimisation of fugitive hydrocarbon emissions from the five dispensers in the area of the refinery.

It needs to be emphasised that the Company does not use any ozone depleting substances and that the utilisation of the Gdańsk refinery’s products does not cause emission of these compounds into the atmosphere.

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**Other initiatives**
Grupa LOTOS minimises its adverse impact on the environment by carrying out a number of investment projects and implementing systemic solutions. We regularly carry out the following activities:

- Continuous monitoring of emissions and pollutants emitted into the air and water, and of carbohydron levels in the vicinity of the company,
- Discharging wastewater of a quality fully compliant with applicable regulations after processing in the three-stage wastewater treatment plant,
- Use of treated wastewater to produce industrial water,
- Use of condensate to produce boiler feedwater,
- Strict supervision of waste management,
- Use of equipment designed to help protect the environment, such as:
  - Double sealing system for tanks with floating roofs,
  - Ensuring air tightness of all process facilities and their connection to the emergency discharge system, where hydrocarbons are burned in flares,
  - Ensuring that all road tankers and railway tank-cars are filled using the airtight vapour recovery system,

Grupa LOTOS’ withdrawal of water from the Motława river through the storage reservoir in Przejazdowo has no significant impact on the environment. The amount of fresh water that can be withdrawn is limited by the conditions specified in the integrated permit granted to Grupa LOTOS. There is no evidence either of a decrease in water volumes in the sources used, lowered water surface level, decreased water flow, or any other negative changes in the ecosystems of the reservoir.

In an effort to reduce its negative impact on the environment, Grupa LOTOS strives to maintain the growing share of recyclable water in the total amount of water consumed in production processes. With this purpose in mind, we are continually reducing the volume of withdrawn water and discharged wastewater. Recyclable water, in this context, is understood as the sum of the volume of process water produced from treated wastewater and the volume of treated condensate from the installation.

Wastewater from Grupa LOTOS’ wastewater treatment plant, such as oily rainwater, technical and sanitary wastewater, is mostly redirected to be reused as industrial water, and it is only the excess of treated wastewater which is discharged to the Martwa Wisła river. The treated rain and drainage waters are released to the Rozwójka river, which flows to Martwa Wisła.

Management of waste generated in the Company is carried out in compliance with EU and national regulations, ensuring maximum safety for the environment. Waste is segregated and stored in designated areas throughout the refinery. As far as waste management is concerned, in the first place we make every effort to limit waste and reduce it as much as possible. We also make sure that recycling compliant with the principles of environmental protection is the main method of managing the waste that is produced. We commission disposal of waste only as a secondary measure.

Many of the LOTOS Group companies’ products are neutral to the environment. They do not have a negative impact on the environment either in the production process or after they are used. Packaging used to introduce these products on the market is similarly neutral. In accordance with applicable regulations, the LOTOS Group companies have contracted Recycling Organizations for recovery and recycling of packaging introduced onto the national market. This obligation applies in particular to LOTOS Asfalt, LOTOS Oil and LOTOS Paliwa.

LOTOS Asfalt products, such as bitumen and heavy fuel oil, are mostly supplied in tankers. Tar papers are among the packaged products sold. In 2012, the share of individually packaged products sold was below 1% of the company’s total sales volume. Altogether, the packaging waste recovery rate of the company was 57%.

At LOTOS Oil, recovery and recycling rates achieved in 2012 by the Recycling Organization contracted by the company were as follows: recovery rate of 50%, including 35% recycling rate. In the case of plastic packaging, paper and cardboard, steel, and wood, the waste recycling rate was 20%, 56%, 42%, and 15%, respectively. Altogether, the recovery rate for packaging waste at LOTOS Oil was 57%, including a 45% recycling rate.
In 2012, LOTOS Paliwa introduced organisational changes involving takeover of the central management of service station shops, meaning that since 2013 it has been obliged to manage its own packaging recovery. The company is currently in talks with Recycling Organizations to contract packaging recovery for the next few years.

Both Polish and European regulations are very specific as to what type of activities a plant has to carry out to provide an effective safety system and what steps must be taken to prevent serious failures. In this connection, Grupa LOTOS has put in place a safety system that features mechanisms for systematic identification of failure risks or the likelihood of their occurrence. The system also include manuals for safe operation in standard conditions, temporary production breaks, or for monitoring of the plant in a manner allowing for corrective actions in case of any incidents deviating from standard procedures.

A number of procedures for effective prevention of emergencies have been introduced within the Integrated Management System. Some of the essential elements ensuring effectiveness are:

- Proper response training for emergencies and critical situations;
- Corrective and preventive actions;
- Prevention of emergencies, preparation for possible emergencies and accidents at work;
- Emergency response;
- Evaluation of the effectiveness of emergency prevention measures and minimisation of consequences;

The effectiveness of the safety measures in place at Grupa LOTOS is proved by the fact that there were only three cases involving hazardous substances reported in 2012. It should be noted that investigation confirmed no violation of environmental standards in any of the cases. Additionally, no leakages were reported that would cause any environmental pollution or affect the local community.

An equally important area of LOTOS Group activities aimed at minimising its negative environmental impact are transport services, usually rendered to our companies by external firms. This is particularly relevant to LOTOS Asfalt, LOTOS Oil and LOTOS Paliwa, which commission transport of their products to specialised carriers. LOTOS Kolej, on the other hand, provides transport services to LOTOS Group companies and other external entities. In the LOTOS Petrobaltic Group the situation with its marine transport, handled by one of its subsidiaries, is similar. Grupa LOTOS undertakes various steps to limit its fleet's impact on the environment.

It is Grupa LOTOS’ aim to ensure the lowest possible emission of harmful fumes from its company vehicles while still using them to their maximum capacity. When choosing a vehicle we consider its fuel consumption and engine parameters to make sure they meet vehicle emission standards. Consequently, in 2012 a year-on-year increase of 36% in fuel consumption was reported for vehicles that meet the Euro 5 standard, and a year-on-year drop of 60% in fuel consumption by vehicles that meet the Euro 4 standard and older. In 2012, fuel consumption of company vehicles was 190,000 litres as compared to the 173,000 litres used in 2011 and 167,000 litres used in 2010. The extra fuel consumption is a result of the increased number of company vehicles used in the company.

LOTOS Asfalt products are reloaded in modern handling terminals, where harmful vapour emissions are minimised. Asphalt is supplied to the end user by specialist transport companies which meet the highest environmental protection and operating standards. Additionally, the company’s own vehicles, which are regularly modernised, meet the Euro 5 exhaust emissions standards. Proper insulation of road tankers significantly prevents fuel products' temperatures from rising in transit, which also contributes to lower environmental pollution. In 2012, road tankers carried over 660,000 tonnes of company products and burned approximately 4 million litres of Diesel oil, covering more than 11 million kilometres. In 2011, they carried over 764 thousand tonnes of bitumen and burned 6 million litres of Diesel oil, covering a distance of more than 17 million kilometres. In 2010, they carried 640,000 tonnes of bitumen and burned 6 million litres of Diesel oil, covering a distance of almost 16 million kilometres. In 2010, the company began shipping bitumen by sea, with the reloading figures reaching over 90,000 tonnes a year. In 2011 and 2012, the annual reloading figures reached a level of 100,000 and 60,000 tonnes, respectively. With a higher share of sea transport in the total transport volume, the economies of scale make it possible to reduce both harmful environmental emissions and fuel consumption per unit of shipped cargo.
In LOTOS Kolej, 2012 was another year in which the share of electric traction in the overall transport figures grew. The company continued to systematically modernise its motive power units, which resulted in further reduction of the consumption of engine fuels and reduced emission of harmful fumes and noise by locomotives. At the end of 2012, LOTOS Kolej operated 98 locomotives, including 59 electric locomotives.

The 8.4% rise in traction electricity used by LOTOS Kolej in 2012 compared to 2011 is chiefly attributable to the increased share of electric traction transport.

Every year a fall in the consumption of unleaded fuel used for non-traction purposes is noted in the company, and today its entire fleet of vehicles meets the requirements of Euro 4 or Euro 5/A.

In LOTOS Oil, the transport of goods is commissioned to providers of transport or forwarding services whose customer service and environmental protection standards meet the highest quality requirements. For piece-goods transport, the ISO 14001 certification is required. Transport companies have a system in place which enables them to monitor the use of basic supplies and materials and control any possible leakages or emergencies. In addition, LOTOS Oil operates on the basis of its own internal procedures, which impose a duty of research in land transport on the specific dangers of its activities, and ensure that road transport as well as loading and reloading of hazardous goods is supervised and conducted in accordance with legal regulations. The company has no data available with regard to the consumption of fuel by its carriers as it is particularly difficult to calculate since part of the transport is carried out in the intermodal and piece-goods systems.

The transport of liquid fuels sold by LOTOS Paliwa has been commissioned to specialist companies: LOTOS Kolej for railway transport and other external transport companies for road transport. Out of a total of 4,620,000 cubic metres of fuel sold in 2012, 9% was transported by railway tankers and 25% by road tankers. The balance was collected from storage terminals by the customers’ own means of transport. For the purpose of comparison, in 2010-2011 railway transport was used in 11% and 12% of deliveries respectively, and road transport remained at 25%. Road and railway transport of fuels is strictly regulated by Polish and international regulations on the transport of hazardous materials (ADR and RID), aimed at minimising the negative impact of their transport on the environment. The company also undertakes many additional activities that increase the transport safety of its products. In 2012, only two fuel spills were reported in road transport, none in 2011 and three in 2010. None of the spills were environmentally harmful.

LOTOS Petrobaltic Group's marine transport services are handled by Miliana Shipmanagement, which uses its fleet to transport materials, supplies and crew to the LOTOS Petrobaltic oil platform. Miliana Shipmanagement manages six sea vessels, and if required, charters additional units to supervise transportation operations during periods of intense activity on the platform. In 2012, the company chartered out two additional vessels. These were the tugboats Bazalt and Granit, which were used to transport supplies and take waste and pollution from the platforms back to land for disposal, and as backup facilities for diving works. The crews of the platform and the Icarus III tanker are mostly transported by the vessel Aphrodite I.

Both the tugboats are powered by low-sulphur Diesel oil, which complies with the requirements of Annex VI to the Marpol Convention 73/78, and have documents confirming their compliance with Stage IIIA - European emission standards for non-road diesel engines. All contaminants and waste from vessels are taken back to land for disposal or treatment. Waste management on the vessels is carried out in compliance with the waste management plans approved by the Polski Rejestr Statków (Polish Register of Shipping). The natural environment is mostly affected by the emission of exhaust fumes from the fuel used to power sea-going vessels, in this case Marine Gas Oil (MGO).

Energobaltic does not have its own product transportation base and so it commissions this part of its operations to transport companies that have all the necessary qualifications and licenses for the transport of such products as LPG (liquid hydrocarbons - propane-butane) and KGN (natural gas condensate). Transport of these products requires use of methods compliant with the regulations on the transport of hazardous goods.

One of the most important elements in minimising the impact of exploration and production operations on the natural environment is protection of the sea from possible pollution by the extracted oil and substances accompanying the drilling process, and limiting to the minimum the effects of emergency situations on the environment.

LOTOS Petrobaltic has an Oil Spill Response Plan in place for spills resulting from the exploration and production that it
conducts within its licence areas. The plan has been approved by the Maritime Office in Gdynia, and is part of the National Plan to Combat Pollution of the Marine Environment. One of the most important activities ensuring the cleanliness of the environment and minimisation of negative impact is environmental monitoring, which is the study of the environment before, during and after operations. In this case, environmental monitoring is mostly focused on testing sea water and bottom sediment.

Proper management of waste from platforms and seagoing vessels is also very important, given the total ban on discharge of any waste or pollutants, both process and sanitary. Chemicals used in the drilling process circulate within a closed system, away from any contact with the environment. In order to ensure that the arrangements set out in the Baltic Sea Action Plan are followed, in 2012 LOTOS Petrobaltic completed assembly and start-up work on an installation for pumping formation waters after the process of separation back up to the structure, using the secondary exploitation method consisting in injecting water back to the field in order to maintain pressure in the formation. Since October 2012, all formation water has been pumped back up to the structure. A detailed marine environmental impact assessment report is also prepared by the company every year.

In other LOTOS Petrobaltic Group production companies, a detailed environmental impact analysis is made prior to extraction works that defines the actions to be taken to mitigate the negative impact of the works, environmental compensation and other parameters.

The raw materials used in exploration and production are those substances used in the drilling and acquisition process.

In drilling, these include:

- Drilling mud components (materials),
- Cement used for binding piping to the drilled rock.

Drilling mud components are brought to the platform where they are added to water to obtain drilling mud of the required physical and chemical properties. The drilling muds used by LOTOS Petrobaltic and LOTOS Geonafta are water-based. In 2012, LOTOS Norge used oil-based drilling mud, which was dictated by the specific nature of their drilling. The main ingredients of drilling mud are bentonite or metal salts (KCl, NaCl), with barite or galena as weighting agents. Various other chemical substances are added to achieve the required properties.

Uses of drilling mud:

- Bringing up rock drillings from the bottom of a borehole,
- Creating a protective layer on drilled rock to prevent excessive filtration of water into the rock layer,
- Powering a hydraulic engine (turbodrill) in directional drilling.

The main raw materials used in resource acquisition:

- Chemical substances (materials) added to the formation and produced water pumping system,
- Materials used as filter inserts (anthracite, ground nut shells, gravel of different grain size, metal and fibrous filter inserts).

Formation water is a saturated brine, mostly chlorine, sodium and calcium in content.

From the point of view of environmental protection, injecting water back into a deposit does not pose any environmental threat because the applied pressure is lower than the fracture pressure of the rock layer, and so does not affect its structure.

However, the appearance of water in the extracted crude oil introduces the problem of its disposal or recycling by further technological process. So far, the main method of managing this highly mineralised formation water, extracted together with the oil, consists in separating it from the oil in separators, and discharging it back into the sea after cleaning it to a level below 15 ppm of oil components (in accordance with the requirements of MARPOL 73/78 and HELCOM).

In order to protect the Baltic Sea and to meet stringent environmental requirements that dictate a total ban on the discharge of waters, including treated formation water, directly into the sea, LOTOS Petrobaltic built an installation which pumps the
produced waters back into the field. As such, since October 2012 all formation water has been pumped back to the field it came from, together with the sea water. This solution does not interfere with the marine environment or with the formation of the oil-yielding fields, but merely returns the extracted substance.

Water parameters around the platforms are continually monitored in order to ensure that they meet the requirements of environmental regulations. Regular monitoring of multiple parameters, including hydrocarbon content in the water, chemical and biological oxygen demand, chlorides, sulphides, bacteria, surfactants and others, is carried out for the purposes of environmental protection.

The cementing process uses water-based grouts with chemical additives which delay the setting time. The purpose here is to merge the casing pipes with the drilled levels, prevent contact between drilled rock layers of different pressure gradients, and ensure the tightness of the non-pipe area to prevent the overflow of drilling mud or extracted agents during operations.

The drilling process is similar in other companies - parameters are monitored before, during and after drilling, in accordance with the relevant environmental decisions and approvals. Any variations that occur are due to country-specific regulations. The Baltic Sea is particularly sensitive, and the regulations governing it are more rigorous than in the North Sea, for example, where oil-based drilling mud is used.

The main source of energy used on drilling platforms is Diesel oil, supplied by ships as well as the natural gas extracted together with the oil.

On the Petrobaltic platform, energy is generated by a system of power engines and generators running on Diesel oil, which meets the legal requirement to keep sulphur content below 1%. Energy generated in this way is then distributed throughout the platform. On the Baltic Beta platform, energy is additionally generated by gas turbines powered by gas separated from crude oil. One turbine is used to supply energy across the Baltic Beta platform and the PG-1 platform, while a second turbine powers the pump which forces water back down to the field. In LOTOS Geonafta and LOTOS Norge, energy on the rigs is produced by diesel generators.

Water for the needs of the LOTOS Petrobaltic platform is extracted from a deep well, for which the company holds the required permit. The amount of water drawn is closely monitored and remains below permitted values. Water is also taken from the municipal water supply system and from the Baltic Sea, mostly for technological purposes, such as the formation water pumping system and cooling of the gas compression system.

Experts consider the Baltic Sea to be a particularly sensitive area because of its high level of pollution and limited water exchange within the basin, and also because of the presence of rare species like the harbour porpoise.

The amount of water drawn from the Baltic Sea for the purposes of LOTOS Petrobaltic is negligible in relation to its total water resources of 21,727 km³ and amounts to 311,972.3 m³ (0.000311 km³).

It should also be noted that none of the other oil extracting companies within LOTOS Petrobaltic Group are depleting water resources through excessive withdrawal.

Water is also used on the platforms for sanitary and technological purposes. In addition to fresh water, sea water is also used for production purposes, for example in the water injection system. This water is drawn directly from the sea by deep-well pumps.

The Diesel-powered internal combustion engines of the energy generation system, the steam boilers and crane engines are all sources of greenhouse gas emissions. On the Baltic Beta platform, gases are emitted by the turbines running on gas separated from crude oil. An additional source of greenhouse gas emissions comes from the gas flared on the platform. On the Baltic Beta platform, most excess gas is compressed and returned to shore where it is used for powering other turbines, hence flaring is reduced to a minimum. All the gas produced on the Petrobaltic platform is burned in flare stacks that are designed to minimise the emission of harmful substances.

Carbon dioxide is the only greenhouse gas emitted by Energobaltic. All of its CO₂ emissions come from the combustion of natural gas and fuel oil in the production of electricity and heat. LOTOS Geonafta's operations are a source of relatively low emissions of harmful substances into the atmosphere, coming mainly from the power generators operating the drilling equipment. According to the Lithuanian legal system, the company is not legally obliged to collect nor report data on the amount of CO₂ emissions. The volatile organic compounds are also emitted while burning diesel fuel to run the generators.
Emissions in LOTOS Norge are produced by diesel-powered generators present on the oil platform.

**CO₂ emissions [tonnes] in 2012:**

<table>
<thead>
<tr>
<th>Company</th>
<th>Emissions [tonnes]</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOTOS Petrobaltic*</td>
<td>368</td>
</tr>
<tr>
<td>LOTOS Norge</td>
<td>1,639</td>
</tr>
<tr>
<td>Energobaltic</td>
<td>12,320</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>14,327</strong></td>
</tr>
</tbody>
</table>

* Emissions excluding marine activities – activities within the Polish Economic Zone are not subject to reporting to the National Centre for Emissions Balancing and Management (KOBiZE).

In LOTOS Petrobaltic, the emission of substances such as nitrogen and sulphur oxides is mainly due to the combustion of fuel oils. It needs to be emphasised that none of the emissions produced by LOTOS Petrobaltic Group companies contains ozone-depleting substances.

<table>
<thead>
<tr>
<th>Substance</th>
<th>LOTOS Petrobaltic *</th>
<th>LOTOS Geonafta</th>
<th>LOTOS Norge</th>
<th>Energobaltic</th>
<th><strong>Total</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>SO₂</td>
<td>0.007</td>
<td>0.4</td>
<td>1.5</td>
<td>0.1</td>
<td>2.007</td>
</tr>
<tr>
<td>NO₂</td>
<td>0.3</td>
<td>4</td>
<td>36.2</td>
<td>11.9</td>
<td>52.4</td>
</tr>
<tr>
<td>VOC</td>
<td>-</td>
<td>100</td>
<td>2.6</td>
<td>-</td>
<td>102.6</td>
</tr>
<tr>
<td>PM</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>0.2</td>
<td>3.2</td>
</tr>
</tbody>
</table>

* Emissions excluding marine activities – activities within the Polish Economic Zone are not subject to reporting to the National Centre for Emissions Balancing and Management (KOBiZE).

Oily wastewater is stored on the LOTOS Petrobaltic platforms in special containers, and is later transported to shore for disposal. Sanitary wastewater is processed in a biological treatment station and then released to the sea. The condition of the sea water around the platform is monitored on a daily basis.

None of the wastewater produced by LOTOS Geonafta in its drilling operations is discharged directly into natural bodies of water. All technological and sanitary wastewater is stored and subsequently transported to a wastewater treatment plant. Management of industrial process wastewater is a company priority as far as environmental protection is concerned. Last year, the company improved the system controlling the solid particle content of drilling mud, resulting in a lower demand for water in its preparation and dilution.

In LOTOS Norge, technological waters (mixtures of drilling mud and industrial process water) are treated on the platforms and then discharged to the sea. The petroleum content of the discharged wastewater is always kept well below the legal limits.

**Volume of wastewater, by destination (m³)**

<table>
<thead>
<tr>
<th>LOTOS Petrobaltic</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Treated sanitary water discharged to the sea</td>
<td>7,365</td>
</tr>
<tr>
<td>Treated drilling mud and technological water (including formation water) discharged to the sea</td>
<td>32,754</td>
</tr>
</tbody>
</table>
### Formation water

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>1.011-1.096 g/cm³</td>
</tr>
<tr>
<td>Mineralisation</td>
<td>136 g/l</td>
</tr>
<tr>
<td>pH</td>
<td>5.1-7.2</td>
</tr>
</tbody>
</table>

The volume of all chemical additives added during the processing of formation water, such as de-emulsifier and corrosion inhibitors, is less than 1%.

Since LOTOS Petrobaltic launched its formation water injection system on the Baltic Beta platform in 2011, the amount of formation water discharged to the sea has been systematically reduced. Since October 2012, all formation water has been pumped back up to a reservoir on the platform, together with the sea water.

In LOTOS Geonafta, all formation water produced in the oil extraction process is stored on the rig and then transferred for disposal. LOTOS Norge did not produce any formation water in 2012 as it did not run any extraction works.

### Volume and disposal method of formation and produced water in 2012

#### LOTOS Petrobaltic

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formation water discharged to the sea</td>
<td>27,920 m³</td>
</tr>
<tr>
<td>Degree of oil contamination of formation water</td>
<td>4.7 ppm</td>
</tr>
<tr>
<td>Water injected back to the field</td>
<td>47,227 m³</td>
</tr>
</tbody>
</table>

#### LOTOS Geonafta

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formation water</td>
<td>180 m³</td>
</tr>
</tbody>
</table>
Drill cuttings (small pieces of rock fragmented by the drilling) are the major waste product of the drilling process. Once recovered to the surface, the cuttings are directed to the drilling mud treatment system. The drill cuttings do not contain any of the substances mentioned in Annex 1 to the Helsinki Convention. The drill cuttings together with the drilling mud of the first and second degree of contamination, are discharged to the seabed whereas the drill cuttings of the third degree of contamination are carried to the shore and transferred to a waste management company. Every batch of disposed drill cuttings is tested for toxic content.

Drilling mud, on the other hand, is recycled and reused in the drilling process, but if it is not suitable for recycling, it is also returned to land and passed on to a waste management company.

LOTOS Petrobaltic platforms carry out preliminary sorting of waste into metal, plastic, glass, paper and hazardous materials such as fluorescent lamps and batteries, before it is transferred to an authorised handler for recycling or disposal purposes.

In LOTOS Geonafta and LOTOS Norge, all waste is transferred to waste management companies for recycling or disposal.

<table>
<thead>
<tr>
<th>Waste generated in 2012</th>
<th>Total weight</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LOTOS Petrobaltic</strong></td>
<td></td>
</tr>
<tr>
<td>Drill cuttings</td>
<td>68 tonnes</td>
</tr>
<tr>
<td>Drilling mud</td>
<td>237 tonnes</td>
</tr>
<tr>
<td>Non-hazardous waste</td>
<td>451 tonnes</td>
</tr>
<tr>
<td>Hazardous waste</td>
<td>11 tonnes</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>767 tonnes</td>
</tr>
<tr>
<td><strong>LOTOS Geonafta</strong></td>
<td></td>
</tr>
<tr>
<td>Drill cuttings</td>
<td>669 tonnes</td>
</tr>
<tr>
<td>Drilling mud and technological water</td>
<td>1,561 tonnes</td>
</tr>
<tr>
<td>Formation water</td>
<td>447.3 tonnes</td>
</tr>
<tr>
<td>Non-hazardous waste</td>
<td>9.6 tonnes</td>
</tr>
<tr>
<td>Hazardous waste</td>
<td>5 tonnes</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>2,691.9 tonnes</td>
</tr>
<tr>
<td><strong>LOTOS Norge</strong></td>
<td></td>
</tr>
<tr>
<td>Drill cuttings</td>
<td>898 tonnes</td>
</tr>
<tr>
<td>Drilling mud</td>
<td>272 tonnes</td>
</tr>
<tr>
<td>Non-hazardous waste</td>
<td>324 tonnes</td>
</tr>
<tr>
<td>Hazardous waste</td>
<td>62 tonnes</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1,556 tonnes</td>
</tr>
</tbody>
</table>

Energobaltic
<table>
<thead>
<tr>
<th>Waste Type</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Municipal waste</td>
<td>6.8 tonnes</td>
</tr>
<tr>
<td>Non-hazardous waste</td>
<td>0.1 tonnes</td>
</tr>
<tr>
<td>Hazardous waste</td>
<td>0.2 tonnes</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>7.1 tonnes</strong></td>
</tr>
</tbody>
</table>

**Total for the LOTOS Petrobaltic Group**: 5,022 tonnes

In 2012, LOTOS Geonafta used only water-based drilling mud instead of the more harmful oil-based mud. Most of the water-based mud's ingredients are biodegradable. Technological water, drilling mud and drill cuttings are temporarily stored on the platform and later carried away for disposal.

In LOTOS Norge, oil-based drilling mud was used for the drilling of lower sections (17½, 12¼, 8½). Processed drilling mud and drill cuttings contaminated by oil were stored on the platform and later returned to land, to waste management companies. The platform has a specialised storage system for drill cuttings that ensures their proper storage and reduces the potential risk of harmful substances penetrating the environment.

In 2012, LOTOS Petrobaltic Group did not report any environmentally relevant oil spills.