

Wednesday 17 October 2018

TECHNICAL INFORMATION:
Air quality in the Principality

Monaco's public policy on air quality is based on three elements: monitoring, information and reducing sources of pollution.

General introduction

Air pollution is a major public health issue, responsible for the deaths of 500,000 Europeans every year.

In the face of the climate emergency, the Prince's Government is taking action. On air quality, a major public health issue, the State is focusing its efforts on several areas:

- ✚ Monitoring: using the air quality monitoring network
- ✚ Improving public information, publishing the Air Quality Index online and creating 3D mapping of air quality and noise pollution
- ✚ Taking action on sources of pollution

As in the Alpes-Maritimes region, **in the Principality, a compact urban coastal area, pollution is generated primarily by transport and oil-fired heating. Taking action in these two areas is therefore the priority.**

Oil-fired heating will be completely banned in 2022, but a movement is already emerging: the development of solar energy and two ocean thermal energy networks (Condamine and Larvotto) will soon make a switch to these clean sources of energy possible.

As for transport, the task is simple: it is imperative to reduce the number of combustion engine vehicles which generate pollution and emit fine particulates. A simple task, but one which calls for a multi-faceted response.

As you will be aware, the Government is promoting the use of public transport, championing eco-friendly vehicles, developing the network of lifts, escalators and moving walkways to persuade people to walk, and encouraging teleworking.

The State is undertaking the necessary actions, but **transport also depends on individual awareness and changes in behaviour.**

There is also a need for companies to introduce transport plans for their employees and expand teleworking. This is one of the ideas supported by the National Energy Transition Pact, which has been signed by more than 500 individuals and organisations.

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Air quality monitoring network: measuring/forecasting/informing:

The air is made up of a variety of pollutants and it is essential to monitor their concentration levels, which can vary from one day to the next. Information and alert thresholds have therefore been defined for each type of pollutant so that the population can be informed.

Pollution can be exacerbated by structural features, such as “canyon” streets, which concentrate pollutants, or meteorological phenomena, such as a lack of wind or periods of hot weather.

In addition, concentrations of atmospheric pollutants in urban areas are not homogenous. Air pollution varies significantly at the local level, depending on urban developments, transport and the weather.

Conscious of the environmental and public health challenges involved, in 1991 the Principality introduced a national air quality monitoring network.

This network makes it possible to monitor compliance with threshold values and to initiate procedures to inform the population in the event that these levels are exceeded. It comprises:

- ✚ 5 permanent stations within the country (authorised stations)
- ✚ Ongoing measurement, carried out automatically or by taking samples which are analysed in the laboratory
- ✚ Processing of all measurements (average data, peak data, current standards, reports, statistics, graphs, etc.) carried out by the Department of the Environment
- ✚ Daily validation of data by AtmoSud, the accredited expert in the PACA region

The pollutants monitored are those that are subject to regulation (European Directives):

- ✚ Carbon monoxide (CO)
- ✚ Nitrogen oxides (NOx)
- ✚ Sulphur dioxide (SO₂)
- ✚ Ozone (O₃)
- ✚ Fine particulates

Moreover, the Department of the Environment has been working in partnership with AtmoSud (formerly Air PACA) since 2015 on:

- ✚ Maintaining and optimising the air quality monitoring network
- ✚ Programmes to improve knowledge, particularly in the road and maritime sectors
- ✚ Predictive modelling of air quality (daily index, high-definition mapping, etc.)

Measuring initiatives carried out in 2018

As part of this effort, the Department of the Environment recently created a high-resolution air quality map of the Principality, taking account of 3D effects (relief, building heights, etc.).

Under a programme titled *Quality of life – Platform for modelling and high-resolution mapping of air quality in Monaco*, **52 sensors were deployed throughout Monaco at the beginning of the year** (with a dense network covering strategic points: ports, tunnels, pedestrian areas and the heliport).

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These sensors will improve our understanding of the breakdown of pollutants and measure emissions of nitrogen dioxide (NO₂), sulphur dioxide (SO₂) and hydrocarbons over the course of one month in winter and one month in summer, allowing an estimate of annual concentrations of these pollutants in the Principality to be made (note: NO₂ and hydrocarbon sensors are the primary indicators of pollution caused by cars and oil-fired heating. SO₂ sensors evaluate the impact of burning the heavy fuel oil used by ships).

A new tool to assist decision-making

A new tool to assist decision-making and development has been devised with AtmoSud (www.atmosud.org/) and Acoucité, the Acoustic Environment Observatory of the Métropole de Lyon (www.acoucite.org/): a 3D Air and Noise map. The results are expected at the end of the year.

Air Quality Index: indication of air quality for the current day and the following day

With regard to monitoring and information, the monitoring initiative is being reinforced through the publication online, via the Government web portal (www.gouv.mc), of an Air Quality Index (AQI) which is accessible by anyone and updated daily.


Air quality in the Principality is expressed using a global index which goes from 0 (very good) to 100 (alert threshold), calculated on the basis of data gathered by the five air quality measurement stations operated by the Department of the Environment. The AQI for the following day is also estimated, taking account of weather forecasts (*for more information, see: [link](#)*).

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Prévision de la qualité de l'air pour le Jour J et le jour suivant



QUALITÉ DE L'AIR À MONACO

51 /100 Moyen

Tendance pour demain : Bon

Données fournies par : AtmoSud

Cette prévision se base sur les concentrations mesurées sur la Principauté et sur les prévisions météorologiques.

Information grand public

Quotidiennement sur www.gouv.mc

Indice journalier	Couleur	Qualification
1Js20 : bleu-vert		Très bon
20<1Js30 : bleu-vert		Bon
30<1Js40 : vert		Bon
40<1Js50 : vert-jaune		Bon
50<1Js60 : jaune		Moyen
60<1Js70 : jaune-orangé		Médiocre
70<1Js80 : orange		Médiocre
80<1Js90 : rouge-orangé		Médiocre
90<1Js100 : rouge		Seuil d'information
100 : carmin		Seuil d'alerte

Département de l'Équipement, de l'Environnement et de l'Urbanisme

Gouvernement Princier
PRINCIPAUTÉ DE MONACO

Reduction measures

Numerous actions to reduce air pollution have been introduced by the State:

- Banning of oil-fired heating in new buildings since 2003
- Banning of oil-fired heating in all buildings from 2022
- Development of soft mobility and public transport
- An incentive policy to promote the use of hybrid and electric vehicles (which represent nearly 4% of all vehicles in Monaco)

Heavy fuel oil

The Government is obliging all ships in Monegasque waters to use a refined fuel or to have the ability to treat fumes.

Ships using heavy fuel oil cause harmful air pollution, particularly through the emission of sulphur. Heavy fuel oil is currently used by almost all merchant vessels, including cruise ships.

Heavy fuel oil contains up to 3.5% sulphur, more than 3,500 times the limit allowed in fuels used by land-based transport. Vessels which are docked in the harbour or at the quayside generate pollution throughout

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their port of call due to the continuous operation of machinery.

Over the last two years, countries have become increasingly aware of the need to find a way to quantify and limit this kind of atmospheric pollution caused by ships. The need to define limits for polluting maritime emissions has been recognised at a global level.

In October 2016, the International Maritime Organization (IMO) ratified a limit of 0.5% sulphur content for fuels from 1 January 2020.

In 2005, the IMO began establishing maritime areas where emissions of sulphur, nitrogen oxides and ozone depleting substances are limited. There are currently four controlled emission zones: the English Channel, the North Sea, the Baltic Sea and North America.

New projects are under consideration, including one covering the Mediterranean, which is particularly supported by France, Morocco and Monaco.

The Prince's Government has decided to ban the use of heavy fuel oil by all vessels in Monegasque waters.




Ships which use a scrubber – a fume treatment system or purifier operating on a closed circuit – are exempt from this ban. The “scrubbed” water is stored on board for disposal at land-based facilities.

A 200-metre cruise ship consumes 1,000 litres per hour during an average 10-hour port of call at the quayside. **The reduction in sulphur dioxide emissions into the atmosphere would be in the region of 97%** (estimated in line with the EMEP/EEA 2016 guidelines – Tier 1 methodology).



All cruise ships docking at Monaco ports, or sailing and mooring in Monegasque territorial waters (12 nautical miles) are covered by this new regulation.

The measure is aimed at commercial shipping – small and large pleasure craft, as well as fishing boats, use diesel.

Random monitoring will be carried out by officials from the Department of Maritime Affairs and the Department of the Environment:

-  Verification of ship's log
-  Analysis of fuel samples
-  Monitoring of docked/moored vessels

The penalties for violation of this rule are:

-  **6 months to 1 year in prison**
-  **fines ranging from EUR 18,000 to EUR 90,000 (Code of the Sea)**

Cruise ships require an average of 10% of Monaco's total power consumption.

Less than 10% of vessels currently have the required connection or equipment which is compatible with the Principality's electricity grid when they are docked.

With regard to pleasure craft of all sizes, **the SEPM and SMEG have embarked on work which will, by 2021, allow these types of vessel to connect directly to the electricity supply when at the quayside, without the need to use generators, for the entirety of their stay.**

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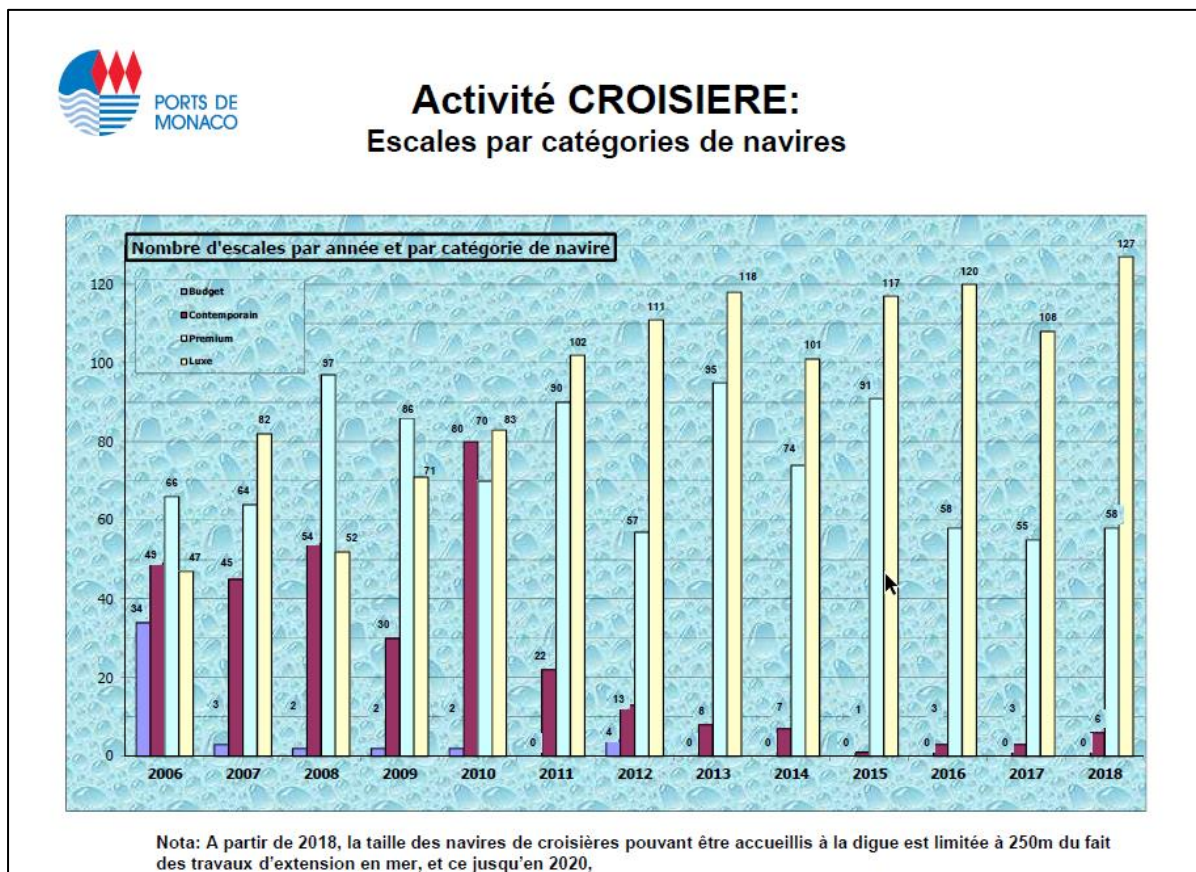
Cruises: economic impact

Since 2006, SEPM has attended Seatrade in Miami on an annual basis in a bid to convince cruise companies to bring luxury or premium boats to the Principality, which should, wherever possible, be small in size and carrying passengers with high spending power.

In 2007 and 2014, two surveys on the economic impact of cruises were conducted. They showed that the direct, indirect and induced benefits for the Principality can be estimated at between 50 and 70 million euros.

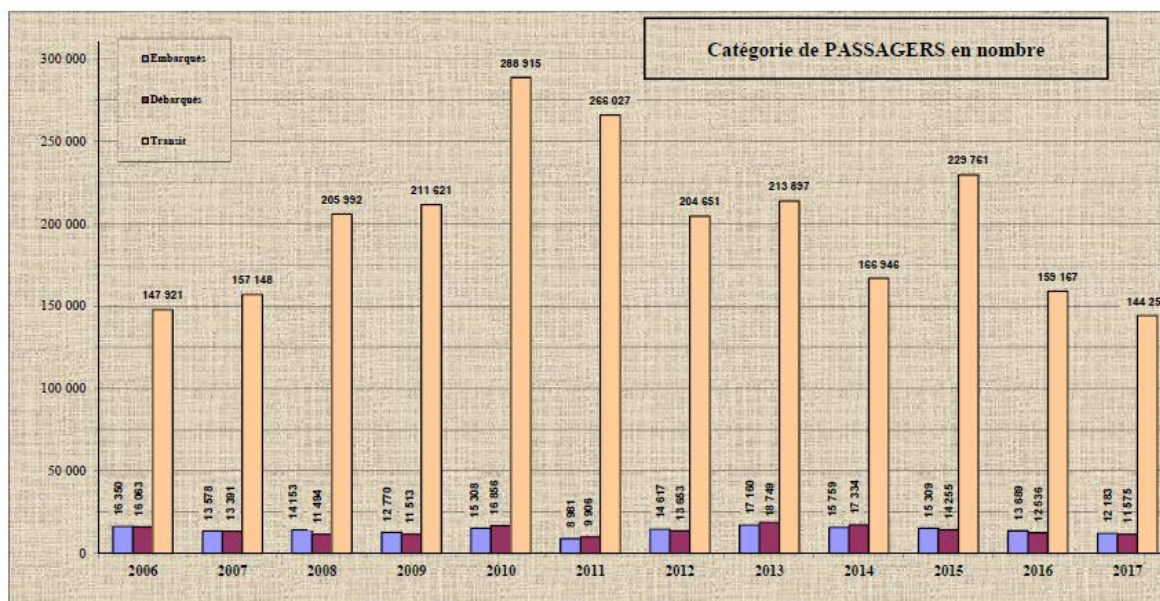
The objective is to provide work for the Principality’s luxury hotels and businesses through the use of Monaco as a base port of call (where all passengers embark and disembark).

Cruise activity: in figures





Activité CROISIÈRE : Passagers Embarqués / Débarqués / Transit



Nombre de passagers estimé en 2018 : 160 000

Cruises and the environment

The impact on the Principality's appeal of this new regulation, which represents an additional cost for cruise companies, should not affect the numbers visiting the country.

In Europe, cruise vessels spending more than two hours docked at the quayside have been obliged to use light fuel oil since 2016, so this is nothing new for them.

Anticipating the recently adopted regulation, SEPM and the Department of Maritime Affairs have been encouraging cruise companies to switch to a refined fuel since April 2018.

Some companies, including Silversea which is headquartered in Monaco and is a member of the Monaco Chamber of Shipping, did not wait for these recommendations to be issued before making the transition to light fuel oil.

Cruise passengers are also increasingly conscious of the environmental footprint of maritime transport.

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Cruises and the environment: solutions are emerging...**1) Liquefied natural gas (LNG):**

“The” solution of the future could involve the use of liquefied petroleum gas, which offers the advantage of no sulphur oxide (SO_x) emissions. It is also a clean fuel from the point of view of nitrogen oxides (NO_x).

- ✚ New combustion engines can use LNG under the same conditions as diesel and are available in dual-fuel models (LNG or diesel).
- ✚ The cruise terminal in the port of Le Havre carried out tests with a view to the first refuelling in France of a liner operating on LNG. The liner involved is the *AIDAprima*, the latest vessel from German company AIDA Cruises (Costa group).
- ✚ The order book for LNG-powered cruise ships is certainly full, with 19 such vessels currently expected to be launched by 2026 (source: Medcruise).

LNG appears to be a solution of the future.



Bateaux fonctionnant au GNL en commande à ce jour

2018	1	AIDA
2019	1	COSTA
2020	1	P&O
	1	CARNIVAL
2021	1	AIDA
	1	PONANT
	1	COSTA
	1	DISNEY
2022	1	ROYAL CARIBBEAN
	1	MSC
	1	CARNIVAL
	1	DISNEY
	1	P&O
2023	1	AIDA
	1	DISNEY
2024	1	ROYAL CARIBBEAN
	1	MSC
2025	1	MSC
2026	1	MSC
	Total : 19	

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2) What about hydrogen?

- ✚ This is a technology under development and involves **transforming hydrogen into electricity through a chemical reaction with the aid of fuel cells**, which are increasingly efficient.
- ✚ **Hydrogen is a 100% eco-friendly fuel which does not emit any fine particulates, nitrogen oxides or CO₂, only water and clean air – so there are no pollutants.**
 - Current problems: cost and how to store and use hydrogen in a way that is entirely safe.
 - Prospects:
 - ✚ We are already seeing some small boats powered by hydrogen fuel cells
 - ✚ Norwegian cruise company Viking is actively working on this issue
 - ✚ In addition to LNG, Royal Caribbean will equip two of its future ships with a small, 100kW fuel cell, which will provide additional energy for the vessels' hotel facilities.

To conclude, there are certainly some good things available or on the horizon for the cruise industry: shore power, LNG, scrubbers, and hydrogen fuel technology as well as wind and solar power – with the option of combining several technologies...

The future of powering cruise ships has entered an active transition phase, which will undoubtedly make it a pioneer in this industrial sector.

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