Sarlux Srl
Environmental Declaration 2013

SARLUX
Refining & Power
SARAS

English translation from
original Italian document
EMAS validated

Sarlux Srl
Environmental Declaration 2013

Version of 1 July 2013
(performance data updated to 31 December 2012)
prepared according to the requirements of EC Regulation 1221/2009

Sarlux Srl

Registered office and production plant: Sarroch (CA)
S.S. 195 Sulcitana, Km 19

Head office: Milan
Galleria de Cristoforis, 1

Activity codes: NACE 19.20 (refinery) and 35.11 (IGCC)
IPPC activity categories: 1.2 (refinery) and 1.1 (IGCC)

Revision 1 of 9 July 2014 (performance data updated to 31 December 2012) of the Sarlux Srl Environmental Declaration
EMAS registration no.: IT 000995 on 20 October 2008

The accredited Environmental Assessor, which approved the Sarlux Srl Environmental Declaration pursuant to EC Regulation 1221/2009 is Lloyd's Register Quality Assurance Italy S.r.l.

EMAS accreditation no.: IT-V-0010 on 19 September 2008

This document describes for the public and all stakeholders:
- the activities conducted by Sarlux
- the direct and indirect environmental aspects associated with these activities
- the objectives that the company has set itself in order to improve its environmental performance

The document is aimed at the company's internal and external community, and is intended to establish a transparent relationship with all its stakeholders, particularly the local population, local authorities and employees, which represents a key component in the proper management of the company's activities.

The Environmental Declaration will be updated on an annual basis and a complete version will be re-issued in 2014.

The Environmental Declaration was produced and managed by:
the EMAS Working Group

The Environmental Declaration was checked by:
Antonello Cogoni, Prevention and Protection Manager

The Environmental Declaration was approved by:
Alberto Maria Alberti, Chairman and Chief Executive Officer

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Foreword

Since 2013, the Environmental Declaration has been produced by Sarlux Srl following the transfer of refining activities from Saras SpA to Sarlux Srl, as approved by the board of Directors of Saras SpA on 24 June 2013.

The publication of the Environmental Declaration, which is revised annually, is an important event for Sarlux, as it allows the organisation to provide to the public, and all interested parties in general, information on its environmental performance in a transparent manner.

Specifically, emissions of sulphur dioxide (SO_2), an issue that is of considerable interest to the local community, have decreased sharply. These results are confirmed by data from the air quality monitoring stations, and measurements taken by Sarlux and Arpas.

Activities launched in previous years to reduce and improve energy consumption and the use of water have continued apace. In 2012, significant results were achieved relating to heat conservation in the processing units, which led to a reduction in consumption of around 40,000 TOE. Water savings have increased considerably, following the installation of new units.

Sarroch, 8 July 2013

The Chairman and Chief Executive Officer
Alberto Maria Alberti

Contents

NOTE TO READERS

Up to 30 June 2013, activities carried out and past events relate to Saras, while from 1 July 2013, all mentions relate to Sarlux.
This document, which provides a detailed description of Sarlux's activities and the company's interaction with the environment and the region in which it operates, has been prepared using illustrative charts so as to make it easy to read and quick to understand.
The features that have been adopted are described below.

At the start of each section, a brief summary is provided of the main information contained in the pages that follow, in order to identify in a few sentences the concepts that will be explained in more detail in that section.

In each section, the headings in blue in the margin of the text provide an extract of the most important information discussed in more detail on that page.

Similarly, in Section 4, which provides information on the main environmental aspects, the reference legislation governing authorisation mentioned in the text is specified in the margin of the text.

Where relevant, reference is also made to the table "Environmental objectives and programmes" (Section 5, page 123), which summarises the objectives and improvement measures that will be the company's particular focus over the next few years, as well as the improvement measures implemented in 2012.

The charts in the document that have an orange border show the measurement of a parameter in comparison to an applicable legal or permit limit.

Lastly, the text boxes with a blue background contain information that, while it does not relate directly to Saras or its activities, will help the reader to gain a better and fuller understanding of the company and the context within which it operates.


SARAS

1.
The Company

Sarlux, a Saras Group company, has its production site in Sarroch, in the province of Cagliari.

The company was founded in 1996 as a joint venture between Saras and the Enron Group. It was wholly acquired by Saras on 28 June 2006. On 1 July 2013, pursuant to a resolution of the Saras Board of Directors, the company's refinery plants and activities were transferred to Sarlux, in order to centralise all the Group's industrial production of oil products and electricity in one company.

The Sarroch refinery in Sardinia, in the heart of the Mediterranean, has been the island's primary operation for over 45 years.

Today, the site's production complexity, capacity and quality make it one of the most important in Italy and Europe. This is an industrial organisation where respect for the environment, health and safety inform all of the company's decisions, as part of an ongoing dialogue with the surrounding area, and it is against this backdrop that Saras achieved EMAS registration in October 2008.

1. The Company

1.1 – Sarlux

[1,020 employees, 7,000 employed in related industries]

Sarlux is active in the energy sector. It is one of the main independent oil refining operators in Europe, and an electricity producer in Italy.
Since 1 July 2013, when it obtained EMAS registration, Sarlux has employed around 1,020 people.
With its registered offices and production site in Sarroch, Sarlux represents the most important employment hub in Sardinia, with more than 7,000 people employed in related industries.
Since 2001, Sarlux has been active in electricity generation via an IGCC (Integrated Gasification Combined Cycle[1]) plant that is highly integrated with the refining cycle; this plant produces more than 4.4 billion kWh of electricity each year, representing over 30% of the region's requirements;
Recently, in July 2013, Sarlux added refining activities, which were previously carried out by Saras, alongside its electricity generation business.
The Saras Group is not only active in this type of electricity generation. Since 2005, the Group has also generated electricity from renewable sources through its subsidiary Sardeolica Srl, the owner of the Ulassai Wind Farm (OG), which comprises 48 aerogenerators with installed capacity of 96 MW.
Lastly, on the gas exploration and research front, the Group is currently going through the process of gaining authorisation to begin drilling activities in an area of Oristanese ("Eleonora" permit), for which annual production is cautiously estimated at between 70 and 170 million cubic metres of gas, with a production period of more than 20 years. The estimated time required to drill the exploratory well ranges from four to six months following the completion of the authorisation process by – in accordance with the procedures laid down by the competent regional authorities – the environmental impact assessment (EIA). Saras SpA has been listed on the Borsa Italiana stock market since May 2006. With revenues at end-2012 of EUR 11.89 billion (up 8% compared with 2011), a comparable gross operating margin[2] of EUR 217.3 million (down 19% from 2011) and adjusted net profit[3] of EUR 35.2 million (an increase of 98% compared with end-2011), the Saras Group operates in the energy sector and is one of the leading independent oil refiners in Europe.
The Group invested EUR 119.3 million in 2012 (EUR 105 million in 2011), confirming its commitment to keeping its plants fully efficient and meeting all health and safety

1 **Gasification Combined Cycle**: the IGCC enables the company to convert heavy hydrocarbons deriving from the refinery's processing activities into electricity.
2 **Comparable Gross Operating Margin**: gross operating margin calculated by valuing inventories using LIFO and adjusted for non-recurring items.
3 **Adjusted net profit:** net profit adjusted by the difference between inventories valued using LIFO (last in, first out at historical values) and inventories valued using FIFO (first in, first out – oil stocks at current values) after taxes, non-recurring items after taxes, and changes in the fair value of derivatives after taxes.

FIGURE 1. Location of the Sarlux site

The Sarroch production site

The Sarlux production site in Sarroch, around 20 km south-west of the Sardinian capital Cagliari, is the location for one of the largest refineries in the Mediterranean region by production capacity, and its complexity makes it one of six "super sites" in western Europe (source: Wood Mackenzie, February 2007). With production capacity of 15 million tons per year (or 300,000 barrels per day), this plant accounts for about 15% of Italy's total refining capacity. The refining cycle is integrated with the IGCC plant, which generates electricity.

The excellent geographical position of the Sarroch plant has proved strategic for trade with central-western Mediterranean countries, both in Europe and North Africa, while its proximity to the plants of Versalis and Sasol Italy enable it to add petrochemical production to its refinery operations (see box on page 13).

requirements. At the same time, the decision was taken to invest in growth, whilst not abandoning the prudent approach to maintaining the Group's sound financial position, given the economic environment, which remains extremely challenging. In 2012, the company invested EUR 97 million in refining activities, some 30% of which were set aside for the revamping of the MildHydroCracking-2 (MHC2) plant. Work on this is proceeding exactly according to plan, and so it is envisaged that all the technological improvements under this project will be fully operational from as early as the second half of 2013.

1.1.1 – Group companies

[oil products, electricity, services]

The parent company **Saras SpA** – a subsidiary of Angelo Moratti Sapa – was created in 1962 to carry out refining activities.
It has shareholdings in a number of subsidiaries in Italy and abroad, which are briefly described below.
Arcola Petrolifera sells oil products on the domestic wholesale market in Sardinia and Italy.
Deposito di Arcola Srl provides delivery, storage and land or sea redelivery services for oil products.
Sarlux, a wholly-owned Saras subsidiary, today owns the Sarroch production site.
Saras Energia SA distributes oil products in the Spanish retail and wholesale market and manages a biodiesel production plant, a hydrocarbon storage facility in Cartagena and 112 service stations.
Sardeolica owns the wind farm, with installed capacity of 96 MW, located in the municipality of Ulassai (OG).
Sartec (Saras Ricerche e Tecnologie) provides industrial engineering and scientific research services nationally and internationally. It also designs, builds and rolls out modular plants to monitor emissions.

1.2 – Sarlux in Sarroch

[in Sardinia since 1962]

The site's history in Sarroch dates back to 1962, when Angelo Moratti identified it as a strategic location for an oil refinery. Construction of the refinery facilities began in 1963, and refining activity in 1965.
Until the end of the 1980s, the plant mainly provided refining services for third parties (i.e. it refined crude oil owned by other oil companies, which provided the site with the raw materials to produce oil products). In the mid-1990s, following a significant downturn in demand for high-sulphur fuel oil, Saras launched a major industrial project to build a plant for the gasification of heavy distillates from the refining process and the subsequent combined-cycle cogeneration of electricity and thermal power (IGCC plant).

[the IGCC project]

[continuous technological development]

With the IGCC plant on stream, the oil production cycle became closely integrated with the electricity generation cycle, thereby maximising the conversion of raw materials into finished oil products and energy. Meanwhile, the company continued to invest in updating the technology of its existing plants and improving the environmental impact of fuels, partly to comply with increasingly stringent quality standards defined by European law. These investments have led to a progressive reduction in the percentage of sulphur in the oil products and to an improvement in the quality of middle distillates and gasoline.
Since 1 January 2009, thanks to the start-up of the gasoline desulphurisation plant

FIGURE 2. The Sarlux production site and the surrounding region

The Sarroch industrial hub

The production hub that built up around Sarroch in the 1960s has helped generate employment and wealth in the region.

Over the years, numerous small and medium-sized companies have sprung up around the large industrial companies present in the region – such as Sarlux, Versalis, Sasol Italy, Air Liquide, Liquigas and ENI Gas GPL. These companies build and maintain the plants of the larger firms, and therefore represent a significant satellite industry. Sarlux maintains mutually beneficial industrial relations with all these production companies.

The site shared by Versalis and Sasol Italy was built in the early 1970s, under the name Saras Chimica (in which Saras also had a stake). The name then went through various changes over the years, until it took on the current names of Versalis and Sasol Italy.

The Versalis plants receive the raw materials from Sarlux and use them for production destined for the plastics industry, while those of Sasol Italy produce detergents and the bases for synthetic lubricants, again from raw materials received from Sarlux (mainly diesel and kerosene).

Air Liquide produces liquid oxygen, which is used in the Sarlux IGCC plants.

Lastly, the Liquigas site stores and sells the LPG from Sarlux (Figure 10, page 36).

[competent authorities informed of the start-up of the Auto Oil and MTD plants on 23 December 2008[1]]

(unit 800) built in 2008, the site has been able to meet new European requirements that gasoline should have a sulphur content of 10 ppm, allowing the company to produce gasoline in accordance with the new restrictions and helping to reduce the indirect environmental impact linked to the sulphur content of motor fuels. In addition to the desulphurisation unit, a new hydrogen plant (unit 600) was completed and put into service within the IGCC plant, increasing the nominal hydrogen production capacity of the IGCC, which the refinery now uses on a permanent basis for the desulphurisation processes for middle and light products.

Throughout the entire process, from selecting raw materials to fitting efficient desulphurisation systems (U800 for gasoline and DEA4 for better removal of H2S from the fuel gas used on-site) and treating Claus tail gases (TGTU)[2], the choices made and projects implemented at the site have produced impressive results.

The 2012 figure, which shows further improvement on the figure for the previous two years, especially as regards sulphur in emissions, validates the technical decisions made over the years. This result confirms the site's desulphurisation capacity, together with a marked reduction in the quantity of sulphur released into the atmosphere.

1.3 – Company organisation

On 1 July 2013, the refining activities, which were previously carried out by Saras SpA, were transferred to Sarlux Srl, a company with a sole shareholder, subject to management and coordination by Saras SpA. At the same time, Saras' previous organisational structure, with direct responsibilities for managing the Sarroch site, was transferred to Sarlux, under the responsibility of the office of the Chairman and Chief Executive Officer, the Employer and Site Manager, pursuant to Art. 33 of Legislative Decree 81/2008. The responsibilities and structure of each unit remained unchanged.

The functions carried out by Sarlux that affect the environmental management of the Sarroch site (see Fig. 3) are: Operations Management, Technology, Asset Management, Prevention & Protection, and Logistics & Health Services.

Operations Management ensures that the production programme and resulting implementation is developed, optimising the productivity of the plants and maximising the energy efficiency of all operations on the site. The production areas listed below, which have a direct influence on the management of environmental aspects (see definition on page 46), report to Operations Management:

- the Movement, Shipping and Wharf production area, which is responsible for the delivery of raw materials, and the internal movement and shipping of products
- the Distillation and Desulphurisation/Conversion production area, which is responsible for the refinery plants
- the Targas and Utilities production area, which is responsible for the IGCC plant and auxiliary services

Within each production area, the Reliability and Area Maintenance unit is responsible for ordinary maintenance operations.

Also in Operations Management, the Technical department plays an important role in relation to atmospheric emissions.

The Technical department is responsible for maximising the productivity and energy efficiency of the site's plants via continuous performance monitoring and the use of

1 **Relevant legislation:** Directive 98/70/EC, amended by Directive 2003/17/EC and within Italy, the following provisions: Prime Ministerial Decree 434 of 23 November 2000, Prime Ministerial Decree 29/2002, and Law 306 of 31 October 2003.
2 **TGTU:** Tail Gas Treatment Unit.

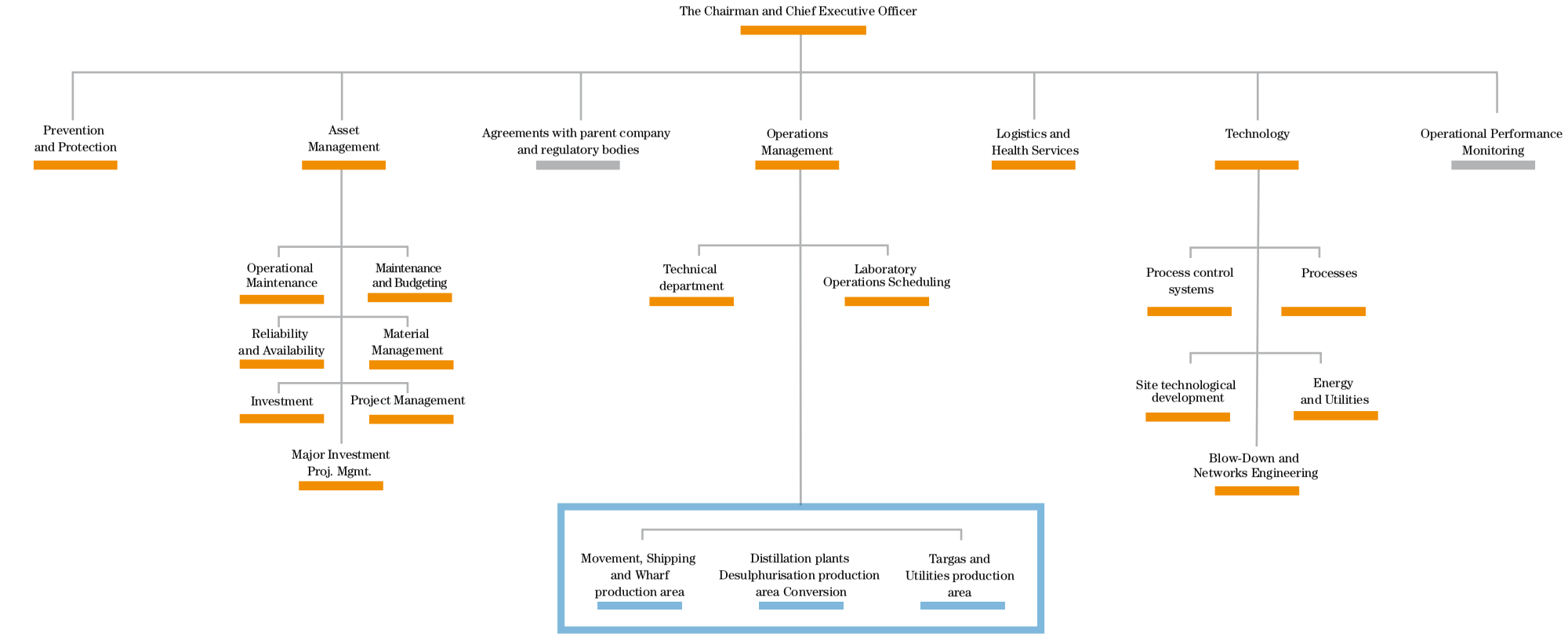


FIGURE 3. Organisational structure of Sarlux

the most advanced monitoring and process optimisation technologies. Within the Technology department, the Blow-down and Networks Engineering area plays a major role in relation to flare emissions.

Asset Management ensures that the assets are reliable and available, and implements maintenance and investment programmes. It also supports the other functions in managing the site and environmental aspects. The following organisational units report to Asset Management:

- Reliability and Availability, responsible for promoting and ensuring the continuous improvement of the reliability and safety of plants and equipment
- Maintenance and Budgeting, responsible for planning maintenance work
- Operating Maintenance, responsible for carrying out scheduled and unscheduled maintenance work
- Investment, responsible for implementing the approved asset investment programme
- Material Management, responsible for the temporary storage of materials and auxiliary substances

[Prevention and Protection]

Prevention and Protection of the site, which in addition to performing the prevention and protection tasks stipulated by legislation on health and safety in the workplace (art.33, Legislative Decree 81/2008), is also responsible for supporting the Employer, Site Manager and the other functions in implementing and fulfilling the obligations arising from health and safety and environmental legislation. This involves planning and launching processes that affect this area, with continuous improvement in mind, ensuring that they are consistent with the environmental management system certified in accordance with ISO14001 and EMAS. The site's Prevention and Protection unit is also in charge of emergency management, which consists of both dedicated staff and officially designated and appropriately trained employees within the operational organisation of the various areas. The Logistics and Health Services unit is responsible for defining security policies and managing access, as well as site logistics, internal roads and personnel transport. It also assists the Employer in fulfilling its obligations relating to health monitoring.

Sarlux uses the resources of parent company Saras for matters relating to Purchasing and Tenders, Human Resources and Organisation, Group HSE Policies and Quality, Legal and Corporate Affairs, and External Relations. Specifically, its internal communication is managed by the Organisational unit, which reports to Human Resources and Organisation, while its external communication is carried out by External Relations.

1.4 – Subject of EMAS registration

[The EMAS-registered Sarroch site]

On 20 October 2008, the Ecolabel and Ecoaudit Committee (EMAS Section)[1] in Italy approved the registration of Saras SpA under no. IT-000995.

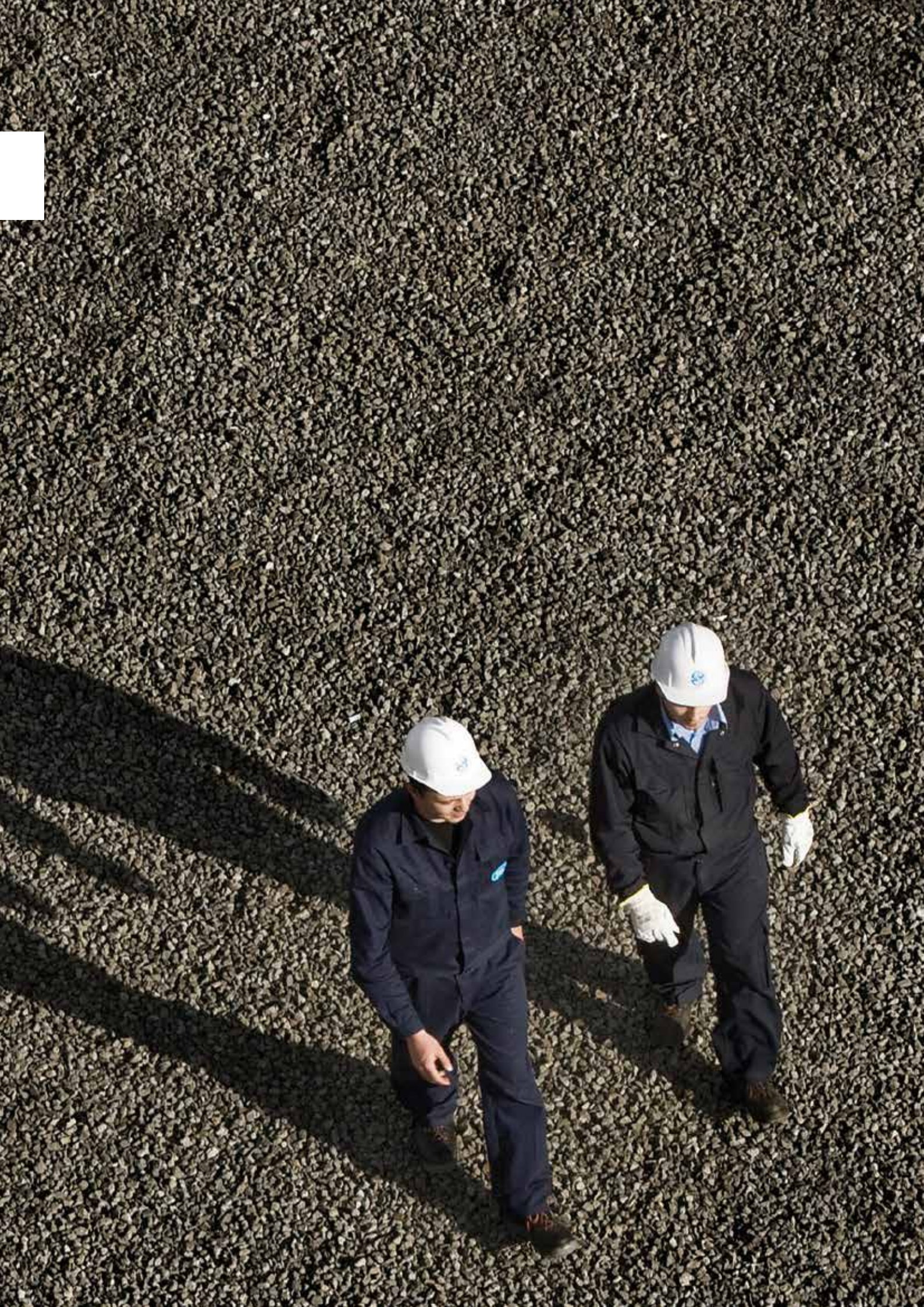
The subject of EMAS registration[1] was the whole company Saras SpA, for the Sarroch site and the Milan headquarters. Following the EMAS registration on 20 October 2008, the Environmental Management System (EMS) became compliant with EC Regulation 761/2001. This validation was updated to EC Regulation 1221/2009 during an external inspection on 12-15 July 2010. In June 2012, the certifying body, Lloyd's Register Quality Assurance (LRQA), validated Saras' 2012 Environmental Declaration, which was prepared pursuant to EC Regulation 1221/2009, recommending the annual renewal of its registration with the EC Control Body, ECOLABEL. On 13 September

[1] **The EMAS registration certificate** issued on 20 October 2008 by Ecolabel-Ecoaudit, in line with EC Regulation 761/2001, which expires on 25 July 2011.

2013, the same body approved the renewal of the three-yearly EMAS certification on completion of the process that started in June 2012. Sarlux has its registered offices at the Sarroch site and it is here that it conducts all its production activities (the area of the site is indicated by the white boundary in Figure 2 on page 13).

The activities covered by the registration relate to the Sarroch site. Specifically, at the Sarroch site, they are the processes for "manufacturing products from oil refining, scheduling, preparing and shipping finished products, and the generation of electricity, and managing the design, engineering and construction of internal plants" All the processes and activities that have a direct or indirect influence on the company's environmental management are monitored as part of the certified Environmental Management System.

The main areas involved in the environmental aspects of Sarlux's activities are therefore located in Sarroch and in the province of Cagliari.



2.
Commitment to protect the environment, health and safety

Sarlux's commitment to environmental sustainability and safety follows the same pattern as that of Saras SpA.

The process was set in motion many years ago by Saras, combining compliance with the law with the search for technological and management solutions that would go beyond statutory requirements in order to translate the company's commitment to respect the region in which it is based into action.

Crucial steps in this journey have included the adoption of an environmental management system, which was ISO 14001 certified in 2004, and of a safety management system, OHSAS 18001 certified in 2007, as well as the strengthening of initiatives to promote openness and collaboration with local communities, which enabled the site to obtain EMAS registration in October 2008.

2. Commitment to protect the environment, health and safety

2.1 – Environmental management

The Environmental Management System

[the commitment to continuous improvement]

Preparing the Environmental Declaration and distributing it to the public forms part of the continuous improvement process for environmental management that has been in place for a number of years (by Saras up to 30 June):

- in May 2002, the company's Environmental Policy, containing the guiding principles and environmental management commitments, was issued to all employees
- the subsequent production of the Environmental Management System (EMS) manual and the associated implementation procedures established a code of conduct for all of the company's employees
- objectives for improvement have been set and approved by the Management Committee; these are checked and updated annually
- internal audit activities have been put in place to periodically check that the EMS is being applied correctly

[ISO 14001 certification]

- in June 2004, the site achieved ISO 14001:1996 certification for it EMS, and in May 2006, ISO 14001:2004 certification
- in June 2007 and June 2010, the three-yearly checks on the EMS were carried out for the renewal of the environmental certification. The certifying body, Lloyd's Register Quality Assurance, also conducts six-monthly inspections as part of its planned assessment activities
- the revised version of the Environmental Policy (Figure 4) was issued in May 2008 and distributed to the company's direct employees and to subcontractors working on site

[EMAS registration]

In October 2008, the process of developing the EMS was completed, enabling the Sarroch site to register in accordance with the Eco-Management and Audit Scheme (EMAS) Regulation (EC Regulation 761/2001). Registration then led to the public dissemination of the first Environmental Declaration in 2008.

This document, aimed at the company's internal and external community, is intended to establish a transparent relationship with the local population, local authorities and employees. It also illustrates the site's activities, the direct and indirect environmental aspects associated with these activities and the environmental improvement targets that the company has set itself.

EMAS is currently the most advanced voluntary tool available to demonstrate a company's commitment to environmental sustainability. For the site, the decision to join this scheme, which was taken several years ago, has meant following a course of continuous improvement that takes a structured approach to the company's relationship with the environment and the local area.

During 2012, the process of integrating the management systems began with the approval and publication of the new complete Environment, Safety and Quality Management systems manual, and of the environment policy, now including health

SARLUX
Refining & Power
SARAS

The Environment, Health and Safety, and Prevention of Major Accidents Policy

Sarlux's mission is to ensure business continuity and growth in full compliance with the protection of the health and safety of workers, the prevention of major accidents and care for the environment.
To achieve these objectives, Sarlux has adopted an integrated environmental, safety and prevention of major accidents management system pursuant to the requirements of UNI-EN-ISO 14001 and BS-OHSAS 18001, and the guidelines for implementing safety management systems (Ministerial Decree of 9 August 2000). By applying an integrated management system to the activities of refining and electricity generation at the Sarroch Refinery, Sarlux seeks to ensure that its plants and on-site activities are carried out efficiently and correctly, and to achieve its performance improvement objectives.

Specifically, Sarlux undertakes to:

- Ensure the utmost safety of its employees and any other person on the site, by implementing all the measures and initiatives necessary to prevent any type of accident, and to minimise the potential consequences for individuals, the environment and property
- Comply with the specific regulations on environmental protection and the reduction of risks associated with the company's activities, and the prevention of major accidents
- Periodically assess the risks associated with the company's activities, identifying safety objectives and defining appropriate programmes for continuous improvement
- Improve its performance by adopting principles, standards and solutions that constitute "best practice" in the sector
- Ensure that plants, machinery and equipment are designed, implemented and maintained with the protection of the health and safety of workers and the environment, and the prevention of major accidents in mind
- Ensure that all its employees and those of subcontractors, and any other person with access to the site are, with respect to their skills and responsibilities, informed, trained and equipped to work with full awareness of the potential risks associated with their activities, both under ordinary and abnormal operating conditions and in the event of an emergency
- Develop a relationship of constructive co-operation, based on complete transparency and trust, both internally and with all external stakeholders, in respect of health and safety issues, the environment, and the prevention of major accidents.
- Disseminate its policy to all employees, suppliers, contractors and any other external person who has access to the site, actively involving the whole of the Site's organisation in the integrated management system, in accordance with each person's competences and attributes.

It is Sarlux's firm belief that achieving the above goals is only possible with the active contribution of all its employees. Everyone at Sarlux is directly responsible for putting the environmental policy into practice when carrying out their activities, and conduct consistent with these issues is one of the objectives at both an individual and group level.
The policy is periodically reviewed and updated if there are significant variations to the risk of accidents, or changes in legislation, technical expertise or the environmental impact of processes.

Sarroch, 1 July 2013

SARLUX Srl
The Chairman and Chief Executive Officer
Alberto Maria Alberti

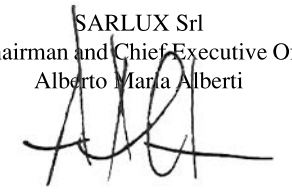


figure 4. The Environment, Health and Safety, and the Prevention of Major Accidents Policy

and safety, and accident prevention. LRQA continued its half-yearly inspections of the Environmental Management System during the year, with positive results.

2.2 – Health and safety management

The Safety Management System

The company introduced its first Safety Policy in 1996, and since then has achieved positive results in continuously protecting its workers: "Saras will treat safety as being equally as important as production, quality and costs." Since 2008, the company has had a specific Major Accident Prevention Policy created for the Sarroch site following the enactment of the Ministerial Decree of 9 August 2000, which set out the legislative framework for implementing a management system for the prevention of major accidents.

[health and safety are key priorities]

The subsequent introduction of specific legislation on the protection of workers' health and safety (formerly Legislative Decree 626/94, now Legislative Decree 81/2008, the Consolidated Law on Occupational Health and Safety) suggested the need to do something above and beyond simply complying with the law. The company considers the protection of health and the prevention of any form of accident or injury (to anyone working on the site) as core values, as stated in the integrated Occupational Health and Safety Policy (Figure 4, page 21), defined by the Employer. The implementation of an Occupational Health and Safety Management System introduced performance measures and the setting of improvement objectives and goals.

The Safety Management System (SMS) has now become an integrated system (Major Accidents, Occupational Health and Safety) that shares components to generate synergies. Following a similar process to that undertaken for the SMS, in December 2007, the company obtained certification for its Safety Management System in accordance with the OHSAS 18001:2007 standard, issued by Lloyd's Register Quality Assurance Italy. In 2011, the site was subject to another audit of its SMS, through an intensive inspection procedure conducted by certification body TÜV Austria, which confirmed it met the BS OHSAS 18001:2007 standard and renewed its certification for a further three years. Compliance with that standard was also confirmed after the scheduled inspection visit carried out in December 2012. The main objectives of Sarlux's commitment to safety management have always been accident prevention and the identification of the most effective methods of reducing the likelihood of accidents.

[OHSAS 18001 certification]

This approach is the same as that which underlies Legislative Decree 334/99 (Seveso II), which stipulated the adoption of a Safety Management System for the Prevention of Major Accidents, also covering electricity generation at the IGCC plant. To enable the common components of the safety management systems to be used in synergy, Sarlux's SMS, integrated with the Management System for the Prevention of Major Accidents, pursuant to the requirements of the Ministerial Decree of 9 August 2000, was integrated, in 2012, with both the Environmental SMS and the Quality SMS. The manual for the management system was approved and published during 2012.

Accidents

The policy of continuous improvement that the site has adopted in a number of areas, such as the environment, technology and training, can also be applied to safety. The "Safety is our Energy" programme, implemented with the support of Du Pont, world leader in occupational safety, and launched in 2009, was completed in 2011. Significant efforts were made in training and information activities targeting aspects of behaviour, which is the main cause of company accidents.

LRQA
Business Assurance

CERTIFICATE OF APPROVAL

It is hereby certified that the Environmental Management System of:

Sarlux Srl
Head Office:
Galleria de Cristoforis, 1 - 20122 Milan - Italy
Registered office and operational site:
S.S. Sulcitana 195 - Km 19 - 09018 Sarroch (Cagliari) - Italy

has been approved by Lloyd's Register Quality Assurance for compliance with the following environmental management system standards:

ISO 14001/2004

The Environmental Management System applies to:

Refining, delivery, storage, preparation and shipping of oil products. Generation and sale of electricity.

Certificate of Approval
No. LRC418Q526/EMS/U/TT

Original Approval: 1 June 2004
Current Certificate: 1 June 2013
Expiry of Certificate: 31 May 2016

Issued by: Lloyd's Register Quality Assurance Italy S.r.l.
on behalf of Lloyd's Register Quality Assurance

UKAS MANAGEMENT SYSTEMS 001

This document is subject to the conditions set out on the reverse
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Approval is executed pursuant to the assessment and certification procedures of LRQA and monitored by LRQA. Use of the UKAS accreditation logo indicates accreditation relating to the activity covered by Accreditation Certificate No. 001 Macro Rev. 13

Figure 5 ISO 14001 environmental certificate

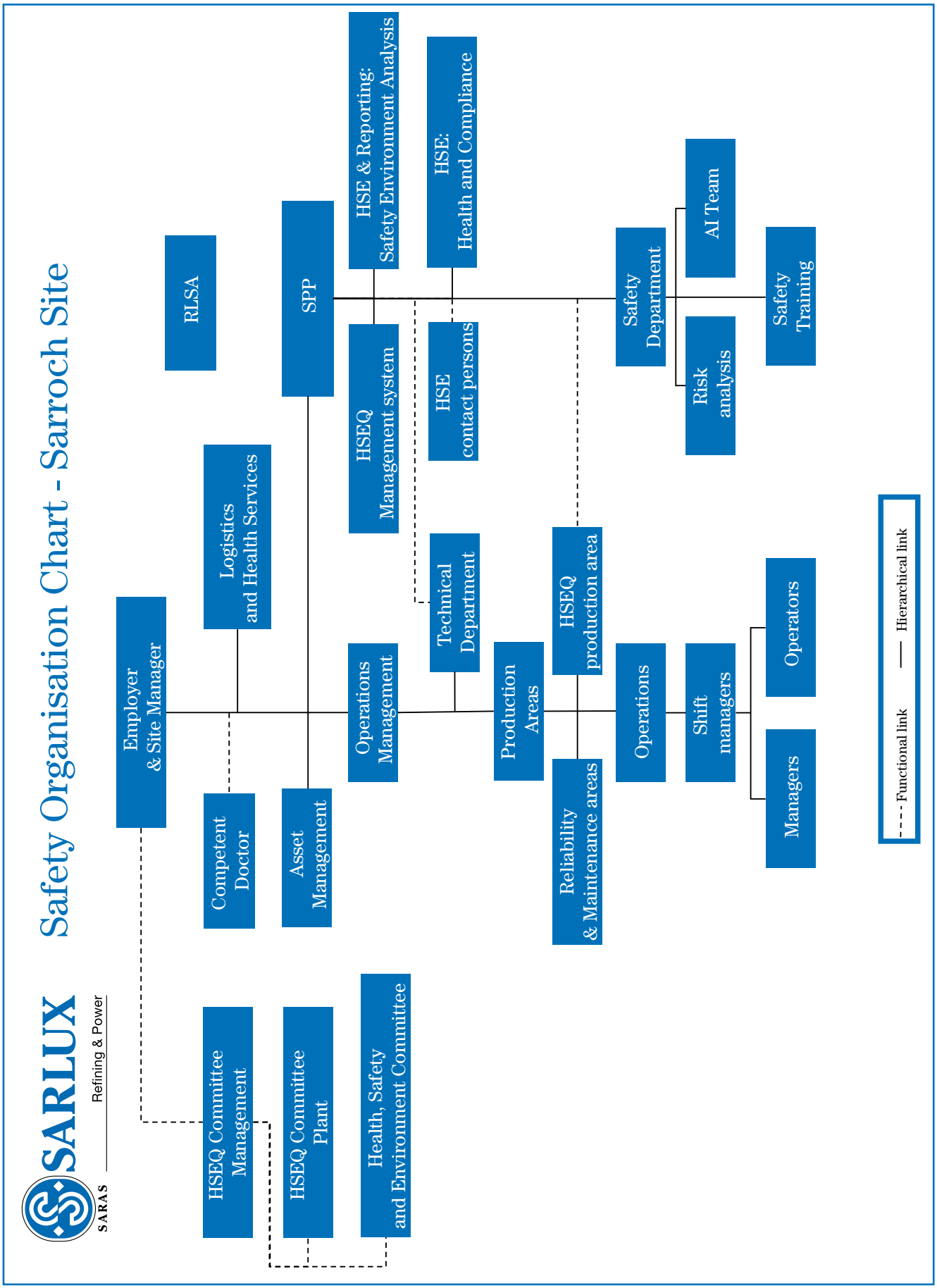


Figure 6 Safety Organisation Chart of Sarroch site

The total frequency and accident frequency indices recorded in 2012 show significant improvement: the 2012 result was the best result ever.
In 2012, there was a further increase (36%) in the number of near accidents reported. These were analysed and corrective action taken to prevent such accidents.

Table 1 Accidents

Parameter	2009	2010	2011	2012
INAIL frequency index* (no. accidents x 1,000,000/total no. hours worked)	7.5	6.3	3.1	1.8
Severity index** (no. days lost x 1,000/total no. hours worked)	0.376	0.434	0.065	0.069
Average duration (days)***	49.9	58.0	41.8	38.0

* Accidents lasting more than 1 day
** Calculated using the number of days lost to accidents
*** Calculated as the ratio (accident days per year + accident days continuing from the previous year) / no. of accidents in the calendar year

2.3 – Environmental communication

Sarlux dedicates particular care and attention to communication, whether it be to internal employees and subcontractors or its external partners.

2.3.1 –Internal Communication

Again in 2012, the primary aim of internal communication activities was to increase the involvement in and contribution to improving environmental management at the site by employees and those of subcontractors operating on site.
The company newsletter continued to be published regularly. It is distributed in paper format and is available digitally on the company's intranet. The newsletter includes a large section on health, safety and the environment, and, on average, more than one article was devoted to this area in each issue. On the subject of the environment, two issues of key importance for the whole organisation were covered in the newsletter: 1) the improvement in environmental performance, partly linked to the Integrated Environmental Authorisation permit; and 2) housekeeping, with a report in numbers and photos on the plastic waste collection initiatives undertaken in the plant on 31 July 2012. Waste collection was relaunched on the network of company monitors that were activated in 2012. These nine monitors, located in the busiest areas in the plant, were also used to assess initiatives and conduct aimed at achieving the energy efficiency improvement objectives, such as those relating to steam and fuel consumption, and flare emissions.

[involving employees]

The final reports on occupational health monitoring carried out during the year were published on the company intranet.
Lastly, the suggestion box system is still in place, allowing all employees of the site and of subcontractors to submit questions and comments, either via email or on paper, to which the company responds publicly on notice boards and in the EMAS section of the company intranet.

2.3.2 – External Communication

Residents and the local community, authorities, schools, universities, customers and suppliers: with each of these groups of stakeholders, the company has for some time been engaged in a series of activities to provide more information about the measures implemented as part of its environmental commitment. Foremost among these initiatives is the preparation of the site's Environmental and Safety Report, which since 2003 has been distributed externally to institutional stakeholders. Anyone wishing

[the Environmental and Safety Report]

to view the Report can find it at www.saras.it, in the “Our Responsibilities” section. Two further means of communicating with external stakeholders are the company’s Annual Report and the Environmental Declaration, which are also available on the company website.

2.3.2.1 – Communication with the region

Even more so than in the past, environment, health and safety for the site mean engaging more with the local community, represented by an approach to communication and dialogue designed to ensure maximum transparency. The confirmation of EMAS registration represents an important tool for the sustainable development of the region, in the spirit of sharing and participation. EMAS is an advanced tool that certifies a company’s commitment to continuous improvement in terms of the environment and sustainable development, partly by involving and talking to direct and indirect employees, as well as all the main stakeholders.

Work also began in 2012 on strengthening relations with external parties, in particular with the local communities around the production facility, in line with the commitments made in the context of EMAS (Eco Management Audit Schemes) registration. EMAS is a tool designed to certify that companies are committed to continuous improvement in environmental matters and sustainable development, including through involvement of and dialogue with employees, both direct and indirect, as well as all main stakeholders.

[meetings with the local community and local authorities]

In this regard, various meetings were held with local authorities, which presented opportunities for discussion, the exchange of information and communication on issues of common interest, such as safety, environmental protection and regional development.

These occasions gave an opportunity to demonstrate the results already achieved and to showcase Sarlux’s environmental programmes and goals for further improvements.

Lastly, to encourage and facilitate communication between Sarlux and the wider region, it is possible for anyone, including individual residents, to contact the company with questions or to request information by writing to the postal addresses or the email address on the front page of this Environmental Declaration. Further contact details for specific areas of interest can be found on the “Contact Us” page of the Saras website (www.saras.it).

2.3.2.2 – Activities with schools

[working with schools]

Within the overall policy of external relations, a special space is set aside for relations with schools.

Over the years, the company has launched specific projects in this area which have afforded valuable opportunities to present itself to schools and exchange information with them.

In 2012, the company, always mindful of the environment and safety issues, in partnership with the Sarroch elementary/middle school, the municipalities of Sarroch and Villa San Pietro, and with the support of UNICEF, supported the “Safe Schools” project, devised by the National Fire Service in Cagliari.

This is a safety campaign specifically designed for the region’s elementary and middle school pupils and aimed at making the children aware of the risks around them in their daily life and at sharing with them experience and suggestions on positive steps that can be taken to prevent and avoid accidents associated with the four main causes of accidents at home, namely fire, electricity, falls and toxic substances.

The programme of activities, which ran throughout the school year, involved among other things the distribution and use of five colouring books, each focusing on a specific theme, and the showing of animated cartoons on these themes to communicate them in a simple and immediate way.

The project concluded with a final event, with games for the children of all the schools involved, and a safety demonstration by the Cagliari Fire Service’s canine unit.

3.
Information about the Sarroch production site

Oil products and electricity from clean technology.

These are the activities that Sarlux carries out at its site in Sarroch, which produces products for daily domestic use (vehicle fuels, other fuels and electricity) and for industrial applications.

It is a facility where more than 1,000 employees operate plants and equipment for the delivery of raw materials, crude oil processing, electricity generation, internal transport and the storage of raw materials and products, before finally shipping the finished products and coordinating the supporting activities performed by external subcontractors.

It is a complex system, safely managed using an intricate network of systems and equipment, where constant attention is paid to compliance with all authorisations and statutory provisions governing activities at the site.

3. Information about the Sarroch production site

3.1 – Activities carried out at the site

The activities carried out at the Sarroch site can be broken down into the following functions:

- delivery of raw materials and shipping of products through the marine terminal
- production of oil products
- electricity generation in the IGCC
- storage of raw materials, liquid products and liquefied gas
- shipping of products by land
- auxiliary services (power generation in the thermoelectric plant, incoming water treatment, wastewater treatment)
- offices, workshops and warehouses
- activities of subcontractors

Figure 7 shows the areas used for the different types of activity carried out in the facility, with a brief description provided in the paragraphs below.

3.1.1 – Delivery of raw materials and shipping of products through the marine terminal

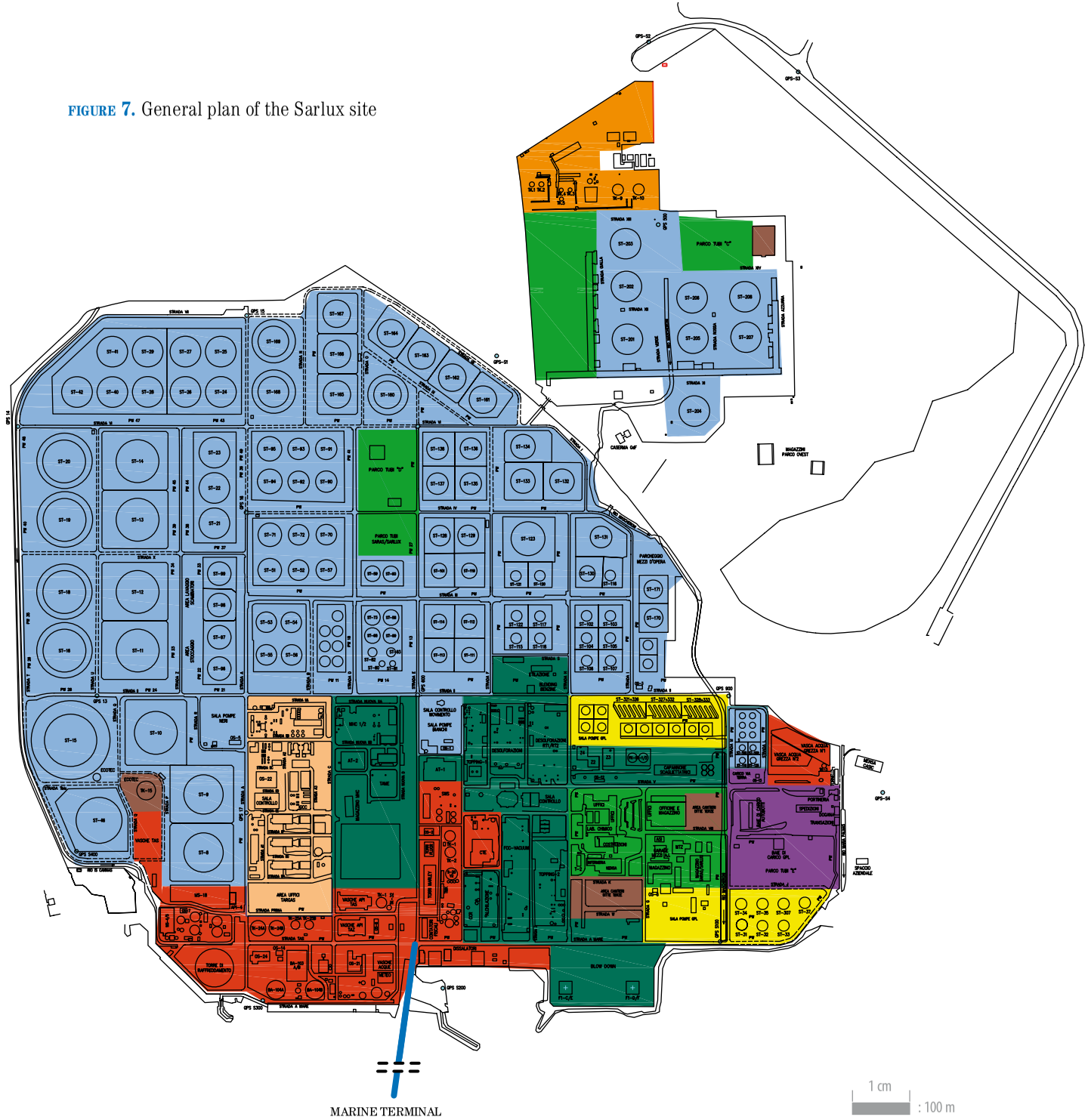
[delivery and shipping by sea]

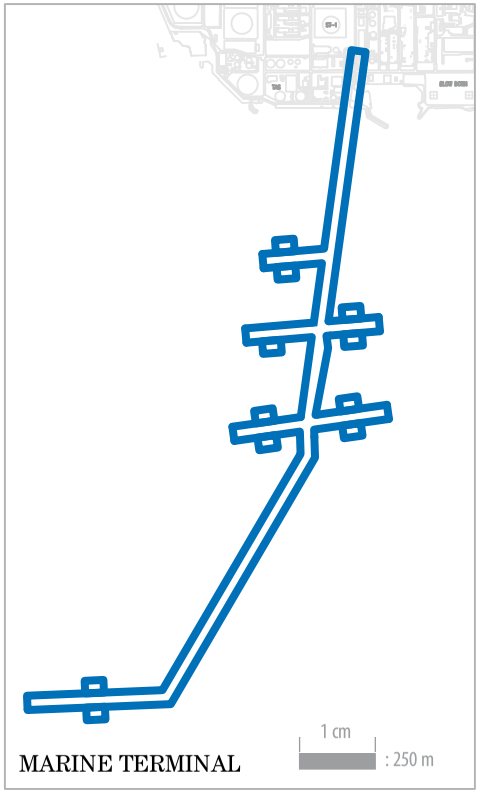
The marine terminal linked to the refinery has a 1,600m-long wharf and fixed platforms connected to it by a 1,200m piling. All raw materials are delivered here, and the bulk of the oil products are shipped from here. In 2012, 82% of oil products were shipped by sea. The terminal has 11 independent docking berths, nine of which are for shipping finished oil products and the delivery of semi-finished products, docking oil tankers of up to 65,000 tons of deadweight capacity. In addition to these docking berths, there are also two platforms which enable ships of up to 300,000 tons of deadweight capacity to dock for the delivery of crude oils.

[continuous monitoring of operations and ships]

The various docking berths can operate simultaneously, thus reducing waiting times for anchored ships. Advanced monitoring systems ensure that all deliveries and shipping operations take place under conditions of the utmost safety: the phases relating to the docking and mooring of ships and the connection between the ship and the loading arms transferring raw materials to the shore and finished products to the ship are carried out under continuous surveillance. In order to be admitted to the Sarlux marine terminal, all incoming ships must comply with rigorous safety standards that conform to internationally recognised criteria as well as additional requirements laid down by Sarlux (section 4.3.2, page 113). A dedicated control room, which has been completely renovated and updated with the latest monitoring technology, is manned and operational 24 hours a day, and is in continuous radio contact with the ships operating in the terminal, ensuring that all operations fully comply with all safety and environmental protection requirements.

FIGURE 7. General plan of the Sarlux site





- Delivery of raw materials and shipment of products via sea
- Production of oil products
- Electricity generation (IGCC)
- Storage of raw materials and products (tank farm)
- Storage of liquefied gases (LPG spheres and bullets)
- Storage of liquid products (national storage facility)
- Shipping of products over land
- Auxiliary services
- Offices, workshops and warehouses
- Area for subcontractors

3.1.2 – Production of oil products

The production process is illustrated in the simplified diagram shown in Figure 8, and involves the following units:

- atmospheric distillation plants (topping) and vacuum distillation plants for raw materials, which produce the primary fractions
- conversion plants (visbreaking, mild hydrocracking 1 and 2, fluid catalytic cracking – FCC), where heavy hydrocarbons and distillates are converted into medium-light fractions; heavy hydrocarbons are sent from the visbreaking plant to the IGCC plant
- catalytic reforming (CCR) plant, where light distillates (naphtha) are converted into high-octane components; hydrogen, which is used in the desulphurisation treatment, is produced at the same time
- plants that improve the quality (alkalisation) and performance (TAME, Tertiary-Amyl-Methyl-Ether plant) of gasoline
- desulphurisation plants, where middle distillates (kerosene and diesel) are subjected to catalytic hydrogenation processes to remove sulphur and improve product quality
- plants to recover and convert sulphur into a solid for subsequent sale
- non-condensable fuel gas treatment plant for the removal of sulphur compounds and subsequent internal re-use of gas
- the tail gas treatment unit (TGTU) downstream of the sulphur recovery plant, which increases the sulphur recovery yield, thereby reducing SO_2 emissions
- the U800 unit at the catalytic cracking plant, which produces low-sulphur gasoline
- the U600 unit, which produces hydrogen used in the desulphurisation of motor diesel, with a very low sulphur content

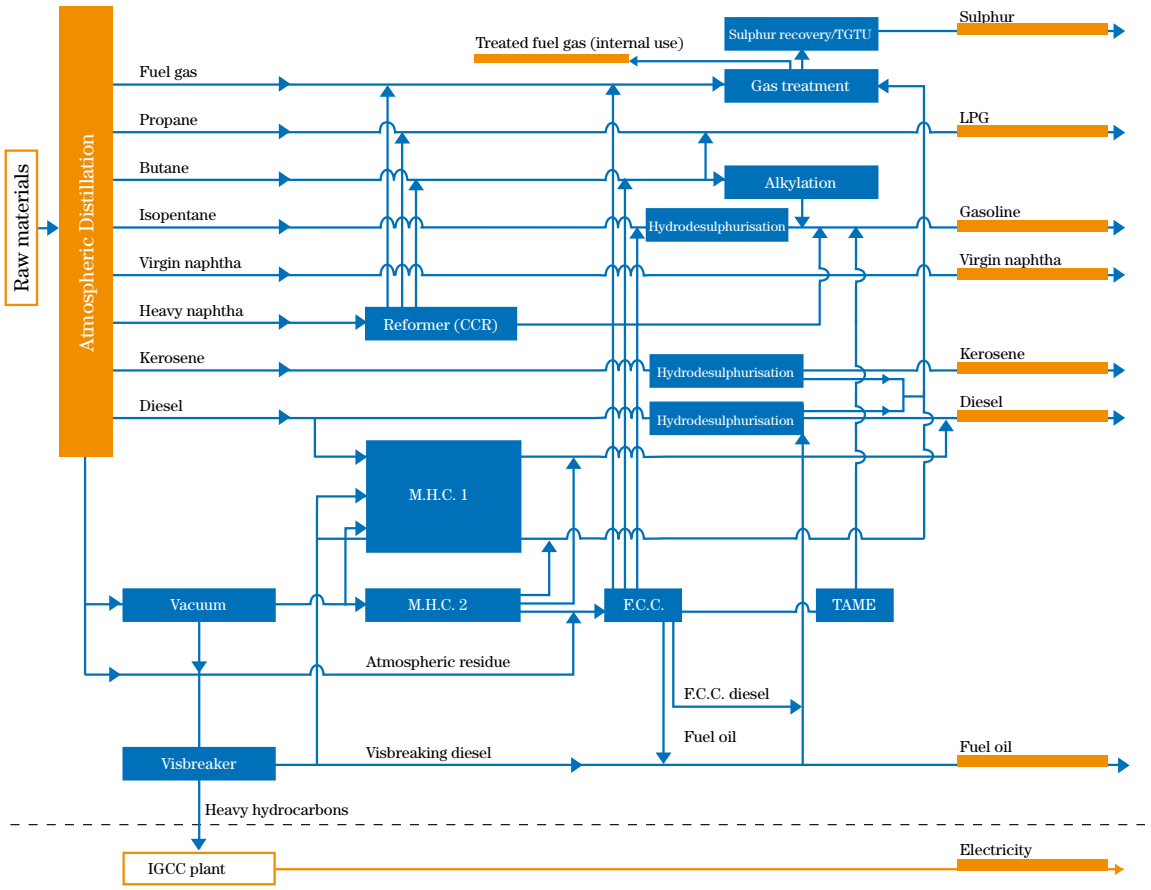


Figure 8 Sarlux plant production cycle: oil production and electricity generation

The Sarroch plant has a high output of medium oil products (diesel) and light oil products (LPG, naphtha and gasoline), which in 2012 accounted for around 82% of total production, as shown in Table 2, which contains production data relating to the period 2008-2011.

[oil products]

In the last few years, more light products have been produced, with fuel oil being kept to a minimum and heavy distillates from refining (TAR) being used to produce electricity.

Table 2 Oil products (tons/year)

	2009	2010	2011	2012
LPG	221,000	323,000	238,000	205,000
Gasoline and virgin naphtha	3,343,000	4,024,000	3,824,000	4,002,000
Middle distillates (diesel, kerosene)	6,769,000	7,517,000	7,415,000	6,891,000
Fuel oil and other	1,119,000	463,000	623,000	272,000
Sulphur*	110,000	130,000	113,000	122,000
TAR	1,077,783	1,166,000	1,075,000	1,146,000

* Includes sulphur recovered both from refining and the IGCC.

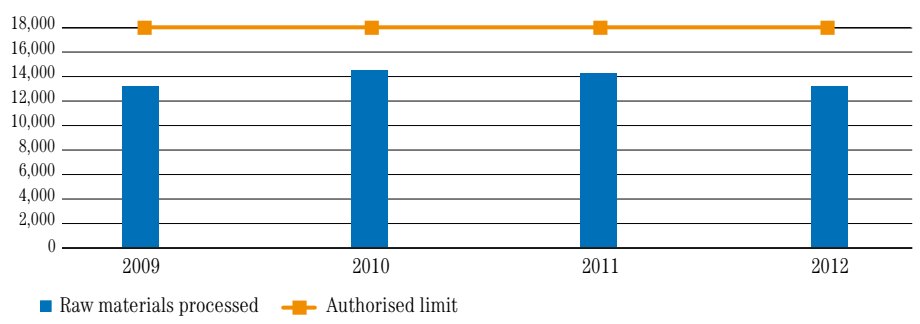
[Sarlux at the heart of the Mediterranean]

Raw materials mainly come from the Mediterranean area (North Africa and the Middle East), the former Soviet Union and North Europe. The primary destination of refinery products is the central and western Mediterranean region, with more than 20% of total production absorbed by the Sardinian market. In 2012, the Sarroch refinery processed approximately 13.3 million tons of raw materials (crude oil and fuel oils), which is an average figure for recent years. Between 2009 and 2012, a total of around 55 million tons was processed with an average of 13.7 million tons of raw materials, or an average of 14.3 million tons per year. Table 3 shows the change in the level of raw materials processed in comparison with the maximum authorised quantity (18 million tons/year) specified by the refinery's Concession to Process Mineral Oils (Decree of the Italian Ministry for Productive Activities no. 17086 of 7 July 2003).

Table 3 Raw materials processed (kt/year)

2009	2010	2011	2012
13,305	14,340	14,006	13,309

CHART T3 (kt/year)



3.1.3 – Energy generation

[electricity, hydrogen, steam]

The Integrated Gasification Combined Cycle (IGCC) plant generates electricity, hydrogen and steam from heavy hydrocarbons deriving from the refining process, and, as a unit, is recognised as one of the best techniques available in the refining sector.
As shown in Figure 9, the plant is divided into two main sections:

- gasification
- combined cycle

In the gasification section, oxygen supplied by the Air Liquide plant is used to convert heavy hydrocarbons from the visbreaking plant into a synthesis gas (abbreviated to "syngas"), which, once purified of the sulphur and metals it contains, is burned in the combined cycle section.

[electricity to the external distribution network]

Electricity is produced in three identical lines, each comprising a gas turbine, a steam recovery boiler and a steam turbine, with an overall net rated power of 551 MW, and is sold to GSE (Gestore Servizi Elettrici, the operator of the Italian national grid). Part of the steam produced and not used to generate electricity is sent to the refinery for use in refining processes, along with the hydrogen produced by the gasification section, further increased by the recently built U600 unit.
As with the sulphur recovered from the refining cycle, the sulphur recovered through the removal of hydrogen sulphide from the syngas is also sold (see figures in Table 4).

[metals recovery]

The metals removed from the syngas are used to form a solid panel called "vanadium concentrate" or "filter cake", which is sent to external plants to recover the metals. The IGCC plant therefore enables the Sarlux production site to maximise the conversion of raw materials into value-added products and to minimise the generation of waste.

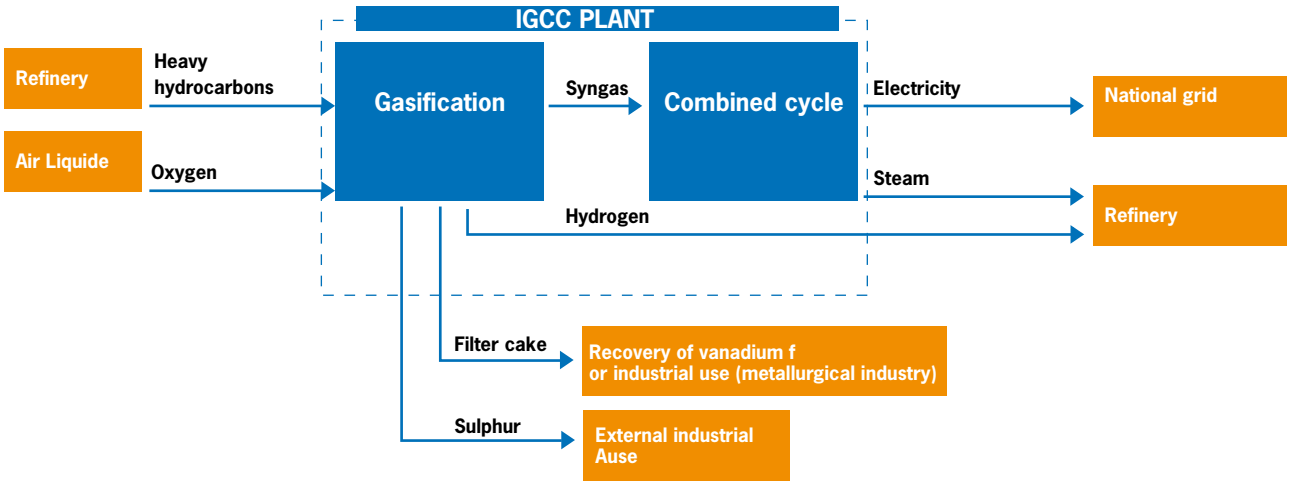


Figure 9 Flow chart of the IGCC plant

TABLE 4 IGCC products

	2009	2010	2011	2012
Electricity (kWh)	4,086,438,699	4,339,335,000	4,034,163,000	4,211.290,000
Low-pressure steam (t/year)	437,003	586,626	555,647	582,843
Medium-pressure steam (t/year)	570,754	737,033	699,486	743,660
Hydrogen (kNm^3)	359,108	376,074	338,952	386,887
Sulphur* (t/year)	48,405	52,666	37,872	43,196

* The quantity shown here is already included in the figure in Table 2 on page 33, "Oil products"

[IGCC efficiency and reliability]

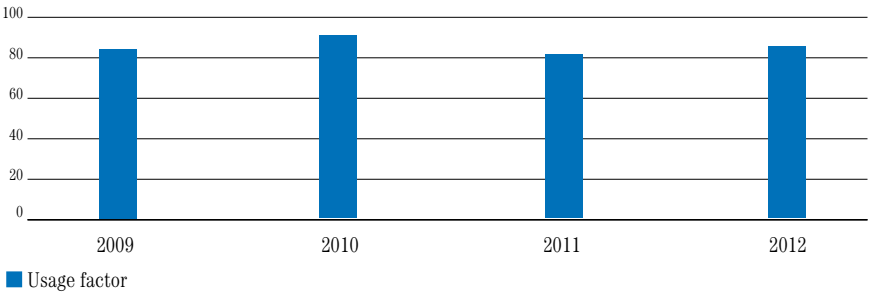
The three-line configuration of the IGCC plant ensures continuity in electricity generation and the production of hydrogen and steam for internal use on the site. The figures recorded to date confirm the effectiveness of the plant processes and technology. The plant is extremely reliable, as shown in Table 5 and Chart T5.

TABLE 5 IGCC plant usage factor

Indicator	2009	2010	2011	2012
Energy produced/potential energy* (%)	84.7	89.9	83.6	87.0

* Potential energy is calculated by multiplying the available power by the maximum number of hours in one year

CHART T5 (%)



3.1.4 – Storage of raw materials and products

The storage facilities on the site are divided into the following areas:

- storage of raw materials and products in the tank farm
- storage of products for which excise duties have been paid in the national storage facility, located outside the bonded area, further along the S.S. 195
- storage of liquefied gases in special pressurised containers ("spheres", "bullets" and "horton spheres").

[extensive and widespread safety systems]

In total, there are 161 tanks with an overall capacity of around 3.5 million cubic metres. All tanks are fitted with permanent fire-prevention systems and containment basins of reinforced concrete (45 tanks) or earthworks (116 tanks).

The fire prevention system in the LPG storage areas is controlled by a device that, depending on various factors (including wind direction), activates systems to prevent fires and contain any product leaks. In addition, to prevent accidents, the LPG tanks are equipped with instruments that monitor and protect against unexpected pressure surges. Raw materials and products are moved within the site between plants and storage and shipping areas using the following systems and equipment:

- pumping lines and systems, including pipelines connecting to the national storage facility and the marine terminal
- systems for the measurement and additivation of products before shipping

- land-loading systems (loading bays)
- sea-loading systems (marine terminal equipment)

3.1.5 – Shipping of products by land

Products are shipped by land using special loading gantries for tanker trucks:

- a gantry with three loading points for LPG and 12 loading bays for liquid products (kerosene, diesel and fuel oil), located near the facility's manned entrance
- ten loading bays for diesel and fuel oil, located in the national storage facility

[synergies between companies in the Sarroch petrochemical industrial hub]

The Sarlux site is linked via the ENI Gas LPG and Liquigas gas pipelines and two oil pipelines to the neighbouring petrochemical plant (for the commercial exchange of semi-finished products and services), as well as to the national storage facility (Figure 10).

3.1.6 Auxiliary Services

The site is equipped with the following units, which provide services necessary for the production cycle:

- thermoelectric power plant for the refining cycle, which produces part of the electricity and steam necessary for the processes
- air compression system, comprising five compressors and two distribution networks, one for instruments and one for services
- treatment unit for water coming into the site, taken from the industrial water supply
- treatment plant for wastewater generated by site activities (process-water purification plant)

Internal infrastructure enables the distribution of water, steam, electricity, fuel and nitrogen, and the collection of wastewater to be sent to the treatment plant before it is discharged into the sea.

3.1.7 – Offices, workshops, warehouses and other services

The office buildings are located next to the production area; opposite these are the mechanical workshop, the electrical workshop and part of the warehouse space,

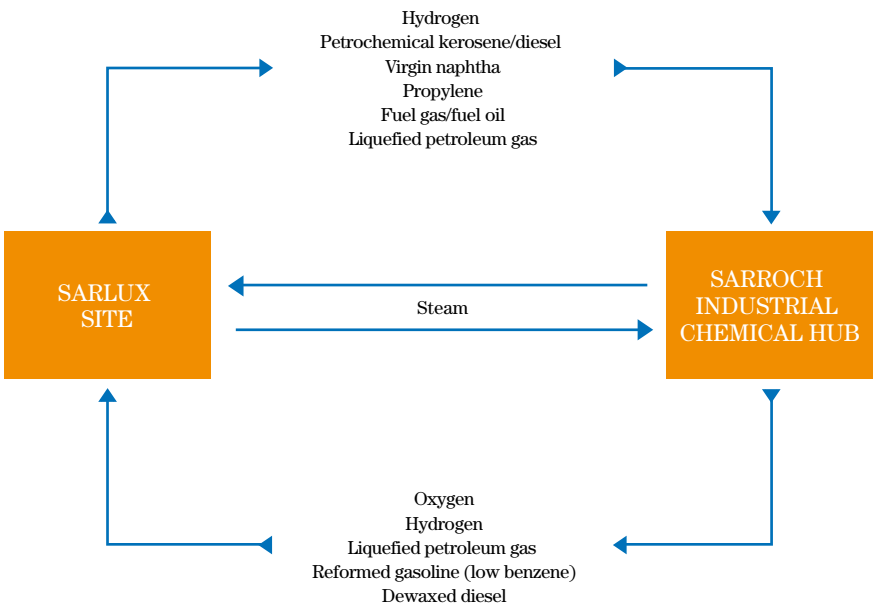


FIGURE 10 Synergies between the Saras plant and neighbouring chemical companies

where auxiliary substances and consumables are stored before being sent to the areas in which they will be used. Other areas used for materials storage (pipe yard) are located in the centre of the tank farm and at the national storage facility. Other general services, such as the canteen and the medical centre, are also located in the offices area.

3.1.8 – Activities of the subcontractors

Subcontractors operating continuously within the Sarlux site (maintenance, construction, mechanical and instrument checks, etc.) have logistics bases in dedicated areas on the site, which enables them to perform their work to the highest possible standard and reduces the need to leave the site. Specifically, two external companies work permanently on the site in waste management: one to manage the waste inertisation plant and one to manage an area in which mainly ferrous and electrical materials are sorted and recovered (section 4.2.6).

3.2 – Authorisation status of the Sarroch site

3.2.1 – Integrated Environmental Authorisation (AIA)

[AIA permit DSA-DEC-2009-0000230]

On 24 March 2009, the integrated environmental authorisation (AIA) permit for the combined operations of the refinery and the IGCC was issued, pursuant to Legislative Decree 59/05, which implements Directive 91/61/EC, more commonly known as the IPPC Directive on integrated pollution prevention and control.

IPPC (Integrated Pollution Prevention and Control) is a new strategy in place throughout the European Union, aimed at enhancing the "environmental performance" of industrial complexes that are subject to authorisation. The key aim of the Directive is to make a comparative assessment of the various environmental segments and to unify authorisation procedures, so that separate approaches to the control of air, water and soil emissions do not encourage the transfer of pollution from one environmental category to another, and to protect the environment as a whole. This also introduces the requirement to assess the various solutions to prevent an improvement in one environmental area from creating an unacceptable deterioration in another. The AIA permit replaces all existing authorisations and fundamentally changes the way in which environmental issues are managed.

The main features introduced by the permit are:

1. New limits on atmospheric emissions for the refinery
2. New limits on atmospheric emissions for the IGCC plant
3. Limits for the refinery flares
4. New control parameters and limits on wastewater
5. New waste management criteria

Fine-tuning of the monitoring and control plan continued in 2012: specific meetings took place with ISPRA and ARPAS (Cagliari) technicians, while, in the oil segment, AIA permits are close to being issued for the Italian refineries.

Regarding the requirements of the preliminary assessment, in the year under review in this report, implementation and research activities continued in relation to measuring flare temperature, recovering wharf steam and measuring dust on the CO-boiler smokestack.

3.2.2 – Existing authorisations

The refining activities at the site are performed in accordance with the "Concession to Process Mineral Oils", which was last updated by the Decree of the Italian Ministry for Productive Activities issued on 7 July 2003. As of 9 April 2009, all of the environmental authorisation permits were combined and replaced by AIA permit DSADEC-2009-0000230 of 24 March 2009.

3.3 – Plans and procedures for handling emergencies

The site's Safety Report

The activities performed at the site involve the presence of substances with hazardous properties or that are hazardous when used at certain levels.

In 1989, following the entry into force of the Italian law implementing the first European Directive on establishments where there are major-accident hazards, the company prepared the first Safety Report on activities at the Sarroch site. In drawing up the Safety Report for the site, the company conducted a precise and in-depth analysis of its activities and the risks associated with them on the basis of the processes and substances used.

[1989: the first Safety Report]

Since then, the document has been continually updated in accordance with the applicable legislation (currently Legislative Decree 334/99, as subsequently amended, which requires the report to be updated every five years) and in order to include all the changes that have been made to the plants over the years. The Safety Report looks at all the different types of hazardous substance, characterised by varying degrees of flammability (e.g. crude oil, gasoline, LPG), toxicity (e.g. hydrogen sulphide) and risk to the environment (e.g. diesel, kerosene).

[an in-depth risk analysis]

On the basis of the quantity and type of substance present on site and the processes in which they are used, possible events and accident scenarios have been identified, such as fires, explosions, toxic gas clouds and the discharge of hazardous substances into the soil or sea. The potential consequences of the accident scenarios identified have been studied in order to determine their impact on the safety of individuals on and off the site and on the environment. The analysis of potential accident scenarios has ruled out any significant consequences outside the site for the time being. The only external area that could potentially be affected is an uninhabited area in the direction of SS 195. As far as the marine terminal is concerned, any potential cases of discharge into the sea involve limited quantities of hydrocarbons. Internal rapid response vehicles and equipment are available to efficiently counteract the effects of any discharge into the sea. A brief overview of these is provided on page 41. In October 2005, the five-year update of the Safety Report was presented, in compliance with the provisions of Art. 8 of Legislative Decree 334/99, and, at the same time, the information sheet intended for the general public was sent to the Municipality. The 2005 Safety Report contained the risk analysis for the new plants (TGTU and U800) that became operational at the end of 2008, for which declarations that there would be no increase in risk were submitted on 5 September 2005.

[Legislative Decree 334/99]

In fulfilment of the provision of Art. 23 of Legislative Decree 238/05, which amended and supplemented Legislative Decree 334/99, in December 2006, an update to the Safety Report was presented, including the progress made on the recommendations of the Sardinia Regional Technical Committee for Fire Prevention (CTR) during the assessment stage for the site's Safety Report (October 2000 edition), and the updated information sheet for the general public was sent to the Municipality of Sarroch.

[the information sheet on major hazards for the general public and employees]

Upon completion of the assessment stage, the Sardinia CTR issued its Final Technical

Evaluations on the above-mentioned Safety Report (October 2005 edition, as amended), as per the report ref. 4921/P12 of the session on 18 July 2007. The conclusions state:

[the assessment of the Regional Technical Committee]

[omissis]
In acknowledging the measures executed, those currently being executed and those planned, we consider that the company has taken positive steps to follow up on the recommendations made by the CTR upon conclusion of the assessment of the Safety Report (2000 edition) and has, on its own initiative, put in place plant and procedural solutions that, taken as a whole, have contributed or will contribute to enhancing the level of safety. However, as on previous occasions, a number of issues need to be addressed further and some of the measures executed or planned could be further improved. This being so, it is in the company's interest to verify the information detailed above based on the priority assigned according to the urgency of the individual measures, and to provide prompt notification of said verification, in whole or in part.
[omissis]

[June 2008 – October 2010: a plan of action]

In June 2008, the CTR was notified of the measures implemented between October 2006 and May 2008, in relation to the recommendations received, and the measures planned for the period May 2008 to October 2010. Upon completion of the planned activities, in accordance with the Ministerial Decree of 19 March 2001 regarding fire prevention procedures for activities involving major-accident hazards, on 26 November 2008 an application was submitted to the Sardinia regional fire service for a Fire Prevention Certificate.
Regular inspections of the site's production areas by the fire service restarted in May 2011 for the purpose of issuing the Fire Prevention Certificate and checking progress on the observations made during previous inspections (for the same purpose) and reported in document no. 0006220 of 20 April 2009.
At the end of 2009, inspection work was begun by the Italian Ministry for the Environment and the Conservation of Land and Sea in order to assess the programmes and measures in place to prevent major accidents, with specific reference to the suitability of management procedures and plant solutions adopted. The inspection was completed, with a successful outcome for the company, in early April 2010.

[October 2010: last update of Safety Report]

The five-year review of the Safety Report was completed in October 2010 (the previous review took place in 2005) pursuant to the regulatory requirements, and was delivered to the competent authorities in the same month. The review of the document included detailed analysis of the company's existing plant and management system, and a reassessment of the risk scenarios and potential incidents, and hence the consequences that these could have for workers, the plant and the surrounding area. The document was also modified to include all the important changes to plants, procedures and the organisation implemented at the site between 2005 and 2010.
In relation to continuous improvement, the Sardinian Regional Technical Committee for Fire Prevention suggested a number of areas for further examination and possible implementation. The analysis method used is based on indices, pursuant to the regulatory requirements. Each plant has therefore been divided into logical units. The logical units were chosen according to pre-established criteria to enable the plant equipment in question to be grouped in a logical way (e.g. equipment operating under similar temperature and pressure conditions and processing the same fluids).
Each logical unit was then analysed, with prior assessment of penalising factors due to:

- risks related to the substances processed

- general process risks
- specific process risks
- risks related to the quantities of substances processed
- layout (design) risks
- health risks in the event of an accident

and the subsequent assessment of compensatory factors that could reduce the number and potential scale of accidents, including:

- measures helping to reduce the number of accidents (e.g. control and safety instruments, operating and maintenance procedures and staff training) and
- measures helping to reduce the potential scale of accidents (e.g. fire prevention systems and fixed fire fighting systems).

An overall analysis of these parameters enables a specific risk category to be assigned to each logical unit. The decisions taken in the past have enabled the elimination of all the logical units that had been classified in the "high I" risk category in the previous review of the document (in 2005), and increased the proportion of units in the average "minor/low" category, as shown below:

2005 Safety Report

258 logical units analysed

Risk category distribution:

88%	minor/low
11%	moderate
1%	high I

2010 Safety Report

276 logical units analysed

Risk category distribution:

89%	minor/low (61% minor, 28% low)
11%	moderate
0%	high I

We can see that, although a higher number of logical units was analysed in 2010 (about 7%) than in the previous review, as a result of the continuous improvement policy, all the logical units that had been classified as high-risk in 2005 were moved down to the minor/low category.

In June 2011, the Cagliari prefecture approved the 2011 External Emergency Plan for the Sarroch urban area, which takes account of updates to the Safety Reports of the various sites at risk of a major incident in Sarroch's industrial areas.

The plan is available in the Civil Protection - Provincial Civil Protection Plans section of the prefecture's website (www.prefettura.it/cagliari).

Following the entry into force of EC Regulation 1272/2008, better known as the CLP Regulation, fuel oil has been reclassified and, therefore, pursuant to article 6 of Legislative Decree 334/99, the 2010 Safety Report sent to the competent authorities in November 2011 required updating. The update also included a review of the crude oil classification detailed in CONCAWE Report no. 11/10.

In 2011, an inspection visit, arranged by the Environment Ministry, was carried out at the site, pursuant to Ministerial Decree of 5 November 1997. The purpose of the inspection, which took place over eight and a half days, was to ascertain progress in implementing the safety management system. The inspection was carried out by a committee appointed for the purpose by the ministry.

It concluded the following: "The safety management system, as currently in existence, is largely adequate, and its essential elements comply, in terms of both structure and content, with the provisions of legislation and the Policy Document."

Internal Emergency Plan (IEP)

After defining the risk scenario for the internal plant area, the company drafted its Internal Emergency Plan (IEP), which includes the procedures to be adopted and action to be taken in the event of an accident, with the aim of managing any such occurrence with maximum efficiency and minimum impact via the coordinated intervention of personnel and vehicles. At the same time as it is updating the Safety Report, the company is also updating its Internal Emergency Plan.

[personnel and equipment for effective intervention]

The objective of the IEP is to ensure the company reacts as effectively as possible to accidents by:

- preventing and minimising injury to people and providing assistance to any casualties
- bringing accidents under control and limiting their effects
- preventing and minimising environmental damage
- preventing and minimising damage to company property

[prevention and control]

The IEP also includes the Marine Pollution Prevention Plan, which was drawn up to deal with emergencies resulting from spills into the sea from the refinery or critical events that could occur at the site's marine facilities.

Based on the content of the refinery's Safety Report, the IEP defines the criteria for reportable accidents, and distinguishes between two types (i.e. levels) of emergency:

- localised emergency: an accident limited to a well-defined area
- general emergency: an accident with the potential to spread to other areas inside or outside the site

[classification of emergencies]

A localised emergency refers to an accident affecting a distinct area of the plant that can be quickly handled using locally available resources. This generally means that a fire is not involved. A general emergency is an accident that, due to its nature or because of particular environmental conditions, risks spreading to other parts of the plant or areas outside the refinery. Lastly, near-accidents are situations that could potentially have led to an accident. Analysis and assessment of such events is essential to the continuous improvement of site safety.

To ensure that accidents are dealt with quickly and efficiently, it is crucial to have reliable procedures for raising the alarm and alerting all personnel concerned, according to the type of event. Another important requirement of the IEP is to have clear and direct lines of communication to alert those involved in executing the plan, all personnel within the plant, the emergency services and the general public.

Communication and alarm devices (fire alarm buttons, telephones, fixed and mobile intercom units at various plant locations or in the possession of key personnel) are widely available throughout the refinery, so that personnel and equipment can be mobilised immediately. Following a list of priorities, the refinery's Emergency Co-ordination Centre distributes information and updates on the management of accidents to certain organisations, as appropriate to the nature of the accident:

[extensive internal communication system]

- the fire service
- the prefecture
- neighbouring industrial sites

Other relevant organisations include the Sarroch municipal authorities, the Sarroch

Carabinieri, the police and the port authority. Continuous updates are provided to these organisations until the emergency is fully resolved, so that the local community can be kept informed.
Table 6 shows the data on emergencies for the four years between 2008 and 2011.

Table 6 Accidents

Parameter	2009	2010	2011	2012
No. of general emergencies	3	3	1	2
No. of localised emergencies	32	17	4	3
No. of near-accidents	20	4	17	10

The overall figures for emergencies in 2012 are broadly the same as in 2011. However, general emergencies increased from 1 to 2. Of the two general emergencies, the one that occurred in the Topping 1 plant led to a plant shutdown of five days. The other happened during the preparation phase for the catalytic reforming plant (CCR), which was to be re-started after maintenance, but did not have significant consequences.
Conscious of the importance of identifying near misses (220 recorded in 2012) in order to ensure effective prevention, and of the correlation between these emergencies and near misses/accidents, bearing in mind the number recorded in 2012, this figure places an obligation on the company to consider objectives for ongoing improvement.

External Emergency Plan (EEP)

[a plan for the entire Sarroch area]

The External Emergency Plan (EEP) is closely related to the Internal Emergency Plan. The EEP is drawn up in conjunction with the Prefecture of Cagliari following a consultation phase involving numerous local bodies, law enforcement agencies and emergency services, including the regional and provincial authorities, the Municipality of Sarroch, the fire service and the local health authority. The plan concerns the Sarroch industrial complex as a whole, and considers hypothetical accidents concerning sites belonging to the various companies located there (Sarlux, Versalis, Sasol Italy, ENI RM, Liquigas, Air Liquide) that could result in harmful consequences for the area outside the facilities. In addition, the safety reports for the various production facilities and analyses of hypothetical accident scenarios (study of the local area, urban districts and infrastructure) are used to plan the best way of managing accidents given the potential effects on people living nearby. Procedures have been defined for executing and managing the EEP, from raising the alarm to the intervention of all company and external personnel responsible for carrying out particular actions in accordance with the various roles assigned to them, including direct management of accidents at the site, monitoring of the surrounding area, dissemination of information to the relevant external bodies and the provision of assistance to local residents (road management, health services, information media, etc.). The organisations concerned (prefecture, police headquarters, fire service, traffic police, *Carabinieri*, *Guardia di Finanza*, forestry authority, harbour authority, health authority, Sardinian regional environment agency, regional and provincial authorities, municipality of Sarroch) will be involved in various ways to ensure that accidents are managed quickly and effectively, and contained within the site if possible. The effectiveness of the EEP and its implementation is monitored via regular drills involving the companies and all other responsible organisations. The EEP currently in place was last reassessed and revised in February 2011, with subsequent changes made up to February 2013.

[a programme of regular drills]

Safety systems at the site

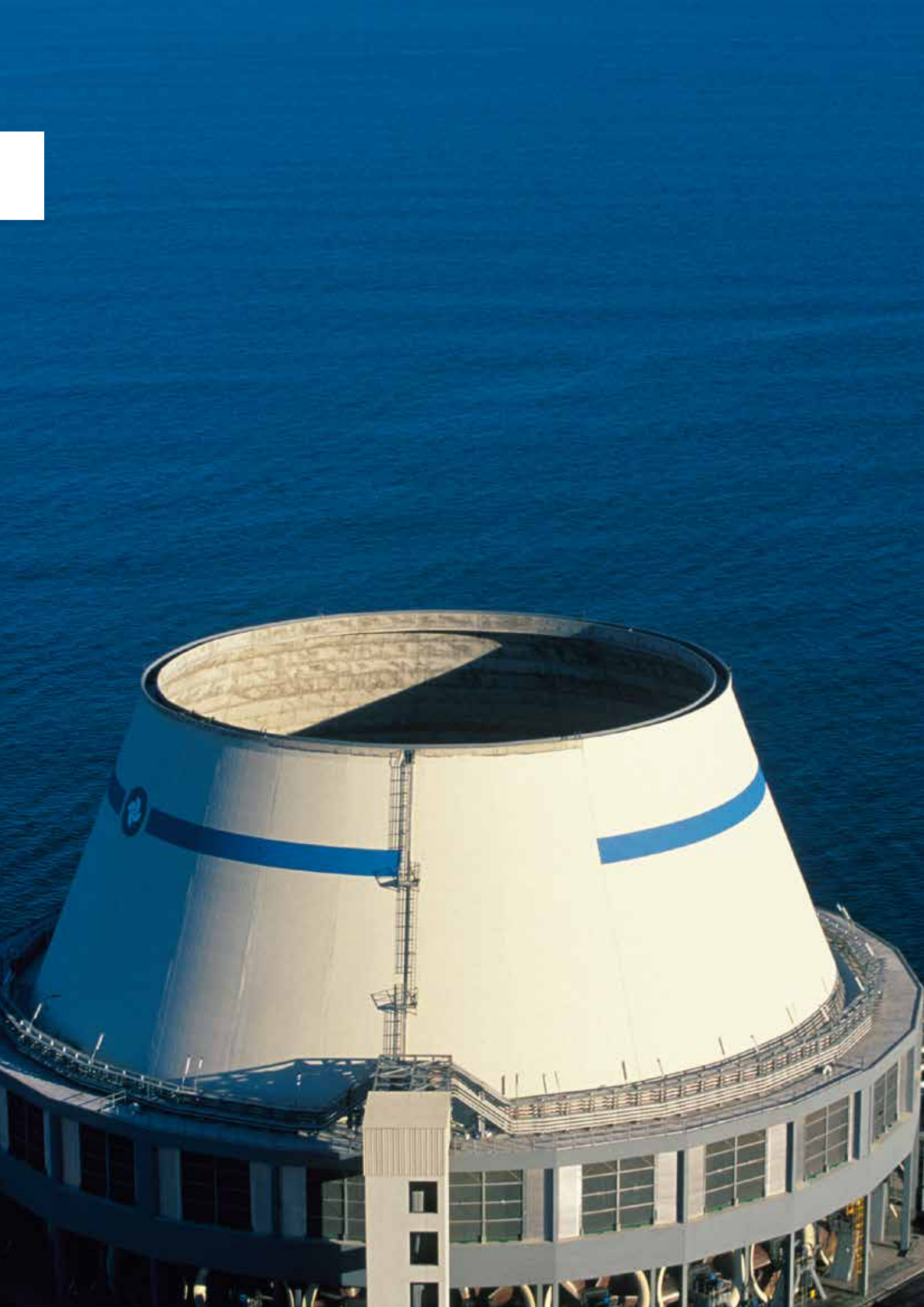
The Sarroch site has a complex safety system designed to detect potentially dangerous situations immediately.

The fire prevention water distribution system comprises an extensive network that covers the whole plant. **[fire prevention system]**

All the storage tanks are protected by cooling systems; the most important of these are activated automatically if a tank overheats. Similar systems are installed on all the pressure tanks, LPG storage and loading equipment and any other piece of equipment for which a rise in temperature could compromise safety. The site also has nine fast and easily manoeuvrable fire trucks carrying powder and foam extinguishers, which can be operated quickly in emergencies and act as a backup to the installed systems. Safety equipment and systems are regularly checked, and carefully and routinely maintained. **[tank cooling systems]** **[nine fire trucks]**

In the event of a spill at sea, vessels and equipment are available to respond quickly to the problem, following procedures laid down in the Internal Emergency Plan which, as mentioned above, includes the Marine Pollution Prevention Plan.

The site has four seagoing vessels that operate 24 hours a day and a wide range of equipment (skimmers, floating booms, etc.), all of which ensure that the site is fully capable of responding quickly to contain and collect any product spills. **[rapid-response seagoing vessels]**



4.
Environmental aspects

Complete, accurate and transparent information forms the solid basis of any dialogue.

In this section, Sarlux sets out all the information necessary for understanding how its production plant interacts with the environment and the surrounding area. The facts and figures show how the plant has improved over time and its commitments to expected new environmental objectives in the next few years: the result of technological and managerial decisions always made with an eye to improving the environment as well as health and safety, and production quality.

The company is committed to the clarity and completeness of information, which will allow it to engage in clear, concrete and ongoing dialogue with stakeholders, in order to give the surrounding area the answers that it expects.

4. Environmental aspects

[environmental analysis]

4.1 – General information

In accordance with the requirements of the European Parliament and Council Regulation (EC) 1221/2009 (EMAS), a thorough environmental assessment was made of the activities conducted under normal, abnormal and emergency conditions. The results of this environmental assessment are set out in a specific document held at the Prevention and Protection organisational unit, where it may be consulted. It is updated periodically and when changes are made.

Definitions contained in EC Regulation 1221/2009
Environmental aspect: *an aspect of an organisation's activities, products or services that has or can have an impact on the environment; a* ***significant environmental aspect*** *is an environmental aspect that has or can have a* ***significant environmental impact.***

Environmental impact: *any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's activities, products or services.*

[environmental aspects]

The direct and indirect environmental aspects of Sarlux's activities have been identified with reference to Annex 1 of the EMAS Regulation. The aspects deemed to be "significant" have also been determined. The direct environmental aspects are those over which the organisation has direct management control. Examples of direct aspects are: atmospheric emissions and wastewater.
Indirect environmental aspects are those over which the organisation can exert an influence but does not have direct control. Examples of indirect aspects are: the transport of raw materials and products.

The significance of each direct environmental aspect under normal operating conditions is assessed using the following criteria:
- the extent of the impact on the environment
- the existence of legislation, authorisation and other regulations to be followed
- the sensitivity of the issue for the local community

Abnormal events or emergencies that may give rise to major accidents such as fires, explosions and discharges into the sea were analysed and assessed as part of the Safety Report (described in section 3.3, page 38).
Other types of abnormal or emergency events not likely to generate major accidents were identified as part of the environmental analysis and assessed using estimates of their probability of occurrence and their potential consequences.

As regards the company's past record, no accidents have been sustained or environmental responsibilities incurred such as to determine significant impacts at the present time, with the exception of accidental spills into the soil and subsoil, as described in section 4.2.7, page 101.

In summary, the direct environmental aspects identified as significant are as follows:

Significant direct environmental aspects
Consumption of raw materials
Energy consumption (fuels, electricity)
Water consumption
Atmospheric emissions
Waste
Discharges into water
Discharges into the soil and subsoil (past activities, prevention activities)
Noise
Odours
Visual impact
Legislative obligations and limits prescribed by the relevant permits

The legislative obligations and limits prescribed the relevant permits are included in the descriptions and tables relating to the specific aspects listed above. For indirect environmental aspects, the degree of influence that Sarlux can indirectly exert over their control was assessed. The assessment led to the identification of the following indirect environmental aspects as significant:

Significant indirect environmental aspects
Product design
Road transport (of products, materials and substances by employees and external companies)
Sea transport (of raw materials and products)
Environmental conduct of external companies

Significant environmental aspects all relate to the Sarroch production facility.
The correlation between the various significant environmental aspects (both direct and indirect) identified for the Sarroch site and the resulting environmental impacts is shown in the table on the next page.

Significant direct environmental aspects	Environmental impacts
Raw materials	
Consumption	Consumption of a non-renewable resource
Storage and use	Risk of accidents (fires, explosions, discharges into the soil and sea)
Consumption of energy in the form of	
Fuels produced by the refinery	Atmospheric emissions from the site and resulting impacts
Electricity purchased	Indirect impacts on external electricity production sites
Water consumption	
Sea water desalinated internally	Energy consumption and resulting impacts
Water from industrial water supply	Consumption of natural resource in the local area
Atmospheric emissions	Effect on air quality at local level
	Contribution to large-scale effects (greenhouse effect, acid rain)
Waste	
Storage and treatment within the site	Indirect impacts on external disposal and recovery sites
Off-site treatment	Risk of discharges into the soil
Discharges into water	Effect on seawater quality
Discharges into the soil and subsoil	
Previous activities	Contamination of soil, subsoil and underground water on the site
Prevention activities	Reduction of the risk of contamination of the soil, subsoil and underground water
Noise	Effect on the acoustic environment outside the site (Sarroch area)
Odours	Nuisance caused outside the site (Sarroch area)
Visual impact	Visibility of the site in the area

Significant indirect environmental aspects	Environmental impacts
Product design	Indirect impact on air quality (fuel combustion)
Transport of products, auxiliary materials and employees over land	Atmospheric emissions
	Road traffic, risk of traffic accidents
Transport of raw materials by sea	Atmospheric emissions
	Risk of accidents and contamination of seawater
Environmental conduct of external companies	
Internal waste management	Risk of accidents and contamination of soil and subsoil
Road transport of employees, materials and equipment	Road traffic, risk of traffic accidents

A qualitative and quantitative description of the significant direct and indirect environmental aspects is set out in the tables on the following pages. Specific numerical performance indicators are given for each environmental aspect.
The indicator values, calculated on an annual basis, are generally provided for the last four years (2009-2012). Where relevant, the indicator values are compared with legal thresholds.
The indicators are divided into:

- operating performance indicators
- environmental sector indicators
- management performance indicators

Direct environmental aspects

Operating performance indicators

Relevant environmental aspect	Applicability	Definition of indicator[1]	Unit of measurement
Consumption of raw materials	Refinery	Quantity of raw materials processed	kt/year
	Refinery	Low-sulphur crude oil used/total raw materials processed	%
	Refinery	Refinery hydrocarbons burned in the flare system	kt/year
	Refinery	Refinery hydrocarbons burned in the flare system	% weight relating to processing
Energy consumption	Site*	Energy input to the site	TOE/year GJ/year
	Site	Energy output from the site	TOE/year GJ/year
	Site	Efficiency of integrated cycle: output/input energy	%
	Refinery	Efficiency of refinery cycle: output/input energy	%
	IGCC	Efficiency of IGCC cycle: output/input energy	%
	Refinery	Specific energy consumption: energy consumed/raw materials input	TOE/t refinery raw materials - GJ/t refinery raw materials
	IGCC	Specific energy consumption: energy consumed/semi-processed goods input	TOE/t IGCC load GJ/t IGCC load
Water consumption	Site	The site's water requirement[2]	m^3/hour - m^3/year
		Site water requirement – specific values	m^3/kt raw materials
		Use of recovered water/site water requirement	%
		Use of freshwater/site water requirement	%
		Use of water from refinery desalinator/site water requirement	%
		Use of water from IGCC desalinators/site water requirement	%
Atmospheric emissions	Refinery, IGCC, Site	SO_2 emissions in mass flow	t/year
	Site	SO_2 concentration bubble	tSO_2/kt raw materials
	Refinery	Sulphur content in fuels	% (in weight)
	Refinery	SO_2 concentration bubble	mg/Nm^3
	IGCC	SO_2 concentration	mg/Nm^3
	Refinery, IGCC, Site	NO_x emissions in mass flow	t/year
	Site	Specific NO_x emissions	tNO_x/kt raw materials
	Refinery	NO_x concentration bubble	mg/Nm^3
	IGCC	NO_x concentration	mg/Nm^3
	Refinery, IGCC, Site	CO emissions in mass flow	t/year
	Site	Specific CO emissions	t CO/kt raw materials
	Refinery	CO concentration bubble	mg/Nm^3
	IGCC	CO concentration	mg/Nm^3
	Refinery, IGCC, Site	Dust emissions in mass flow	t/year
	Site	Specific dust emissions	t dust/kt raw materials
	Refinery	Dust concentration bubble	mg/Nm^3
	IGCC	Dust concentration	mg/Nm^3
	Refinery	PM10 emissions in mass inflow	t/year
	Refinery	Specific PM10 emissions	t PM10kt raw materials
	Refinery	PM10 concentration bubble	mg/Nm^3
	Site	Diffuse emissions fugitive emissions	t/year
	Refinery, IGCC, Site	CO_2 emissions in mass flow	t/year
	Site	Specific CO_2 emissions	tCO_2/kt raw materials
Discharges into water	Site	Total capacity of discharged water[2]	m^3/hour
		Specific capacity of discharged water	m^3/kt raw materials
		COD (chemical oxygen demand) in mass flow	t/year
		Specific COD emission	m^3/kt raw materials
		Annual average COD concentration	mg/litre
		Total hydrocarbons in mass flow	t/year
		Specific hydrocarbon emission	t/Mt raw materials
		Annual average concentration of hydrocarbons	mg/litre
		Emission of nitrogen (ammoniacal, nitrous or nitric) in mass flow	t/year
		Specific emission of nitrogen (ammoniacal, nitrous or nitric)	t/Mt raw materials
		Annual average concentration of nitrogen (ammoniacal, nitrous or nitric)	mg/litre
		Total capacity of primary treatment units for incoming water, desalinators, IGCC towers[2]	m^3/hour
		Specific emissions of primary treatment units for incoming water, desalinators, IGCC towers	m^3/kt raw materials

Relevant environmental aspect	Applicability	Definition of indicator[1]	Unit of measurement
Discharges into water	Site*	Emissions of suspended solids in discharges from primary treatment units for incoming water, desalinators and IGCC towers in mass flow	t/year
		Specific emission of suspended solids in discharges from primary treatment units for incoming water, desalinators and IGCC towers	t/Mt raw materials
		Annual average concentration of suspended solids in discharges from primary treatment units for incoming water, desalinators and IGCC towers	mg/litre
		Difference in the temperature of the seawater 1 km from the point of discharge from the IGCC tower	Temperature in °C
Waste	Site	Total waste production (split into hazardous and non-hazardous)	t/year
	Site	Waste disposed of externally	t/year
		Waste sent to landfill	%
		Waste sent for incineration	%
		Waste sent for recovery	%
		Waste sent for preliminary storage	%
	Refinery	Specific production of typical refining waste	kg/t raw materials
	Site	Vanadium concentrate (filter cake) produced by the site	t/year
Accidental spills into the soil and subsoil – past activity	Site	Protection of the soil in storage areas: paved surface area of basins/total surface area	%
Accidental spills into the soil and subsoil - contamination prevention activities	Site	Quantity of product recovered/quantity of water drained from the wells of the hydraulic barrier	%
		Protection of the soil in storage areas: number of double bottom tanks	no.
		Protection of the soil along pipeways	m^2
		Inspection and maintenance: non-destructive testing expenses	EUR thousands/year
Noise	Site	Equivalent sound pressure level at site limits	dB(A)

*"Site" is understood to mean refinery + IGCC

Quality indicators for specific environmental sectors

Relevant environmental sector	Applicability	Definition of indicator	Unit of measurement
Atmosphere	Sarroch area (surveys by the public air quality monitoring network)	SO_2 – Compliance with the three-hourly, hourly and daily concentration limits	no. of times threshold exceeded/year
		SO_2 – Average annual concentration	Micrograms/m^3
		PM10 – Compliance with hourly concentration limits	no. of times threshold exceeded/year
		PM10 – Annual average concentration	Micrograms/m^3
		NO_2, NO_x – Average annual concentrations	Micrograms/m^3
		NO_2 – Compliance with the three-hourly, hourly and daily concentration limits	pure no. plus a quality assessment
	Sarroch hinterland (surveys using bio-indicators)	Index of Atmospheric Purity (IAP)	pure no. plus a quality assessment
Seawater	Stretch of sea surrounding the site (chemical surveys)	Trophic index (TRIX)	pure no. plus a quality assessment qualità
		CAM Index	
Noise	Sarroch area	L90 statistical indicator of sound pressure at points located in the town of Sarroch	dB(A)

*"Site" is understood to mean refinery + IGCC

(1) With reference to EC Regulation 1221/2009, Annex IV, it should be noted that for Sarlux it is not total annual production that is significant, but rather total annual processing of crude oil.

(2) With reference to EC Regulation 1221/2009, Annex IV, it should be noted that Sarlux, believing the hourly figure to be more intuitive, also expresses its water consumption in (m^3/hour) and not just in (m^3/year) to make the figure more immediately comprehensible.

Management performance indicators

Relevant environmental sector	Applicability	Definition of indicator	Unit of measurement
Training	Employees	Environmental protection training/total training hours	%
		Management emergency training/total training hours	%
Audit	Combined audit of environment, safety and quality	Hours spent on audits/total hours worked by auditors and employees audited	%
	"Arrow" field inspections	Hours spent on inspections/total hours worked by auditors and employees audited	%
Product design	Design and development	Product design hours/thousands of hours worked	hours/thousands of hours worked
Design and engineering of internal plant & equipment	Engineering	Plant & equipment engineering hours/thousands of hours worked	hours/thousands of hours worked
Investment	Environmental protection and safety	Total investment	EUR thousands/year

Indirect environmental aspects

Operating performance indicators

Relevant environmental sector	Applicability	Definition of indicator	Unit of measurement
Product characteristics	Oil products	Production of fuel oil/total oil products	%
		Quantity of sulphur in products/quantity of sulphur entering the site with raw materials	%
	Sulphur produced	Quantity of sulphur produced/quantity of sulphur entering the site with raw materials	%
Transport	Maritime traffic	Use of twin-hulled ships/total ships	%
		Use of ships with segregated ballast tanks/total ships	%
	Road traffic	Total number of heavy transport vehicles/quantity of raw materials processed	no. of vehicles/kt raw materials

Management performance indicators

Relevant environmental sector	Applicability	Definition of indicator	Unit of measurement
Transport	Maritime traffic	Safety checks of ships: number of ships checked/total number of ships	%
	Road traffic	Number of in-house company vehicles checked/number of authorised vehicles	%
External companies	Environmental behaviour	Companies that have ISO 9001 certification/total companies	%
		Companies that have ISO 14001 certification/total companies	%
		Companies that have OHSAS 18001 certification/total companies	%
		Training provided to employees of external companies/total hours worked	%

4.2 – Direct environmental aspects

4.2.1 – Consumption, storage and use of raw materials

Consumption

The raw materials entering the production cycle mainly comprise crude oil and small quantities of fuel oils and other semi-processed hydrocarbons.

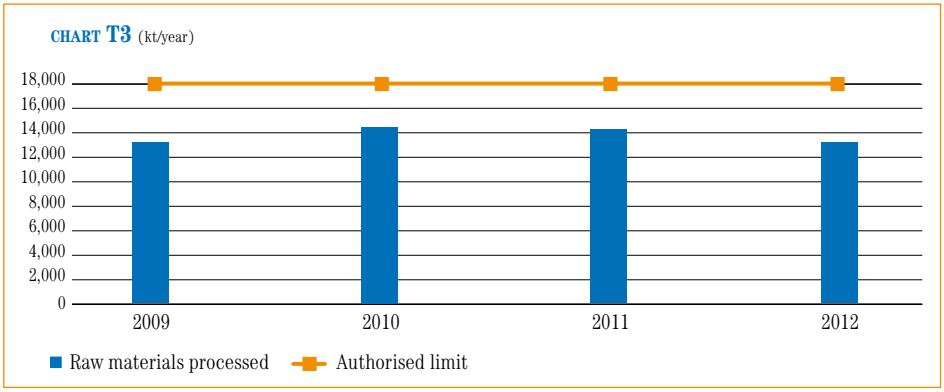
[Decree of the Italian Ministry for Productive Activities no. 17086 issued on 7 July 2003]

The refining of mineral oils (oil) is subject to specific authorisation. In Sarlux's case, an upper limit of 18 million tons a year has been set.

The consumption of raw materials is a significant environmental aspect of the activities carried out at the Sarroch site, since oil is a natural, non-renewable resource and the quantities processed are considerable, as shown in Table 3 above. For ease of reference, the table is reproduced below.

TABLE 3 Raw materials processed (kt/year)

2009	2010	2011	2012
13,305	14,340	14,006	13,309



In 2012, the Sarroch refinery processed approximately 13,309 kilotons (kt) of raw materials (crude oil and fuel oils), which is in line with the average for recent years. Between 2009 and 2012, a total of 55,000 kt of raw materials were processed, an average of 13,700 kt per year. In the last few years more light products have been produced, with fuel oil being kept to a minimum and heavy distillates from refining (TAR) being used to produce electricity.

In addition to the quantity of materials processed, the sulphur content in crude oil is another important parameter for managing the refining processes and controlling product characteristics.

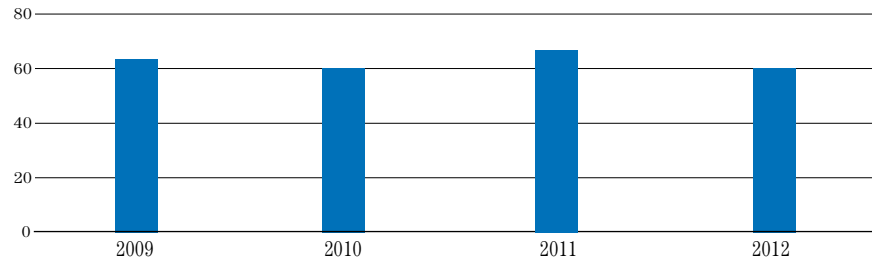
Table 7 and Chart T7 below show the values of the key indicator, which is calculated as the quantity of low-sulphur crude oil used as a proportion of the total quantity of crude oil processed.

TABLE 7 Consumption of low-sulphur crude oils *

Parameter	2009	2010	2011	2012
Low-sulphur crude oil used/total raw materials processed (%)	62.0	60.0	66.0	60.0

*Using the same criterion as that set out in Legislative Decree 152/06, Part V, Appendix X, for low-sulphur fuel oils, low-sulphur crude oils are defined as those with a sulphur content of less than 1%.

CHART T7 (%)



An examination of the above-mentioned figures shows that the use of low-sulphur crude oil was broadly stable over the four-year period 2009-2012. In addition to oil, auxiliary chemical substances are also used in refining and the IGCC. These auxiliary substances can be classified under the following main categories:

[auxiliary chemical substances]

- catalysts of chemical reactions
- treatment and process additives
- additives for correct product formulation
- oxygen, nitrogen, hydrogen

The consumption of auxiliary substances is less significant than that of raw materials as they are generally renewable resources and the total quantities used are much lower. However, the supply of raw materials and auxiliary substances involves the need for sea and road transport, which is an indirect environmental aspect. This aspect is examined in section 4.3.2 on page 115.

Storage and use

Under normal operating conditions, the use and storage of raw materials may involve, as an induced environmental aspect, diffuse and fugitive emissions of volatile organic substances into the atmosphere. This aspect is discussed in section 4.2.4.3 on page 72. As regards abnormal or emergency conditions, any events that may involve hazardous substances on the premises, such as raw materials, auxiliary substances or products, are analysed in the plant's Safety Report (section 3.3, page 38).

Flare emissions management

In 2012, the Group continued activities relating to a project launched in 2010 aimed at minimising flare emissions from the refinery (Flare Minimisation Plans), to be achieved by optimising management of the fuel gas and hydrogen networks. The work in 2012 included a critical analysis of the start-up and shut-down procedures of the units undergoing maintenance activities to implement preventive measures that would help reduce the impact on flare emissions. The results obtained in 2012 were extremely successful, since they broadly confirmed the level of emissions reached in 2011, with flare emissions down significantly compared with the final 2010 figure (-23 kt or -64% for specific processing).

The significant cut in emissions led to:

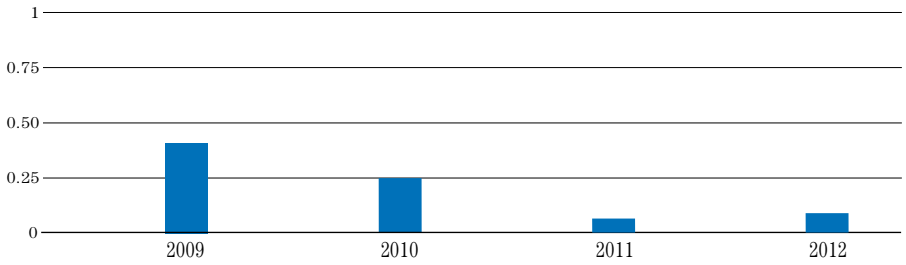
- a substantial reduction in the flares' visual impact
- greater availability of hydrogen from blow-down gas recovery (average 3 kN^3/h) used to increase the portion of diesel from MHC2 conversion

Table 7 bis and Chart T7 bis below show the values of the key indicator (expressed in kt/year) for hydrocarbons burned in the blow-down system.

TABLE 7 BIS Refinery hydrocarbons burned in the flare system

Parameter	2009	2010	2011	2012
Refinery hydrocarbons burned in the flare system (kt/year)	49.0	36.0	11.9	12.9
Refinery hydrocarbons burned in the flare system (% weight in relation to processing)	0.39	0.25	0.08	0.09

CHART T7BIS % refinery hydrocarbons burned in the flare system



4.2.2. – Energy consumption

The consumption of energy resources in the form of electricity and fuels represents a significant environmental aspect for the Sarlux site, and has a considerable economic impact on the business. Figure 11 shows a diagram of the site's energy balance and a table with the 2012 figures for external energy coming into the site, broken down into electricity, thermal energy and crude oil.

ENERGY INPUT TO THE SITE 2012	(GJ)	(TOE)
Energy	7,482,196	178,710
Termal energy (steam, H_2)	3,239,064	77,364
Crudes	55,181,359	13,284,195
Total energy input tothe site	566,902,619	13,540,269

ENERGY OUTPUT FROM THE SITE 2012	(GJ)	(TEP)
Oil products	485.558.783	11.597.400
Electricity	32.389.592	773.614
Fuel gas	1.388.978	33.175
Total energy output from the site	519.337.353	12.404.189

For oil product figures see: Table 2, page 33

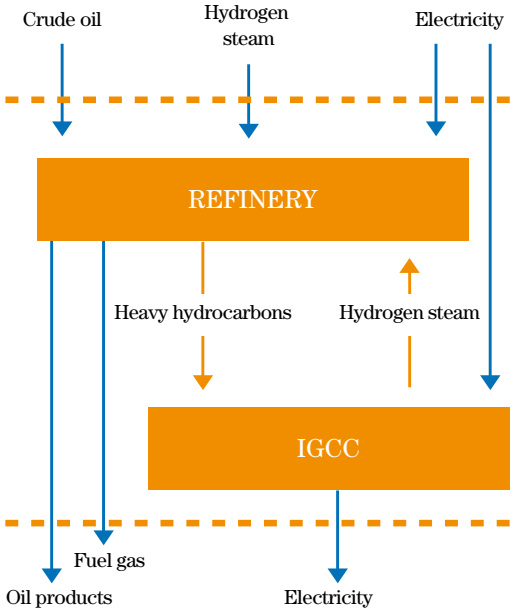


FIGURE 11 Energy balance chart

[Law 10 of 9 January 1991]

The company's commitment to improving energy efficiency dates back to the end of the 1970s/early 1980s, when it began to invest heavily in energy and heat conservation. Today, energy saving and efficiency are still strategic objectives and part of the improvement of the plant's overall environmental performance. As part of this commitment, important initiatives in thermal recovery implemented in 2009, together with the management activities identified in the FOCUS project (including the reduction of over-consumption in kilns and the maximisation of thermal integration between plants), reduced consumption by about 40,000 TOE in 2012.

[energy efficiency of the integrated cycle]

For these significant investments, applications were filed with the AEEG for certification of energy savings and for energy efficiency credits (also known as white certificates), which are an incentive towards making and maintaining investments to improve energy efficiency.

In accordance with legislation, an Energy Manager is appointed each year to monitor and promote energy conservation activities and efficient energy use on the Sarroch site. As mentioned earlier, the combined operations of the refinery and the IGCC plant effectively represent a large integrated cycle that transforms hydrocarbon inputs into refined oil products and energy.

The tables and charts below show the indicators relating to energy consumption. To enable comparisons to be made between the figures relating to the various types of energy, the Group has adopted the unit of measure "tons of oil equivalent" (TOE): all quantities of raw materials coming into the site and products leaving the site (fuels) and electrical energy inflows and outflows have been converted to TOE. In accordance with EC regulation 1221/2009, the same figures have also been expressed in gigajoules (GJ).

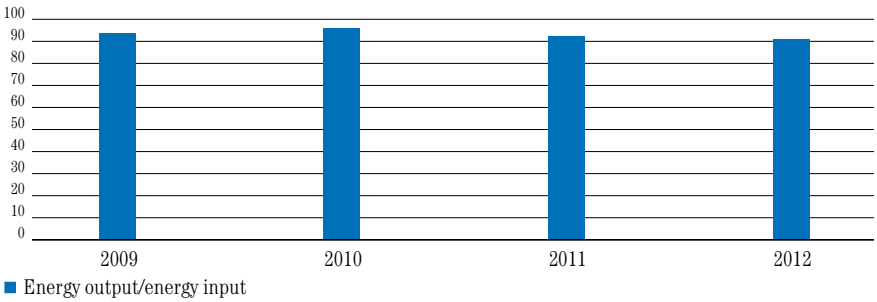
The energy efficiency of the integrated cycle (refinery and IGCC), shown in Table 8 and Chart T8, is calculated as the ratio of:

- the energy output from the integrated cycle (the sum of the energy content of oil products sold and of energy sold); to
- the energy input to the integrated cycle (the sum of the energy content of the raw materials used in the refining process and energy purchased externally).

TABLE 8 Energy efficiency of the integrated cycle (refinery and IGCC)

Parameter	2009	2010	2011	2012
Energy input (GJ)	567,062,841	611,424,036	596,691,048	566,902,619
Energy output (GJ)	523,381,381	577,055,445	550,018,697	519,337,353
Energy output/energy input (%)	92.3	94.4	92.2	91.6

CHART T8 Energy output/energy input (%)



It can be seen from the figures that the integrated cycle (refinery and IGCC) is extremely efficient, with a total value of over 92% in the last four years. The difference between energy input and energy output is mainly due to the internal consumption of energy necessary for the operation of the manufacturing processes and to an amount lost during operations.

The IGCC, as a producer of electricity for sale and of steam and hydrogen to be used in the refining process, converts the energy in the heavy hydrocarbons (that cannot be used in its present state) into valuable energy. This helps to meet the site's energy requirement through the recovery of steam and hydrogen. The energy efficiency indicator for the IGCC, shown in Table 9 and Chart T9, is calculated as the ratio of:

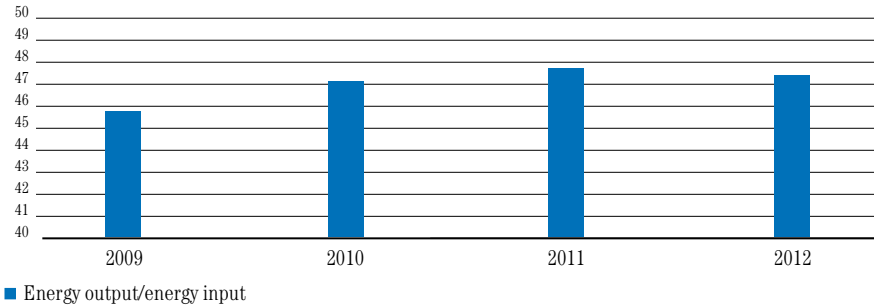
- energy output from the IGCC, in the form of electricity, steam, hydrogen or sulphur
- energy input to the IGCC, in the form of hydrocarbon feedstocks and electricity consumed

The efficiency values obtained by the IGCC are much higher than those of traditional thermoelectric plants.

TABLE 9 Energy efficiency of the IGCC

[energy efficiency of the IGCC plant]

CHART T9 (% TOE output / TOE input)



Parameter	2009	2010	2011	2012
Energy output/energy input (% TOE output/TOE input)	45.8	47.1	47.8	47.3

The indicator for the refining process is given as the ratio of:

- energy output from the refining process (the sum of the energy content in the oil products sold) to
- the energy input to the integrated cycle (the sum of the energy content of the raw materials used in the refining process and energy purchased externally)

Here too, Table 10 and Chart T10 show high energy efficiency values.

[energy efficiency of the refining cycle]

CHART T10 (% TOE output/TOE input)

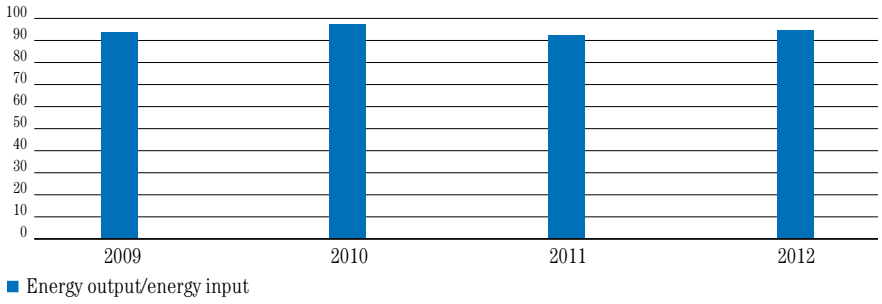


TABLE 10 Energy efficiency of the refining process

Parameter	2009	2010	2011	2012
Energy output/energy input (% TOE output/TOE input)	94.6	96.7	94.3	94.0

[energy consumption]

Internal energy consumption comprises the combustion of oil products and electricity used. Small quantities of thermal energy, in the form of steam, can be exchanged with the neighbouring petrochemical plant, especially during plant shutdowns or on other specific occasions.

Fuels used in the refining process comprise:

- fuel gas generated automatically from the refining process, which is not saleable as it is non-condensable
- low-sulphur fuel oil
- coke consumed directly in the fluid catalytic cracking (FCC) process

Fuels used in the IGCC cycle comprise:

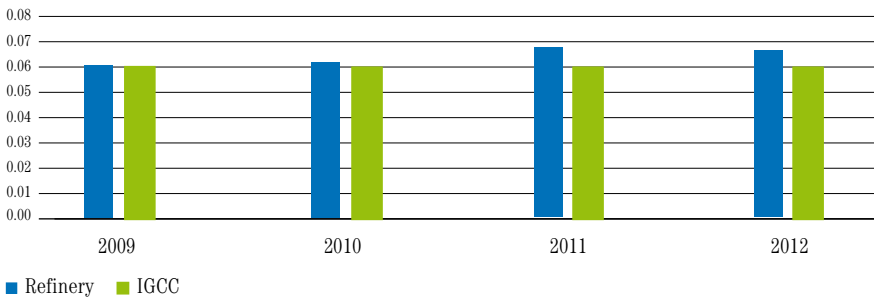
- syngas generated automatically from the gasification section and used in the combined cycle section diesel, used only as an emergency fuel
- diesel, use only as an emergency fuel

Table 11 and Chart T11 show the values of the specific energy consumption indicators relating to the raw materials processed in refining and used as feedstock for the IGCC.

TABLE 11 Specific energy consumption

Parameter	2009	2010	2011	2012
Specific energy consumption: refinery (TOE/t raw materials used in refining)	0.061	0.062	0.066	0.067
Specific energy consumption: IGCC (TOE/t IGCC feedstock)	0.060	0.060	0.060	0.060
Specific energy consumption: refinery (GJ/t raw materials used in refining)	2.554	2.650	2.745	2.805
Specific energy consumption: IGCC (GJ/t IGCC feedstock)	2.512	2.512	2.512	2.512

CHART T11 (TOE/T raw materials)



[table of objectives and measures: objective 2, page 125]

The value of the "specific energy consumption: IGCC" indicator has remained constant over the years. The "specific energy consumption of the refinery" has risen over the years due to the calculated effect of the increase in specific consumption generated by the different mix of crudes processed (shift towards those that are more energy-consuming) and the tendency to maximise finished products, which has taken precedence over reducing energy consumption since 2009.

4.2.3 – Use of water resources

At the Sarroch site, water is mainly used to generate steam for technological use (steam stripping, heat exchangers and power generation), to supply the fire prevention system, to replace cooling cycle losses and for civil use. Figure 12 shows a diagram of the site's water cycle.

Aware of the problem of scarce water resources in the region, Sarlux has adopted a policy, over the years, to reduce its dependence on primary water sources from the surrounding region, by:

- installing a first desalinator in 1994 with a capacity of 300 m^3/hr, followed by a further six desalination modules for the IGCC in 1999, with a total capacity of approximately 600 m^3/hr
- implementing measures to maximise the recycling of purified water from the

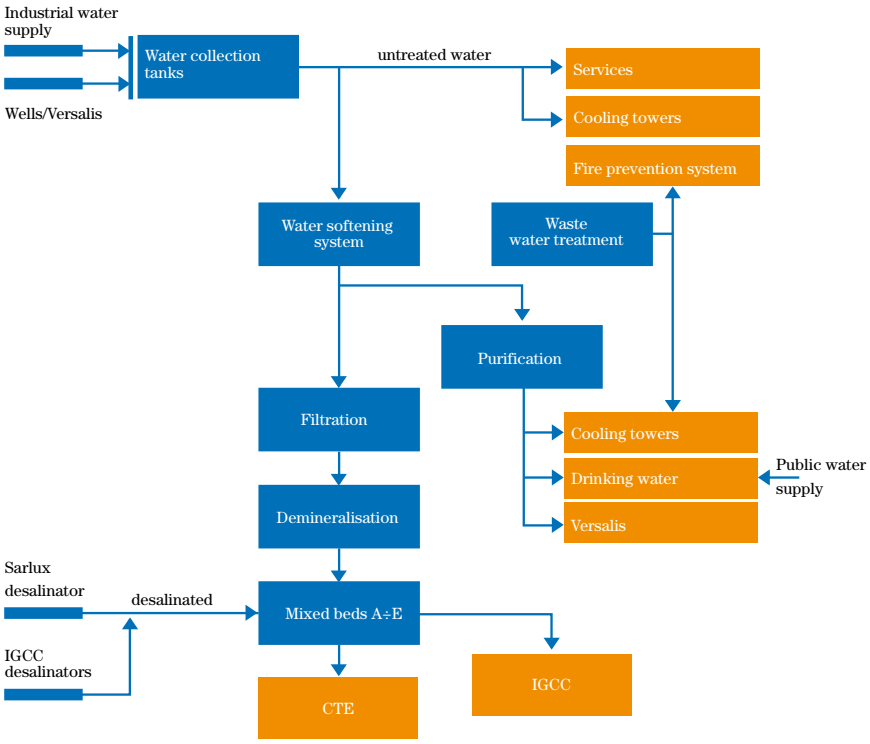


Figure 12 Water usage chart

purification process, following improvements to the treatment process and increased filtering capacity

Specifically, a new "filtration, ultra-filtration and reverse osmosis" plant (known as the BE-5, with a capacity of 230 m^3/h of demineralised water) entered into service in 2012. This innovative system for producing demineralised water has enabled the Group to further increase the percentage of wastewater reused after purification by the wastewater treatment plant (TAS).

[concession decree pursuant to Presidential Decree 250/49, Constitutional Law 3/48 of 5 June 1998 and renewal application of 12 June 2007 to the Civil Engineering Department of the Province of Cagliari]

Currently, the main types of water resources used are:

- seawater that has been treated using dedicated desalination units
- untreated water supplied by the CASIC industrial water system, which is fed by reservoirs in the area
- water recovered by the wastewater purification system (after filtering)

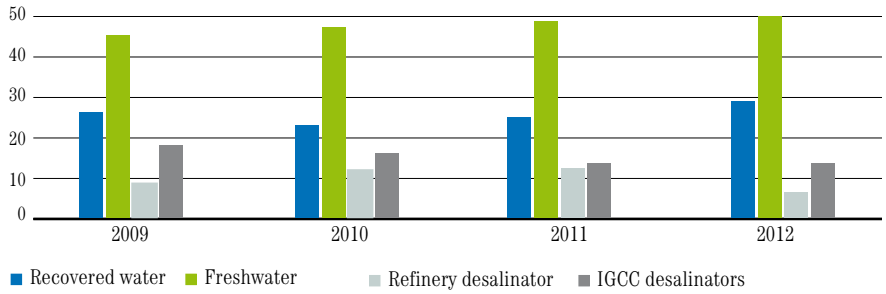
A limited quantity of demineralised water obtained through an exchange with the Versalis industrial site was also used in 2012. The figures on the site's water consumption are shown in Table 12 and Chart T12. These also include quantities relating to the IGCC, which mainly uses water from the dedicated desalinators for its production activities. A closed-circuit seawater system with a cooling tower has been installed to cool the IGCC equipment.

Supply sources in 2012 continued the trend seen in previous years, as shown in Table 12 and Chart T12.

Table 12 Water sources for the site

Parameter	2009	2010	2011	2012
Recovered water/water requirement (%)	26.5	23.4	24.4	29.3
Freshwater/water requirement (%)	45.7	47.9	49.3	49.6
Water from refinery desalinator/water requirement (%)	8.7	11.4	11.4	8.0
Water from IGCC desalinators/water requirement (%)	18.4	17.1	14.4	12.6
Demineralised water from Polimeri Europa (%)	0.8	0.2	0.5	0.5

CHART T12 (%)



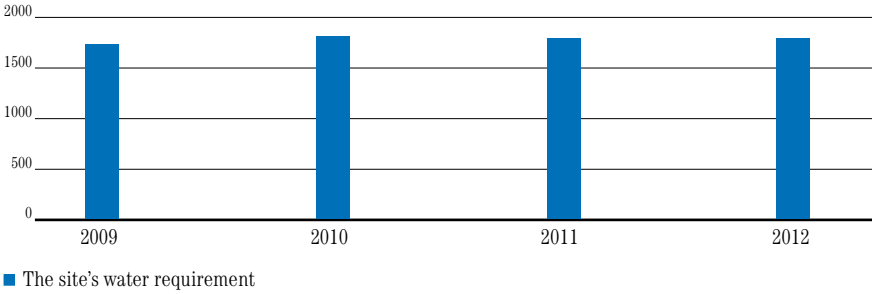
In the period under review, internal recovery on average met approximately 30% of the total annual requirement, and desalination was also a source of supply, accounting for 20% of the total. Taken together, desalination and recovered water met approximately 50% of the requirement in 2012. This is a significant result for the site, confirming the strategy undertaken: to rationalise consumption and internal recycling.

The site's water consumption (in absolute terms) is shown in Table 13 and Chart T13.

TABLE 13 The site's water requirement - absolute values

Parameter	2009	2010	2011	2012
The site's water requirement - average flow rate (m^3/hour)	1,687	1,891	1,796	1,849
The site's water requirement (m^3/year)	14,778,120	16,565,160	15,732,960	16,241,616

CHART T13 (m^3/hour)

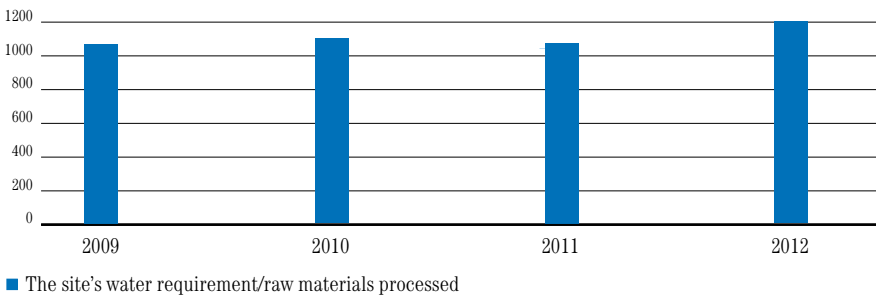


The ratio of specific water consumption to raw materials processed is shown by the indicator in Table 14 and the related chart.

TABLE 14 The site's water requirement – specific values

Parameter	2009	2010	2011	2012
Site's water requirement/raw materials processed (m^3/kt raw materials)	1,116	1,157	1,123	1,223

CHART T14 (m^3/kt raw materials)



4.2.4 – Atmospheric emissions

4.2.4.1 – General

Atmospheric emissions represent a significant environmental impact for the activities carried out at the Sarlux site under normal conditions and in specific abnormal and emergency conditions. In 2012, the reference legislation governing atmospheric emissions by the Sarlux plant consisted of the AIA permit DSA-DEC-2009-0000230 of 24 March 2009, which entered into force on 9 April 2009. The AIA permit contains the regulations on the limits for atmospheric emissions from the refinery and the IGCC. As regards the refining process, the limits on emission concentrations relate to the concentration "bubble", i.e. the ratio of the total quantity of the mass of each pollutant to the total volume of the gaseous effluents of the refinery as a whole.

In accordance with legislation, atmospheric emissions can be divided into:

- emissions ducted to smokestacks
- non-ducted emissions.

Ducted emissions

[table of objectives and measures: objectives 1, 2, 3, 4, 5, 7, pages 125-126]

Emissions ducted to smokestacks are mainly due to:

- combustion processes carried out in furnaces to guarantee the thermal energy necessary for refining
- combustion processes necessary for producing electricity and steam (thermoelectric plant and IGCC)

The main pollutants in these emissions are SO_2, NO_x, CO, dust and CO_2. Figure 13 shows the location of the emission points ducted from the refinery and the IGCC. Numerous objectives and improvement measures have been defined for ducted atmospheric emissions.

Non-ducted emissions

[table of objectives and measures: objective 6, page 126]

Non-ducted emissions are mainly due to:

- the storage and transportation of raw materials and products, and the treatment of wastewater (diffuse emissions)
- minor systemic emissions from sealing components, such as valves and flanges (fugitive emissions).

Diffuse and fugitive emissions are technically not ductable. These may be contained by installing appropriate sealing systems and through monitoring and maintenance.

The substances present in diffuse and fugitive emissions are volatile organic compounds (VOCs), which contain light hydrocarbons and can evaporate in ambient and in processing conditions.

As can be seen from the plan of the facility in figure 7 (page 31), the areas in which diffuse emissions can arise relate to storage, shipment, the production processes and wastewater treatment.

Objectives and improvement measures have also been defined for diffuse and fugitive atmospheric emissions.

Calculation of emissions values

Ducted emissions may be calculated in various ways. Specifically:

- Emissions of SO_2, NO_x, dust, CO and the flue gas flow rate from Sarlux's centralised smokestack (which collects approximately 33% of the emissions from the refining process) and from the IGCC smokestack (which collects 100% of the emissions from the plant) are determined using continuous instrument analysis; instruments

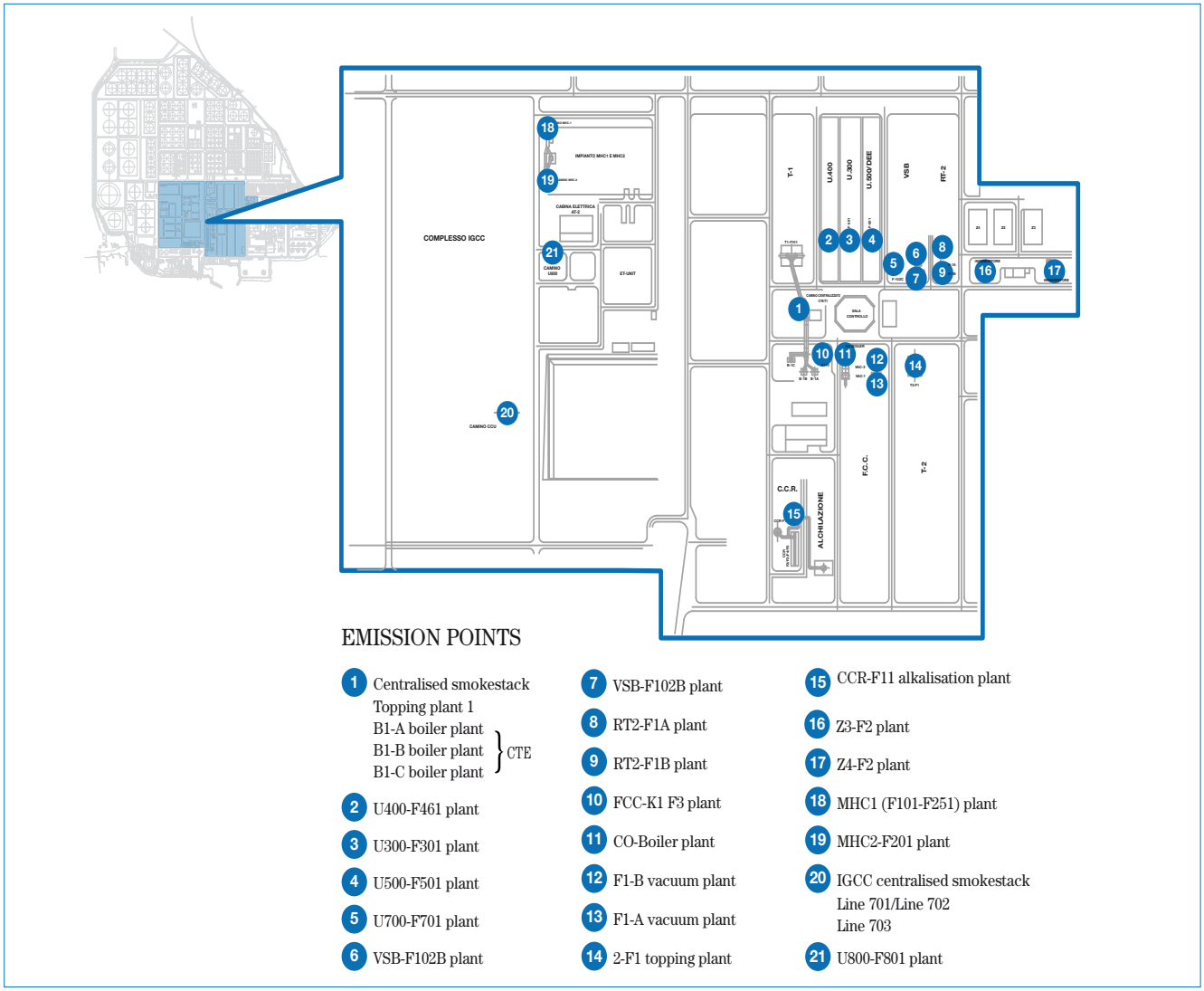


Figure 13 Map showing the locations of the plant's emission points

for carrying out the continuous measurement of emissions from sulphur plants (Z3-F2 and Z4-F2) were also installed in 2009 but did not become operational until June 2010; instruments to continuously measure emissions from the CCR/Alkalisation, CO-Boiler and Topping 2 plants were installed in September 2010, becoming operational in December 2010;

- emissions from the other smokestacks are calculated based on the measurement of fuels consumed, laboratory analysis of their quality and the characteristics of the burners

The calculation methods used for 2012, in line with the procedures implemented in 2009, also took account of the H_2S, VOC and NH_3 parameters + chlorine-based compounds and follow the instructions contained in new European and international guidelines[1].

From 2009, alternative checks will also be made on all smokestacks in the site every six months. This will involve taking a sample and sending it for analysis by an external laboratory.

1 CONCAWE – Air pollutant emission estimation methods for E-PRTR reporting by refineries – 2009 edition
RTI International - Emission Estimation Protocol for Petroleum Refineries – December 2009
European Environment Agency - Air pollutant emission inventory guidebook – 2009

[table of objectives and measures: objective 6, page 126]

Non-ducted emissions are determined based on estimates and calculations using formulae and widely accepted models[2].
Diffuse and fugitive emissions for 2009–2012 were determined using estimates based on formulae and accepted calculation methods (source: United States Environmental Protection Agency (USEPA) for emissions from the transportation and storage of raw materials and products; American Petroleum Institute (API) for emissions from wastewater treatment; and Unione Petrolifera for fugitive emissions). A monitoring campaign is currently under way for fugitive emissions using LDAR monitoring methodology[3], which is considered one of the best techniques available in the sector[4]. The results obtained with this technique show that the calculation methods adopted previously were very conservative.
The next few sections set out the figures for 2009-2012, calculated according to the above-mentioned methodologies and broken down into the following categories:
- ducted emissions of SO_2, NO_x, dust, PM10 and CO (section 4.2.4.2 below)
- non-ducted emissions of volatile organic compounds (section 4.2.4.3, page 70)

Since atmospheric emissions from the facility may affect the air quality in the locality, the data collected by the public monitoring network on the air quality in the Sarroch area and processed by the Cagliari provincial authority are also presented after the figures on emissions (section 4.2.4.4. page 71).
Lastly, the data on CO_2 emissions from the facility are also provided (section 4.2.4.5, page 79). Although these emissions fall into the category of ducted emissions, it was considered appropriate to show them separately as their impact is global rather than local, given that they contribute to the "greenhouse effect".

4.2.4.2 – Data on ducted emissions of SO_2, NO_x, dust, PM10 and CO

Data on ducted emissions of SO_2, NO_x, dust, PM10 and CO are provided using the following indicators:
- absolute mass flow values for the refinery, the IGCC and the whole site (refinery + IGCC)
- specific mass flow values, given as ratios to the raw materials input to the integrated production cycle, relating to the whole site
- total concentration values for the refinery ("bubble" values)
- concentration values for the IGCC

Of the indicators given above, the following are subject to limits:
- absolute mass flow values for the refinery
- concentration values for the IGCC
- concentration "bubble" values for the refinery

All indicators are determined annually.

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2 For diffuse emissions from the storage tanks, the "TANKS" model is used (source: US Environmental Protection Agency (E.P.A.); for diffuse emissions from the shipping of products and wastewater treatment tanks, specific formulae are used from the E.P.A. and A.P.I. (American Petroleum Agency) respectively.
For fugitive emissions, an algorithm from Unione Petrolifera and CONCAWE is used, as well as, from 2008 onwards, new monitoring technologies (varifocal infrared video camera) and a new monitoring approach (SMART LDAR programme). The calculation algorithms take account of: the quantity of raw materials processed for storage emissions and for fugitive emissions, the quantity of products delivered for delivery emissions and the quantity of incoming wastewater to be treated for emissions from the wastewater treatment plant.
For storage emissions, the technical characteristics of the tanks are also relevant.

3 LDAR: Leak Detection and Repair.

4 Guidelines on the Best Available Techniques in the Refining Sector, Ministerial Decree of 29 January 2007.

Sulphur dioxide (SO_2)

The site recorded its best ever year for total SO_2 emissions in 2012, confirming the downward trend under way for several years.

This result is due to both steady improvement in the quality of the fuels used (Chart 17) and the stability of the TGTU.

This can be clearly seen from the absolute values relating to the refinery and to the whole site, as shown in Table 15 and Chart T15. IGCC data are in line with 2010 performance. The decrease in 2011 is due to the ten-yearly shutdown of the whole plant for statutory planned maintenance and inspections.

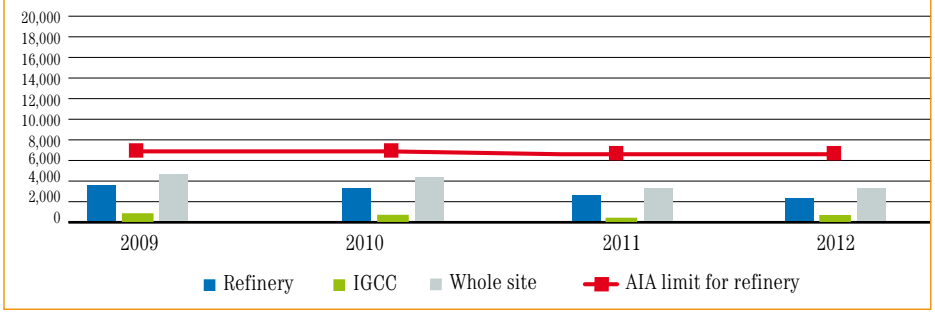
TABLE 15 SO_2 Emissions: absolute mass flow values

Parameter	2009	2010	2011	2012
Refinery (t/year)**	3,896	3,709	3,566	3,348
IGCC (t/year)	514	463	389	443
Whole site (t/year)*	4,410	4,172	3,955	3,791

* Compared with the limit of 16,000 t/year, established by DEC/VIA/2025 of 28 December 1994, in force until 8 April 2009.

** Compared with the limit of 6,700 t/year valid (for the refinery alone) from 9 April 2009 until 31 December 2010; as of 1 January 2011, this limit was changed to 6,400 t/year.

CHART T15 (t/year)

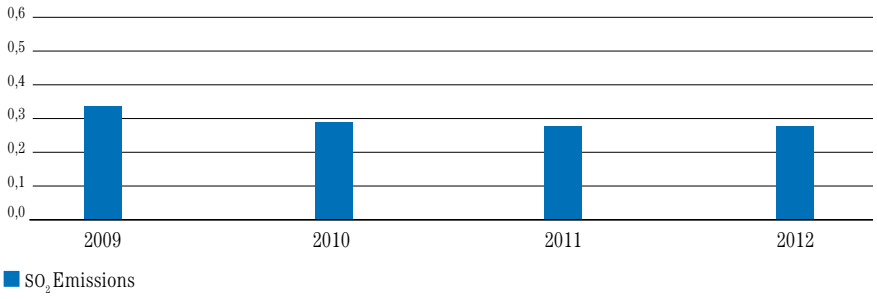


The values of all the mass flow indicators show a general reduction over time and, in any case, the indicators are always well within the limits. Specific emissions from the site are also in line with the trend recorded in previous years, as shown in Table 16 and Chart T16.

TABLE 16 SO_2 emissions: specific mass flow values

Parameter	2009	2010	2011	2012
Emissions (t SO_2/kt raw materials)	0.33	0.29	0.28	0.28

CHART T16 (t SO_2/kt raw materials)



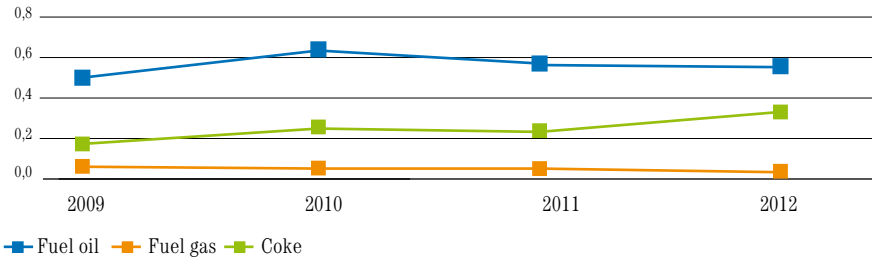
As mentioned above, the reduction in SO_2 emissions is consistent with the balance between the gradual improvement in the quality of fuels and the related quantity used: in 2012, the tendency to prefer the use of fuel gas, in which the percentage of sulphur is gradually being reduced, was confirmed, as shown in Table 17 and Chart T17.

TABLE 17 Sulphur content of fuels used in the refinery

Parameter	2009	2010	2011	2012
Sulphur content of fuel oil (%)	0.53	0.62	0.59	0.58
Sulphur content of fuel gas (%)	0.07	0.05	0.05	0.03
Sulphur content of coke * (%)	0.19	0.23	0.22	0.33

*Fuel generated automatically and consumed in the Fluid Catalytic Cracking (FCC) plant

CHART T17 (%)



The general reduction of SO_2 emissions over time is also borne out by the concentration values reported in the following tables, which are, moreover, much lower than the applicable limits, even though these have been reduced.

TABLE 18 SO_2 emissions: concentration "bubble" values for the refinery

Parameter	2009	2010	2011	2012
SO_2 concentrations - refinery (mg/Nm^3)	395	335	314	309
Limit for the refinery * (mg/Nm^3)	650	650	600	600

* Limit of 1,700 mg/Nm^3 pursuant to Legislative Decree 152/06 Part V, Appendix I, Part IV, applicable until 8 April 2009; from 9 April 2009, the limit of 650 mg/Nm^3 in accordance with AIA permit DSA-DEC-2009-0000230 of 24 March 2009, valid until 31 December 2010; from 1 January 2011, this limit was changed to 600 mg/Nm^3.

CHART T18 (mg/Nm^3)

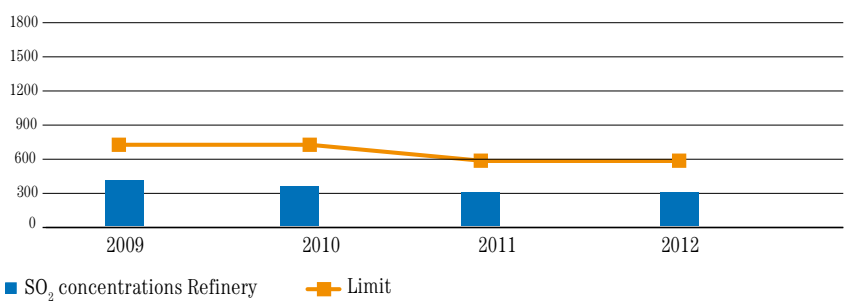
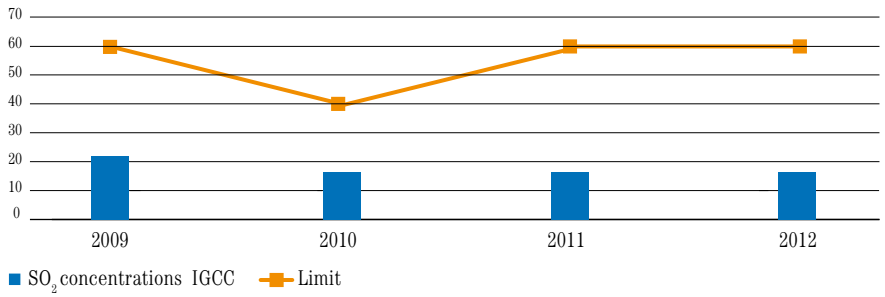


TABLE 19 SO_2 emissions: concentration values for IGCC

Parameter	2009	2010	2011	2012
SO_2 concentrations - IGCC (mg/Nm^3)	23	16	16	17
Limit for the IGCC* (mg/Nm^3)	60	40	60	60

* Limit of 60 mg/Nm^3 established at the conclusion of the environmental impact assessment procedure for the IGCC project (DEC/VIA/2025 of 28 December 1994) in force until 8 April 2009; from 9 April 2009 a limit of 40 mg/Nm^3 in accordance with AIA permit DSA-DEC-2009-0000230 of 24 March 2009
From 27 July 2010, the Ministry followed the Operator's recommendation and changed the SO_2 emission limit in the VIA Decree to 60mg/Nm^3

CHART T19 (mg/Nm^3)



Nitrogen oxide (NO_x)

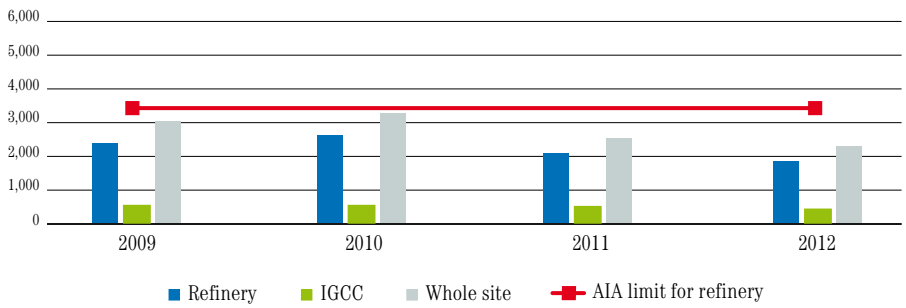
NO_x emissions are only marginally affected by fuel quality, and largely depend on combustion techniques, which in turn are related to technological factors such as burner type. The installation in 2007 of burners that produce low levels of NO_x, for the furnaces of the Topping RT2 and Visbreaking plants led to a significant reduction in emissions from the refinery. This performance, shown below, was repeated in subsequent years. The trend in emissions concentrations in 2012 confirmed that of previous years. The figures for the absolute mass flow indicators are shown in Table 20 and Chart T20.

TABLE 20 NO_x emissions: absolute mass flow values

Parameter	2009	2010	2011	2012
Refinery (t/year)**	2,426	2,854	2,133	1,907
IGCC (t/year)	578	600	565	519
Whole site (t/year)*	3,004	3,454	2,698	2,426

* Compared with the limit of 5,000 t/year, established by DEC/VIA/2025 of 28 December 1994, in force until 8 April 2009.
** Compared to the limit of 3,400 t/year applicable (for the refinery only) from 9 April 2009, in accordance with AIA permit DSA-DEC-2009-0000230 of 24 March 2009.

CHART T20 (t/year)

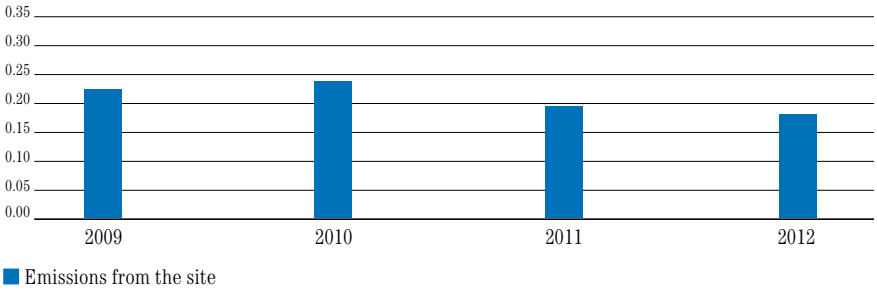


The indicators relating to the site and the refinery have always been lower than the authorised limits, and have decreased over time, assisted by the reduction in the indicator values relating to the refinery and by the start-up of the IGCC. The specific mass flow indicator (figures in Table 21) has also come down over the years, in keeping with the absolute mass flow indicator for the site.

TABLE 21 NO_x emissions: specific mass flow values

Parameter	2009	2010	2011	2012
Emissions (tNO_x/kt raw materials)	0.23	0.24	0.19	0.18

CHART T21 (t NO_x / kt raw materials)



The concentration indicators are also lower than the applicable limits and are improving all the time, as shown in the tables and charts below.

TABLE 22 NO_2 emissions: Concentration "bubble" values for the refinery

Parameter	2009	2010	2011	2012
NO_x concentrations - refinery (mg/Nm³)	273	258	188	176
Limit for the refinery * (mg/Nm³)	500	300	300	300

* Limit of 500 mg/Nm³ stipulated by Legislative Decree 152/06 Section V, Appendix I, Part IV in force until 8 April 2009; from 9 April 2009 limit of 300 mg/Nm³ in accordance with the AIA environmental authorisation (DSA-DEC-2009-0000230 of 24 March 2009).

CHART T22 (mg/Nm³)

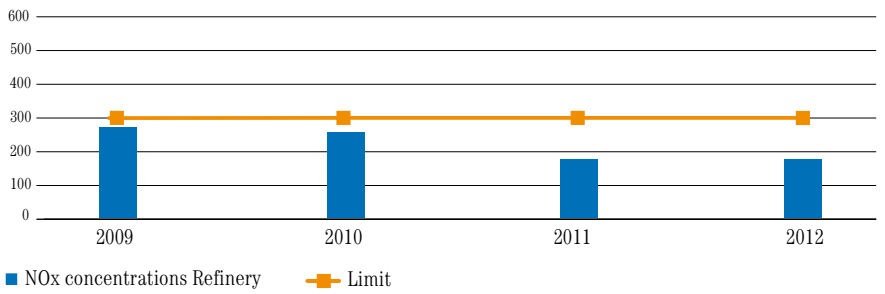
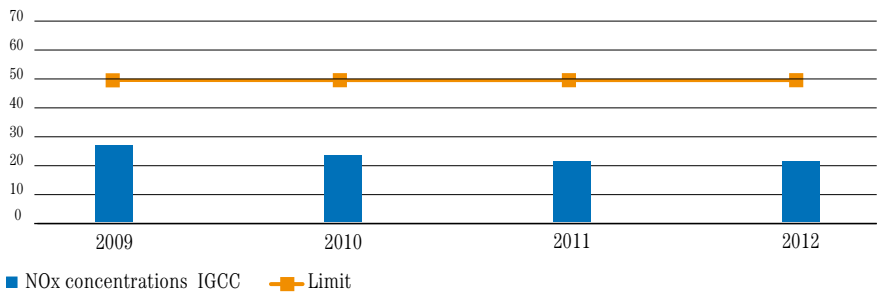


TABLE 23 NO_x: Concentration values for the IGCC

Parameter	2009	2010	2011	2012
NO_x concentrations - IGCC (mg/Nm³)	27	22	21	19
Limit for the IGCC* (mg/Nm³)	60	50	50	50

* Limit of 60 mg/Nm³ established at the conclusion of the environmental impact assessment procedure for the IGCC project (DEC/VIA/2025 of 28 December 1994) in force until 8 April 2009; from 9 April 2009 a limit of 50 mg/Nm³ in accordance with AIA permit DSA-DEC-2009-0000230 of 24 March 2009.

CHART T23 (mg/Nm³)



Dust

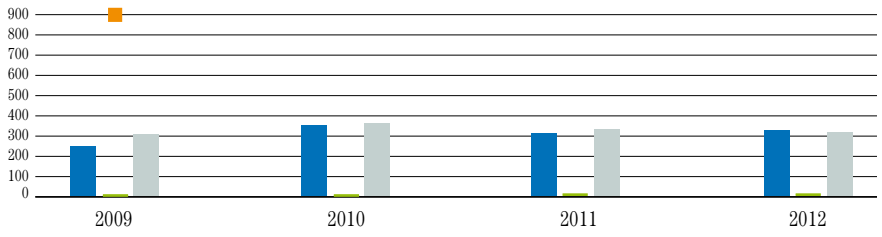
The figures relating to the absolute mass flow indicators for dust are shown in Table 24.

TABLE 24 Dust emissions: absolute mass flow values

Parameter	2009	2010	2011	2012
Refinery (t/year)	277	348	324	328
IGCC (t/year)	26	28	35	28
Whole site* (t/year)	303	376	358	355

* Compared with the limit of 900 t/year, established by DEC/VIA/2025 of 28 December 1994, in force until 8 April 2009. The AIA permit DSA-DEC-2009-0000230 of 24 March 2009, in force from 9 April 2009, stipulates mass flow limits only for PM10, which are reported in Table 24 bis. The dust emissions figure for 2012 is also provided for comparison purposes.

CHART T24 (t/year)



The refinery's exclusive use of fuel oil with a low sulphur content (BTZ) in the past few years has kept dust emissions at low levels. The emissions indicator for the site has always been much lower than the authorised limit. Concentration values have remained broadly stable (Table 26). The concentration indicators, shown in the tables and charts below, are in line with previous years.

TABLE 25 Dust emissions: specific mass flow values

Parameter	2009	2010	2011	2012
Emissions from the site: t dust/kt raw materials	0.02	0.02	0.03	0.03

CHART T25 (t dust/kt raw materials)

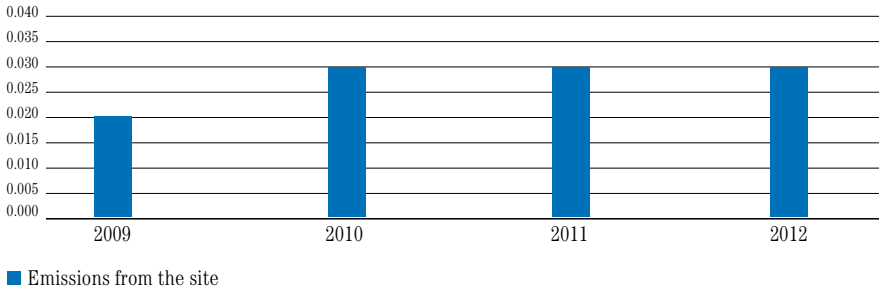


TABLE 26 Dust: Concentration "bubble" values for the refinery

Parameter	2009	2010	2011	2012
Dust concentrations - refinery (mg/Nm^3)	31	31	29	30
Limit for the refinery * (mg/Nm^3)	80	50	40	40

* Limit of 80 mg/Nm^3 pursuant to Legislative Decree 152/06 Part V, Appendix I, Part IV, applicable until 8 April 2009; from 9 April 2009, the limit of 50 mg/Nm^3 in accordance with AIA permit DSA-DEC-2009-0000230 of 24 March 2009; from 1 January 2011, this limit was changed to 40 mg/Nm^3.

CHART T26 (mg/Nm³)

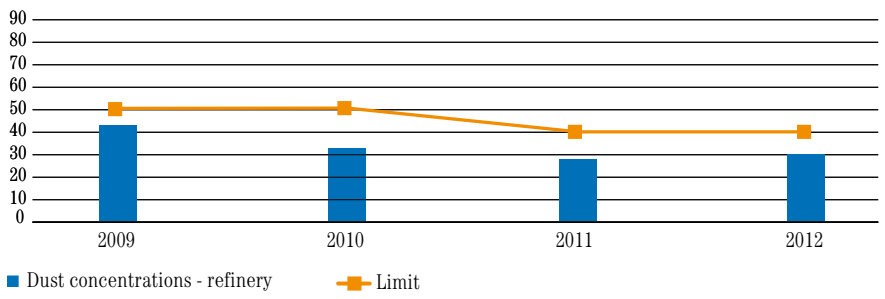
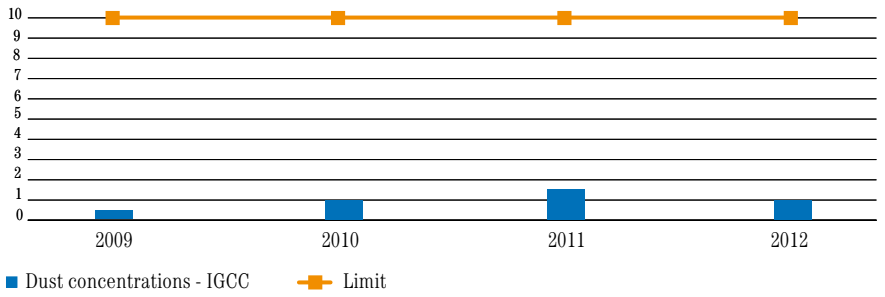


TABLE 27 Dust: Concentration values for the IGCC

Parameter	2009	2010	2011	2012
Dust concentrations - IGCC (mg/Nm³)	1.1	1.0	1.4	1.04
Limit for the IGCC (mg/Nm³)	10	10	10	10

CHART T27 (mg/Nm³)



All the values shown are much lower than the applicable limits.

[table of objectives and measures: objectives 2, 3, 4 and 5, page 125]

PM10

Table 24 bis shows the figures relating to the absolute mass flow indicator for PM10. The authorised limits, which were introduced on 9 April 2009 by the AIA permit, relate only to the refinery.

[PM10]

TABLE 24 BIS PM10 emissions: absolute mass flow values

Parameter	2009	2010	2011	2012
Refinery (t/year)*	229	250	223	213
Limit for the refinery (t/year)	-	330	330	330

* Compared with the limit for the refinery only of 330 t/year in accordance with AIA permit DSA-DEC-2009-0000230 of 24 March 2009 in force from 9 April 2009. Legislation prior to 2009 did not stipulate limits for this parameter.

The figures reported in the three tables below are calculated using the US-EPA 1998 method. In 2012, the absolute mass flow value of PM10 was lower than the limit. Table 25 bis below shows the specific values. The concentration indicator values given in the next table (Table 26 bis) show that the new legal limits have been complied with.

TABLE 25 BIS PM10 emissions: absolute mass flow values

Parameter	2009	2010	2011	2012
Emissions from the site: t PM10/kt raw materials	0.017	0.017	0.018	0.016

TABLE 26 BIS PM10 emissions: concentration "bubble" values for the refinery

Parameter	2009	2010	2011	2012
PM10 concentrations - refinery (mg/Nm^3)	25	23	20	20
Limit for the refinery * (mg/Nm^3)	30	30	30	30

* Limit of 30 mg/Nm^3 in accordance with AIA permit DSA-DEC-2009-0000230 of 9 April 2009. Legislation prior to 2009 did not stipulate limits for this parameter.

All the values shown are lower than the applicable limits.

Carbon monoxide (CO)

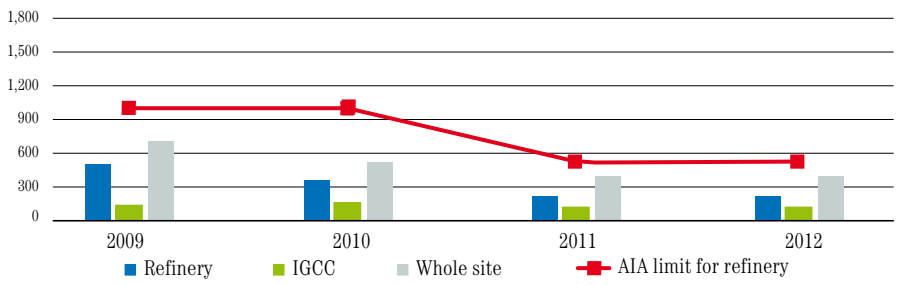
The figures for the absolute mass flow indicators are shown in Table 28 and Chart T28.

TABLE 28 CO emissions: absolute mass flow values

Parameter	2009	2010	2011	2012
Refinery (t/year)**	542	360	255	248
IGCC (t/year)	123	159	173	196
Whole site* (t/year)	665	519	428	444

* Compared with the limit of 1,700 t/year, established by DEC/VIA/2025 of 28 December 1994, in force until 8 April 2009.
** Compared with the limit of 1,000 t/year valid (for the refinery alone) from 9 April 2009, in accordance with the AIA permit (DSA-DEC-2009-0000230 of 24 March 2009) valid until 31 December 2010; as of 1 January 2011, this limit was changed to 500 t/year.

CHART T28 (t/year)



The emissions indicator for the site has always been lower than the limit and reveals a broadly positive trend over time: the IGCC figure has fallen, due to the optimisation of the combustion process in certain furnaces, and especially to the new contribution made by the TGTU in this area since 2009. The figure relating to the specific mass flow indicator for the site shown in Table 29 and Chart T29 is also positive and in 2012 was similar to that recorded the previous year.

TABLE 29 CO emissions from the site: specific mass flow values

Parameter	2009	2010	2011	2012
Emissions from the site: t CO/kt raw materials	0.05	0.04	0.03	0.03

The values of the concentration indicators shown in the tables below are much lower than the applicable limits.

CHART T29 (t CO/kt raw materials)

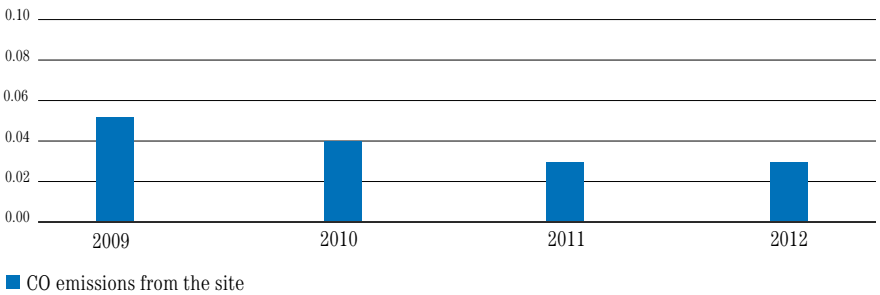


TABLE 30 CO emissions: Concentration "bubble" values for the refinery

Parameter	2009	2010	2011	2012
CO concentrations – refinery (mg/Nm³)	41	33	22	23
Limit for the refinery * (mg/Nm³)	250	50	50	50

* Limit of 250 mg/Nm³ stipulated by Legislative Decree 152/06 Section V, Appendix I, Part IV in force until 8 April 2009; from 9 April 2009 limit of 50 mg/Nm³ in accordance with the AIA environmental authorisation (DSA-DEC-2009-0000230 of 24 March 2009).

CHART T30 (mg/Nm³)

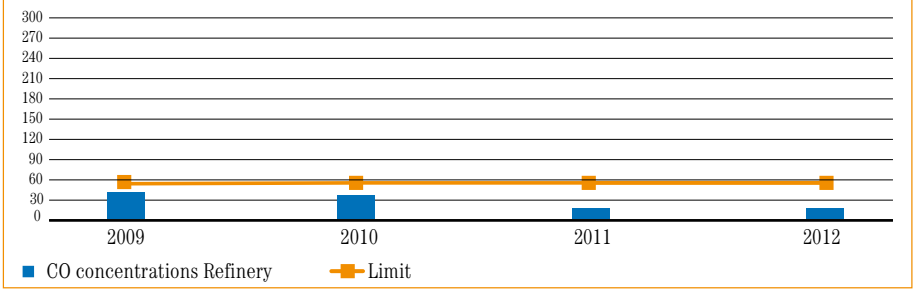
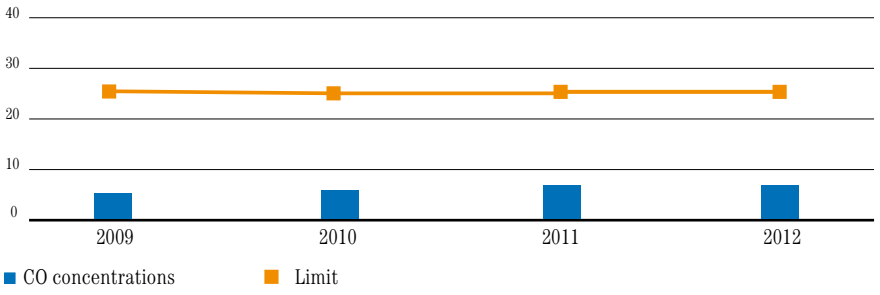


TABLE 31 CO emissions: Concentration values for the IGCC

Parameter	2009	2010	2011	2012
CO concentrations - IGCC (mg/Nm³)	5.4	5.9	6.6	7.4
Limit for the IGCC* (mg/Nm³)	30	25	25	25

* Limit of 30 mg/Nm³ established at the conclusion of the environmental impact assessment procedure for the IGCC project (DEC/VIA/2025 of 28 December 1994) in force until 8 April 2009; from 9 April 2009 a limit of 25 mg/Nm³ in accordance with AIA permit DSA-DEC-2009-0000230 of 24 March 2009.

CHART T31 (mg/Nm³)



Lastly, the AIA permit stipulates new limits for the refinery in terms of concentrations for VOCs (volatile organic compounds), H2S and NH3 , and chlorine-based compounds. These limits were also fully complied with in 2012.

[table of objectives and measures: objectives 3 and 4, page 125]

Abnormal or emergency situations

An analysis of abnormal or emergency situations that can affect the plant's atmospheric emissions led the company to identify the following event as significant:

- increase in SO_2 emissions and the emission of thick smoke from the incinerator smokestack for the refinery's sulphur recovery plants.

The operation of the treatment unit for tail gases from the refinery's sulphur recovery plants reduces the probability of this type of event and its consequences.

[table of objectives and measures: objective 1, page 125]

In effect, the tail gas treatment unit helps reduce the sulphur compound content in tail gases before they are sent to the incinerator. SO_2 emissions have also been reduced under normal operating conditions, generating a total reduction of over

30% in such emissions from the site per year. To prevent other types of emergency relating to emissions from the centralised smokestacks of the refinery and the IGCC, warning thresholds for emission concentrations have been defined for internal use: as soon as such thresholds are reached, the appropriate corrective measures are rapidly activated in the plants responsible for the emissions in order to prevent the spread of the ground-level effects of the pollutants.

4.2.4.3 – Data on non-ducted emissions

The data on non-ducted emissions, comprising diffuse and fugitive emissions, are summarised in Table 32.

Table 32 Non-ducted (diffuse and fugitive) emissions of volatile organic compounds from the site

Parameter	2009	2010	2011	2012
Diffuse (t/year)	434	443	386	792
Fugitive (t/year)	457	320	220	53
Total (t/year)	891	763	606	846

Fugitive emissions tend to increase as raw material inputs increase (Table 3 on page 33). In 2008, based on the new monitoring technology (varifocal infrared video camera) and new monitoring approach (Smart LDAR programme)* used, it was found that these emissions had been overestimated by at least 50% in previous year, and stood at no more than 16% of estimated emissions in 2011. In 2012, the monitoring/repair service was further optimised, allowing the site to achieve an emissions value of no more than 4% of emissions estimated with the EPA formulas.
The diffuse emissions value increased in 2012 due to a larger concentration of hydrocarbons in the API tanks caused by a smaller operating factor for certain plant equipment (skimmers).

4.2.4.4 – Air quality in the Sarroch area

4.2.4.4.1 Air quality monitoring using fixed measurement sensors

Air quality outside the Sarroch refinery (immissions) is checked by three monitoring networks (CENSAs).

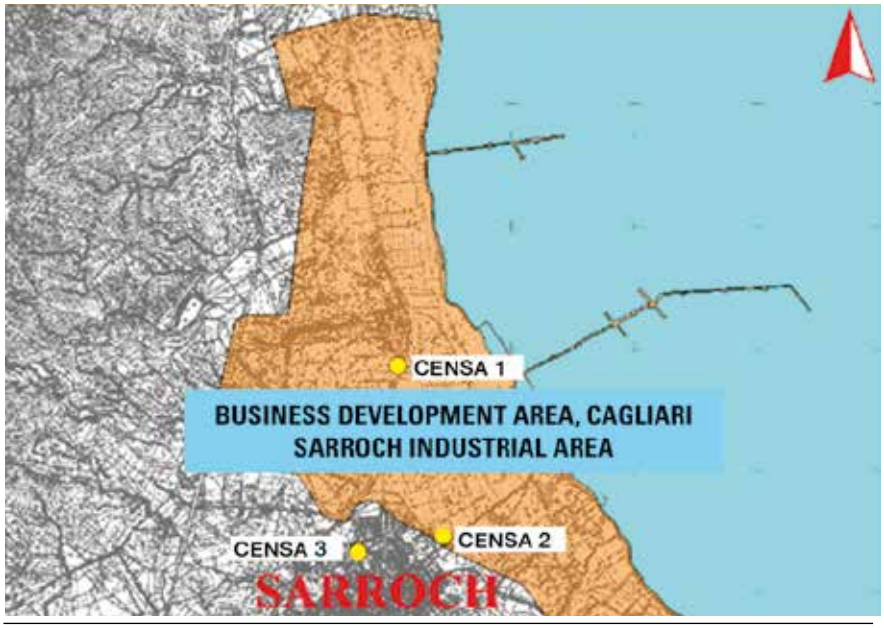


Figure 14 Map showing the location of the air quality monitoring stations of the public network.

* See note 2 on page 60

Sarlux manages its own air quality measurement sensors (four), while Versalis is currently restructuring its own monitoring network and ARPA Sardegna (ARPAS) operates the three sensors owned by the Sardinian regional authorities; the CENSA9 station, Sarroch Villa d'Orri, was dismantled in May 2011 to be used in another location. The location of the measurement sensors of the public network is shown in Figure 14. The data measured by the sensors includes emissions from all sources in the area, including industrial, urban and non-urban emissions, such as those from vehicle traffic. The reference legislation for air quality monitoring methodology and limits are as follows:

- Ministerial Decree 60/2002 and Legislative Decree 155/2010 for SO_2, nitrogen oxides (NO_2 and NO_x), PM10, CO and benzene
- Legislative Decree 183/2004 and Legislative Decree 155/2010 for ozone
- Presidential Decree 322/1971 for hydrogen sulphide

The Sarlux network – managed alongside those of the local authorities and other companies in the region – provides data on changes in parameters relevant to air quality in real time, to ensure that pollution is kept below the minimum levels set out by the laws in force and that immediate steps can be taken when necessary. Each of the four Sarlux monitoring stations (Villa d'Orri, Sarroch, Porto Foxi and the national storage facility) is equipped with analysers that continuously gauge levels of the following pollutants in the air:

- SO_2; NO_2; CO; H_2S (hydrogen sulphide); PM10; ozone; hydrocarbons.

Since 2012, continuous measurement of PM10 has been recorded and archived only for the Porto Foxi station, as the software is currently being updated. The station located in the area of the national storage facility is also supplemented by a weather station. In the second half of 2010, two stations (at Sarroch and at the national storage facility) were fitted with PM2.5 continuous analysis equipment.

The ARPAS network records hourly average concentrations in all the stations of the following pollutants:

SO_2; NO_2; H_2S; PM10 and ozone

In two stations:

Benzene; PM2.5; and CO.

A dedicated monitoring system constantly checks emissions from the IGCC plant for

SO_2; NO_x; PTS; CO; smoke load,

providing a high degree of reliability, as shown by the data availability index (the ratio between the device's operating hours and normal plant operating hours), which in 2012 was around 98%. A similar system monitors emissions from the refinery's central smokestack, which collects approximately 30-35% of total emissions (Topping 1 and thermoelectric plant), monitoring the same parameters as described above. In 2009, similar monitoring systems were also installed for emissions from the smokestacks of the Z3 and Z4 sulphur recovery plants, and since September 2010, monitoring systems for the smokestacks of the Topping 2, Reformer/Alkalisation (CCR/Alky) and CO Boiler plants have also been on stream. The remaining emissions are monitored periodically through half-yearly sampling. The results obtained by the public network for the pollutants monitored in 2009-2012 are shown below. The figures and comments are taken from reports prepared annually by ARPAS.

[table of objectives and measures: objective 7, page 126]

Measurements of SO_2 recorded by the provincial network

As regards SO_2, the report issued by ARPAS shows that the improvement on previous years continued in 2012, and that no legal limits were breached. These results are shown in the tables and charts below. In 2009, a further clear improvement in the effects of SO_2 emissions was recorded associated with the start-up of the TGTU. This was fully confirmed in subsequent years, when the limit was not exceeded, except for once in 2012 when the hourly limit was exceeded. This trend is shown in Tables 33, 34, 35, 36 and associated charts. Note that Sarlux does not have access to the hourly data measured by the public network in sufficient time to allow it to implement immediate corrective action when the hourly/daily thresholds are exceeded. Following receipt of a report by the monitoring authorities that one of the above-mentioned limits or thresholds had been exceeded, Sarlux always promptly instituted the necessary checks of the plants' systems and the sulphur content in the fuels used. If anomalies were found, details were provided to the authority that notified the company of the breach, with a written summary of the event and its causes. Even if no anomalies were found, a written reply was always provided. Lastly, Table 37 shows the number of reports submitted to Sarlux of warning thresholds reached in respect of the pollutant SO_2, measured by the sensors of the public air quality monitoring network. The table shows that the reports sent by the regional authorities are in line with the number of breaches registered. No reports were submitted in 2009, as a result of the clear improvement recorded in the impact of SO_2 emissions. The same was true of 2010 and 2011. In 2012, one report of an hourly limit being exceeded was submitted.

TABLE 33 SO_2: measurements recorded by the provincial network - no. of days the warning threshold was exceeded

Parameter	2009	2010	2011	2012
CENSA0**	0	0	-	-
CENSA1	0	0	0	0
CENSA2	0	0	0	0
CENSA9**	0	0	0	-
CENSA3**	0	0	0	0
Limit*	**500 µg/m³ not to be exceeded for 3 consecutive hours**			

*Limit stipulated by Ministerial Decree 60/2002.
**The sensor CENSA0 (Sarroch – Su Nuraxeddu) was removed on 13 July 2009. On 16 July, the sensor CENSA3 (Via Rossini in the urban area of Sarroch) was installed with identical equipment to that of CENSA0. Data from the new sensor are available from 16 July 2009. The CENSA9 station at Sarroch Villa d'Orri was removed in May 2011 for use in another location.

CHART T33 (No. of times limit exceeded)

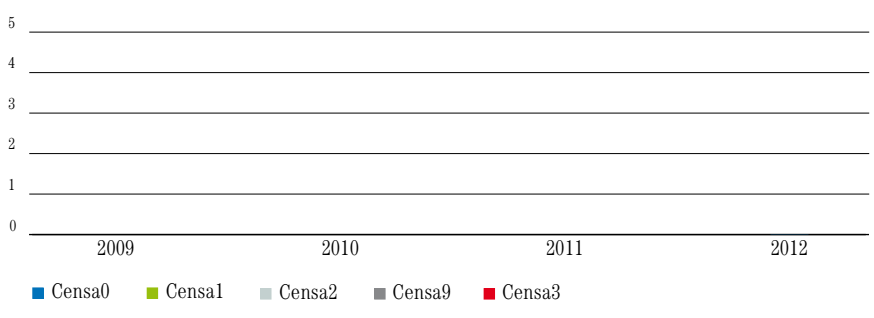


TABLE 34 SO_2: measurements recorded by the provincial network - no. of times the hourly limit for the protection of human health was exceeded

Centralina	2009	2010	2011	2012
CENSA0**	0	-	-	-
CENSA1	0	0	0	1
CENSA2	1	0	0	0
CENSA9**	0	0	0	-
CENSA3**	0	0	0	0
Limit*	350 µg/m³ not to be exceeded more than 24 times in a calendar year			

*Limit stipulated by Ministerial Decree 60/2002 from 2005. In 2004, the threshold that should not have been exceeded was 380 µg/m³

**The sensor CENSA0 (Sarroch – Su Nuraxeddu) was removed on 13 July 2009. On 16 July, the sensor CENSA3 (Via Rossini in the urban area of Sarroch) was installed with identical equipment to that of CENSA0. Data from the new sensor are available from 16 July 2009. The CENSA9 station at Sarroch Villa d'Orri was removed in May 2011 for use in another location.

CHART T34 (No. of times limit exceeded)

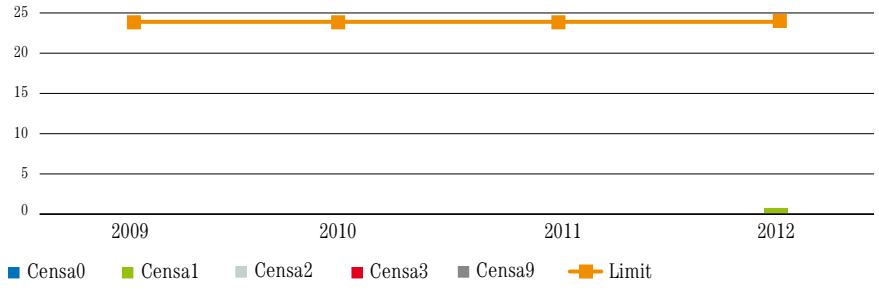


TABLE 35 SO_2: levels recorded by the provincial network - no. of times the daily limit for the protection of human health was exceeded

Parameter	2009	2010	2011	2012
CENSA0**	0	-	-	-
CENSA1	0	0	0	0
CENSA2	0	0	0	0
CENSA9**	0	0	0	-
CENSA3**	0	0	0	0
Limit*	125 µg/m³ not to be exceeded more than 3 times in a calendar year			

*Limit stipulated by Ministerial Decree 60/2002.

**The sensor CENSA0 (Sarroch – Su Nuraxeddu) was removed on 13 July 2009. On 16 July, the sensor CENSA3 (Via Rossini in the urban area of Sarroch) was installed with identical equipment to that of CENSA0. Data from the new sensor are available from 16 July 2009. The CENSA9 station at Sarroch Villa d'Orri was removed in May 2011 for use in another location.

CHART T35 (No. of times limit exceeded)

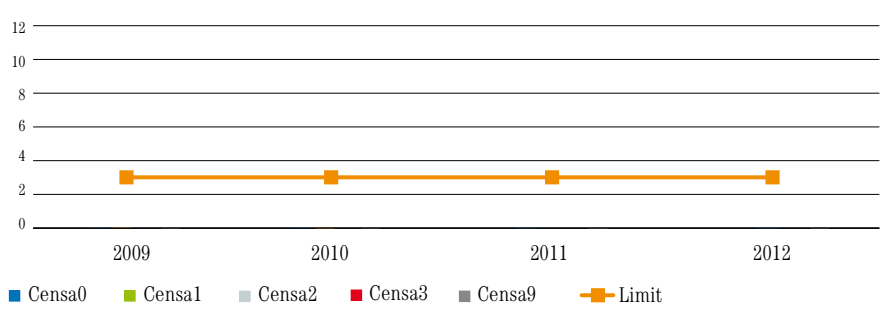


TABLE 36 SO_2: Concentration values measured by the provincial network - Annual average concentration.

Parameter	2009	2010	2011	2012
CENSA0 (µg/m³)**	n.a.	n.a.	n.a.	-
CENSA1(µg/m³)	n.a.	n.a.	3	3
CENSA2 (µg/m³)	n.a.	n.a.	3	3.5
CENSA9 (µg/m³)**	n.a.	n.a.	3	-
CENSA3 (µg/m³)**	n.a.	n.a.	3	2,5
Limit*	20 µg/m³ limit for the protection of eco-systems			

*Limit stipulated by Ministerial Decree 60/2002.
n.a. figure not available as not supplied by ARPAS
**The sensor CENSA0 (Sarroch – Su Nuraxeddu) was removed on 13 July 2009. On 16 July 2009, the sensor CENSA3 (Via Rossini in the urban area of Sarroch) was installed with identical equipment to that of CENSA0. Data from the new sensor are available from 16 July 2009. The CENSA9 station at Sarroch Villa d'Orri was removed in May 2011 for use in another location.

CHART T36 (µg/m³)

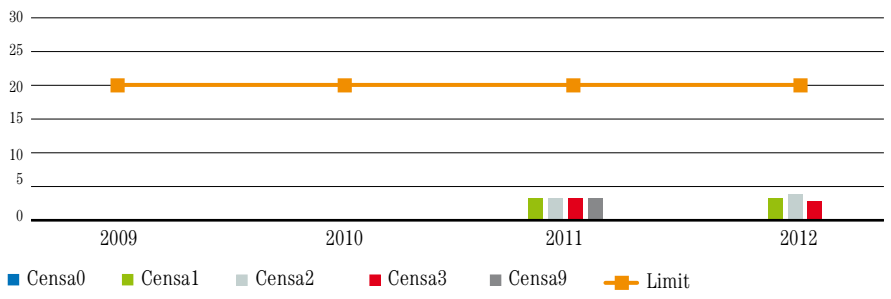


TABLE 37 Reports received by Saras on breaches of warning thresholds for SO2 pursuant to Ministerial Decree 155/2010

Parameter	2009	2010	2011	2012
No. of reports/year	0	0	0	1

PM10: measurements recorded by the provincial network

No breaches of the legal limit for PM10 were recorded in 2009-2012, except at CENSA3 in 2010. An official published report on the breach at CENSA 3 is available on the Sardegna Arpas* website, which explains that, in the winter period, the sources of small dust particles include a significant contribution from the combustion of heating plants, especially wood-fired plants. The number of times that the hourly limit for the protection of human health was exceeded and the annual average concentration values for PM10 are shown in Tables 38 and 39.

* An official assessment is available on the Sardegna Arpas website at www.sardegnaambiente.it.

TABLE 38 PM10: Concentration values recorded by the provincial network - no. of times the daily limit for the protection of human health was exceeded

Parameter	2009	2010	2011	2012
CENSA0**	2	-	-	-
CENSA1	5	2	9	13
CENSA2	10	15	18	1
CENSA9**	10	1	2	-
CENSA3**	22	59	32	3
Limit*	50 µg/m³ not to be exceeded more than 35 times in a calendar year			

*Limit stipulated by Ministerial Decree 60/2002; --: data not available

**The sensor CENSA0 (Sarroch – Su Nuraxeddu) was removed on 13 July 2009. On 16 July 2009, the sensor CENSA3 (Via Rossini in the urban area of Sarroch) was installed with identical equipment to that of CENSA0. Data from the new sensor are available from 16 July 2009. The CENSA9 station at Sarroch Villa d'Orri was removed in May 2011 for use in another location.

CHART T38 (No. of times limit exceeded)

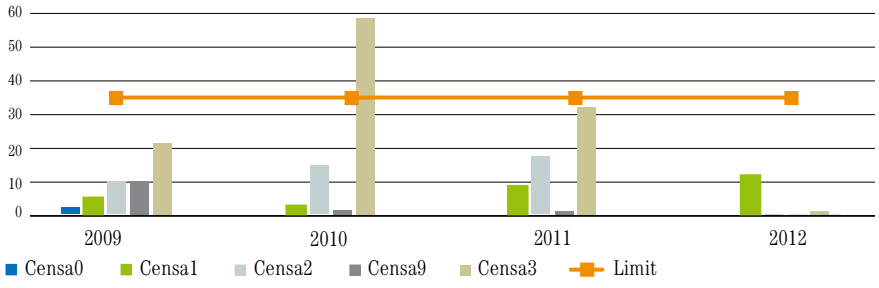


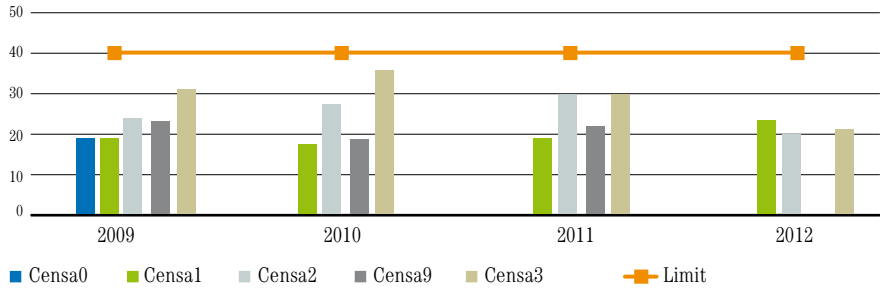
TABLE 39 PM10: Concentration values measured by the provincial network - Annual average concentration.

Parameter	2009	2010	2011	2012
CENSA0 (µg/m³)**	19	-	-	-
CENSA1 (µg/m³)	19	18	19	22,2
CENSA2 (µg/m³)	25	28	30	20,3
CENSA9 (µg/m³)**	23	19	22	-
CENSA3 (µg/m³)**	32	36	30	22,1
Limit*	40 µg/m³ limit for the protection of eco-systems			

*Limit stipulated by Ministerial Decree 60/2002; --: data not available

**The sensor CENSA0 (Sarroch – Su Nuraxeddu) was removed on 13 July 2009. On 16 July, the sensor CENSA3 (Via Rossini in the urban area of Sarroch) was installed with identical equipment to that of CENSA0. Data from the new sensor are available from 16 July 2009. The CENSA9 station at Sarroch Villa d'Orri was removed in May 2011 for use in another location.

CHART T39 (µg/m³)



Measurements of NO_2 recorded by the provincial network

The indicators at all stations show that the values for NO_2 are well below the legal limits. In 2009-2012, no breaches of the hourly limit for the protection of human health were recorded.

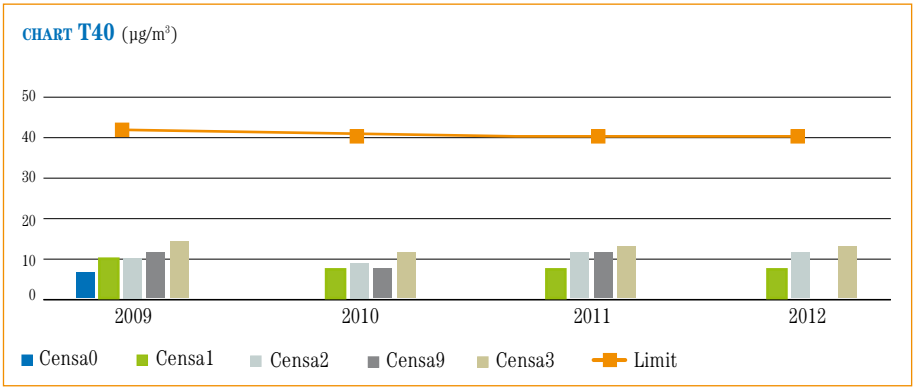
The average concentration values of NO_2 are shown in Table 40.

TABLE 40 NO_2: measurements recorded by the provincial network - annual average concentration of NO_2

Parameter	2009	2010	2011	2012
CENSA0 (µg/m3)**	6	-	-	-
CENSA1 (µg/m3)	10	8	8	8
CENSA2 (µg/m3)	10	9	11	11,1
CENSA9 (µg/m3)**	11	8	8	-
CENSA3 (µg/m3)**	14	11	13	13
Limit for the protection of human health (µg/m³)*	42	40	40	40

*Limit stipulated by Ministerial Decree 60/2002; it became 40 µg/m³ in 2010 - n.a. figure not available as not supplied by ARPAS

**The sensor CENSA0 (Sarroch – Su Nuraxeddu) was removed on 13 July 2009. On 16 July 2009, the sensor CENSA3 (Via Rossini in the urban area of Sarroch) was installed with identical equipment to that of CENSA0. Data from the new sensor are available from 16 July 2009. The CENSA9 station at Sarroch Villa d'Orri was removed in May 2011, for use in another location.



Measurements recorded by the provincial network for other pollutants (H_2S, benzene, ozone, CO)

As regards the other pollutants monitored, the report from the provincial authority shows that:

[Ministerial Decree 155/2010]

- the values for **CO** were much lower than the legal limits and in line with those of previous years; in 2009 and 2010, the only data received related to the sensor CENSA2, and confirmed that there were no breaches of the legal limit; in 2011, the data received related to CENSA2 and CENSA3, and confirmed that there were no breaches of the legal limit; in 2012, the data received related to CENSA1, CENSA2 and CENSA3, and confirmed that there were no breaches of the legal limit

[Legislative Decree 183/2004]

- the values for **benzene** recorded in the period 2009-2012 were lower than the legal limits with the exception of the sensor CENSA0 (which has now been removed as it was considered by ARPAS* not to be representative), which recorded an annual average of 10.3 µg/m³ in 2009 compared with the legal limit of 5 µg/m³. None of the other stations recorded breaches. In 2012, the annual average of the stations managed by the province did not breach the limit of 1.8 µg/m³ (CENSA2 and CENSA3).

* An official assessment is available on the Sardegna Arpas website at www.sardegnaambiente.it.

- for **ozone**, four breaches of the information thresholds were recorded (CENSA1) in 2009, while no warning thresholds were exceeded and no data relating to the thresholds for the protection of human health were received. The report emphasises that the problem of ozone emissions can only be tackled on a large scale given the long-distance transportation of this pollutant. In 2010, two breaches of the target value for the protection of human health were recorded (by CENSA1 and CENSA9), but there were no breaches of the warning thresholds. In 2012, 29 breaches of the target value for the protection of human health were recorded by CENSA1, 24 by CENSA2 and 19 by CENSA3, but no breaches of the information or warning thresholds.
- with regard to the legal limits for **hydrogen sulphide** (40 µg/m^3 for average daily concentrations and 100 µg/m^3 for average hourly concentrations), the concentration values recorded six breaches of the hourly average in 2009. No breaches of the legal limits were recorded in subsequent years.

[Presidential Decree 15/04/1971]

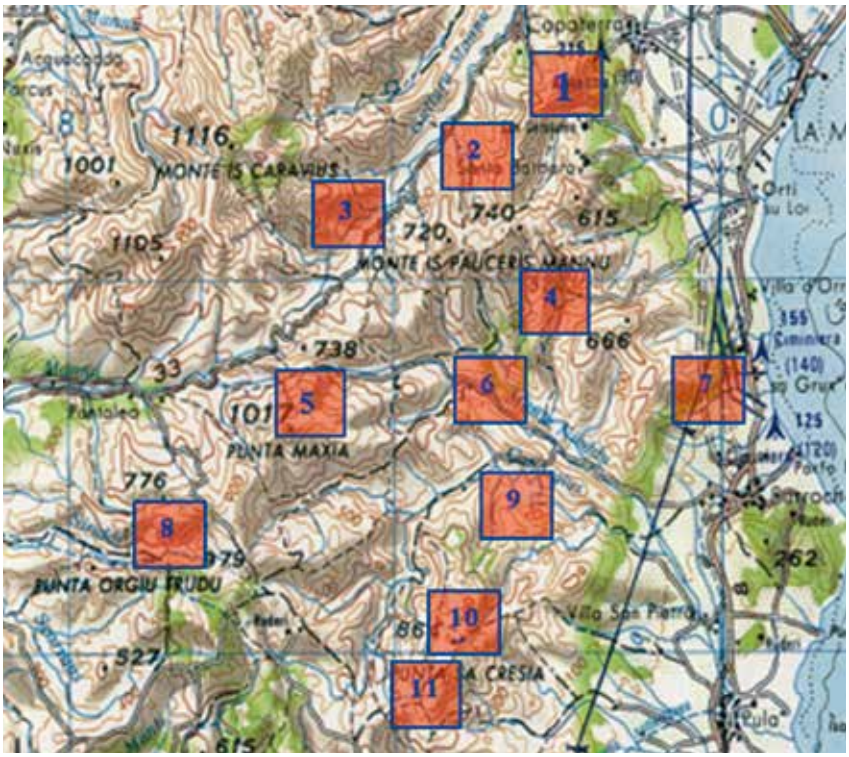


Figure 15 Location of the air quality bio-monitoring stations

4.2.4.4.2 Monitoring of air quality using bio-indicators and biodiversity studies

Air quality can be monitored using bio-indicators as well as chemical indicators.

Epiphytic mosses (mosses that grow on tree trunks) are the bio-indicators most frequently used for monitoring air quality. The monitoring methodology is based on a measurement of biodiversity, i.e. the abundance of different moss species. The presence of atmospheric pollutants (mainly sulphur and nitrogen oxides) can reduce biodiversity values.

For some years, the Botanical Sciences Department of the Mathematical, Physical and Natural Sciences Faculty at Cagliari University has been monitoring the condition of the vegetation over a very wide area covering the inland region of Sarroch, as illustrated in Figure 15. It also uses the epiphytic mosses methodology as a bio-monitor of air quality.

Table 42 shows the key criteria for interpreting the categories of air quality and atmospheric purity, with reference to the Index of Atmospheric Purity (IAP)[1]

1 The IAP index was created by: P.L. Nimis, *Linee guida per la bioindicazione degli effetti dell'inquinamento tramite la biodiversità dei muschi epifiti* (Guidelines for the bio-indication of the effects of pollution through the biodiversity of epiphytic mosses), Department of Biology, University of Trieste, 1999, and has been used in various air quality studies, as well as by the ARPAs (Regional Environmental Protection Agencies).

Table 42 Index of Atmospheric Air Purity (I.A.P.): categories of air quality and atmospheric purity

IAP categories	IAP values	Air quality assessment	Purity/pollution
7	I.A.P. = 0	Very poor	Very high pollution
6	1 < I.A.P. < 10	Poor	High pollution
5	11 < I.A.P. < 20	Low	Average pollution
4	21 < I.A.P. < 30	Mediocre	Low purity/low pollution
3	31 < I.A.P. < 40	Average	Average purity
2	41 < I.A.P. < 50	Fair	High purity
1	I.A.P. > 50	Good	Very high purity

The categories that include the indicator values measured in the stations being monitored are highlighted in Table 42.
In 2012, air quality in the area studied again fell into category IAP3 with an assessment of "average" for air quality and atmospheric purity in eight out of the 11 monitoring stations, while the remaining three units fell into category IAP4 with an assessment of "mediocre" for air quality, "low" for atmospheric purity and "low" for pollution.
These monitoring stations also include the one nearest the industrial area.
As could reasonably be expected, air quality is generally higher in the stations further inland and lower in the one nearest to the Sarroch industrial area.
The picture that emerges from an analysis using bio-indicators shows, therefore, that the air quality falls in the mid-range of the IAP index.
In the area under review, a survey was also carried out to monitor the condition of the vegetation. The survey is conducted through visual checks of the condition of different species of vegetation and by monitoring the bioaccumulation of pollutants.
According to the results of these field measurements, in 2012 there is again no particularly critical threat to the condition of the vegetation in the area studied.

4.2.4.5 – Greenhouse gas emissions

Greenhouse gas (carbon dioxide, CO_2)

The activities carried out on the Sarroch site, i.e. refining and electricity generation, fall within the scope of application of the European Emissions Trading Directive.
The directive was introduced across Europe to control and reduce carbon dioxide emissions in accordance with the Kyoto Protocol. The objective of this legislation is to reduce greenhouse gas emissions, especially carbon dioxide, which are thought to cause the progressive global warming of the planet known as the greenhouse effect.
The emissions trading scheme was introduced in 2005 to help member states comply with the requirements of the Kyoto Protocol.
It works by assigning each individual plant falling within the scope of the directive an emissions allowance established by the member state through a national allocation plan.
Surplus allowances may be traded and/or stockpiled, and any deficit must be covered by purchasing emissions allowances on the market. The allocation authorised by the competent authority for the five-year period 2008-2012 involved a reduction of around 15% for all companies in the oil sector.
Once Sarlux's U800 unit came on stream in December 2008, and based on the regulation governing new entries (Decree of 28 February 2008), the company received additional allowances as follows: 489 tons of CO_2 for 2008 and 22,313 tons of CO_2 per year for the period 2009-2012.
The year 2012 marked the end of the second period of application of the ETS Directive.

[implemented by Legislative Decree 216/06 as subsequently amended]

EC Directive 2003/87/EC, amended by EC Directive 2009/29/EC, also provides for the option, in the period after 2012, to assign, free of charge, a certain quantity of CO_2 emissions quotas based on harmonised European Community regulations.

Emissions by the IGCC in 2012 were also in line with previous figures. On the other hand, the figures for the refinery show that CO_2 emissions are continuing the downward trend under way since 2010, a reduction due to investment in energy saving.

The figures for 2012 also demonstrate that the route taken by Sarlux involving reasonable energy use and the adoption of efficient production systems, is the key mechanism for controlling and reducing CO_2 emissions.

A new Emissions Trading Directive is planned for the period 2013-2020. The objective of the new directive for the period until 2020 is to reduce CO_2 emissions by 20% compared to the levels recorded in 2005. The system to allocate allowances to companies will also be changed significantly. CO_2 emissions from the Sarlux site are calculated based on an appropriate monitoring plan, which is defined in accordance with specific European and Italian guidelines[1]. Monitoring is carried out by measuring fuel consumption and applying specific emissions factors for each fuel.

The requirements relating to the monitoring instrumentation are very stringent and must be checked and maintained over time. Moreover, the laboratories that carry out analysis on fuels must obtain specific accreditation[2]. Sarlux's internal laboratory was one of the first Italian laboratories operating in a refinery (the third in Italy) to obtain the accreditation necessary to carry out checks on some of the fuels used.

The National Emissions Trading Register, which is available for consultation, records both the allowances assigned and the annual CO_2 emissions in Italy. Sarlux has been assigned one position based on the total emissions from all its operations at the Sarroch site.

The tables and charts on the next page show the annual figures on CO_2 emissions from the site in both absolute and relative terms, as a proportion of the quantity of raw materials processed in a year. As has been the case since 2005, the figures for 2012 were approved by LRQA Italy, one of the companies on the list of bodies specifically accredited for this purpose by the Italian Ministry for the Environment.

[1] The European guidelines for the period 2005 – 2007 are set out in Decision 2004/156/EC; they were enacted in Italy with the implementation provisions in DEC/RAS/854/05. For the following five-year period (2008 – 2012), new guidelines must be applied. These are contained in Decision 2007/589/CE and implemented by Resolution 14/2009.

[2] The reference standard for the accreditation of laboratories is ISO 17025.

TABLE 43 CO_2 emissions: absolute values and allowances assigned

Parameter	2009	2010	2011	2012
Refinery emissions (t/year)	2,130,113	2,368,781	2,353,582	2,239,006
Allowances assigned to the refinery* (t/year)	2,159,696	2,159,696	2,159,696	2,159,696
IGCC emissions (t/year)	3,539,598	3,782,755	3,519,056	3,689,724
Allowances assigned to the IGCC (t/year)	444,404	444,404	444,404	444,404

[1] The European guidelines for the period 2005–2007 are set out in Decision 2004/156/EC; they were enacted in Italy with the implementation provisions in DEC/RAS/854/05 For the following five-year period (2008–2012), new guidelines must be applied. These are contained in Decision 2007/589/CE and implemented by Resolution 14/2009.
[2] The reference standard for the accreditation of laboratories is ISO 17025.

CHART T43A (t/year)

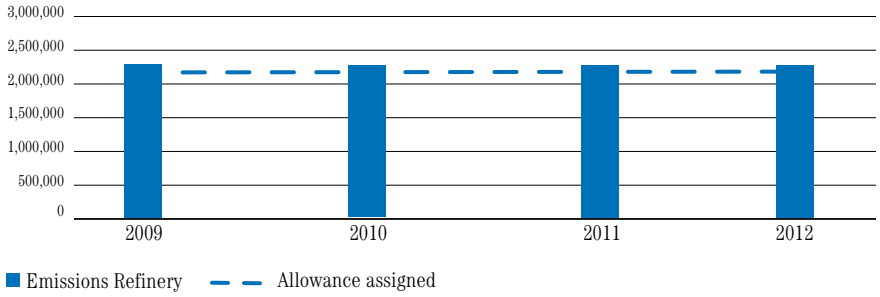


CHART T43B (t/year)

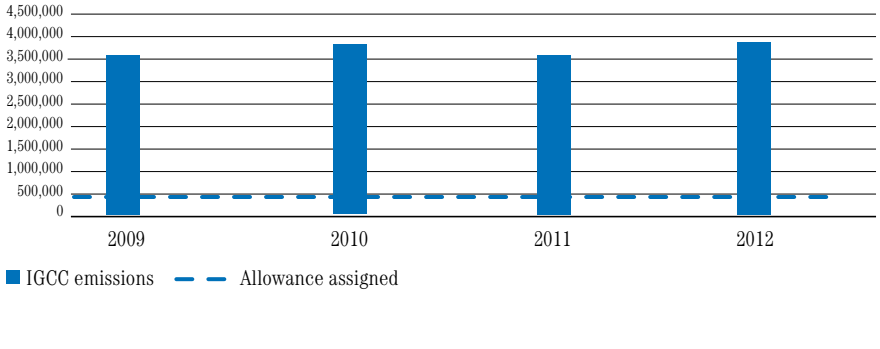
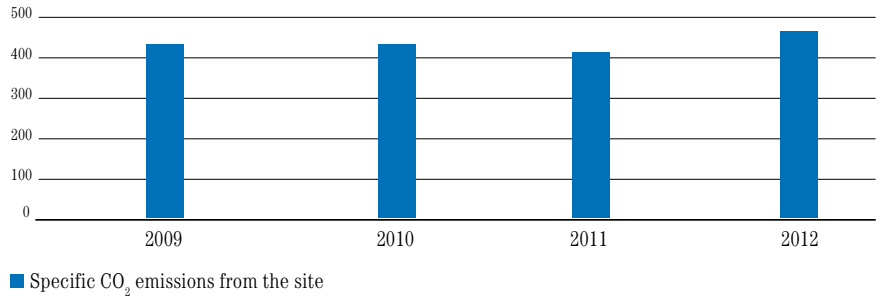


TABLE 44 Specific CO_2 emissions from the site

Parameter	2009	2010	2011	2012
Specific emissions from the site tCO_2/kt raw materials	427	429	419	445

CHART T44 (t CO_2/kt raw materials)



4.2.5 – Discharges into water

4.2.5.1 – General

[AIA permit DSA-DEC-2009-0000230]

Figure 16 shows the location of the points of discharge into water on the Sarlux site. In accordance with the AIA permit, each discharge point is identified by a specific code.

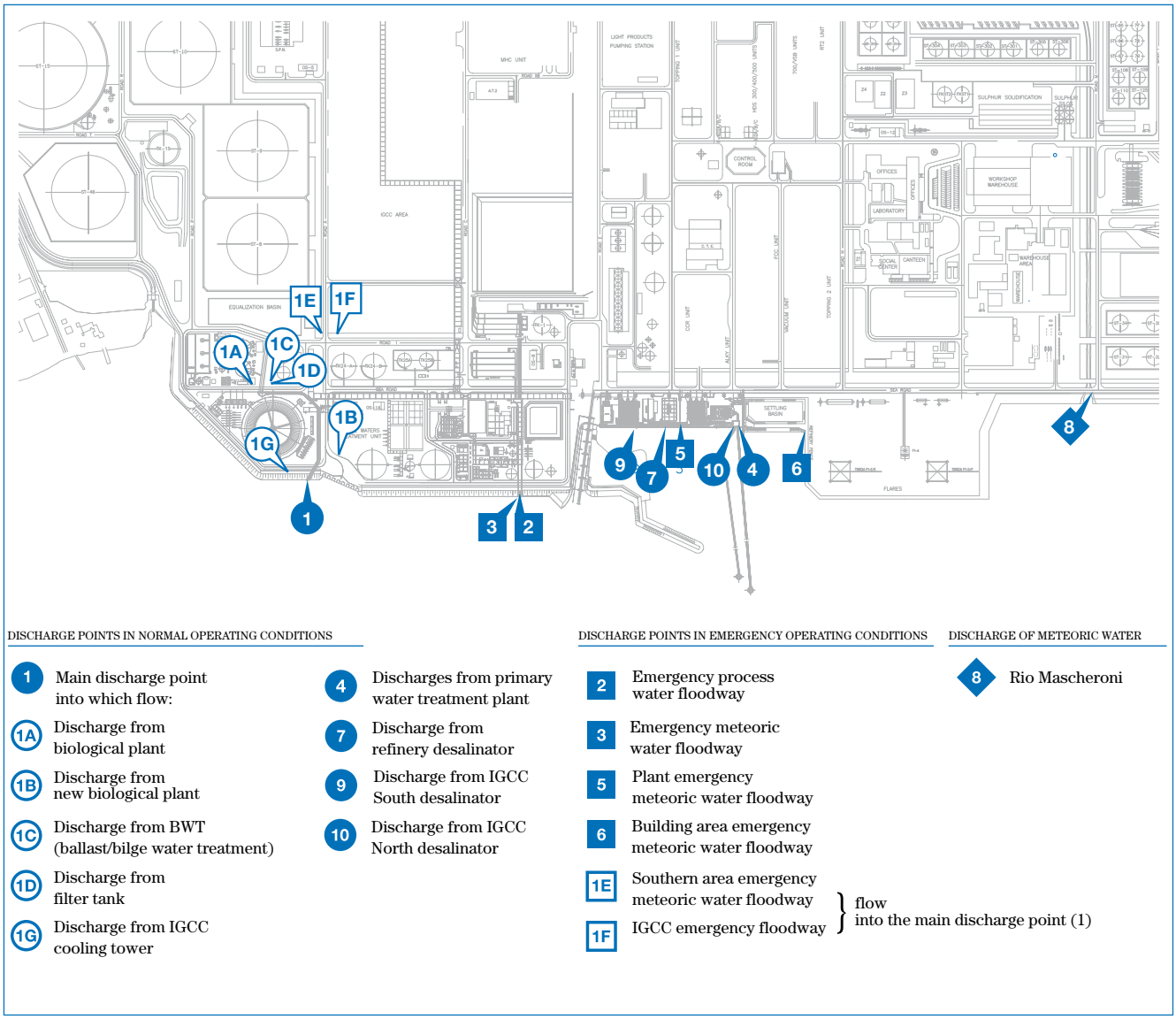


Figure 16 Map showing the location of the site's discharge points

Discharge points in normal conditions

Water from the plants and units listed below is discharged into the sea via the main discharge point (1).

- treatment plant for the wastewater generated by the facility, which has two discharge points (1a and 1b); the plant carries out chemical, physical and biological treatment of waters from the oily water sewer network, to which wastewater and meteoric water from the plant areas and domestic water are ducted
- treatment plant for ballast water (slops and washing water) and bilge water (section 4.2.6) from tankers that dock at the marine terminal and from private ships, respectively; water pumped from the wells in the site's hydraulic barrier (section 4.2.7); and meteoric water, except for water collected from the plant area; the treatment plant has one discharge point (1c)
- filter tank, which collects water that has been purified in the wastewater treatment plant, equipped with an overflow discharge point (1d)
- discharge point from the IGCC cooling tower (1g)

The following plants also discharge water into the sea from discharge points 4, 7, 9 and 10:

- primary unit for treating water coming into the site, taken from the industrial water supply (4)
- desalinators of the refinery and the IGCC (7, 9, 10)

All the above-mentioned discharges occur under normal conditions and are continuous, with the exception of the discharges from the filter tank and the primary unit for treating incoming water.

Meteoric water principally coming from roads and large paved areas in the northern part of the refinery and from the basins around the LPG spheres, which does not come in contact with pollution sources, is ducted to the Rio Mascheroni and from there to the sea (discharge point 8).

Discharge points in emergency conditions

In emergency conditions caused by extraordinary events (e.g. torrential rain), meteoric water (including water from the roofs of the buildings in the IGCC and the terraces that lead from the IGCC to the sea) is ducted via emergency process water floodways and the plants' drainage systems (1e, 1f, 2, 3, 5, 6).

These discharge points are normally closed and sealed by the supervisory authorities. The integrity of the seal applied by the authorities is periodically checked and any tampering is reported. If it becomes necessary to open one or more of these discharge points, an internal emergency procedure is followed and the supervisory bodies are notified, within the deadline specified by the permit, of the reasons for the removal of the seals and the time taken to restore normal conditions. A request is also made for a new seal to be inserted.

Calculation of water discharge values

In line with the provisions of the AIA permit, monthly samples are taken from discharges into the sea and sent for analysis by an accredited external laboratory, while daily samples are analysed by the site's in-house laboratory. This data (for COD, nitrogen and suspended solids), together with information from continuous hydrocarbon analysis, forms the basis for calculating the annual figures, which are shown below.

CONTRIBUTION TO THE DISCHARGE FLOW (%)	2012
Main discharge point (escluding IGCC tower)	16.1
Discharge from desalinators	51.5
Discharge from IGCC tower	31.2
Discharge from treatment of incoming water	1.1

4.2.5.2 – Water discharge figures

Discharges from wastewater treatment units

The significant parameters regarding quantities of emissions in water ducted to the main discharge point (1) are as follows*:

- flow rate of water discharged
- COD
- total hydrocarbons
- nitrogen in various forms (ammoniacal, nitrous or nitric)

The data on these parameters for the four discharge points (1a, 1b, 1c and 1d) ducted to the main discharge point are shown below.

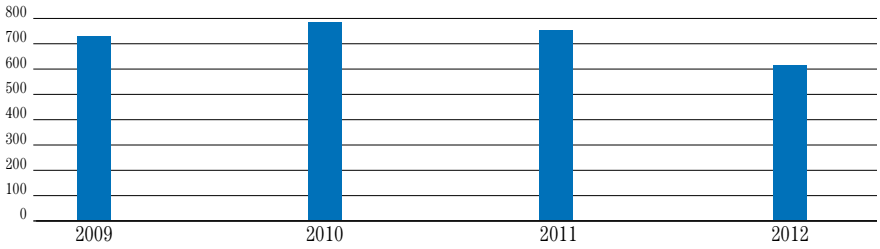
[flow rate]

Table 45 and Charts T45a and T45b show the figures for the hourly average flow rate of the water discharged both in absolute terms and in specific terms as a proportion of raw materials processed. An analysis of the figures for the four years 2009-2012 shows that the trend has seen a decline from previous values both in absolute and specific terms. A new plant using reverse osmosis technology was built and brought on stream in 2012. Using purified wastewater, it produces around 230 mc/hr of pure, demineralised water to feed the refinery's boilers. Purified water discharged into the sea is therefore reduced by the entire amount of demineralised water produced through reverse osmosis, leading to a significant reduction in annual average flows.

TABLE 45 Discharges from wastewater treatment plants (discharge points 1a, 1b, 1c, 1d) - flow rate

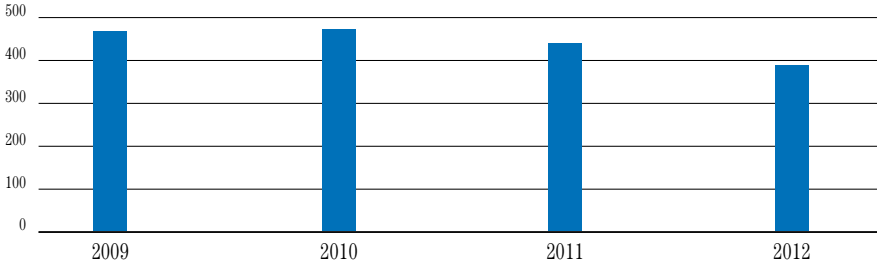
Parameter	2009	2010	2011	2012
Total water discharged – annual average flow rate (m^3/hour)	729	796	751	615
Total water discharged/raw materials processed (m^3/kt raw materials)	480	486	470	385

CHART T45A (m^3/hour)



■ Total water discharged from wastewater treatment plants

CHART T45B (m^3/kt raw materials)



■ Total water discharged/raw materials processed

*Discharge points 1G, 1E and 1F are excluded from these figures, as these do not discharge from wastewater treatment units.

[COD]

The data relating to COD, expressed as absolute and specific mass flow values and annual average concentration values, are shown in Table 46. COD indicators have fluctuated over the years, but average concentration levels remain well below the legal limit. In 2012 in particular, it was down against previous years.

TABLE 46 Discharges from wastewater treatment plants (discharge points 1a, 1b, 1c, 1d) – COD

Parameter	2009	2010	2011	2012
Absolute values (t/year)	561	673	571	368
Specific values (t/millions of t raw materials)	42.2	46.9	40.8	27.7
Average concentration values (mg/l)*	87.9	96.5	86.8	71.8

* Compared with the limit of 160 mg/l, stipulated by Legislative Decree 152/06 Part III, Appendix 5

CHART T46A (t/millions of raw materials)

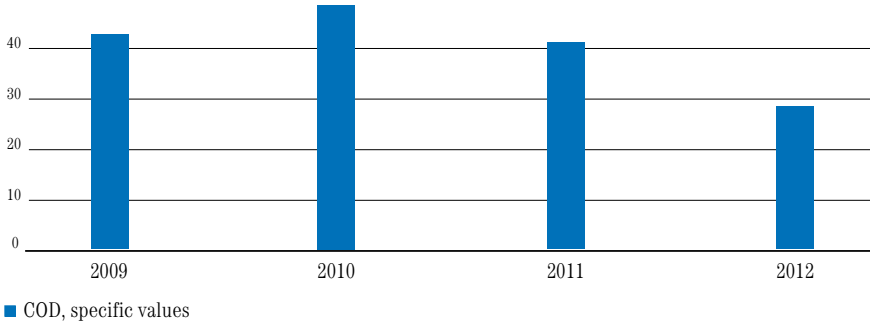
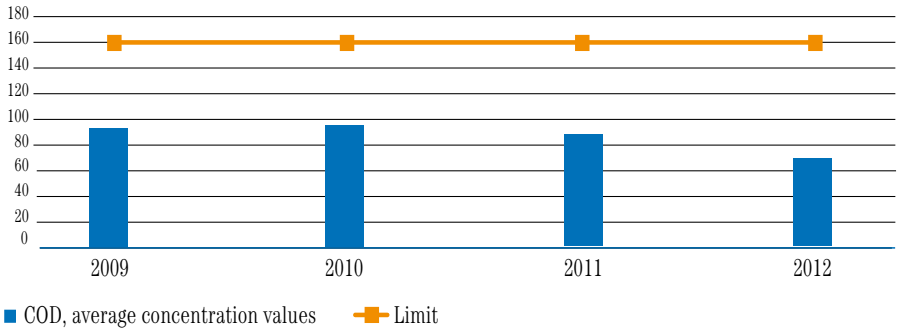


CHART T46B (mg/l)



[total hydrocarbons]

Table 47 shows the data relating to the total hydrocarbon indicators, expressed as absolute and specific mass flow values and annual average concentration values.

TABLE 47 Discharges from wastewater treatment plants (discharge points 1a, 1b, 1c, 1d) – Total hydrocarbons

Parameter	2009	2010	2011	2012
Absolute values (t/year)	12.2	13.8	14.8	13.5
Specific values (t/millions of t raw materials)	0.92	0.96	1.05	1.02
Average concentration values (mg/l)*	1.9	2.0	2.2	2.6

* Compared with the limit of 5 mg/l, stipulated by Legislative Decree 152/06 Part III, Appendix 5

CHART T47A (t/millions of t raw materials)

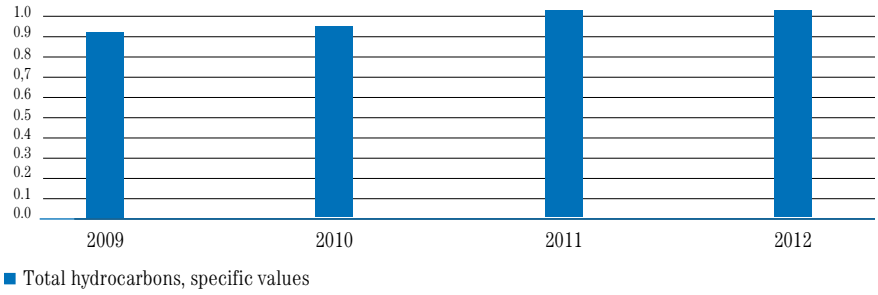
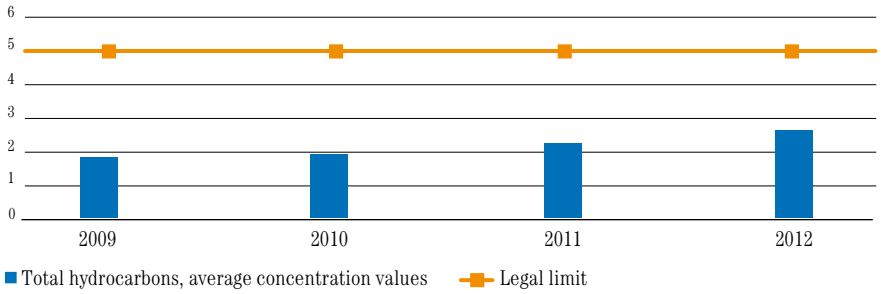


CHART T47B (mg/l)



The average concentration values of total hydrocarbons have always been well below the legal limit.

The parameter values under review are aligned with typical values.

The slight increase in concentration is due to the activity of the plant using reverse osmosis technology, which entered into production in 2012. This led to a significant reduction in annual flows to the discharge point and consequently a greater concentration thereof. The reduction in terms of mass flows following the decrease in flows confirms this (Table 47).

[nitrogen]

The data relating to nitrogen indicators, expressed as absolute values of total nitrogen mass flow and as annual average concentrations of nitrogen in its individual forms (ammoniacal, nitrous and nitric) are shown in Tables 48 and 49. Indicators have improved in the last few years. (Table 48).

Table 48 Discharges from wastewater treatment plants (discharge points 1a, 1b, 1c, 1d) – total nitrogen (ammoniacal, nitrous and nitric): mass flow

Parameter	2009	2010	2011	2012
Absolute values (t/year)	23.2	38.0	18.9	12.0
Specific values (t/millions of t raw materials)	1.74	2.65	1.35	0.90

chart T48a (t/year)

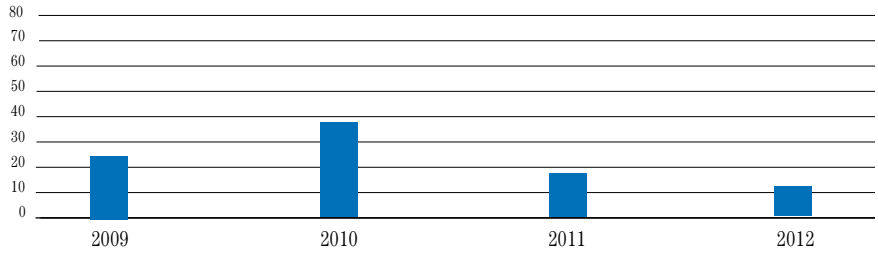


chart T48b (t/millions of raw materials)

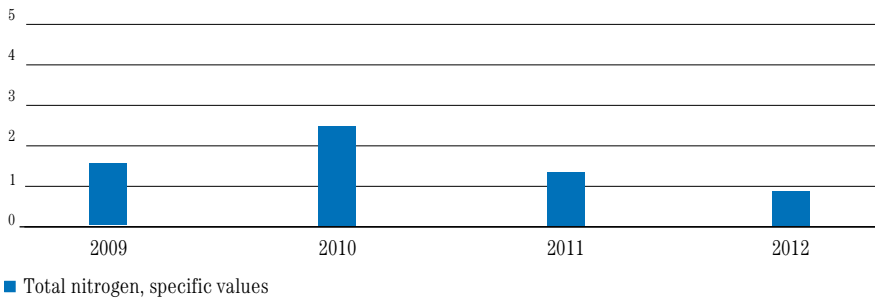


Table 49 Discharges from wastewater treatment plants (discharge points 1a, 1b, 1c, 1d) - ammoniacal, nitrous and nitric nitrogen: average concentrations

Parameter	2009	2010	2011	2012	Valore limite*
Ammoniacal (mg/l)	1.82	2.47	1.55	1.20	15.00
Nitrous (mg/l)	0.04	0.06	0.04	0.04	0.60
Nitric (mg/l)	1.77	2.92	1.28	1.09	20

*Limit stipulated by Legislative Decree 152/06 Part III, Appendix 5

In 2012, the parameters shown in Table 49 did not vary significantly from the previous three years, although they recorded the lowest values for the period under review. The figures for the last four years are shown in the charts on the next page.

CHART T49A (mg/l)

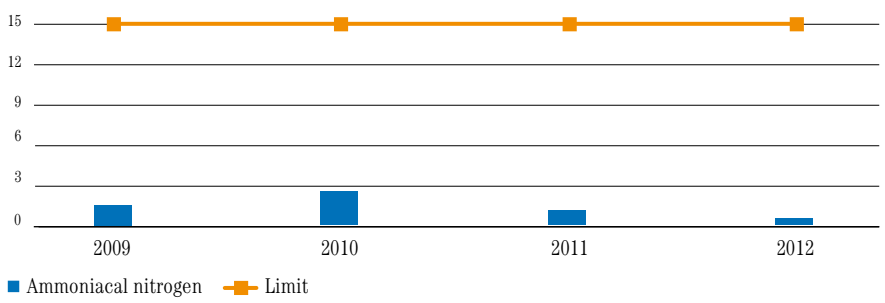


CHART T49B (mg/l)

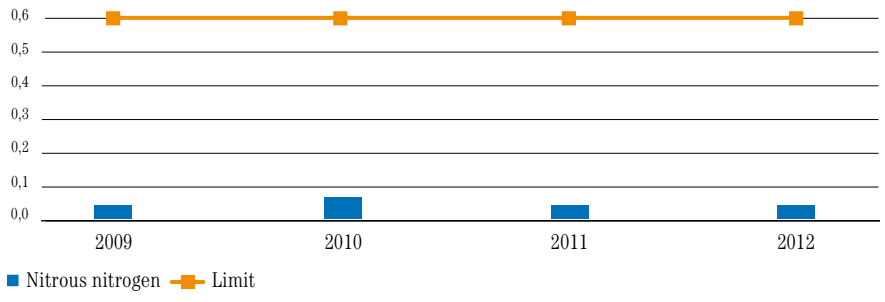
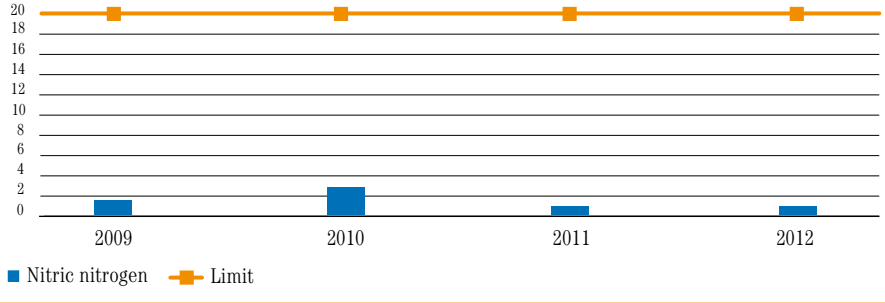


CHART T49C (mg/l)



Discharges from other units

The flow rate of discharged water and suspended solids are the two main parameters for the discharge points from the following units:

- primary treatment units for incoming water (discharge point 4)
- desalinators (discharge points 7, 9, 10)
- IGCC tower (discharge point 1g)

The figures relating to these parameters for the three types of discharges mentioned above are shown in the tables and charts below.

Table 50 shows the hourly average flow rate of discharged water as both absolute and specific values. **[flow rate]**

The significant contributions to the total flow rate made by the desalinators and the IGCC tower can also be seen in the charts.

Table 50 Discharges from the primary treatment units for incoming water (point 4), desalinators (points 7, 9, 10), the IGCC tower (point 1g) – flow rate.

Parameter	2009	2010	2011	2012
Absolute values (m³/hour)				
Treatment of incoming water	48.0	75.5	66.0	42.7
Desalinators	1,925	2,278	2,286	1,965
IGCC tower	1,134	1,025	819	1,189
Specific values (m³/kt raw materials)				
Treatment of incoming water	31.6	46.1	41.3	26.9
Desalinators	1,268	1.392	1,430	1,148
IGCC tower	747	626	512	785

Chart T50a (m³/hour)

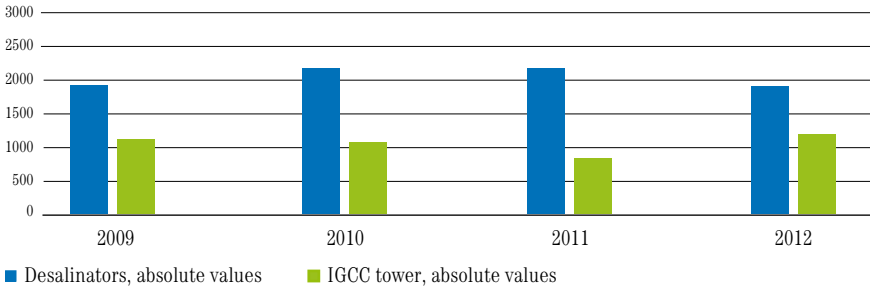
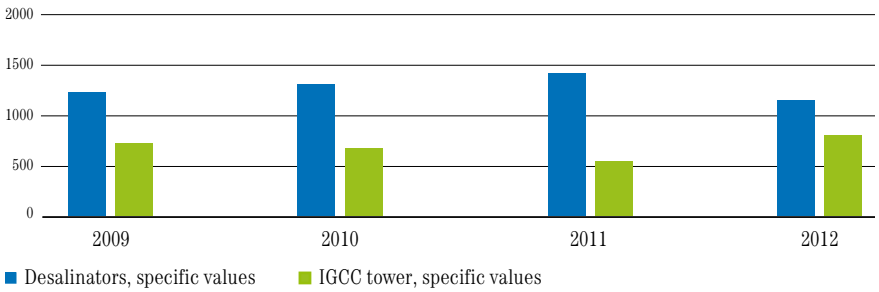


Chart T50b (m³/kt raw materials)



[suspended solids - mass flow]

Table 51 shows the figures relating to the suspended solids indicators, expressed as absolute and specific mass flow values. These charts also show the significant contributions made to the total flow rate by the desalinators and the IGCC tower.
The annual average concentrations are shown in Table 52 and related charts on the opposite page.
The data relating to mass flow and concentrations of suspended solids in discharges from the desalinators and the IGCC tower show variations over the years. The variations in suspended solids are mainly due to the number of sea storms during the year.

Table 51 Discharges from the treatment units for incoming water (point 4), desalinators (points 7, 9, 10) and the IGCC tower (point 1g) – suspended solids: mass flow

Parameter	2009	2010	2011	2012
Absolute values (t/year)				
Treatment of incoming water	6	5	15	5
Desalinators	414	590	517	254
IGCC tower	327	315	184	266
Specific values (t/millions of t raw materials)				
Treatment of incoming water	0.4	0.3	1.1	0.4
Desalinators	31.1	41.2	36.9	19.1
IGCC tower	24.6	22.0	13.2	20.0

Chart T51a (t/year)

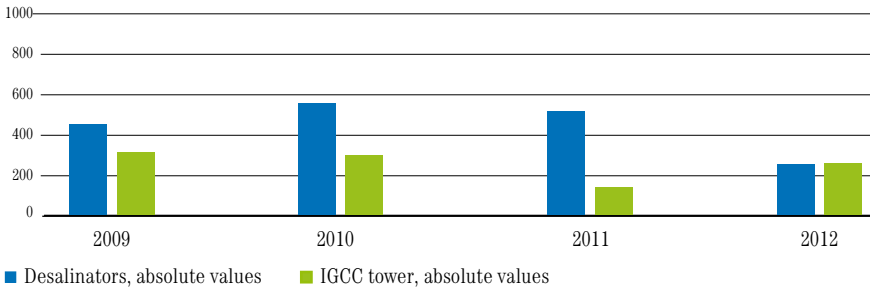
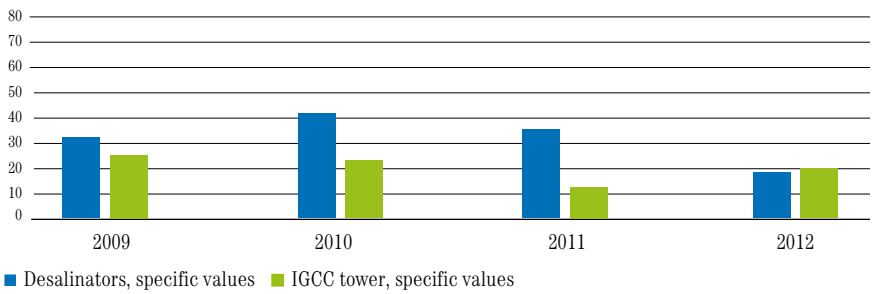


Chart T51b (t/millions of t raw materials)



[suspended solids – concentrations]

Table 52 Discharges from the treatment units for incoming water (point 4), desalinators (points 7, 9, 10) and the IGCC tower (point 1g) – suspended solids: average concentrations

Parameter	2009	2010	2011	2012	Limite*
Primary water treatment units (mg/l)	14.2	6.8	26.0	14.7	80
Desalinators** (mg/l)	24.0- 25.7	28.8- 29.8	24.1 - 26.4	15.9-19.7	80
IGCC tower (mg/l)	33.0	35.1	25.7	25.5	80

* Limit stipulated by Ministerial Decree 152/06 Part III, Appendix 5
**The minimum and maximum values for the three desalinators are shown.

CHART T52A (mg/l)

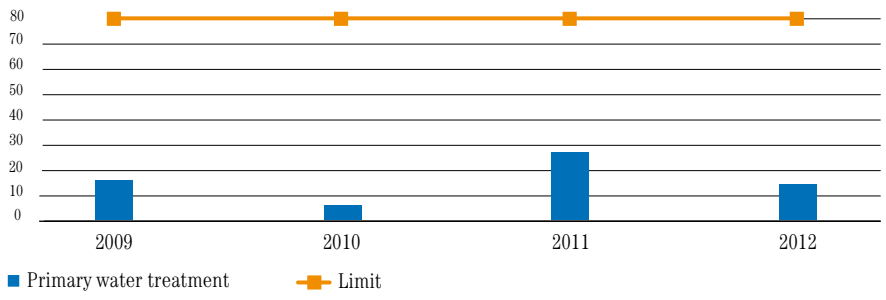


CHART T52B (mg/l)

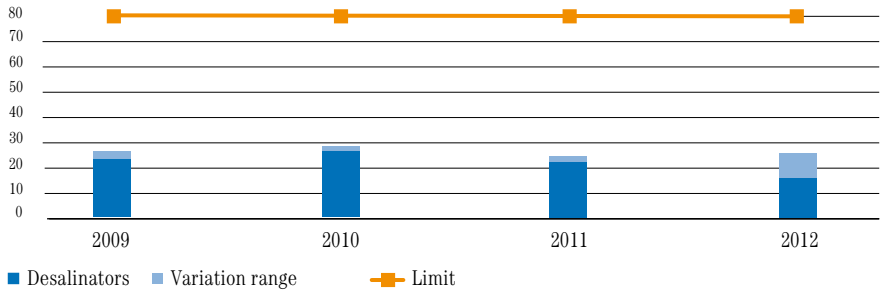
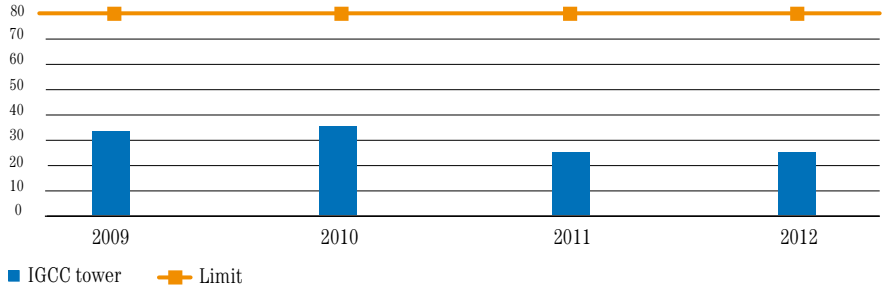


CHART T52C (mg/l)



Emergency situations following spills into the sea

Emergency situations that could affect seawater are caused by spills of hydrocarbons from the marine terminal. These situations are analysed and assessed in the Safety Report (section 3.3, page 38).

Measures to prevent spills into the sea include a programme of inspections carried out on board ships during the loading of products and unloading of raw materials. A high proportion of ships are checked (section 4.3.2, page 115).

A marine pollution prevention plan has been drawn up to deal with emergencies at sea. It describes the different procedures to be taken according to the type of spill.

There were no significant incidents during the period 2009-2012.

4.2.5.3 – Seawater quality

For several years, marine biologists have been carrying out periodic checks on the quality of the seawater in the stretch of sea in front of the area occupied by the Sarlux site.

The surveys include detailed chemical and physical analysis of seawater samples taken at different depths at a series of points positioned along lines perpendicular to the coastline, as shown in Figure 17.

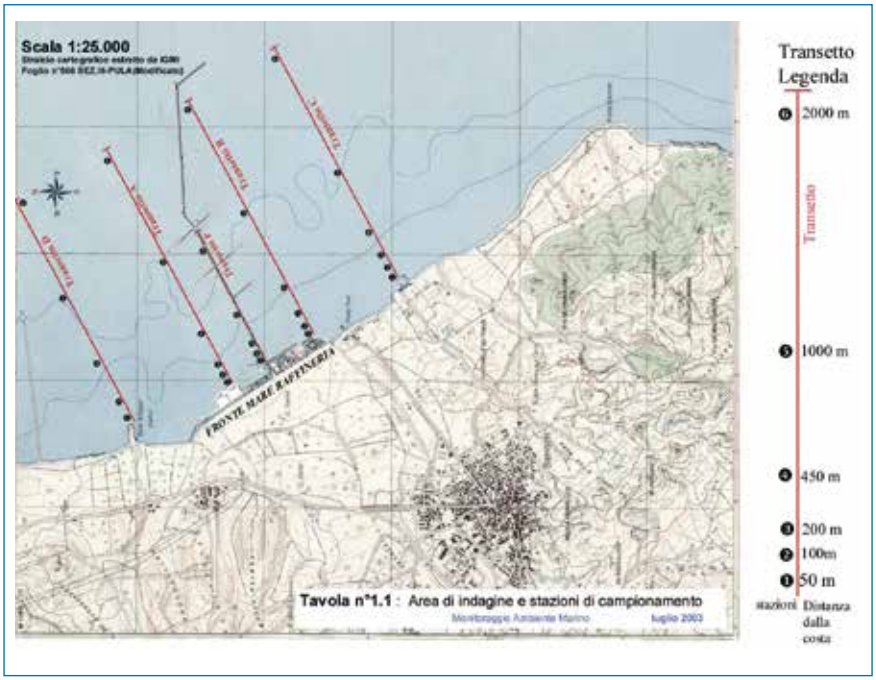


Figure 17 Area covered by the seawater quality survey

[TRIX indicator of seawater quality]

The quality of seawater can be described in summary form using an indicator known as the Trophic Index (TRIX[1] for short). This indicator is calculated using a mathematical formula that takes into account chemical values (percentage of dissolved oxygen, concentrations of phosphorous and nitrogen) and biological values (chlorophyll "a") measured in the seawater.

Table 53 on the opposite page provides a key to interpreting the categories of seawater quality. The categories that include the indicator values measured at the points in the above-mentioned survey are also highlighted in the same table.

The results of the seawater surveys in the four-year period 2009-2012 all fall into the top band of the classification (high).

[1] TRIX - stipulated by Legislative Decree 152/99 to determine seawater quality - was not included in Legislative Decree 152/06, which repealed the previous decree. However, until the European Water Framework Directive is fully implemented, this index continues to be used by the supervisory bodies (ARPA), including to enable comparisons with data collected in previous years.

Table 53 Trophic index (TRIX): seawater quality categories and results

Trophic index	Trophic state	Seawater quality
2 – 4	High	Good transparency of water; no abnormal water colouration; no undersaturation of dissolved oxygen in the benthic zone.
4 – 5	Good	Occasional turbidity of water; occasional water colouration, occasional hypoxia in the benthic zone.
5 – 6	Mediocre	Poor water transparency; abnormal water colouration, hypoxia and occasional anoxia of the benthic zone; benthic ecosystem under stress.
6 – 8	Poor	High degree of water turbidity; widespread and persistent abnormal water colouration; widespread and persistent hypoxia/anoxia in the benthic zone; kills of benthic organisms; alteration/simplification of benthic communities; economic damage to the tourism, fishing and aquaculture industries.

[new parameter: CAM index]

In recent years a new parameter, the CAM (seawater classification) index[2], has been introduced to provide an assessment of the trophic state of water. This index is based on specific algorithms for the sea around Sardinia. Generally, the CAM index produced an "average" rating for the quality of seawater in the whole of the survey area. The sole exception was 2009 when the quality of seawater was poor due to a particularly rainy period that started in the last quarter of 2008, causing a number of water courses to overflow into the Gulf of Cagliari with the resulting transport of sediment-forming nutrient substances (Table 53 bis). In any case, these indices are meaningful over long periods rather than in a single period. In 2012, the parameter showed a continuation of the trend seen in previous years.

Table 53 bis CAM index (specific to the sea around Sardinia)

		Bottom water
January 2009	low	low
July 2009	low	low
January 2010	average	average
July 2010	low	low
January 2011	average	average
July 2011	high	high
January 2012	average	average
July 2012	average	average

[Law 502 of 6 December 1993]

The stretch of sea covered by the analysis is also affected by thermal discharges, i.e. discharges of water at a higher temperature than the ambient water. Applicable legislation stipulates that the increase in the temperature of the receiving body should not exceed 3°C over 1,000 metres away from the point of introduction. Every six months, in accordance with the IRSA method (*Manuale dei metodi analitici per le acque, Quaderno Istituto Ricerca sulle Acque* no. 100, 1995, Manual of water analysis methodology, Institute of Water Research Paper 100, 1995) provided for in Ministerial Decree of 16 April 1996, a check is made of temperature differences at 1,000 metres from the point of discharge from the IGCC's seawater cooling circuit along a semi-circular line centred on the discharge point. The results of checks carried out in 2012 show temperature differences of 0.9°C in the summer survey and 2.5°C in the winter survey, as can be seen in the figures shown in Table 54, which fall within the variability range of coastal seawaters.

[2] The CAM (seawater classification) index: this index is used to monitor the coastal marine environment. The indicator converts the measurements into a summary rating of seawater quality.

Table 54 Measurements taken at a depth of 0.1 m along the semi-circular curve with a 1 km radius from the IGCC tower discharge point (point 1g)

Parameter	January 2009	July 2009	January 2010	July 2010	January 2011	July 2011	January 2012	July 2012
Minimum T°C	12.3	25.6	12.1	26.2	11.4	25.3	9.8	24.1
Maximum T°C	12.5	26.8	12.5	27.1	12.4	26.0	12.3	25.0
Temperature increase °C	0.2	1.2	0.4	0.9	1	0.7	2.5	0.9

4.2.6 – Waste

4.2.6.1 – General

[SISTRI]

With Ministerial Decree of 17 December 2009, as subsequently amended, the Ministry for the Environment set out a series of new requirements for businesses, largely consisting of registration with SISTRI (waste traceability control system) and the use of new IT procedures in waste management. These IT procedures will replace the current paper-based system (registers, forms and MUDs (unified environmental declarations). The plant registered with SISTRI in February 2010 and used the new IT system, during the periods of operation, alongside the paper-based documentation still in use. It has also taken part in SISTRI test days organised by the Ministry for the Environment. SISTRI was due to come into force on 30 June 2012, but article 52 of Decree Law 83 of 26 June 2012 suspended the deadline for its implementation until 30 June 2013. Lastly, with Ministerial Decree of 20 March 2013, the Ministry for the Environment set the date on which SISTRI enters into force for 1 October 2013.

[waste management phases]

Waste management at the Sarlux site is geared towards the primary objectives of minimising the quantities of waste produced and progressively increasing the waste flows sent for recovery. With reference to the areas indicated in Figure 18, the main operational phases of waste management at the site before the waste is sent off-site for disposal or recovery are described below:

- waste generated, appropriately separated into individual categories, is generally sent to temporary storage areas (point 2, Figure 18)
- filter cake from the IGCC can be stored in the temporary storage area or in an area specifically authorised[1] for this purpose before it is despatched externally for the metals to be recovered (points 3 and 4)
- ferrous scrap metal is recovered in a specially designated area, managed by an authorised external company[2], which subjects the scrap metal to a selection process and reduces its volumes without altering the type and mass (point 1)
- used oils are stored in designated containers (point 7)
- plastic, glass, aluminium and paper waste is collected separately and stored in a designated area (point 5)
- most of the waste generated, consisting mainly of waste contaminated by hydrocarbons, is sent to an internal plant, which separates it into its oily and aqueous phases and then subjects it to a process to convert it into chemically inert matter. These processes considerably reduce the quantity of waste and, by mixing it with an inert matrix, change its type; the recovered oily phase is reused in the refining process and the aqueous phase is collected by the sewerage network and ducted from there to the treatment plant for wastewater generated by the facility. This plant is managed by an external company specifically authorised for this purpose[3] (point 6)

[1] Regional decision no. 35 of 1 March 2011

[2] Regional decision no. 163 of 23 June 2009

[3] AIA permit - decision by the province of Cagliari no. 86 of 21 April 2010

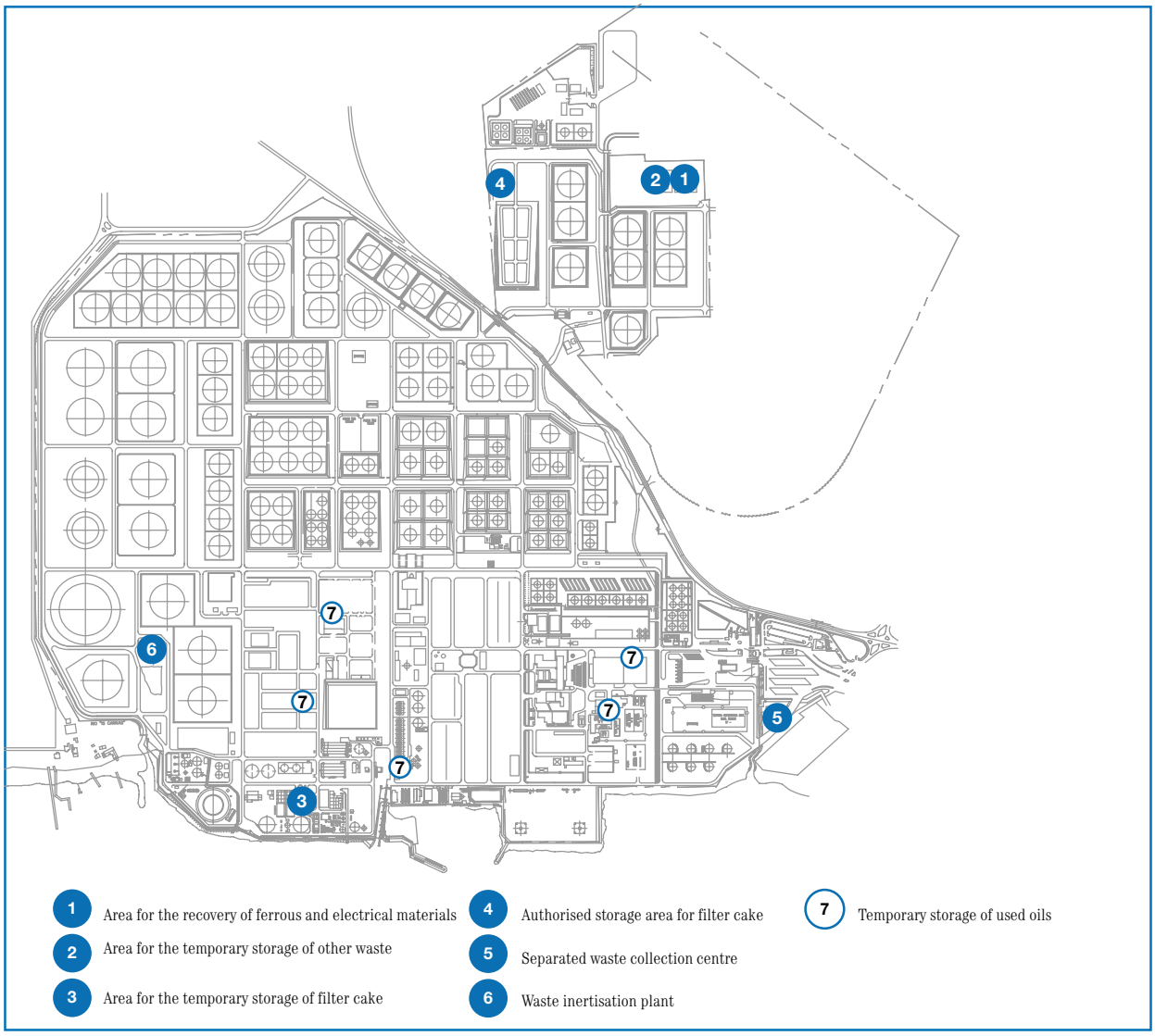


Figure 18 Areas dedicated to the main waste management activities on the site.

The two companies are responsible for the waste they receive from the plant, and disclose the quantities of waste sent externally, after carrying out the necessary treatment processes, in their annual declaration. These companies were carefully selected and are checked regularly, including by means of specific audits (section 4.3.3). As the filter cake from the IGCC is sent for external recovery to plants located in Germany, the company applies for a permit for the cross-border shipment of waste[4] every year in accordance with EC Regulation 1013/2006. Lastly, Sarlux is authorised[5] to receive and treat waste comprising bilge water, slops and ballast water that has come from ships. This activity is carried out completely free of charge for the ships that dock in the marine terminal and for the ships that send these types of waste to Sarlux from regional ports in tanker trucks. These types of aqueous waste are treated at the ballast water treatment plant mentioned in section 4.2.5.

[treatment of bilge water]

Nello stesso impianto vengono trattate le acque di falda emunte dai pozzi della barriera idraulica (paragrafo 4.2.7), anch'esse classificate e contabilizzate tra i rifiuti generati dalle attività del sito Sarlux.

[4] Provincial decision no. 112 of 25 July 2011

[5] Regional decision no. 2520/IV of 4 November 2004, supplemented by Decision no. 964/IV of 31 May 2005, replaced by AIA permit DSA-DEC-2009-230 of 24 March 2009

This plant also treats the groundwater pumped from the wells in the site's hydraulic barrier (section 4.2.7): this waste is also classified and disclosed as part of the waste generated by the activities of the Sarlux site.

4.2.6.2 – Waste data

Based on the waste management processes described, the figures and assessments relating to waste take into account both the waste generated by Sarlux's activities (figures disclosed in the MUD) and the waste leaving the site after treatment to convert it into inert matter. In 2012, total waste production was in line in absolute terms with 2011 figures. Also in 2012, no solid waste was generated from remediation work. Table 55 shows the data on total waste generated by Sarlux's activities, broken down into hazardous and non-hazardous waste.

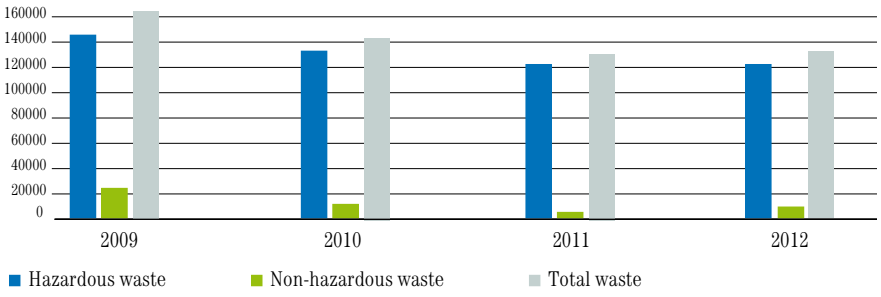
WASTE GENERATED ON SITE (%)	2012
Waste sent to the internal inertisation plant	14.8%
Water from the wells in the hydraulic barrier sent to the wastewater treatment plant	77.8%
Filer cake sent for external recovery	1.2%
Other types of waste	6.2%

TABLE 55 Waste generated on site by Sarlux (refinery and IGCC)*

Parameter	2009	2010	2011	2012
Hazardous waste (t/year)	141,948	134,540	123,962	125,193
Non-hazardous waste (t/year)	22,035	7,122	5,151	6,793
Total waste (t/year)	163,984	141,662	129,113	131,986

*Includes all types of waste generated by the refinery and the IGCC disclosed in the Unified Environmental Declaration (MUD).

CHART T55 (t/year)



The large quantity of hazardous waste in the four-year period 2009-2012 is mainly due to site remediation work, as can be seen from the table below. However, the table also shows that the quantity of hazardous waste generated from ordinary operations and site remediation work was in line with previous years (see Table 55 bis "Hazardous waste (t/year)".

TABLE 55 BIS Hazardous waste (t/year)

Parameter	2009	2010	2011	2012
Water from site remediation (t/year)	91,661	105,027	102,599	102,676
Soil from site remediation (t/year)	19,497	2,849	0	0
Hazardous waste from ordinary operations (t/year)	30,791	26,664	21,363	22,516
Total (t/year)	141,948	134,540	123,962	125,193

Table 56 shows the figures relating to outgoing waste from the Sarlux site: this is also in line with previous years, again due to site remediation work, which was reduced considerably from 2010.

TABLE 56 Outgoing waste from the Sarlux site*

Parameter	2009**	2010	2011	2012
Hazardous waste (t/year)	39,644	18,659	11,832	14,844
Non-hazardous waste (t/year)	20,350	3,881	3,830	6,205
Total waste (t/year)	59,993	22,540	15,662	21,050

* Includes all types of waste generated by the refinery and the IGCC, with the exception of waste sent to the on-site plant to be converted into inert matter and water pumped from the wells in the site's hydraulic barrier. Waste that has been converted into inert matter by the on-site plant is included.
** The increase in the quantity of hazardous waste generated in 2009 is mainly due to site remediation work.

CHART T56 (t/year)

Table 56 shows the figures relating to vanadium concentrate (filter cake) leaving the Sarlux site: this is the solid formed from the gasification of heavy refinery products, which contains high percentages of metals, especially vanadium.

TABLE 56 BIS Outgoing waste from the Sarlux site - filter cake

Parameter	2009	2010	2011	2012
Filter cake - quantity leaving the site (t/year)	1,657	969	1,128	1,570

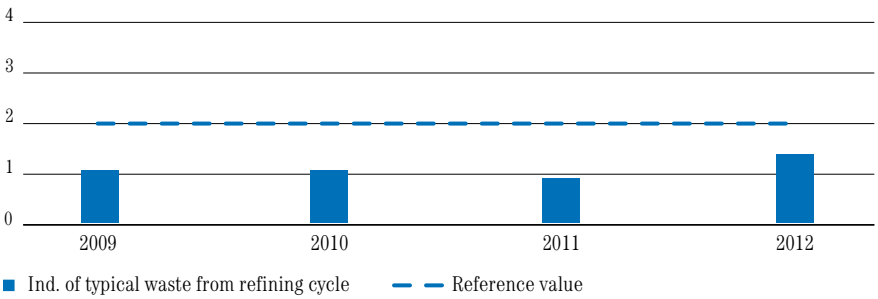
The indicator shown in Table 57 is calculated taking into account the various types of waste from the refining process, as a proportion of the quantity of raw materials processed. The indicator values are compared with the reference values (less than 2 kg of waste per ton of crude processed) contained in the Italian guidelines on best practices in the refining sector. The slightly higher value in 2012 compared with previous years is due to the reduction in the processing of raw materials.

TABLE 57 Waste generated by Sarlux's activities

Parameter	2009	2010	2011	2012	Reference value**
Indicator of typical waste generated from the refining process * (kg/t raw materials)	1.07	1.07	0.99	1.37	<=2

* Indicator calculated by subtracting waste from extraordinary activities and/or waste that does not pertain to the refining process (e.g. excavated soil and rocks, material resulting from the cleaning of the sea floor of the small harbour, vanadium concentrate from the IGCC plant, etc.) from total outgoing waste.
** Value indicated by the Italian guidelines on best practice (Decree issued by the Italian Ministry for the Environment on 29 January 2007)

CHART T57 (kg/t raw materials)



In addition to industrial waste, the site also generates urban solid waste, mainly from its office and catering activities. The separated waste collection of plastic, glass and paper, which started in 2006 with a total amount of 50 tons collected, doubled in 2007, and reached around 112 tons in 2011, in line with the other years.A further increase of approximately 148 tons was recorded in 2012. This was obtained thanks to an in-house campaign to raise awareness and, most importantly, to the contribution of all

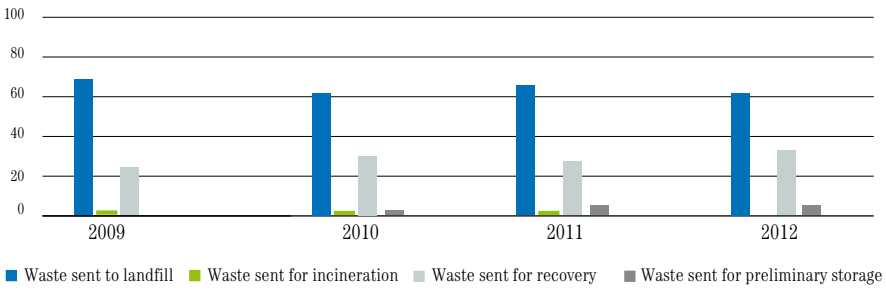
[table of objectives and measures: objective 11, page 127]

staff. Since 2008, the company has also collected organic waste from the company canteen, which in 2012 amounted to approximately 22 tons. The company has a specific objective to improve the collection of separated waste.
Table 58 shows the final destinations of waste and the percentages of waste from the site sent to each of them.

Table 58 Destination of outgoing waste from the Sarlux site

Destination of waste	2009	2010	2011	2012
Waste sent to landfill (% of total waste)	73.0	62.9	66.1	63.2
Waste sent for incineration (% of total waste)	0.83	1.73	1.90	0.1
Waste sent for recovery (% of total waste)	26.1	34.0	32.0	34.1
Waste sent for preliminary storage (% of total waste)	0.02	1.37	2.80	2.6

chart T58 (%)



[table of objectives and measures: objective 12, page 127]

Table 58 shows that waste sent for recovery and to landfill, as percentages of total outgoing waste from the site, were broadly in line with the previous year.
The breakdown of hazardous and non-hazardous waste sent from the site for recovery is shown in Table 59. It can be seen that more non-hazardous waste than hazardous waste was sent for recovery again in 2012. Around 109,854 tons of waste were recovered or recycled in 2012, in line with recent years. This was mainly due to site remediation activity and to the delivery of used catalysts to companies specialising in the recovery of metals (Pt, Co, Mo, Ni).

Table 59 Outgoing waste from the Sarlux site sent for recovery: Hazardous and non-hazardous

Parameter	2009	2010	2011	2012
Hazardous waste sent for recovery (% of total waste sent for recovery)	81.3*	59.1	44.9	32.4
Non-hazardous waste sent for recovery (% of total waste sent for recovery)	18.7*	40.9	55.1	67.6

* The increase is mainly due to site remediation work

4.2.7 – Accidental spills into the soil and the subsoil

Previous activities

In accordance with the provisions of Ministerial Decree 471 of 25 October 1999 (regulations containing criteria, procedures and methods for the safety, reclamation and environmental restoration of polluted sites), and having identified a problem of contamination of the soil, subsoil and underground water on its production site, the company submitted its Site Characterisation Plan on the condition of the terrain and the layers of water beneath the refinery to the competent authorities, pursuant to Art. 9 of the above Decree. The contamination mainly stems from the presence, in concentrations above the limits stipulated for underground waters, of the following substances or categories of substances: total hydrocarbons, benzene, lead, methyl tert-butyl ether (MTBE), p-Xylene and toluene. There have been few instances where the limits for heavy hydrocarbons (C>12) in the soil and subsoil have been exceeded. Subsequently, based on Ministerial Decree 468 of 18 September 2001 and the Ministerial Decree of 12 March 2003, the Sarroch municipal area and 33 other municipalities were included in an area called "Sulcis Iglesiente Guspinese", identified as a site of national interest for remediation. In 2004, in conjunction with the Italian Ministry for the Environment, the Region of Sardinia, the Province of Cagliari, Local Health Authority no. 8 and the Municipality of Sarroch, the company defined the procedures for implementing the Site Characterisation Plan, which set out a series of surveys to be carried out and proposed the measures needed to protect the environment and safeguard public health. In July 2004, work to assess the site was initiated using the following techniques:

[Ministerial Decree 471/99, replaced by Legislative Decree 152/06, Part IV, Section Five]

- environmental surveys using continuous core drilling at depths of between 5m and 10m, to establish the stratigraphy of the subsoil and extract samples to ascertain whether any contaminants are present and measure their concentrations
- piezometric surveys at depths of between 10m and 20m, which monitor the water table and ascertain the environmental condition of the underground water. Piezometric surveys are conducted by inserting windowed PVC tubes into the aquifer, separated from the surrounding terrain by drainage gravel, in order to periodically take samples of water to check its quality
- gas surveys, to check for the presence of hydrocarbon gas in the soil interstices

[site characterisation work]

The Site Characterisation Plan is currently nearing completion. By December 2010, 879 surveys, 144 piezometric readings and 539 gas survey control points had been completed.

Preparation of the final documentation for the Site Characterisation Plan began in 2011. The document was officially submitted for approval to the supervisory bodies in December 2012. Based on the results of the characterisation activities, a plan was drawn up to make the groundwater safe in emergency and operational situations, which was approved at the Services Conference held at the Italian Ministry for the Environment in April 2007. The project phase involving construction of a hydraulic barrier with supernatant recovery systems has already been completed. All 46 wells required have been created: of these, 26 are already operating on the mid-line, extracting contaminated water and recovering the supernatant, while 13 are being used for groundwater replenishment on the sea side, including one outside the plant to the south, to prevent salt inflows. The remaining seven wells are hydrogeologically upstream, controlling groundwater levels, and became operational in early 2011. In September 2011, replenishment tests were carried out on the 13 wells on the sea side. The physical barrier will extend over 3,050 m and will be constructed using jet grouting

[the Intervention Plan]

and waterproofing injections. Field tests were carried out in 2009 to test operating and construction conditions in preparation for the implementation project. Preliminary surveys were carried out in 2010 to assess the best techniques for installing barriers on the southern side of the refinery. The tender specifications for the whole project, subdivided into operational lots, were defined in 2011.

During 2008, the company drew up the project for the remediation of C>12 hydrocarbon hot spots in soil in the West Tank Farm area and for decontaminating soil in the area of the disused ST1 tank.

Since 2009, in line with the project schedules, the process of earth excavation, soil washing for removal of hydrocarbons and the subsequent restoration of washed soil to the original site has been ongoing at the West Tank Farm area, while contaminated soil in the ST1 area has been removed and delivered to authorised landfill. Both activities are nearing completion. In 2010, sampling and analysis was carried out jointly with ARPAS to approve the replacement of washed soil and uncontaminated soil in the West Tank Farm area.

All contaminated soil from the former ST1 area has been sent to landfill, and in December 2011 the plan to make the site permanently safe was presented. After the plan has been implemented, restitution of the site will be requested.

In 2012, the quantity of supernatant recovered fell appreciably compared with the previous year, indicating a clear improvement in the condition of the contaminated subsoil (see Table 60).

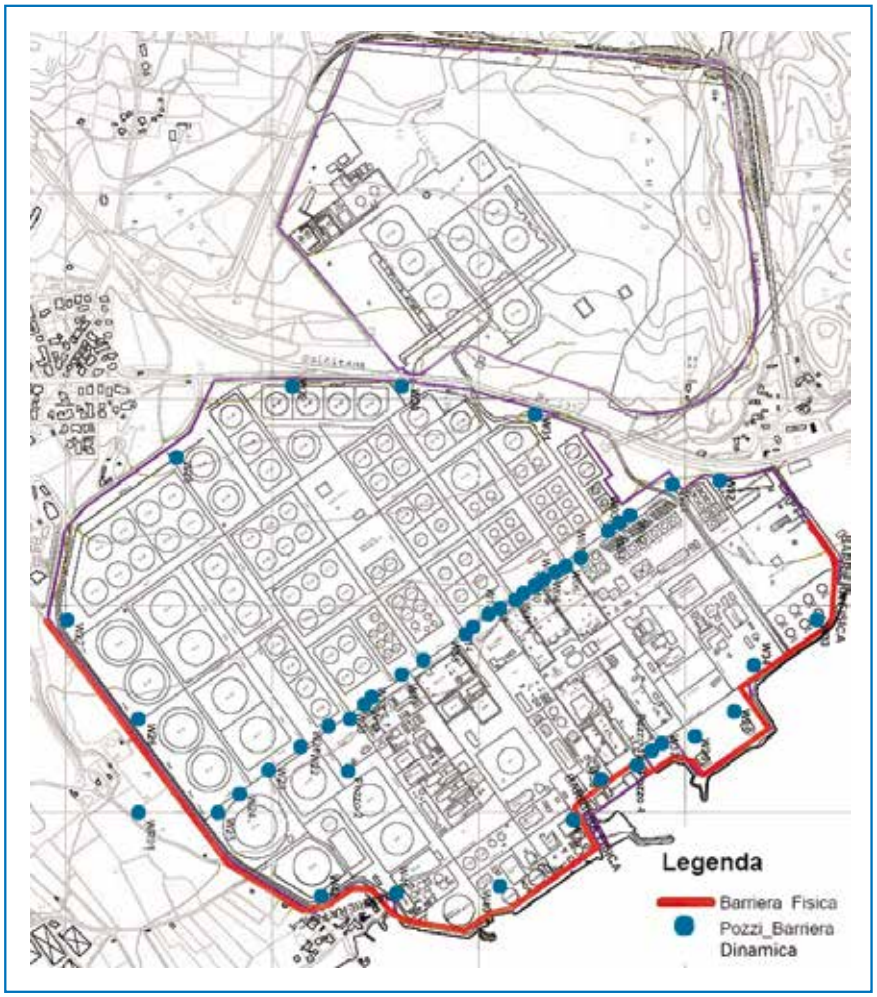


Figure 19 Location of wells constituting the dynamic barrier and planned location of physical barrier

Table 60 Previous activities

Parameter	2009	2010	2011	2012
Ratio of quantity of product recovered to water drained* (%)	0.70	1.39	0.30	0.16

* Activities relating to the hydraulic barrier and product recovery started in 2007

Prevention of soil and subsoil contamination

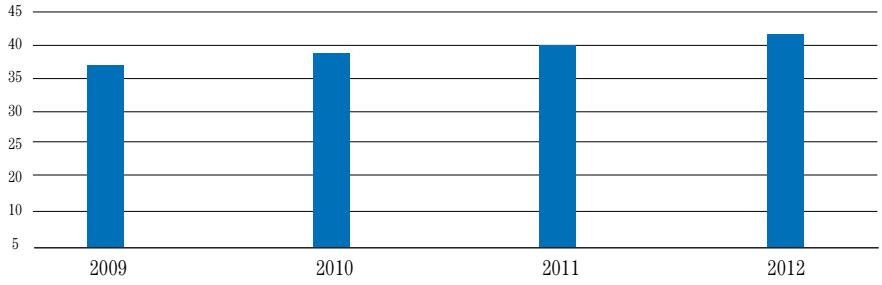
It is not possible for the soil and subsoil to become contaminated under normal conditions. Contamination is only likely to occur after an accidental spill of liquid hydrocarbons (raw materials, semi-processed products or finished products). This type of event may particularly affect storage areas and the stretches of land underneath the pipes that connect the plants, tanks and wharf. Assessments of abnormal and emergency situations associated with the internal movement and storage of hazardous substances are examined and documented in the Safety Report (section 3.3, page 38). The indicators given in Table 61 show how the company is continually implementing additional measures to prevent contamination of the soil and subsoil. In 2012, all checks scheduled for the year in the multi-year plan and the budget were completed.

Table 61 Activities to prevent contamination

Parameter	2009	2010	2011	2012
Paving of containment basins for crude oil and product tanks: paved surface/total surface (cumulative figure) (%)	36.5	39.2	40.1	42.0
Protection of soil in storage areas: no. of double bottom tanks (cumulative figure)	14	15	16	20
Protection of the soil along pipeways: paved surface (cumulative figure) (m^2)	33,092	45,285	50,504	53,831
Inspection and maintenance: non-destructive testing expenses (thousand/year)	1,474	870	1,562	1,420

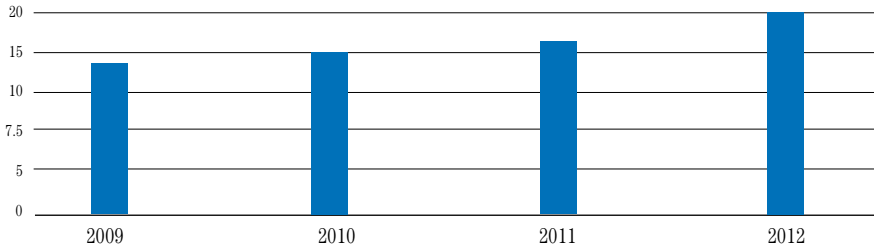
[table of objectives and measures: objective 9, page 126]

CHART T61A



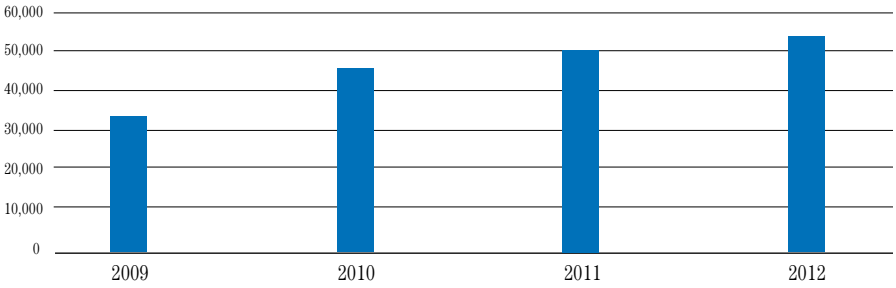
■ Paving of containment basins for crude oil and product tanks

CHART T61B



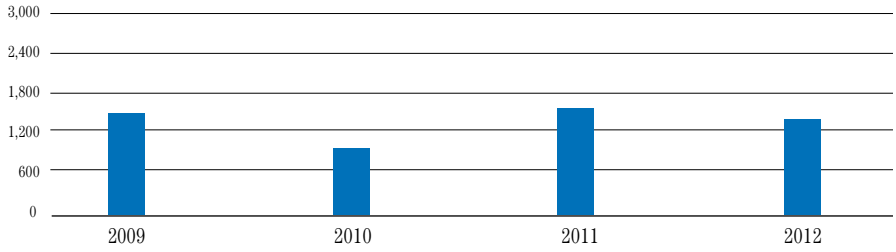
■ Number of double bottom tanks

CHART T61C



■ Paving along pipeways

CHART T61D (EUR thousand)



■ Inspection and maintenance costs

4.2.8 – Noise

To monitor noise pollution, in 1999 the site planned and implemented annual, systematic controls of noise levels in the local area, by means of phonometric surveys to establish the acoustic characteristics of the surrounding environment. The surveys have been repeated over the years at numerous measurement points, some of which are located in the plant and in the streets adjacent to its boundaries, while others are in access roads and in Sarroch city centre. The location of the measurement points is shown on the map at Figure 20, which is based on the Municipal Town Plan.

The limits that must be complied with at the measurement points derive from the Acoustic Classification Plan, which was approved by the municipal administration with municipal council resolution no. 6 of 13 April 2011. This plan divides the region into uniform acoustic areas governed by limits specified by Art. 2 of Law 477/98 (shown in Table 62A for emission limits, measured near the source, and 62B for immission limits, measured near the receptors) and defines the acoustic category and consequently the absolute emission and immission limits that must be complied with at the sampling points.

[Prime Ministerial decree of 1 March 1991]

Figure 20 Location of noise monitoring units in 2012

Table 62 A Emission limits, Prime Ministerial Decree 14 November 1997 – Municipal Acoustic Classification, Municipal Council Resolution no. 6 of 13 April 2011

Categories of the area's intended use	Daytime limits * LAeq [dB(A)]	Night-time limits * LAeq [dB(A)]
I particularly protected areas	45	35
II predominantly residential areas	50	40
III mixed areas	55	45
IV areas of intensive human activity	60	50
V predominantly industrial areas	65	55
VI exclusively industrial areas	65	65

*The daytime period runs from 6 a.m. to 10 p.m.; the night-time period runs from 10 p.m. to 6 a.m.

Table 62 B Immission limits, Prime Ministerial Decree 14 November 1997 – Municipal Acoustic Classification, Municipal Council Resolution no. 6 of 13 April 2011

Categories of the area's intended use	Daytime limits * LAeq [dB(A)]	Night-time limits * LAeq [dB(A)]
I particularly protected areas	50	40
II predominantly residential areas	55	45
III mixed areas	60	50
IV areas of intensive human activity	65	55
V predominantly industrial areas	70	60
VI exclusively industrial areas	70	70

*The daytime period runs from 6 a.m. to 10 p.m.; the night-time period runs from 10 p.m. to 6 a.m.

Tables 63A and 63B show the noise levels recorded at some of the measurement points for the last four years. The surveys have been repeated over the years at measurement points, some of which are located in the Sarlux plant and in the streets adjacent to its boundaries, while others are in access roads and in Sarroch city centre. Table 63A shows the emission values recorded in some of the stations located within the plant, nos. 3 and 6. For applicable limits, see those set out by the Municipal Acoustic Classification (and shown in Table 62A).

Table 63A Noise (emission) levels at representative points near the boundary of the Sarlux site

Acoustic Classification	Measurement point	Values measured [dB(A)] (L90 values)			Emission limit (applicable near emission sources)	
		Year	Daytime period	Night-time period	Daytime period	Night-time period
VI	**3**	2012	51.0	59.0	**65**	**65**
		2011	54.0	56.5		
		2010	50.5	53.5		
VI		2009	48.5	48.5		
	6	2012	40.5	40.0		
		2011	42.0	34.5		
		2010	43.0	41.5		
		2009	38.5	41.0		

Table 63B shows the noise immission values in the external environment recorded at two stations located in Sarroch city centre, near the boundaries of the industrial site (nos. 14 and 15). These values relate to the statistical parameter L90, i.e. the noise is above this level for 90% of the time. This parameter can be considered to include industrial noise, which is continuous and largely sustained over time, in the sense that the value recorded excludes one-off acoustic events and includes the noise generated by the Sarlux site, other industrial sites and acoustic events of a significant duration not caused by Sarlux (e.g. vehicle traffic noise). For applicable limits, see those set out by the Municipal Acoustic Classification for the types of area in which the measurement points are located (and shown in Table 62B).

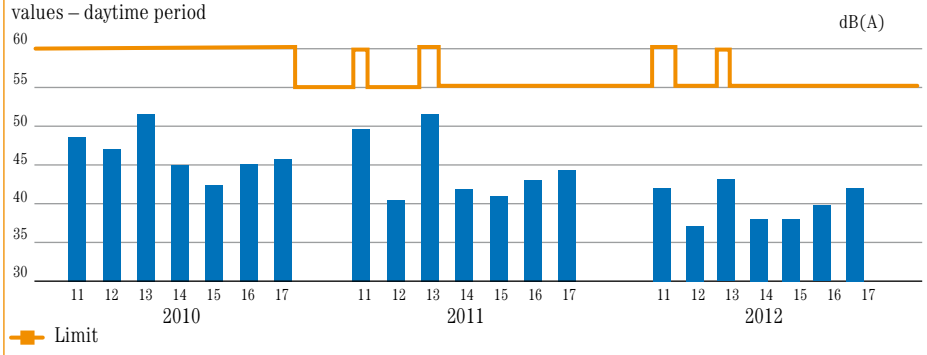
Table 63B Noise (immission) levels at representative points in the centre of Sarroch

Acoustic classification	Measurement point	Values measured [dB(A)] (L90 values)			Immission limit (applicable to the external environment)	
		Year	Daytime period	Night-time period	Daytime period	Night-time period
II	**14**	2012	39.0	41.5	**55**	**45**
		2011	42.0	38.0		
		2010	45.0	45.5		
		2009	45.5	43.0		
	15	2012	39.0	39.0		
		2011	41.0	34.5		
		2010	43.5	43.0		
		2009	47.5	45.5		

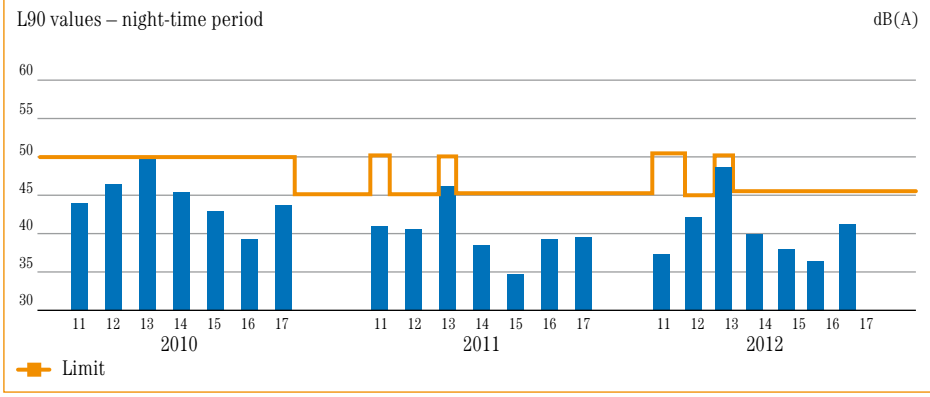
Chart T63B shows the complete series of data recorded at all the measurement points located in Sarroch city centre, compared with the applicable legal limits stipulated in the Municipal .Acoustic Classification and set out in Table 62B. Each bar of the histogram is labelled with a number identifying the corresponding noise measurement station shown in figure 20 on page 103. The differential criterion is not applicable to the existing continuous production cycle plants or plants that already held permits at

the time the decree came into force, as in the case of the refinery and the IGCC at the Sarroch site, pursuant to Art. 31 of Ministerial Decree of 11 December 1996.
Following a specific request from the assessment committee for AIA permits, the company submitted, as a provisional measure prior to the completion of the municipal acoustic classification, an acoustic classification relating to the measurement points being surveyed in April 2008. The provisional classification, which was determined by

CHART T63B Noise levels at representative points in the centre of Sarroch L90 values – daytime period



L90 values – night-time period



an acoustics engineer, was based on the zones contained in the Municipal Town Plan, applying the criteria for defining acoustic categories set out in the Ministerial Decree of 14 November 1997. Specifically:

- stations located at the boundaries of the plant (stations 1 to 10) were deemed to fall into Category V: “predominantly industrial area”, with limits of 70 dB(A) during the day and 60 dB(A) at night, except for stations 9 and 10, which, given that they fall within the boundaries of the plant, are to be considered, to all extents and purposes, to belong to Category VI with a limit of 65 dB(A) for both daytime and night-time periods
- most of the stations located in Sarroch City Centre (points 11 to 17) were deemed to belong to Category II: “predominantly residential areas” with limits of 55 dB(A) during the day and 45 dB(A) at night; or Category III: “mixed areas” with limits of 60 dB(A) during the day and 50 dB(A) at night (see stations 14 and 15)

4.2.9 – Visual impact

The company has also made a commitment to improving the plant's visual impact, which has been stepped up since 2000. Improvements were made to structures and spaces comprising areas in direct contact with the outside: these involved naturalisation projects to provide areas of continuity between the site and the region. The junction on the S.S.195 was rebuilt and the green spaces in the car park were improved. Work has been completed in recent years to prevent a steam plume from rising from the boilers in the combined-cycle section of the IGCC unit. The new installation eliminated the visual impact of the steam plume, and also enabled heat to be recovered for use in process activities.

Again in 2012, the programme to reduce the volume of hydrocarbons being sent to the flare system continued. The results were extremely successful and also reduced the visual impact of the flame produced by the flare system.

[table of objectives and measures: objective 8, page 126]

4.2.10 – Odours

In the past, the company received a number of reports on the presence of unpleasant odours outside the site. As a result, in 2004, it conducted an initial investigation to identify the sources of the odours reported in the surrounding area. Over the next few years, the company undertook more in-depth investigations and analysis, which led in 2008, after a testing phase, to the development of a monitoring methodology using a combination of analytical techniques, modelling and olfactometric assessments. The ultimate aim of the work is to arrive at an assessment of the main odour-emitting sources and the possible events that could generate an olfactory impact on the surrounding area.

In 2009, a number of different sampling and analysis activities were performed within the refinery (sources) and in the parts of Sarroch most at risk (receivers). These activities were necessary to validate the methodology and prepare the Monitoring and Control Plan for odour emissions. In accordance with the regulations in the AIA permit (preliminary assessment of 12 January 2009), the Monitoring and Control Plan was submitted to the Ministry for the Environment in October 2009. This document describes the methodology, timeframe and methods of communicating the results obtained.

[table of objectives and measures: objective 14, page 127]

The methodology is based on an integrated approach that uses instrumentation and sensory techniques to examine the odour-emitting sources and identify the compounds responsible for the odour (tracers), in conjunction with modelling to study the dispersion of odour-emitting compounds into the atmosphere. This approach provides an accurate assessment of the olfactory impact produced by the emitting source on the receivers at risk.

The Plan includes two six-monthly monitoring campaigns: a "summer" one in the spring/summer (June-July) and a "winter" one in the autumn/winter period (November-December). In each campaign, an assessment will be carried out at both the refinery and the points at risk in Sarroch.

The first monitoring campaign was carried out in June 2010, while the second was completed in March 2011.

In 2011, a study on the dispersion of odour emissions into the atmosphere was conducted using an atmospheric diffusion model to simulate the transport and diffusion of odours. The main aim of the study was to define a monitoring plan and

[1] United States Environmental Protection Agency

an analytical plan appropriate for the phenomenon of dispersion from the industrial site under examination. It also emerged that the use of statistical methodology for the monitoring and management of odour emissions from the site needs to be consolidated over time, increasing the statistical sample (number of statistical measures) in order to examine in more depth potential correlations between the odour impact and the statistical concentrations identified. An odour monitoring plan will be developed based on the results of the work carried out in 2011. This will involve two monitoring campaigns, with the first to be carried out in the summer period (as the worst case), and the second in the winter period as a comparison.
Lastly, the results have shown that it is possible to use statistical methodology to monitor and manage odour emissions objectively, by establishing the causes and sources of emissions and the nuisance levels of immissions. The two planned monitoring campaigns (summer and winter) were conducted in 2012, enabling the information collected to be compared and therefore improved. In 2013, the company plans to conduct both a summer and winter monitoring campaign in order to boost the statistical analysis of the results.

4.2.11 – Less significant environmental aspects

PCB

Polychlorinated byphenals (PCBs) are chlorinated organic compounds that are chemically and thermally extremely stable. For this reason, they were widely used in the past as dielectric fluids in electrical equipment (e.g. industrial transformers) before the dangers were recognised and their use banned.
Today, the sale and use of PCBs in new applications is prohibited but, given the recognised difficulties in disposing of such substances, there are various legal provisions that apply to existing equipment, according to the quantities and concentrations of PCBs present.
Following an inventory and periodic analytical checks, the 130 oil-insulated transformers were decontaminated by removing the PCBs. Periodic checks are undertaken to ascertain the condition of the transformers and to ensure that the PCB content is kept below the minimum threshold required by law to consider an item of equipment decontaminated.

[Ministerial Decree of 11 October 2001]

Asbestos

Asbestos was used for a long time in a variety of industrial and domestic applications until the dangers of this material were discovered and its use banned.
Over the years, the site has implemented the requirements of sector legislation. It has compiled an inventory of materials containing asbestos, notified all the supervisory authorities and decontaminated plant and equipment when any maintenance was carried out.
Cement asbestos roofs have gradually been removed over the years, from a surface area of 10,800^{2}in 2004 to the complete absence of such roofs on the site today.
Any asbestos still present (as an insulator used in the layers of insulation on pipes) is protected from the effects of atmospheric agents that could alter its integrity, and is removed when maintenance work is carried out. Specialist firms are used when asbestos is discovered.

[Law 257/1992, as subsequently amended]

Refrigerant gases

Legislation stipulates specific management procedures to prevent the dispersal of these substances into the atmosphere and to ensure their progressive elimination from the production process. All the equipment in the facility is checked via periodic maintenance by specialist personnel. In recent years, the company has gradually been replacing ozone-depleting substances with others that do not have this effect. Currently, the only substance of this type is Freon R22, which is present in a total quantity of 335 kg, down by approximately 50% compared with the previous year. The use of this type of substance as virgin gas in existing air conditioning plants is permitted until 31 December 2009. As recycled or reclaimed gas, it will be permitted until 31 December 2014. From 1 January 2015, its use as recycled or reclaimed gas will also be prohibited. The declaration to be sent to ISPRA relating to the substances that could have a greenhouse effect is currently being prepared.

[Regulation EC/2037/00 and Presidential Decree 147/2006, Regulation EC 842/2006]

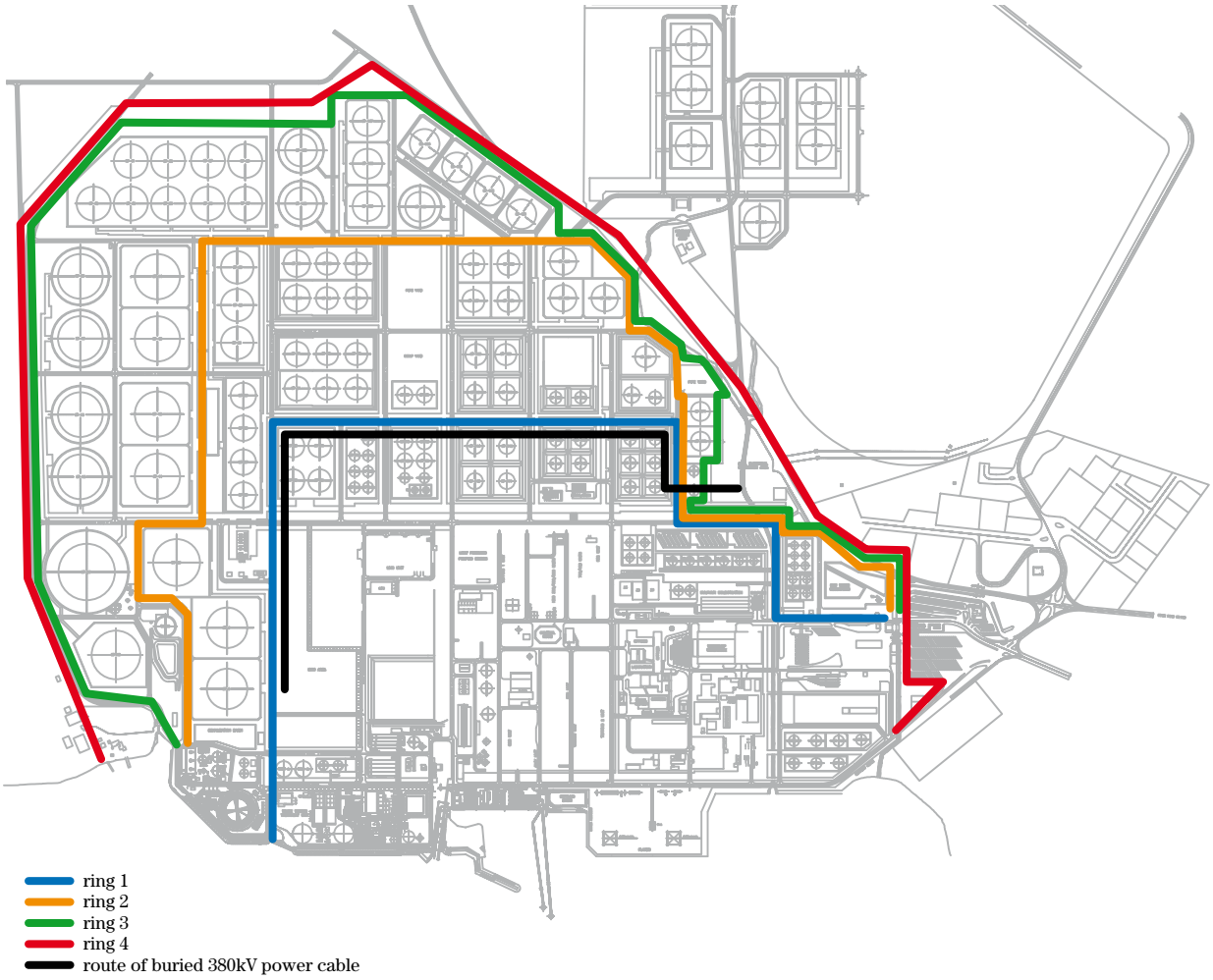
Non-ionising radiation (electromagnetic fields)

The main sources of electromagnetic fields in the facility can be broken down into two broad categories:

- point sources such as pumps, electrical switchboards, motors
- linear sources, i.e. conductor cables for transmitting electricity, such as the buried cable operating at 380 kV that transmits electricity from the IGCC to the ENEL electrical substation situated on the western boundary of the site

A study on the presence of electromagnetic fields was carried out across the whole

Figure 21 Map of the sampling lines for the survey of electromagnetic fields



site and at external measurement points near the boundary in 2004. It was repeated in 2007 using the same methodology but with an increased number of measurement points.

As shown in Figure 21, measurements were made along four main lines:

- the first line largely follows the route of the buried 380 kV cable, which constitutes the main source of electromagnetic fields in the plant
- the second follows the route of the buried cable but at a distance of around 200 m
- the third and fourth follow the inside and outside of the site boundaries respectively

The results obtained for both electrical and magnetic fields are much lower than the legal limits stipulated for exposure of the general public. **[Prime Ministerial decree of 8 July 2003]**

The electrical field values decrease very rapidly as the distance from the buried cable increases and are undetectable just a few metres away.

The magnetic field values measured along the external boundary do not exceed 1.5 µTesla, compared to a limit of 100 µTesla for exposure of the general public and a limit of 3 µTesla, set as a qualitative objective. As expected, the maximum values were measured along the route of the buried cable and near to the ENEL electrical substation. These were 20 µTesla and 10 µTesla respectively. The monitoring campaigns conducted in 2004 and 2007 will be repeated in 2013, as a periodic check.

Ionising radiation

The sources of ionising radiation in the facility consist of small radiogenic sources in level gauges and analytical equipment located in the internal laboratory. All radiogenic sources are adequately confined and are checked annually by an appropriately qualified specialist pursuant to Legislative Decree 230/95, as subsequently amended. **[Legislative Decree 230/95]**

The assessments made in previous years, applicable to abnormal and emergency conditions, were repeated in 2012.

4.3 – Indirect environmental aspects

4.3.1 – Product design

4.3.1.1 – General

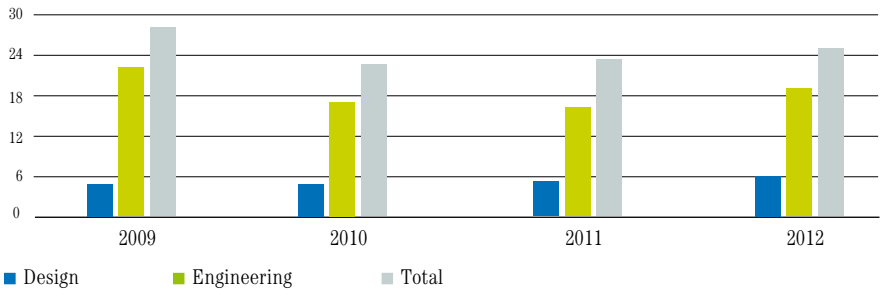
Sarlux carries out research and development activities aimed at designing products that meet the demands of the market and the requirements of environmental legislation. Implementing plans to modify products usually also requires adjustments to be made to existing plants. The modifications that need to be carried out on the site's plant and equipment are also designed and developed in-house with the assistance of specialist engineering companies. As shown in table 64, the total number of hours spent on product design and plant engineering in 2012 grew by more than 10% compared with the number recorded in 2011. Analysis of the parameters confirms that hours spent on product design have been continuously increasing since 2009. The increase in 2012 was mainly due to the substantial one-off investment in *revamping* the MHC2 plant The necessary plant modifications have therefore been engineered and coordinated by a dedicated team, generating a significant year-on-year increase also in the "plant and equipment engineering hours" parameter. The total hours recorded in 2012 therefore confirm Sarlux's ongoing commitment to research and development and the engineering of the necessary modifications.

TABLE 64 Design and engineering

Parameter	2009	2010	2011	2012
Product design hours/thousands of hours worked	4.5	4.5	5.4	5.8
Plant & equipment engineering hours/thousands of hours worked	23.2	17.9	17.5	19.5
Total hours of product design and plant engineering/thousands of hours worked	27.7	22.4	22.9	25.3

4.3.1.2 – Low-sulphur fuel oil

CHART T64 (hours/thousands of hours worked)



In recent years, the production of motor vehicle fuels has been guided by legislation towards a decisive reduction in sulphur, as described below.

["Auto Oil" Directive 98/70/EC, amended by Directive 2003/17/EC]

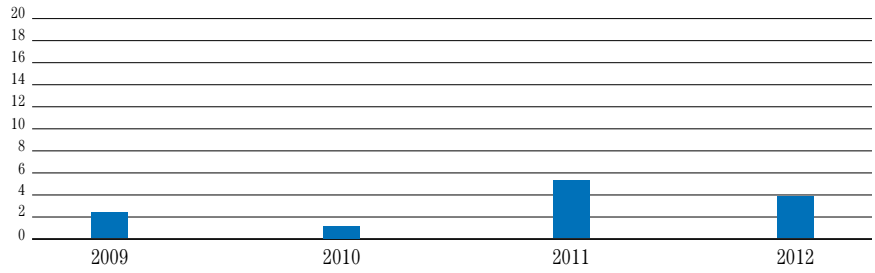
From 1 January 2005	- sulphur content in gasoline and diesel fuel must be less than 50 ppm - the sale of gasoline and diesel fuel with sulphur content of less than 10 ppm
From 1 January 2009	- sulphur content in gasoline and diesel fuel must be less than 10 ppm

To enable the plant to achieve the 2009 objective for reducing the sulphur content of gasoline, it was necessary to adapt the FCC plant by installing the new U800 desulphurisation unit. Note how from 2005 to 2008 (particularly in 2008) the quantity of sulphur in finished products entering the market decreased significantly, which led to the increase in the quantity of sulphur sold as a product. This can be attributed to the company's ongoing investment in the desulphurisation capacity of the production plants, which led to the completion of the gasoline desulphurisation plant in 2008. This has allowed the refinery to comply with the new European requirements stipulating a sulphur content in gasoline of 10 ppm, which entered into force on 1 January 2009. As shown in Table 65, the sulphur content in products that entered the market showed a significant decrease in 2012 compared with the previous year. The TGTU plant for the treatment of tail gases and sulphur recovery, which was built in 2008, was fully operational throughout 2012, allowing the company to significantly reduce the sulphur content of emissions.

TABLE 65 Sulphur content in products

Parameter	2009	2010	2011	2012
Quantity of sulphur in products/quantity of sulphur entering the site with raw materials (%)	2.3	1.3	5.4	3.8

CHART T65 (%)

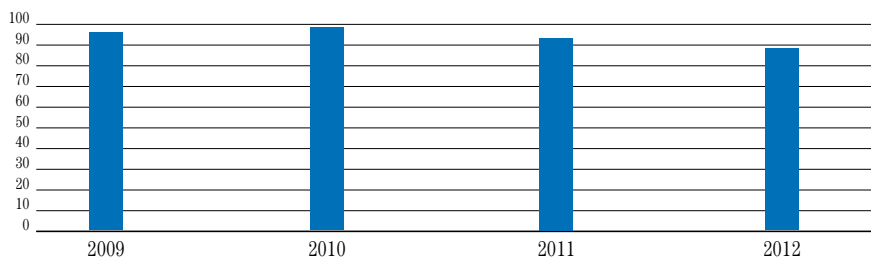


2012 saw another reduction in the quantity of sulphur recovered in the production cycle compared with the quantity entering the site, as shown in Table 66.

TABLE 66 Quantity of sulphur recovered in the production cycle

Parameter	2009	2010	2011	2012
Quantity of sulphur produced/quantity of sulphur entering the site with raw materials (%)	95.9	97.1	92.7	89.6

CHART T66 (%)



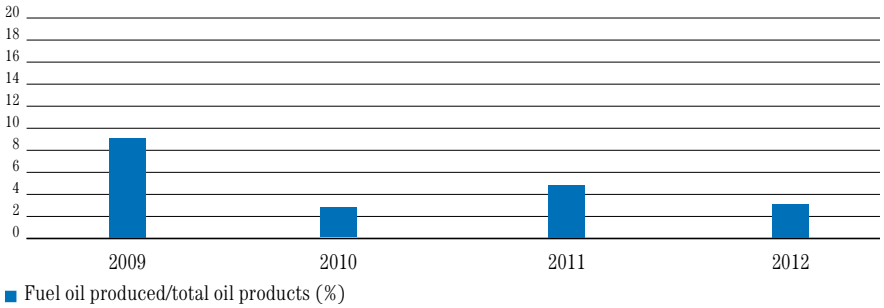
Range of oil products

In recent years, the production and sale of oil products has increasingly revolved around the "light" fractions, while the refinery's production of heavy distillates was for the most part destined to be converted into syngas for the purposes of generating electricity in the IGCC. Table 67 below shows the figures relating to the fuel oil fraction produced compared with total oil products. The result for 2012 also confirms the strategy of keeping the fuel oil quota at minimum values, focusing on production for purely internal use.

TABLE 67 Fuel oil fraction as a percentage of total oil products

Parameter	2009	2010	2011	2012
Fuel oil produced/total oil products (%)	8.7	2.5	4.7	2.0

CHART T67 (%)



As described in section 3, the production cycle of the IGCC removes the pollutants in the heavy hydrocarbons used as feedstock for the plant. This applies particularly to sulphur, which is recovered and sold, thereby contributing to the positive results shown in Table 66 on the previous page.

Summary of considerations relating to the indirect environmental aspects of product design

Based on the foregoing, it can be observed that:

- the lower sulphur content in motor vehicle fuels destined for sale leads to a reduction in SO_2 emissions from vehicle traffic
- the generation of energy from the syngas obtained from the gasification of heavy hydrocarbons maximises the use of incoming raw materials and allows the sulphur content to be recovered
- sulphur recovered from the production cycle is effectively considered a product, which is sold and used as a raw material in other production cycles (e.g. for the production of sulphuric acid), thus reducing the need for natural raw materials (minerals) to be refined, with further savings of energy and other resources

4.3.2. – Transport

Maritime traffic

All raw materials entering the site and a significant portion of oil products leaving the site are transported by sea. Given the large number of ships (around 750–800 per year), the plant has for several years promoted a policy of selecting and checking the ships used, with the aim of preventing accidents and spills of hazardous substances at sea. It has done this ahead of the deadlines stipulated by European regulations for discontinuing the use of single-hulled ships.

[MARPOL 73/78, the international convention on the prevention of pollution from ships, and Regulation 417/2002/EC, as amended by Regulation 1726/2003/EC]

The company (then Saras) met the target stipulated by the regulations for discontinuing single-hulled ships (2010) well ahead of schedule in 2006. Sarlux is currently continuing the activity begun by Saras aimed at considerably reducing its use of ships with segregated ballast tanks (SBTs), which must be taken out of operation by 2015.

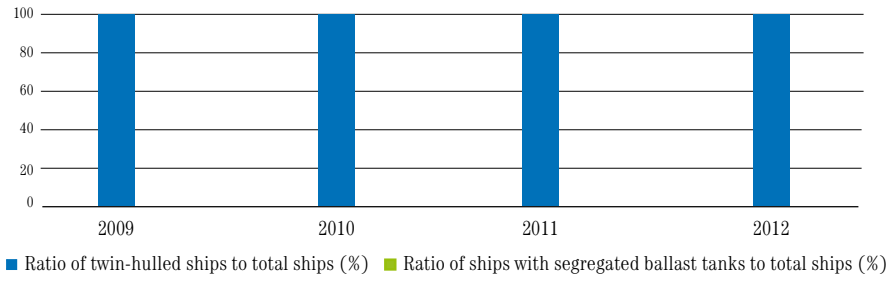
[table of objectives and measures: objective 15, page 127]

As shown in Table 68, in the last four-year period, 2009-2012, only twin-hulled ships have been used. In the same period, no ships with SBTs were used.

TABLE 68 Twin-hulled ships

Parameter	2009	2010	2011	2012
Ratio of number of ships checked to total ships (%)	100.0	100.0	100.0	100.0
Ratio of ships with segregated ballast tanks to total ships (%)	0	0	0	0

CHART T68 (%)



Given the potential seriousness of accidents at sea, ships have always been and still are selected by consulting international databases (e.g. SIRE) containing the results of checks made on transport ships. In addition, the company carries out a programme of direct checks, encompassing both technical and operational aspects, on ships arriving at the marine terminal.

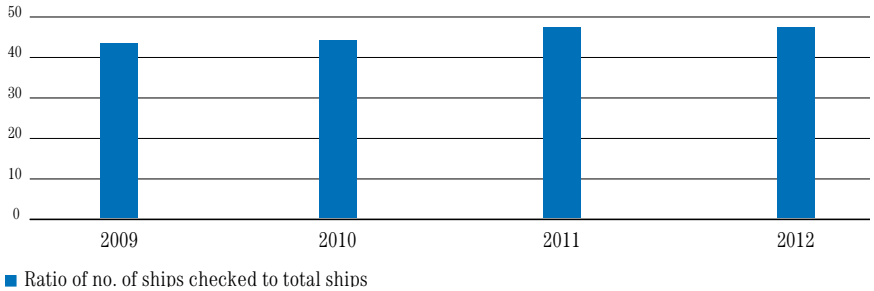
[table of objectives and measures: objective 16, page 127]

The benchmark specification for checks is the “Minimum Safety Criteria” document adopted first by Saras and now by Sarlux, in accordance with the ship inspection protocols established by the Oil Companies International Marine Forum (OCIMF), an organisation that promotes improvements in safety and responsible environmental management in the transportation of oil and its derivatives, and marine terminal management. A high number of ships are checked and this has increased over the years, as shown in Table 69. The ships expected at the site are meticulously checked by specialist companies at the port of departure before they set sail.

TABLE 69 Ship safety checks

Parameter	2009	2010	2011	2012
Ratio of number of ships checked to total ships (%)	42.0	43.2	46.2	45.9

CHART T69 (%)



[table of objectives and measures: objective 17, page 127]

Road traffic

The road traffic caused by the activities carried out on the site is due mainly to:

- transport of refined oil products via tanker trucks (around 36,000 vehicles a year)
- transport of sulphur via articulated lorries (around 4,400 vehicles a year)
- transport of auxiliary production materials and substances (around 400 vehicles a month)
- transport of employees of the company and of external companies working on the site (around 1,000 motor vehicles and 60 buses a day)

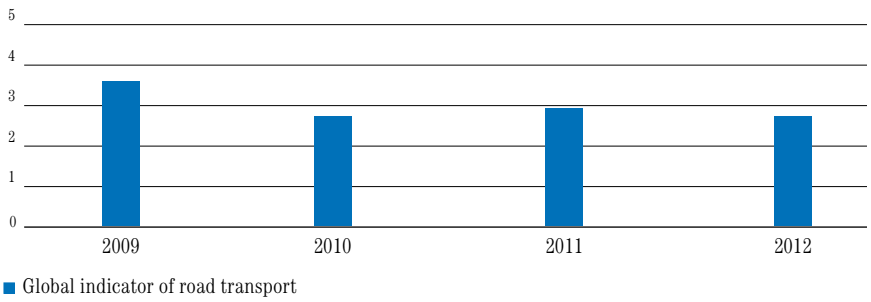
The table below shows the indicator for heavy vehicle traffic, which mainly consists of tanker trucks for transporting products and, to a lesser extent, articulated lorries for transporting sulphur.

TABLE 70 Road traffic

Parameter	2009	2010	2011	2012
No. of heavy vehicles/kt raw materials	3.58	2.87	2.90	2.79

In 2007, the company implemented a regular programme of checks to verify the compliance of the tanker trucks used for transporting products. In 2012, 25% of tanker trucks authorised for entry were checked. The number has risen steadily from 17% in 2007.

CHART T70 (%)



4.3.3 – Environmental conduct of external companies

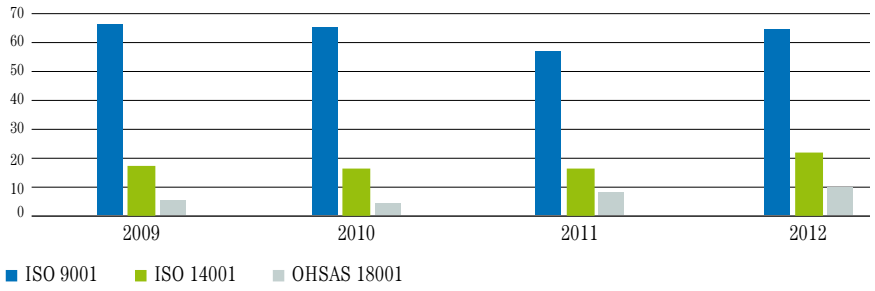
The plant has put in place appropriate procedures governing relationships with third parties involved in the site's activities. These are intended to ensure that the conduct of the staff of external companies complies with the company's policies on safety, health and the environment.

The plant places great value on the commitment of external companies to achieve and maintain certification of their quality, environmental and safety management systems. In 2012, the number of companies with environmental certification (see Table 71) significantly increased versus the figure for 2011.

Table 71 Percentage of external companies with certified management systems

Parameter	2009	2010	2011	2012
Subcontractors with ISO 9001 certification (quality management system) (%)	67.7	66.7	58.2	64.9
Subcontractors with ISO 14001 certification (quality management system) (%)	18.4	17.2	17.0	21.2
Subcontractors with OHSAS 18001 certification (occupational health and safety management system) (%)	5.3	4.9	7.4	9.6

Chart T71 (%)



Before being allowed to carry out any type of activity at the site, each company must satisfy the necessary conditions by demonstrating that it complies with the basic legal requirements relating to administrative, tax and insurance matters and that it operates in conditions conducive to health and safety and that safeguard the environment both on the industrial site and outside it.

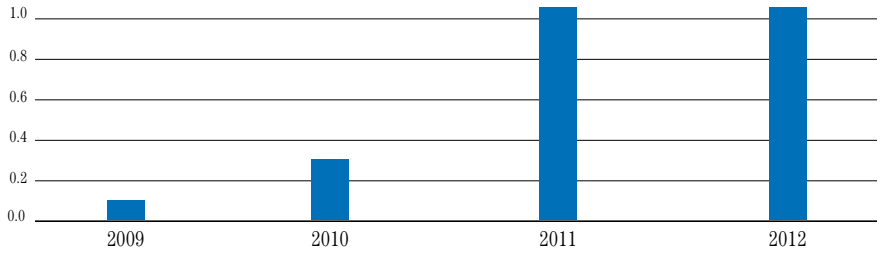
Before entering the facility, employees of external companies undergo further basic training on the risks relevant to the areas in which they will work. This is in addition to the requirement that they must work in accordance with their own company's organisational safety plan.

The site plays an active role in training the employees of external companies on health, safety and environmental protection. Table 72 shows how the number of training hours provided to employees of external companies has increased significantly compared with previous years.

Table 72 Training for external companies

Parameter	2009	2010	2011	2012
Training for external companies: no. of training hours on the environment and safety run by the site/no. of hours worked by external companies (%)	0.14	0.36	1.06	1.07

CHART T72 (%)



One of the major impacts of external companies' activities, in environmental management terms, relates to the generation and management of waste.

As mentioned in section 4.2.6 on page 94, two specialist waste treatment companies work on the site. Specific procedures govern the methods of waste management at the plant, including the transfer of waste to waste treatment plants and storage areas. The work of the external companies that manage the waste treatment plants is subject to regular checks and various audit activities, in accordance with the waste management procedure. More generally, the conduct of employees of external companies is the subject of checks under the Arrow programme (section 4.4.2, page 118). Note that most of the waste generated by the activities of external companies on the site is dealt with and accounted for by the site. This applies particularly in periods of general shutdown and plant maintenance when more waste is produced.

4.4 – Management performance indicators

In addition to specific indicators for various environmental aspects and the environmental factors that are or could be involved, the company has defined other types of indicator that allow it to monitor certain activities essential for improving the environmental management system.

These indicators relate to training and audit activities, and engineering work aimed at developing technological and plant improvements.

4.4.1 – Training on environmental protection and safety

Staff training on environmental protection was given a particular boost in 2005 with the launch of information and awareness-raising initiatives on the environmental management system throughout the company. Specific in-depth training sessions were arranged for operational staff, focusing particularly on the management of atmospheric emissions and discharges into water. In order to achieve ongoing environmental improvements, it is essential to provide training to personnel, both to bring them up to date and to raise awareness of the importance of their individual roles. To check compliance with standards and the State and Regions Agreement no. 221 of December 2011, in 2012, the company analysed the training undertaken by all staff in the four-year period 2008-2011. This assessment confirmed that Sarlux, following on from Saras, continues to foster the health and safety and environmental protection of its employees, including through its training initiatives, in advance of regulations. The results of this assessment confirmed that, when the above-mentioned agreement entered into force, almost all employees had already undergone training in compliance with legal provisions and the guidance contained in the national collective labour agreement on the duration, content and methods of taking courses.

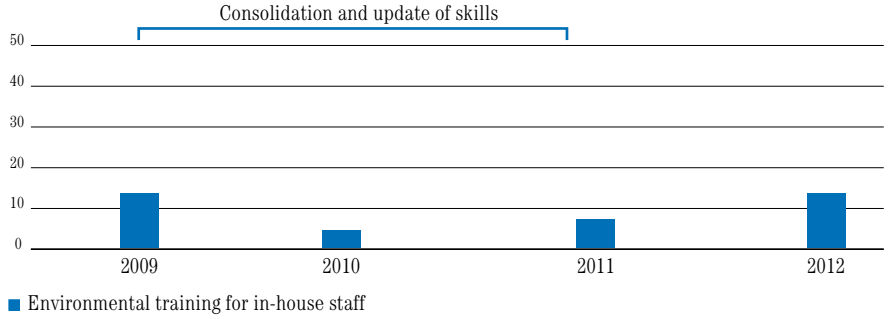
An analysis of past activities enabled the company to optimise its commitment to training, bringing it into line with the regulations and freeing up resources to meet other training requirements. A particular focus was placed on the environment, which

has always gone hand in hand with health and safety issues. Alongside the activities that are now part of the normal schedule, such as general orientation training for new recruits and continuous training, 2012 saw the completion of dedicated training on the site's AIA permit. This training was given to managers (particularly shift managers and works assistants) in order to increase awareness and focus on everyone's ability to reduce environmental impact. A special two-hour module on the Environmental Management System is included in the general orientation training for new recruits. A total of 4,604 hours of environmental training were provided in 2012, equal to 13.7% of total training.

TABLE 73 Environmental training for in-house staff

Parameter	2009	2010	2011	2012
Environmental training for in-house staff: no. of environmental training hours/total training hours (%)	13.2	4.0	6.0	13.7

CHART T73 (%)

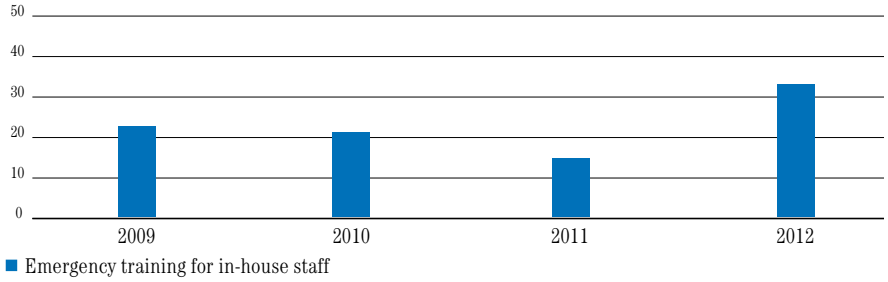


Training on health and safety issues complements environmental training. Training on these issues begins when staff first join the company and continues throughout their working lives at the site, with theoretical instruction and practical exercises. Of the approximately 21,500 hours dedicated to health and safety, specific training was given in emergency management for staff assigned to fire-fighting teams. Sarlux's commitment to emergency management training and exercises, which could have an impact on both the safety of individuals and environment protection, can be seen from the figures in Table 74.

TABLE 74 Emergency management training for in-house employees

Parametro	2009	2010	2011	2012
Training for emergencies: no. of hours of emergency management training/total training hours	23.02	21.00	14.00	32.40

CHART T74 (%)



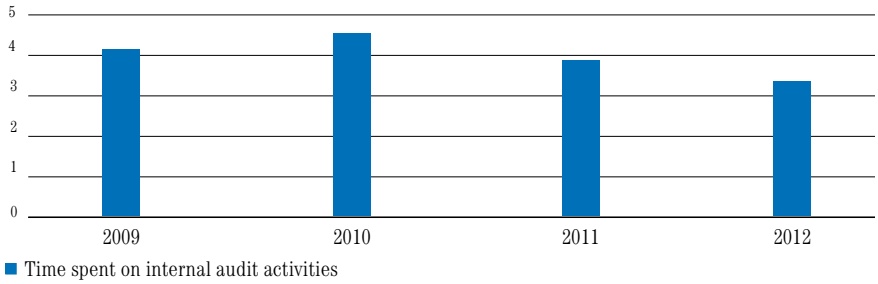
4.4.2 – Audit Activities

Sarlux places particular emphasis on internal audits as a verification, training and improvement tool. The company has a team of 52 internal auditors, from both Saras and Sarlux, trained to carry out quality, environmental and safety audits. Internal audit activities are planned annually and cover all activities that directly or indirectly affect environmental, safety and quality management issues for each audited process. Audits may reveal areas for improvement or failure to comply with the procedures of the management system or reference legislation. These nonconformities are formally reported to the managers of the activities in which they were encountered so that measures can be identified to restore conformity and avoid a repetition of such breaches. The indicator fell slightly compared with previous years, as not all auditors carried out an average of two audits during the year.

TABLE 75 Internal audit activities (combined environmental, safety and quality audits)

Parameter	2009	2010	2011	2012
Internal audit activities: no. of hours spent on audit/total hours worked by auditors and employees undergoing audits (%)	4.15	4.43	3.97	3.40

CHART T75 (%)



Other checks on the methods of managing operating activities are also carried out regularly following the launch of the Arrow programme. The programme is a comprehensive plan of field inspection visits (audits) covering the whole of the site, the adjoining national storage facility and the wharf. The aim of the project is to develop an awareness of accident prevention and environmental protection both in the audited employees and the auditors. To achieve this aim, the Arrow programme relies on an extensive programme of inspections in the facility's 24 operational and administrative areas. Arrow inspections were comprehensively changed in 2010. The number of inspectors dedicated to each inspection was reduced from 4 to 2 from September onwards. From 2011, in a further change, it was decided to carry out Arrow inspections only to check the correct application of the procedure for obtaining work permits.

TABLE 76 Arrow programme activities (field inspections)

Parameter	2009	2010	2011	2012
No. of hours spent on activities	1,606	1,036	855	1,125
Hours spent/hours worked by auditors and employees audited (%)	0.12	0.12	0.12	0.12

4.4.3 – Investment in environmental protection and safety

The site's commitment to continually improving environmental performance can also be measured and evaluated in terms of the financial investment devoted to this purpose. The figures in Table 77 show the company's strong commitment on this front, with total investment of EUR 43 million in the past four years. In 2012, the main investments were as follows:

- start of work on the development of a plant to recover water from the sour water stripper unit
- ongoing installation of double seals on gasoline pumps
- ongoing tank and pipeway paving
- ongoing installation of double bottoms in tanks
- start of work on the building of a unit to filter slurry, in the FCC plant

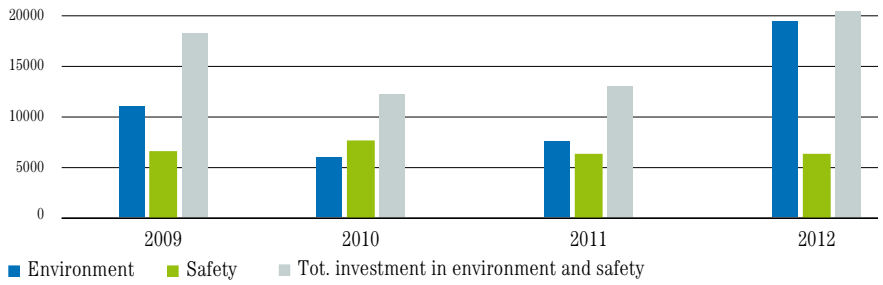
Between 2009 and 2012, the site invested over EUR 28 million in projects and policies to continually improve safety levels at its refinery, spending on average around EUR 7,100 million a year. The main measures funded in 2012 involved both the improvement of existing safety equipment and modifications to plant and product handling systems, as follows:

- fitting of further product volume interception valves to the FCC plant
- the replacement of glass "klingers" with magnetic ones at the processing plant (Topping 1, Vacuum 2 and MHC2 plants)
- the continued upgrading of the fire prevention system and new equipment
- the continued upgrading of the fire and hydrocarbon detection systems (alkalisation plant)
- the completion of the upgrade of the fire prevention systems at the facilities
- safety improvements within the tank containment basins

TABLE 77 Investment in improvements to environmental protection and safety

Parameter	2009	2010	2011	2012
Investment in environmental protection (k€/year)	11,690	5,680	6,485	19,445
Investment in safety (k€/year)	6,608	7,640	6,889	7,300
Total investment in the environment and safety k€/year	18,298	13,320	13,374	26,745

CHART T77 (k€/year)



5.
Environmental objectives and programmes

Complete, accurate and transparent information remains the solid basis of any dialogue.

In this section, Sarlux presents its environmental improvement objectives for the period 2009-2013 and the activities it carried out in 2012.

The facts and figures show the plant's commitments to expected new improvements in the next few years: the result of technological and managerial decisions always made with an eye to improving the environment as well as health and safety.

The company is committed to the clarity and completeness of information, which will allow it to engage in clear, concrete and ongoing dialogue with stakeholders, in order to give the surrounding area the answers that it expects.

5. Environmental objectives and programmes

5.1 – Environmental improvement objectives planned for 2010-2013

With regard to the objectives presented in this section, it should be noted that the environmental objectives for 2009-2013 were rescheduled during the first half of 2009, mainly as a result of the current situation on the international markets and the recent global financial and economic crisis, which meant that the company had to revise its investment plans for 2008-2013.
The rescheduling of the investments set out in the table on the next page has caused the period of implementation for the activities to be postponed for a maximum of two years.

As part of this commitment, important initiatives in thermal recovery implemented in 2012, together with the management activities identified in the FOCUS project (including the reduction of over-consumption in kilns and the maximisation of thermal integration between plants), reduced consumption by about 40,000 TOE in 2012.

For each EMAS objective, one or more actions have been put in place and the indicators for monitoring the progress made towards achieving the objective and the period of implementation have been identified.
The main objectives relating to significant direct environmental aspects are:

- **Atmospheric emissions**, with measures to reduce the quantity of pollutants and extend continuous monitoring
- **Energy consumption**, with measures to recover energy and consequently reduce fuel consumption
- **Prevention of potential spills of hydrocarbons into the soil**, with the extension of paved floors in the storage areas and, in parallel, oil recovery activities using the dynamic barrier

The objectives linked to significant indirect environmental aspects relate specifically to:

- maritime traffic and road traffic, with increased monitoring of ships used to transport raw materials and road vehicles used to transport products

OPEN OBJECTIVES

n°	Objective	Actions	Indicator	Implementation period	Position at end-2012
	Environmental aspect: Energy consumption - atmospheric emissions (SO_2, Dust)				
2	Energy recovery and reduction of fuel oil consumption by around 30% compared to current levels	**B -** Implement measure to recover energy from the U500-U700 desulphurisation units.		2010 - 2013	Objective replaced, following the application submitted by the company on 5 December 2012 and approved by MATMM on 11 April 2013, with heat recovery from the new steam generator on MHC2 in operation with the same modifications for the MHC2.
		C - Install a boiler to recover energy from the sensible heat of the fumes from the Topping1 plant		2010- 2014	Objective replaced, following the application submitted by the company on 5 December 2012 and approved by MATMM on 11 April 2013, with the closure and dismantling of the B1C. Completion of activity by end-2014
		D - Install a boiler to recover energy from the sensible heat of the fumes from the Topping2, RT2, VSB, Vacuum1 and Vacuum2 plants, which will be ducted to the new centralised smokestack		2010- 2014	Objective replaced, following the application submitted by the company on 5 December 2012 and approved by MATMM on 11 April 2013, with the closure and dismantling of the B1C. Completion of activity by end-2014
	Environmental aspect: Atmospheric emissions (SO_2, NO_X, Dust, CO)				
4	Feasibility study for a new centralised smokestack and extension of continuous monitoring to: 85% of SO_2 emissions 70% of NO_X emissions 99% of dust emissions 85% of CO emissions	**A** - Implement the continuous monitoring system.	% of continuously monitored emissions	2009 - 2014	Work in progress. Feasibility study completed in 2009. In the case of dust, an extension to 31 December 2013 has been requested for installing the continuous monitoring system for dusts emitted from the co-boiler. 2012: In December 2014, continuous monitoring systems will be installed for the K1F3 (FCC) and F102C (VSB) kilns; the kilns of the Vacuum 1/2, RT2 and F102B (VSB) plants will be fuelled with fuel gas only, and will not require continuous monitoring systems.
	Environmental aspect: atmospheric emissions (dust)				
5	Confirmation of the use of fuel oil with a carbon residue of less than 9.5% by weight for 2010, less than 9.2% for 2011 and 2012.	**A** - Prepare fuel oil with the required characteristics.	annual average % of carbon residue in fuel oil	2010 - 2013	2012: 8.6% achieved (compared with a planned figure of 9.2%). Target of 9.1% set for 2013.
	Environmental aspect: atmospheric emissions (volatile organic compounds)				
6	Reduction in diffuse and fugitive emissions of volatile hydrocarbons.	**A** - Complete (1) the installation of double seals on the gasoline-handling pumps.	% replacement completed (cumulative figure).	2009 - 2016	Total no. of pumps on which to install double seals: 229. 213 (93%) installed as of December 2012. 2012: prefabrication on 7 pumps at 83% (completion of installation expected in Dec. 2013). For the 4 pumps of the alkalisation plant, detailed engineering and material purchases in progress: completion during the TA of Dec. 2014
		B - Install a system for sealing the bypass pipes and support pipes in the floating-roof tanks at the refinery perimeter (2). (86.4% in 2011)	no. of tanks upgraded/total no. of tanks at the refinery perimeter (cumulative figure).	2009 - 2012	2012: installation completed on the 2 tanks planned. For 2013, installation planned on 5 tanks (ST 18, ST46, ST95, ST9, ST117)
		C - Apply the Smart LDAR methodology to all of the site's units, proceeding in accordance with the monitoring and action timescales specified by the AIA permit.	- IR 100% - PID3 or FID5 100% for components leaking from IR - statistical sampling for components not leaking from IR 100% plants	2009 - 2013	2012: Programme implemented for all plants as sipulated by AIA plan 2013: six-monthly campaigns will be carried out, in accordance with AIA requirements, for the following units: Shipment via sea, H2 Linde Purification, H2 UOP Purification, Sour Water Strippers 1, Sour Water Strippers 2, Sour Water Strippers 3, Thermoelectric plant, De-ethaniser, IGCC, Wharf Islands, Dea1, Dea2, Dea3; Annual campaigns will also be carried out, in accordance with AIA requirements, for the following units: MHC1, MHC2, TAME, U800, CCR, alkalisation plant, FCC, Topping1, U300, U400, U500, U700, Topping2, RT2, Visbreaking, Blow Down, Movement, Shipment.
	Environmental aspect: atmospheric emissions – air quality				
7	Prompt identification of potential increases in concentrations of pollutants in emissions to prevent any breaches of the warning thresholds for concentrations of pollutants in the soil measured by the public air quality monitoring network	**B** - Complete implementation of the CALMET-CALPUFF model. Apply the model.	100% with CALMET-CALPUFF model 100% in line with AIA Monitoring Plan.	2010 - 2013	Installation of the weather sensor in Sarroch, which is fundamental for the implementation of the Calmet-Calpuff model. This is still awaiting approval by the Municipality of Sarroch. The simulations of the emissions scenarios associated with the smokestacks at the SARAS refinery for 2011, run with the ISC/AERMOD model, did not show any particularly critical situations associated with the dispersion and impact of pollutants in the area around the industrial site. 2012: The weather sensor was installed in March. The collection of data enabling the model to be implemented should be completed by end-2013.
		C - Develop a prototype system to measure the flame temperature.	% of work completed.%	2011 - 2013	2012: Targeting and survey system installed and currently undergoing testing. Report sent to the ministry, since it is possible to design and build the prototype using the results recorded to date.

(1) The work is 93% complete. Work to replace the seals has been further postponed: the overall programme is expected to be 95% complete by end-2013.

(2) Limited to the 18 tanks at the refinery perimeter compared with the 65 planned.
This work is also being carried out on all the floating-roof tanks that are out of service for maintenance; four of these have currently been completed, in addition to those at the refinery perimeter.

(3) The leakage of VOC (volatile organic compounds) from process components was quantified in accordance with method 21 - DETERMINATION OF VOLATILE ORGANIC COMPOUND LEAKS - EPA using a PID (Photo Ionisation Detector) rather than an FID (Flame Ionisation Detector) for safety reasons.

OPEN OBJECTIVES CONT.

n°	Objective	Actions	Indicator	Implementation period	Position at end-2012
	Environmental aspect: prevention of hydrocarbon spills into the soil				
9	Reduction in the risk of soil and subsoil contamination.	**A** - Continue work to pave the containment basins for the crude oil and product tanks, in accordance with AWCTR requirements.	% of surface paved	2009 - 2016	2012: work 42% complete in total. Basins ST 206, 109, 110 and 161 paved, in accordance with the multi-year plan (work brought forward on ST206 and ST161 instead of ST19 due to processing needs)
		C - Perform instrumentation checks on the integrity of the pipework for transporting crude oil from the marine terminal to the tanks and transporting hydrocarbons internally/externally.	% checks performed/checks planned completion of work	2010 - 2016	2012: 100% of all planned non-destructive controls (CND) on the transport of crude oil and hydrocarbons were completed, while guided wave checks on pipework were 70% completed owing to delays in the signing of agreements with contractors in the second half of the year onwards; they will however be conducted in the first half of 2013. 2013: complete the checks not carried out in 2012 and perform all checks in the audit plans for 2013.
		D - Motorise the aspirator valves at the bottom of the gasoline tanks in accordance with the multi-year plan.	% completion of work	2011 - 2016	2012: planned activities completed in tanks ST-137 (aspirator valve), ST-138 (aspirator valve), ST-160 (aspirator valve) 2013: objective for tank ST-131 (aspirator and delivery valve) still outstanding
	Environmental aspect: prevention of hydrocarbon spills into the soil				
10	Confinement of contamination from past activities.	**A** - Build the physical barrier planned as part of the site remediation project. Technical specifications for the request for proposals are planned to be issued in 2010, based on the findings from the field tests.	% of work completed.	2009 - 2016	2012: Draft procedural change presented to the Ministry in January 2013, for the installation of a second dynamic barrier rather than a physical barrier
	Environmental aspect: Waste				
11	Contribute towards increasing the separated collection of USW to 30%.	**A** - Increase the separated collection of plastics, aluminium, glass and paper.	% separated USW.	2009 - 2013	2012: 29.4% achieved compared with 30% planned. Same target as in 2012 (30%) set for 2013.
12	Increase quantity of industrial waste sent for recovery to 50%.	**A** - Increase the amount of excavated earth sent for recovery.	% of waste leaving the site sent for recovery	2009-2013	2012: result achieved was 21% against set target of 50%, affected by contractual availability during the year. Same target as 2012 (50%) set for 2013.
	Environmental aspect: Odours				
14	Assessment of the main sources of odour emissions for the prevention or reduction of the odour impact on the surrounding area	**B** - Implementation of the six-monthly monitoring plan in accordance with AIA requirement.	% in line with AIA Monitoring Plan	2009 - 2013	2012: planned campaigns carried out. 2013: 2 campaigns planned (summer-winter) to strengthen the statistical analysis of the results
		C - Create a chemical diffusion system with an anti-odour effect for the ST99 tank.	% completion of work	2011 - 2013	In 2011, the "turnkey" design, supply and assembly of the system was subcontracted to the specialist firm CHIMEC. Systems engineering work was therefore started in line with the plan, which sees the launch of the system in 2013. 2012: 70% of assembly completed. The work is still expected to be complete in early 2013.
	Environmental aspect: Transport - Maritime traffic: prevention of emergencies at sea				
15	100% use of twin-hulled ships for loading/unloading operations.	**A** - Continue to select twin-hulled ships.	% twin-hulled ships out of total no. of ships.	2009 - 2013	2012: Objectives achieved in full: 100% twin-hulled ships for supplying light crude and 100% twin-hulled ships for shipping products.
	For ships unloading products with a flash point below 55°C at the marine terminal, at least 99% use of ships with an inert gas system (IGS).	**B** - Select ships equipped with an inert gas system (IGS).	% ships with IGS out of the total no. of ships unloading products with a flash point below 55°C.	2010-2013	Objective introduced in 2010. Remains the same for 2011 including the unloading of products with a flash point of <60° 2012: Objective fully achieved Objective remains the same for 2013
16	Performance of on-board checks on at least 44% of ships during loading/unloading.	**A** - Continue inspection activities in line with the criteria adopted by Sarlux to protect workers' safety and the environment (minimum safety criteria).	% of ships checked.	2019-2013	2012: 45.9% achieved compared with 44% planned: a target of 45% was set for 2013.
	Environmental aspect: Transport - Road traffic: accident prevention				
17	Performance of checks on at least 26% of the tanker trucks used to transport products	**A** - Continue checking activities in line with Sarlux's internal procedures.	% tanker trucks checked.	2009 - 2013	2012: 25.6% achieved compared with 26% planned: a target of 26.5% set for 2013.
	Environmental aspect: Training and information.				
18	Raise awareness of the companyenvironmental initiatives among employees.	**A** - Include a section on environmental issues in the company newsletter, six months, detailing the initiatives undertaken by the company	% of work completed.	2011-2013	2012: 3 articles, 2 infographics and 2 Learn More boxes produced on environmental issues. Objective remains the same for 2013

OPEN OBJECTIVES CONT.

n°	Objective	Actions	Indicator	Implementation period	Position at end-2012
	Environmental aspect: Consumption of raw materials				
19	Reduce flare hydrocarbon emissions from the refinery for 2011 =< 0.25 (% weight in relation to processing), while for 2012 the target is fixed at =< 0.14 from the refinery (% weight in relation to processing). For 2013, the target is fixed at =<0.15.	The objective aims to achieve a reduction in flare emissions from the refinery by optimising management of the fuel gas and hydrogen networks.	% weight relating to processing.	2011 - 2016	Result achieved for flare emissions in 2012: 0.09% weight (relating to processing), practically in line with the result for 2011 (0.08%), and in any case well below the target of =<0.14% weight. The target remains the same for 2013 at ≤ 0.15%, slightly higher than the previous year due to temporary factors relating to shutdowns/restarts for planned maintenance

CLOSED OBJECTIVES

n°	Objective	Actions	Indicator	Implementation period	Position at end-2012
	Environmental aspect: Atmospheric emissions – air quality				
7	Prompt identification of potential increases in concentrations of pollutants in emissions to prevent any breaches of warning thresholds for concentrations of pollutants in the soil measured by the public air quality monitoring network	**D** - Collection of waters from automatic drainages of the benzene storage tanks for pumping into the API plant.	% of work completed.	2011 - 2012	Work completed. Objective closed
	Environmental aspect: Noise				
13	Containment of noise emissions at the source.	**A** - Install sound-absorbent panels in the MHC-2 plant.	% of work completed.	2011 - 2012	Fully achieved. Activities to limit noise emissions from the MHC-2 (9) plant completed. Objective closed
		B - Study and planning for soundproofing the areas of Topping 1.	% of work completed.	2009 - 2012	2011: work to install sound-absorbent panels proceeded according to plan. Installations scheduled to be completed in July 2012. 2012: installation of panels completed as planned. Objective closed.
	Environmental aspect: Odours				
14	Assessment of the main sources of odour emissions for the prevention or reduction of the odour impact on the surrounding area	**A** - Identify the chemicals responsible for the odour nuisance in the emissions sources at the refinery. Prepare artificial mixtures of these odour-generating substances in order to correlate the odour nuisance to the concentration.	% of work completed.	2009 - 2012	In 2011, the results were: a study on the characteristics of the dispersion into the atmosphere of odour emissions generated by the refinery was completed using the ISC/AERMOD atmospheric diffusion model statistical methodology was identified to monitor and manage odour emissions generated by the refinery; further analysis to be done by increasing the statistical sample, in order to examine in more depth any correlation between odour impact and the odour concentrations identified. Two campaigns planned for 2012 (summer/winter). Position at end-2012: planned campaigns conducted. Objective closed

5.2 – Improvement activities carried out in 2012

During 2012, the majority of the environmental objectives set out in the 2012 Environmental Declaration were achieved. Investments mainly concerned the reduction of atmospheric emissions, the reduction of energy consumption, the prevention of potential spills of hydrocarbons into the soil, the monitoring of air quality and the reduction of the visual impact.

[Significant environmental aspect: SO_2 atmospheric emissions]

For many years now, a large portion of investment has been directed towards the environment and safety, and this programme also includes constant monitoring of air quality. The activities targeting atmospheric emissions addressed a number of different aspects. One of the most important of these was the construction of the tail gas treatment unit (TGTU): with the TGTU in regular operation during 2012, it was possible to further increase the percentage of sulphur recovered, reducing SO_2 emissions by more than 30%, thereby meeting the formal commitment made by the company through its environmental improvement objectives.

[environmental aspect: Water consumption, use of recovered water]

Specifically, a new "filtration, ultra-filtration and reverse osmosis" plant (known as the BE-5, with a capacity of 230 m^3/h of demineralised water) was introduced in 2012. This innovative system for producing demineralised water has enabled the Group to further increase the percentage of wastewater reused after purification by the wastewater treatment plant (TAS).

[Environmental aspect: prevention of hydrocarbon spills into the soil]

In terms of the protection of the soil and subsoil, measures aimed at reducing the risk of contamination were continued. Motorisation of the aspirator valves at the bottom of the gasoline tanks (SST137, ST138, ST160) was completed, and 42% of the containment basins for crude oil and product tanks were paved, as planned for 2012. In addition, the instrumentation checks on the integrity of the pipework for transporting crude oil from the marine terminal to the tanks and transporting internal/external hydrocarbons, which were scheduled for 2012, were completed.

[Environmental aspect: Atmospheric emissions, diffuse emissions, fugitive emissions

Initiatives to improve furnace combustion and to reduce diffuse emissions (by installing double seals on gasoline-handling pumps) have also been implemented.

In line with the 2008-2012 investment plan, work on the FCC plant (K1T1, GT10 and CO boiler) and on the U950 deaerator at the IGCC, aimed at achieving greater energy efficiency was completed. These measures have led to a considerable decrease in fuel consumption, with a resulting drop in CO_2, SO2 and dust.

[Environmental aspect: transport - maritime traffic]

At the same time, in order to ensure the high quality of the fuels used at the site, in 2012, the company further improved on the excellent result it achieved the previous year on the use of fuel oil with a carbon residue of less than 9.2% by weight.

There have also been improvements in the figures for the transport of products by sea: the company continued to use only twin-hulled ships for the supply of light crude, and hit its target of ensuring that 100% of the ships transporting products out of the Sarlux terminal also had twin hulls. The target for checks on board ships during the loading and unloading stages was also met, reaching 46%.

[Environmental aspect: noise]

Lastly, in order to prevent road traffic accidents, checks were carried out on 25% of the tanker trucks used to transport products, which was consistent with the objectives set.

Last but not least, activities to reduce noise emissions in the area of the TP1 compressors are scheduled to be completed by 2012. Similarly, significant improvement was achieved in this area in 2011 purely via the reduction in flare hydrocarbon emissions.

6.
Summary of relevant legislation

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6. Summary of relevant legislation

Below is a non-exhaustive list of the main environmental laws that apply to the activities carried out at the Sarlux site. The detailed list is checked on the basis of section 4.3.2 of the EMS.

ATMOSPHERE

- Resolution 14 of 10 April 2009.
  Provisions implementing decision 2007/589/EC of the European Commission of 18 July 2007, which establishes the guidelines for monitoring and reporting greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council.
- Resolution 20 of 27 November 2008.
  Execution of the decision to allocate CO2 allowances for 2008-2012, drawn up pursuant to Art. 8 (2)(c) of Legislative Decree 216 of 4 April 2006, as subsequently amended, in compliance with the authorisation from the European Commission.
- Legislative Decree 284 of 8 November 2006 with "Corrective and supplementary provisions to Legislative Decree 152 of 3 April 2006, establishing environmental legislation".
- Resolution 14 of 6 August 2008.
  Updates to permits for greenhouse gas emissions.
- Legislative Decree 4 of 16 January 2008 with further corrective and supplementary provisions to Legislative Decree 152 of 3 April 2006, establishing environmental legislation.
- Legislative Decree 152 of 3 April 2006.
  Environmental legislation. Part V: Laws governing the protection of air quality and the reduction of atmospheric emissions.
- Legislative Decree 216 of 4 April 2006, as subsequently amended.
  Implementation of Directives 2003/87 and 2004/101/EC governing greenhouse gas emissions allowance trading within the Community, in respect of the Kyoto Protocol's project mechanisms.
- Resolution 001/2008 of the Italian National Committee for Managing and Implementing Directive 2003/87/EC. Recognition of permits to emit greenhouse gases issued between 2005 and 2007 for the purpose of issuing permits for 2008-2012 pursuant to the Legislative Decree of 4 April 2006.
- Decisions of the European Commission of 29 January 2004 and of 18 July 2007.
  These establish guidelines for monitoring and reporting greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council.
- Ministerial Decree 60 of 2 April 2002.
  Implementation of Council Directive 1999/30/EC of 22 April 1999 relating to limits for sulphur dioxide, nitrogen dioxide, oxides of nitrogen, particulate matter and lead in ambient air, and Directive 2000/69/EC relating to limits for benzene and carbon monoxide in ambient air.
- Legislative Decree 183 of 21 May 2004.
  Implementation of Directive 2002/3/EC relating to ozone in ambient air.
- Presidential Decree 322 of 15 April 1971.
  Regulation for the execution of Law 615 of 13 July 1966, containing provisions against atmospheric pollution, limited to the industrial sector.

WATER

- Legislative Decree 4 of 16 January 2008.
  Further corrective and supplementary provisions to Legislative Decree 152 of 3 April 2006, establishing environmental legislation.
- Legislative Decree 152 of 3 April 2006.

Environmental legislation. Part III, specifically: Laws governing the prevention of water pollution and the management of water resources.

- Regulation 417/2002 of 18 February 2002, amended by Regulations 1726/2003 of 22 July 2003 and 2172/2004 of 17 December 2004.
  Fast-track introduction of laws governing twin hulls or equivalent technology for single-hulled oil tankers, repealing EC Council Regulation 2978/94.

WASTE, SOIL AND SUBSOIL

- Legislative Decree 205 of 3 December 2010.
  Directive 2008/98/EC of the European Parliament on waste.
- Ministerial Decree of 17 December 2009.
  Establishment of a system to monitor the traceability of waste, pursuant to Art. 189 of Legislative Decree 152 of 2006 and Art. 14-bis of Decree Law 78 of 2009, converted – with amendments – by Law 102 of 2009.
- Legislative Decree 4 of 16 January 2008.
  Further corrective and supplementary provisions to Legislative Decree 152 of 3 April 2006, establishing environmental legislation.
- Legislative Decree 152 of 3 April 2006.
  Environmental legislation. Part IV: Laws governing the management of waste and the remediation of polluted sites.
- EEC Regulation 259 of 1 February 1993.
  Supervision and control of shipments of waste within, into and out of the European Community.

NOISE

- Regional Council Resolution (Sardinia) 62/9 of 14 November 2008.
  Regional directives governing environmental noise pollution.
- Ministerial Decree of 16 March 1998.
  Methods of detecting and measuring noise pollution.
- Ministerial Decree of 11 December 1996.
  Application of the differential criteria to continuous production cycle plants.
- Law 447 of 26 October 1995.
  Framework law on noise pollution.
- Prime Ministerial Decree of 14 November 1997.
  Establishing limits for noise sources.
- Prime Ministerial Decree of 1 March 1991, as subsequently amended.
  Maximum limits for noise exposure in inhabited areas and outdoors.

ASBESTOS

- Ministerial Decree 248 of 29 July 2004.
  Regulation governing the definition of and rules for the recovery of products and goods made from or containing asbestos.
- Ministerial Decree of 14 December 2004.
  Prohibition on the installation of materials containing asbestos that has been intentionally added.

PCB

- Legislative Decree 209 of 22 May 1999.
  Implementation of Directive 96/59/EC on the disposal of polychlorinated biphenyls and polychlorinated terphenyls.
- Ministerial Decree of 11 October 2001.
  Conditions for the use of transformers containing PCBs awaiting decontamination or disposal.
- Law 62 of 18 April 2005, European Community Law 2004, Art. 18.
  Obligations on owners of equipment containing PCBs and PCTs.

ZONE-DEPLETING SUBSTANCES

- Presidential Decree 147 of 15 February 2006.
  Methods for monitoring and recovering leaks of ozone-depleting substances from refrigeration, air conditioning equipment and heat pumps, pursuant to EC Regulation 2037/2000.

- EC Regulation 2037/2000 of 29 June 2000 on substances that deplete the ozone layer.
- Regulation 842/2006/EC of 17 May 2006 on certain fluorinated greenhouse gases.
- Presidential Decree 43 of 27 January 2012 implementing Regulation 842/2006/EC on certain fluorinated greenhouse gases.

ELECTROMAGNETIC FIELDS

- Legislative Decree 194 of 6 November 2007.
  Implementation of Directive 2004/108/EC on the approximation of the Laws of Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC.
- Prime Ministerial Decree of 8 July 2003.
  Definition of exposure limits, warning levels and quality objectives for protecting the population from exposure to electrical, magnetic and electromagnetic fields generated at frequencies between 100 kHz and 3,000 GHz.
- Law 36 of 22 February 2001.
  Framework law on protection against exposure to electrical, magnetic and electromagnetic fields.

IONISING RADIATION

- ISPESL Circular 40 of 3 January 2002.
  New methods for sending documentation relating to workers who have been exposed to ionising radiation pursuant to Legislative Decree 230/1995, as subsequently amended (Legislative Decree 241/2000 and Legislative Decree 257/2001).
- Legislative Decree 230 of 17 March 1995.
  Implementation of Directive 89/618/Euratom, 90/641/Euratom, 92/3/Euratom and 96/29/Euratom on ionising radiation.

INTEGRATED ENVIRONMENTAL AUTORIZATION PERMIT

- DSA-DEC-2009-230 of 24 March 2009.
  Integrated environmental authorisation (AIA) permit to operate its refinery and the IGCC plant.
  for Saras SpA.
- Ministerial Decree of 1 October 2008.
  Establishing guidelines for the analysis of economic aspects and cross-media effects for the activities listed in Annex I of Legislative Decree 59 of 18 February 2005.
- Ministerial Decree of 7 February 2007.
  Format and method for submitting an application for a state-issued AIA permit.
- Ministerial Decree of 29 January 2007.
  Establishing guidelines for identifying and applying the best practices in the refining sector for the activities listed in Annex I of Legislative Decree 59 of 18 February 2005.
- Ministerial Decree of 19 April 2006.
  Determination of timescales for submitting an application for an AIA permit for plants falling within the government's responsibility, pursuant to Legislative Decree 59 of 18 February 2005.
- Legislative Decree 59 of 18 February 2005.
  Full implementation of Directive 96/61/EC concerning integrated pollution prevention and control.

In addition, the following laws on health and safety in the workplace and the prevention and control of major-accident hazards are also applicable.

HEALTH AND SAFETY IN THE WORKPLACE

- Legislative Decree 106 of 3 August 2009.
- Supplementary and corrective provisions to Legislative Decree 81 of 9 April 2008 governing health and safety in the workplace.
- Legislative Decree 81 of 9 April 2008.
- Implementation of Art. 1 of Law 123 of 3 August 2007 governing health and safety in the workplace.

PREVENTION AND CONTROL OF MAJOR-ACCIDENT HAZARDS

- Legislative Decree 139 of 24 July 2009, "Regulation governing the forms of consultation with the population on external emergency plans, pursuant to Art. 20 (6) of Legislative Decree 334 of 17 August 1999".
- Legislative Decree 138 of 26 May 2009, "Regulation governing the forms of consultation with members of staff working in the facility in relation to internal emergency plans, pursuant to Art. 11 (5) of Legislative Decree 334 of 17 August 1999".
- Circular Letter DC-PST/A4/RE/1008 issued by the Interior Ministry on 15 April 2008.

- Fire prevention procedures in the event of changes to activities subject to major-accident hazards.
- Ministerial Decree of 16 February 2007. Fire resistance classification of products and building materials used in building projects.
- Ordinance of the President of the Council of Ministers 3519 of 28 April 2006. “General criteria for the identification of seismic zones and for the creation and updating of lists of those areas”.
- Decree of 28 February 2006. Implementation of Directive 2004/74/EC incorporating the 29th adaptation to the technical progress of Directive 67/548/EC on the classification, packaging and labelling of dangerous substances.
- Legislative Decree 238 of 21 September 2005. Implementation of Directive 2003/105/EC, which amends Directive 96/82/EC, on the control of major-accident hazards involving dangerous substances.
- Ordinance of the President of the Council of Ministers 3431 of 3 May 2005. Further amendments and additions to the Ordinance of the President of the Council of Ministers 3274 of 20 March 2003, establishing “Initial aspects relating to the general criteria for the classification of Italy into seismic zones and regulations for building in seismic zones”.
- Decree of the President of the Council of Ministers of 25 February 2005. Guidelines for preparing the external emergency plan pursuant to Art. 20 (4) of Legislative Decree 334 of 17 August 1999.
- Legislative Decree 260 of 28 July 2004. Corrective and supplementary provisions to Legislative Decree 65 of 14 March 2003 on the classification, packaging and labelling of dangerous preparations.
- Ordinance of the President of the Council of Ministers 3274 of 20 March 2003. Initial aspects relating to the general criteria for the classification of Italy into seismic zones and regulations for building in seismic zones.
- Legislative Decree 65 of 14 March 2003. Implementation of Directives 1999/45/EC and 2001/60/EC on the classification, packaging and labelling of hazardous preparations.
- Ministerial Decree of 9 January 2003. Amendment of Annex III to the Ministerial Decree of 14 June 2002, implementing Directive 2001/59/EC incorporating the 28th adaptation to the technical progress of Directive 67/548/EEC, on the classification, packaging and labelling of dangerous substances.
- Ministerial Decree of 7 September 2002. Implementation of Directive 2001/58/EC on the methods of providing information on dangerous substances and preparations introduced onto the market.
- Ministerial Decree of 14 June 2002. Implementation of Directive 2001/59/EC incorporating the 28th adaptation to the technical progress of Directive 67/548/EEC on the classification, packaging and labelling of hazardous substances.
- Legislative Decree 293 of 16 May 2001. Implementation of Directive 96/82/EC on the control of major-accident hazards involving hazardous substances.
- Ministerial Decree of 10 May 2001. Storage of LPG in fixed tanks with a total capacity of over 5 m3 located in plants that are subject to major-accident hazards and are required to submit a safety report.
- Decree of the Ministry of Public Works of 9 May 2001. Minimum safety requirements regarding urban and regional planning for the areas affected by plants subject to major-accident hazards.
- Ministerial Decree of 19 March 2001. Fire prevention procedures for activities involving major-accident hazards.
- Decree of 9 August 2000. Guidelines for implementing a safety management system.
- Decree of 9 August 2000. Identification of changes to plants and deposits, industrial processes, or the nature or quantity of hazardous substances that could increase the underlying level of risk.
- Ministerial Decree of 19 April 2000. Creation of a database of hazardous preparations, implementing Art. 10(2) of Legislative Decree 285 of 16 July 1998.
- Legislative Decree 334 of 17 August 1999. Implementation of Directive 96/82/EC on the control of major-accident hazards involving hazardous substances.


MARE TIRRENUM

7.
Glossary

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7. Glossary

AIA: (integrated environmental authorisation) permit is a provision authorising operation of a plant, while imposing measures for the avoidance or reduction of emissions into the air, water or soil in order to achieve a high level of overall environmental protection. The AIA permit replaces all other environmental permits, authorisations, approvals or opinions specified by law and in the implementation legislation.

ARPA: *Agenzie Regionali per la Protezione Ambientale* (Regional Environmental Protection Agencies). In April 1993, a referendum resulted in the removal of environmental control and protection powers from Italy's national and local health services. This left a gap that was filled by parliament with Law 61 of 1994 (introduced to enact Decree Law 496/93), which gave these powers to special regional agencies responsible for monitoring and protecting the environment at local level. Law 61/94 also set up the ANPA (*Agenzia Nazionale per la Protezione dell'Ambiente* - National Environmental Protection Agency), which is now the APAT (*Agenzia per la Protezione dell'Ambiente e per i servizi Tecnici* - National Agency for Environmental Protection and Technical Services), giving it the task of directing and coordinating regional agencies and those based in Italy's autonomous provinces. In the years that followed, all of Italy's regions and autonomous provinces set up their own agencies. ARPA Sardinia (ARPAS) was created under Regional Law 6 of 18 May 2006.

Audit: a word used in various contexts to mean "check", or "review". In the environmental management field it refers to a systematic, documented check to objectively assess an organisation's compliance with set environmental management criteria.
Average quality - water with varying degrees of eutrophication, but ecologically intact

Ballast water: water deriving from the ballasting of empty ships with sea water.

CAM (classification of seawater) index: the indicator used to monitor the coastal marine environment. The indicator converts the measurements into a summary rating of sea quality, which can be interpreted and assigned to three quality classifications, where quality is understood to mean the degree of eutrophication of coastal systems and the likelihood of a potential heath or hygiene hazard:

Carbon dioxide (CO_2): an odourless, colourless, flavourless gas produced from the combustion, respiration and decomposition of organic material. Its characteristics include the ability to absorb infrared radiation emitted by the earth's surface, thereby contributing to the greenhouse effect.

CO (carbon monoxide): a gas produced by the incomplete combustion of vehicle fuels and fossil fuels. The main source is gasoline engines that do not have catalytic converters.

COD (chemical oxygen demand): the quantity of oxygen needed to oxidise the organic content of waste, including non-biodegradable matter.

Cogeneration: the process by which two different energy products, such as electricity and heat, can be generated together by a single, purpose-built plant, resulting in high environmental efficiency.

dB(A): the unit of measurement of sound, expressed in logarithmic units (deciBels) and frequency-weighted to take account of the varying sensitivity of the human ear to different sound frequencies ("A-weighting" filter).

Desulphurisation: the process of treating oil fractions in order to reduce the sulphur content in refined products.

EMAS (Eco-Management and Audit Scheme) established by EEC Regulation 1836/93, updated by EC Regulation 1221/2009 (EMAS III), this is a voluntary scheme intended to promote continuous improvement in the environmental efficiency of industrial activities. Under the regulations, participating companies must adopt environmental management systems at their production sites based on policies, programmes, procedures and objectives aimed at improving the environment, and must publish an environmental declaration. Before a site can be added to the register set up by the European Commission, this declaration must be approved by an inspector accredited by an authorised national body. In Italy, this body is the Ecolabel and Ecoaudit committee, which has been operational since 1997 and works with the technical support of APAT.

Emission: the discharge of any solid, liquid or gaseous substance into the ecosystem from a plant or any other source, which can have a direct or indirect effect on the environment. Emissions are measured at the point of issuance.

Emissions trading: on 13 October 2003, the European Commission published the European directive on emissions trading (Directive 2003/87/EC), better known as the emissions trading system. The key points established by the directive are as follows:

EPER (European Pollutant Emission Register): the European Pollutant Emission Register was set up by the European Commission with its decision of 17 July 2000 (2000/479/EC) in accordance with Article 15 of European Council Directive 96/61/EC on integrated pollution prevention and control. It is the EU's first and most wide-ranging record of emissions into the air and water from industrial plants.

Filter cake: the solid formed from the gasification of heavy refinery products. It contains high percentages of metals such as iron, carbon vanadium and nickel.

Frequency index: together with the severity index, this is a commonly-used performance indicator for health and safety in the workplace. With reference to a given period of time, it expresses the ratio of the number of accidents occurring to the number of hours worked (calculated using the formula: number of accidents x 106/hours worked).
from 1 January 2005, no plants falling within the scope of the directive may emit CO2 (i.e. continue to operate) without appropriate authorisation; each year the operators of these plants must surrender CO2 allowances equal to those released into the atmosphere to the competent national authority; maximum CO2 allowances have been set for every plant regulated by the directive; CO2 emissions effectively released into the atmosphere are monitored in accordance with the requirements of the competent national authority and certified by an accredited inspector.

Greenhouse effect: gradual rise in average atmospheric temperature due to the increased concentration of gases in the atmosphere. Substances that contribute significantly to the greenhouse effect (greenhouse gases) include chlorofluorocarbons (CFC), carbon dioxide (CO_2), methane (CH_4), nitrogen oxides (NO_x) and sulphur hexafluoride (SF_6).

GSE (Gestore dei Servizi Elettrici): a company established by Article 3 of Legislative Decree 79/99 and controlled by the Italian treasury, which provides incentives for the production of electricity from renewable sources and other eligible sources and is responsible for assessing renewable energy plants and their electricity production.
High quality - uncontaminated water

IGCC: Integrated Gasification Combined Cycle

Immission: the release of a pollutant into the atmosphere or water, which then spreads into the environment. The concentration of the pollutant is measured at a distance from the point at which it was emitted.

INAIL frequency index: calculated using the number of accidents reported by the company to the work accident compensation authority (INAIL) and the number of hours worked (calculated using the formula: number of accidents reported to INAIL x 1,000,000/hours worked).

INES (*Inventario Nazionale delle Emissioni e loro Sorgenti* - National Inventory of Emissions and their Sources): national register of emissions set up pursuant to Legislative Decree 372 of 4 August 1999 (implementing Directive 96/61/EC) and to decrees issued by the environment ministry on 23 November 2001 and 26 April 2002. It consists of information on emissions from industrial sites in Italy subject to IPPC regulations.

IPPC (Integrated Pollution Prevention and Control): European directive of 1996 relating to the reduction of pollution from the various places where it is emitted throughout the European Union, implemented in Italy by Legislative Decree 59/2005.

ISO (International Organization for Standardization): an international non-governmental organisation based in Geneva, to which the standard-setting bodies of around 140 countries belong. It is responsible for examining, drafting and distributing to the international community standards relating mainly to environmental management (ISO 14000) and quality assurance (ISO 9000) for companies in all sectors.

kt (kiloton): unit of measurement of mass, equal to 1,000 tons.

kWh (kilowatt-hour): unit of measurement of electricity generated or consumed, equal to the power generated by 1 kW in one hour.

Kyoto Protocol: an executive agreement approved by the Conference of the Parties in Kyoto, 1-10 December 1997, containing the initial decisions on the implementation of some commitments (the most urgent priorities relating to certain sectors of national economies) of the United Nations Framework Convention on Climate Change (UN-FCCC), which was approved in 1992 and ratified by Italy in 1994. The Protocol commits industrialised countries and those whose economies are in a transition phase (eastern European countries) to reduce overall emissions of greenhouse gases (carbon dioxide, methane, nitrogen oxide, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride) by 5% by 2010.

L90: the level of sound pressure exceeded for 90% of the time for which a noise is measured. This statistical indicator is frequently used to describe the background noise caused by continuous sources over time, as is the case with many continuous-cycle industrial sources.
Low quality - eutrophic water with evidence of environmental changes that are partly due to human activity

Major-accident hazard: the probability that an event linked to an uncontrolled development in an industrial activity could give rise to serious danger, either immediate or in the future, for people and the environment.

Management system: the organisational structure, planning activities, responsibilities, procedures, practices, processes and resources to formulate, implement, achieve, review and maintain control, where possible, over all the internal and external variables of an organisation.

MW (megawatt): a multiple of kW (kilowatt), the unit of measurement of a power station's power, i.e. its energy-generating capacity. It also measures the power consumed by an item of electrical equipment. For example, a light bulb may use 0.1 kW (100 watts). 1 MW = 1,000 kW.

MWh (megawatt-hour): unit of measurement of electricity generated or consumed, equal to the power generated by 1 MW in one hour and equivalent to 1,000 kWh.

Nitrogen oxides (NO_x): gaseous compounds consisting of nitrogen and oxygen (NO, NO_2, etc.), normally released during the combustion of fossil fuels when free nitrogen (N2) is oxidised. In the atmosphere they are the main agents responsible for photochemical smog and, after SO_2, the biggest cause of acid rain.

OHSAS (Occupational Health and Safety Assessment Series): regulations developed to replace the previous British Standard 8800 in order to meet the growing demand for a recognised standard on the organisation needed to manage health and safety. OHSAS 18001 certification was developed to be compatible with ISO 14001 and ISO 9001 and to allow for the adoption of an integrated

management system. Although it does not yet represent an international standard, OHSAS 18001 certification can be obtained by following a similar procedure to that used for the ISO standards.

Piezometer: a small-diameter tube or well inserted into a body of water and used to measure, by means of the water level reached inside the tube, the piezometric level (the line where points with a level equal to that of the body of water are located) at a set point.

PM10: particulates with a diameter of less than 10 µm (1 µm = 1 millionth of a metre) can pass through the airways and penetrate the lungs, becoming a potential health hazard depending on the substances involved.

ppm (parts per million): unit of measurement of the concentration of a substance present in small quantities in a liquid or gas.

Reliability: the reliability of a piece of equipment is defined as the probability that it will function correctly, for a specific period of time, under certain conditions.

Severity index: expresses, with reference to a given period of time, the ratio of the number of days' sick leave due to accidents to the number of hours worked (calculated using the formula: number of working days lost x 1,000/hours worked).

Sulphur dioxide (SO_2): a colourless, pungent gas that is released during the combustion of fossil fuels containing sulphur. In the atmosphere high concentrations of SO_2 are the main cause of acid rain.
The regulations state that such companies must submit qualitative and quantitative data to APAT each year in relation to a set list of pollutants present in gaseous and aqueous waste from their plants. This information is then submitted to the Ministry for the Environment for forwarding to the European Commission and inclusion in the EPER register.

TOE (ton of oil equivalent): a unit of measurement conventionally used to determine the energy contained in various sources taking into account their calorific value.

TSP (total suspended particulates): these are tiny solid particulates suspended in the air. They mostly comprise uncombusted carbonaceous material able to absorb various types of compound onto its surface. Particulates with a diameter of less than 10 µ (1 µ = 1 millionth of a metre) can pass through the airways and penetrate the lungs, becoming a potential health hazard depending on the substances involved.

Wholesale: refers to the wholesale market in oil products sold to customers such as industries, consortia and public bodies.

Yield: the yield of a machine is defined as the ratio between the power distributed (or energy generated) and the power absorbed (or energy consumed) at a given time. The greater the yield, the more efficient the machine; the lower the yield, the more energy wasted.

Photography
Archivio Saras

Print
Arti Grafiche Pisano – Cagliari

Printed in July 2014 on environmentally-friendly
Fedrigoni Tatami paper

SARLUX

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Refining & Power

Sarlux Srl – Registered office: Sarroch (CA)
S.S. 195 Sulcitana, Km 19