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SCHOOL OF BUSINESS, ECONOMICS AND LAW

Air emissions
arise from cruise vessels in the Port of Gothenburg

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Abstract

It is not new for cruise ships to cause air pollution to the port they pass by. Nevertheless, the amount of pollutants emitted by cruise ships is still staggering. Since air emissions derive from cruise industry is not a new subject for academic literature, in the case of Port of Gothenburg, the academic articles are extremely limited. Therefore, the focus of this thesis was to investigate the effects and status of air emissions arise from cruise activities in the port of Gothenburg. The aim was able shed some light on the effects and how air emissions arise from cruise activities in the Port of Gothenburg has been throughout the years.

The results were gathered through semi-structured interview with Gothenburg port authority. This interview aimed to find what strategies are used, what factors occur from cruise activities affected the Port of Gothenburg from the perspective of air emission. Also, numerical knowledge was obtained through both the interview and the confidential documents that are obtained from the port authority. To generate an overview of the results, the figures, tables and illustrations were used in both analysis chapter and in the entire thesis.

Keywords: Cruise shipping, the Port of Gothenburg, air emission, SECA, NECA, fuel consumption, IMO, CLIA.

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Cem Ozturk & Di Zhang

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Abbreviations

- CLIA Cruise Lines International Association
- CO2 Carbon Dioxide
- CSI Clean Shipping Index
- ESI Environmental Shipping Index
- EU European Union
- IMO International Maritime Organization
- LNG Liquified Natural Gas
- MARPOL The International Convention for the Prevention of Pollution from Ships
- NECA Nitrogen Emission Control Area
- NOx Nitrogen Oxide
- PM Particulate Matter
- SECA Sulphur Emission Control Area
- SO2 Sulphur Dioxide

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1. INTRODUCTION

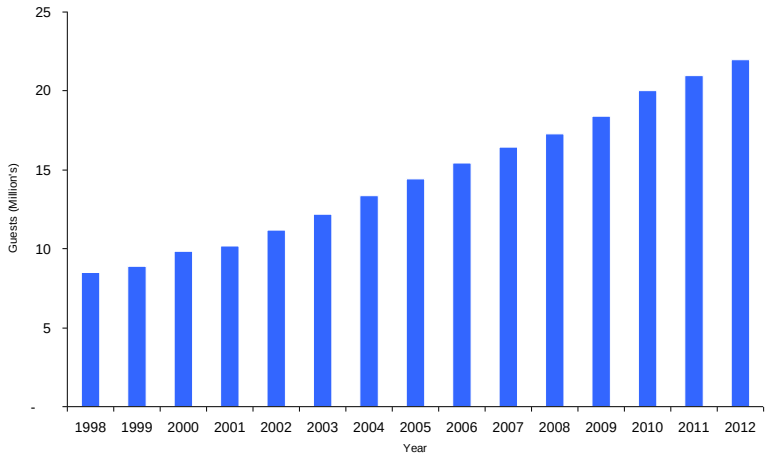
In this chapter, the environmental issues that might be caused by the air emissions of cruise ships in Gothenburg are first put forward, in addition, the relevant background has also been introduced. Secondly, it introduces the general situation of the global cruise industry and the historical, cultural, and geographical conditions of Gothenburg. Finally, the cruise activities in Gothenburg are discussed in detail.

1.1. The cruise industry

Cruise liners used to refer to large passenger ships with fixed routes and regular sailing on the ocean, but now they refer to tourist passenger ships sailing in the ocean. So far, the cruise has a history of nearly 100 years. With the development of the past century, the cruise industry has been growing, the scale of cruise ships is getting larger and larger, the supporting facilities are more and more luxurious and complete, and the manufacturing standards are becoming more and more stringent (Perdiguero et al.z, 2020), (Simonsen et al.,2019), (Mölders et al., 2013).

In recent years, the global cruise tourism market has been growing steadily with great potential. According to CLIA, since 1980, cruise tourism has been growing at an average annual rate of 7% (FCCA, 2018), much higher than the overall development rate of the international tourism industry (Figure 1). According to the forecast of the International Cruise Association, in 2010, there will be 18 million cruise tourists in the world. In 2015 and 2020, global cruise passengers will reach 25 million and 30 million passengers, respectively (CLIA, 2019).

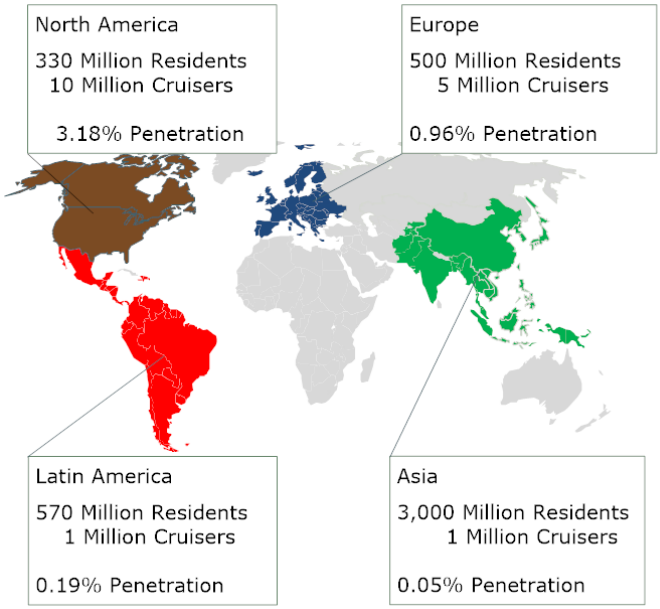
Figure 1. Global Industry Growth 7% CAGR



Source: G.P. Wild (international Ltd) from PSA, CLIA, ECC

In today's international cruise travel pattern, the United States occupies the core of the international cruise tourism market and is the largest beneficiary of the global cruise economy. However, with the expansion of the market, the number of tourists including Europe and Asia increased year by year (as shown in Figure 2). In Europe alone, the annual spending of the cruise industry is 12.9 billion euros, with an annual total output value of 29 billion euros, providing 280,000 local jobs (CLIA,2020).

Figure 2. Regional market Potential



Source: G.P. Wild (international Ltd) from CLIA

1.2. The cruise activities in the Gothenburg port

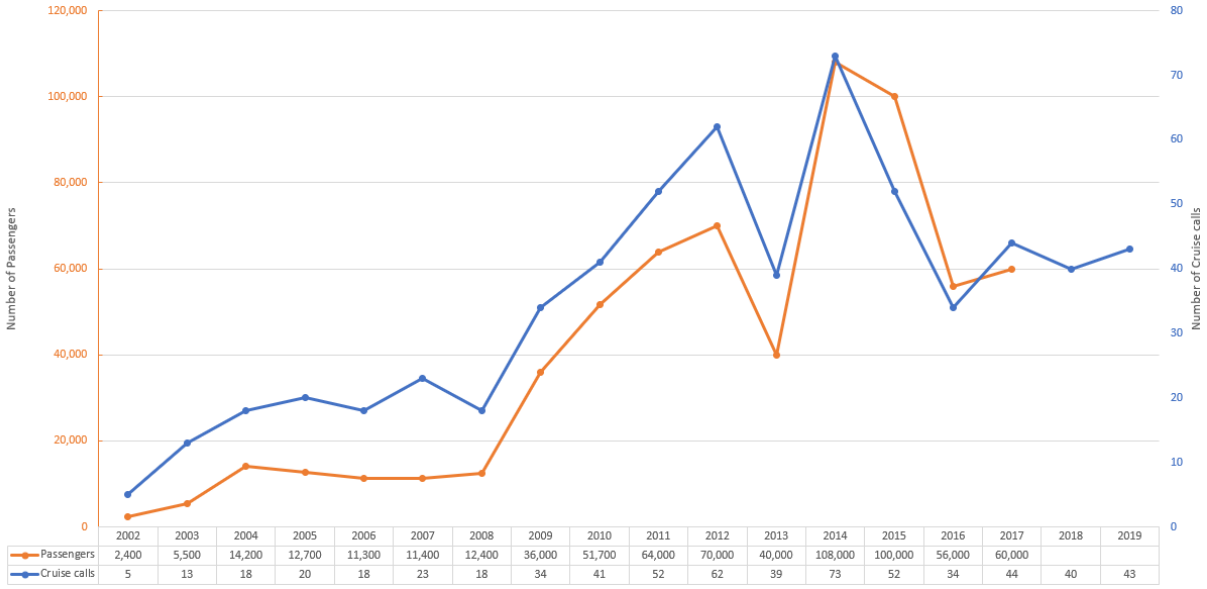
Gothenburg is a famous port city on the southwestern coast of Sweden. It is the second-largest city in Sweden after Stockholm and located on the western coastline of Stockholm, across the sea from the northern tip of Denmark, with a population of 900,000 in 2016 (Port of Gothenburg, 2020). Gothenburg has a history of nearly 400 years. At the beginning of the 18th century, Gothenburg flourished as Sweden carried out shipping. After the introduction of the steam engine in 1870, it gradually developed into the largest port in Sweden. The main industries of Gothenburg are shipbuilding, automobile, oil refining and food industry. On the island of Hishinyan, there is the largest shipyard in the country. Late 18th century, to widely absorb foreign advanced technology and experience, accelerates economic development, the authorities encourage Germans and Scots to settle here, which made Gothenburg developed into a large commercial center and a metropolis with an international perspective (Port of Gothenburg, 2020). Within 300 kilometers of Gothenburg is the most advanced industrial area in the three Nordic countries and the industrial center of Northern Europe.

Besides, Gothenburg is one of Sweden's touristic attraction locations. There are more than 450 routes to all parts of the world, attracting thousands of domestic and foreign tourists every year (Port of Gothenburg, 2020).

As the second-largest city in Sweden, Gothenburg has been described as a very trendy and vibrant port city by prominent international travel guides (Stromberg, 2017). As the port located on the west coast, the port of Gothenburg has an excellent location advantage in terms of reaching the whole Baltic Sea region, including Russia, all territories of Scandinavia as well as the North Sea/Atlantic (Port of Gothenburg, 2020). Nowadays, the Baltic Sea has become an emerging market for the cruise industry, Gothenburg has naturally become a famous cruise destination in the region (Ilona 2019). As a result, the cruise shipping industry has been gradually developing in the city of Gothenburg.

Specifically, in recent years, the number of cruise ship visits in the port of Gothenburg has significantly increased, and even each year the number of cruise ship visits breaks new records. Based on the data in 2014, from April to October, 73 cruise ships visited the port of Gothenburg, and the number of visitors reached 110,000. At present, there are two terminals for cruise shipping in the port of Gothenburg; Arendal & America Cruise Terminal. America Cruise Terminal has started to receive cruise ships since 2018 (Sustainability report 2017). America Cruise Terminals has already received 60,000 international tourists to the city of Gothenburg just in 2018, and the total revenue that has been gained from cruise tourists has reached 30 million SEK (Port of Gothenburg, 2020). In 2020, during the cruise season, there will be an astonishing 80 cruise ships docked (Sustainability report, 2018).

Figure 3.The total number of cruise calls and cruise passengers in the port of Gothenburg between the years 2002 and 2019



	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Passengers	2,400	5,500	14,200	12,700	11,300	11,400	12,400	36,000	51,700	64,000	70,000	40,000	108,000	100,000	56,000	60,000		
Cruise calls	5	13	18	20	18	23	18	34	41	52	62	39	73	52	34	44	40	43

Source: own elaboration

To better illustrate the activities of cruise ships in Gothenburg, the changes of the number in cruises call as well as passengers vary with year are specially plotted. Figure 4 shows the number of cruise calls and the corresponding passengers from 2002 to 2019. It can be directly seen that although the number of cruise ships fluctuates, the overall trend is still increasing, and it peaked in 2013. In recent years, from 2016 to 2019, the number has decreased but relatively stable. Besides, the number of Passengers also changes similarly to the year.

1.3. Problem description

It is not new for cruise ships to cause air pollution to the port they pass by. Nevertheless, the amount of pollutants emitted by cruise ships is still staggering. The latest study by the non-governmental organization European Federation of Transport and Environment found that the largest cruise company, Carnival Cruise Group, had sulfur emissions in 2017 that reached almost 10 times the total emissions of all European cars. Royal

Caribbean Cruises ranks second, with sulfur emissions equivalent to four times the total emissions of European cars (Anonymous, 2019).

Research data shows that Spain, Italy, Greece, France and Norway are the five most serious European countries with air pollution from cruise ships, while Barcelona, Palma De Mallorca, Venice, Civitavecchia and Southampton are the most serious polluted European port city (Greencarcongress, 2020). The reasons why these countries are heavily polluted, on the one hand, because they are the main destination for cruise passengers, and on the other hand, their marine fuel standards are not strict enough, cruise ships in their coastal areas are still using ultra-high sulfur fuel.

However, even within the sulfur emission control zone where the strictest marine fuel oil standards are implemented, the air pollution caused by cruise ships is still worrying. Taking Denmark as an example, all of the coastal areas belong to sulfur emission control zones, but in 2017, cruise ships emitted sulfur oxides 17 times more than the total sulfur emissions of 2.5 million vehicles in the country (Transport and Environment, 2019). Therefore, for many port cities, environmental problems and emission control have become difficult problems that must be dealt with for city managers.

As the earliest European country to advocate the protection of the natural environment, Sweden has successively promulgated two basic environmental protection laws, the Nature Protection Law and the Environmental Protection Law, in the 1960s, which clarified the goals of environmental governance (Naturvärdsverket, 2020). Gothenburg, as the second-largest city in Sweden and a famous tourist city, has always paid enough attention to environmental protection and governance. The Gothenburg Port Authority considers the environment and climate work as a key element in achieving the vision of becoming the most competitive port in the world. Thus, the new "Green Gothenburg Gateway" initiative launched by APM Terminals Gothenburg will make the container terminals of the Gothenburg port fossil-free by 2020 (Sustainability report, 2018). Simultaneously, as part of the new climate strategy initiated by APM Terminals Gothenburg, it also supports the use of renewable energy in industrial parks within the

port, with a view to fulfilling the predetermined climate goal of reducing carbon emissions in Gothenburg by 70% before 2030 (The container terminal at the port of Gothenburg to be fossil-free by 2020) (Laxman, 2019).

Gothenburg as the transportation hub of Scandinavia and the largest port in the Baltic Sea region plays an important role in the Nordic transportation network. In the meantime, as a famous cruise ship berth, it attracts thousands of tourists every year. However, various human activities have brought huge environmental pressure to the local area. Although the authorities have taken many measures to deal with environmental issues, and have given sufficient attention to environmental protection, unfortunately, there is still limited knowledge about the impact of the cruise industry on Gothenburg's environment, particularly about harmful gas emissions. In this paper, we will focus on the impact of the cruise industry on the local environment of Gothenburg, especially the extent of its harmful gas emissions. To achieve the research purpose, air emission as a topic has been chosen to be investigated in this study.

1.3.1. Research purpose and question

This research aims to broaden the understanding of the cruise ship's air emission on the port Gothenburg by investigating the effects and status of hazardous gases, since the year 2010. In this research, researchers set up "How the cruise activities affect the port of Gothenburg in the perspective of air emission?" as the research question.

The main contributions of this research could contribute to the officials of the city of Gothenburg such as the Gothenburg Port Authority, the Swedish Maritime Administration, the Gothenburg Transportation Administration, and other government departments. The research could be served as information and reference to help these official departments further promote their environmental sustainability from the perspective of air emission.

1.4. Limitations

Given the scope of our project, the port of Gothenburg is the most important factor for the project, however, one of the main limitations is making an interview with one person due to the situation, in fact, occurs from the port authority and its organisational structure. The interviewee provided us various fruitful information on both air emission arises from cruise ships and some general knowledge on cruise shipping activities in the port of Gothenburg throughout the years.

Besides, various emails were sent to particular cruise companies that include the port of Gothenburg in their itinerary, the Swedish Maritime Administration and the Swedish Transport Administration, however, none returned. Thus, the lack of involving more participants in the interviews and the lack of cruise companies' participation in the project can be considered as the main limitations of our project.

On the other hand, the translation of documents that are obtained from the port authority is another limitation due not only it is more time taking but also the nature of translating from one language to another. The actual documents are in Swedish and hence there may be minor differences between the actual and translated documents due translation. Moreover, confidentiality is another challenge for the authors since the content of the documents that are obtained from the port authority is confidential and the authors are not allowed to share everything that they have learned from the documents due confidentiality.

The approach of the port authority regarding the calculations of air emission in the Gothenburg port is due to missing years since the year 2010 for the last decade. Although this is explained in the analysis chapter and this limitation does not related to the authors, still it can be considered as a limitation for the project since when considering the last decade there are some missing years and hence this may cause some reliability and validity issues.

2. LITERATURE REVIEW

In this chapter, we briefly explain air emissions and introduce related research work firstly. Then the pollutants emitted by the cruise ship and their impacts were discussed, and the relevant research works were cited to get a general understanding of the cruise's overall impact on the world. At last, we briefly introduce the relevant laws, regulations and various measures for ship pollutants.

2.1. Air Emission

There are many harmful emissions in the atmosphere, and more than one hundred have caused harm or attracted people's attention. Among them, the most extensive and the most harmful are dust, sulfur dioxide, carbon monoxide, nitrogen oxides, hydrocarbons, hydrogen sulfide, ammonia, ozone, etc. (Liu et al., 2016).

With the vigorous development of the marine transportation industry, the number of ships has increased dramatically, creating huge economic benefits, but at the same time, its harmful gas emissions have caused serious environmental problems. According to relevant statistics, ships account for 97% of the global trade and transportation volume and consume 3% of the global energy. The emissions of its power plant are quite alarming. In addition to emitting large amounts of air emissions into the atmosphere every year, it also releases hundreds of millions of tons of harmful solid particles (Ballini and Bozzo, 2015).

Through further research on air emissions that released by various ships, people have not only paid attention to the impact of air emissions on global warming (Kujanpää et al., 2017) but also gradually began to pay attention to the air pollution and the relevant health problems that caused by the ship emissions. Ship emissions have a significant impact on many harmful gases in the atmosphere, especially in coastal areas (Lawrence et al. , 1999). Therefore, ports need to pay special attention to the environmental problems caused by ship air emissions. Studies in the last one or two decades have

shown that the concentration of various harmful substances emitted by ships, such as PM2.5, is gradually increasing, resulting in an increase in the number of deaths due to cardiovascular and lung diseases (Carlton et al., 1995; Corbett et al., 1997; Corbett et al., 2007). Thus, all of the above researches shows that the air emission of ships not only a problem of the ecological environment, but also has become a major tumor that threatens human safety.

2.2. Air emission from cruise vessels

Cruise is one of the fastest-growing and most energy-intensive tourism industries. Johansson et al. (Johansson et al., 2017) found that in 2015, the CO2 emissions from the shipping industry accounted for 2.2% (831 Mt) of the total global emissions. By 2050, this proportion will further increase to 50%-250%. However, in the Paris Agreement, there are no measures for greenhouse gas emissions from ships or cruise ships (UNFCCC, 2018). Fortunately, people have realized the seriousness of the problem, and began to give enough attention to the greenhouse gas emissions caused by shipping (Traut et al., 2018). At the same time, it has been found that a variety of harmful emissions can cause serious threats to the body, and related research has proved that these substances are closely related to bronchitis, asthma, lung cancer, and cardiovascular diseases (Pope Iii et al., 2002). Due to the frequent activities of ferries and cruise ships, port cities are facing higher levels of air pollution, and residents are exposed to a worse environment (Saxe et al., 2004). For example, Viana et al. found that approximately 70% of ship emissions occur within 400 kilometers of the coast, usually accounting for 1-7%, 1-20% and 8-11% of the annual average of PM10, PM2.5 and PM1 level in coastal areas, respectively (Viana et al., 2014).

Ship exhaust will cause serious environmental problems, and the main air pollutants include SOx, NOX, and PM (Liu et al.,2016; Thornton et al., 2017; Li et al., 2018).

- NOx often refers to NO and NO2. NOX is extremely harmful to the environment. It is not only one of the main substances that form acid rain, but also an important

substance that forms photochemical smog in the atmosphere, and, as well as an important factor that consumes O3.

- SO2 is a common and important atmospheric pollutant. It is a colorless and irritating gas, mainly derived from the combustion of sulfur-containing fuel in ships.
- PM2.5 refers to particles with an aerodynamic equivalent diameter of 2.5 microns or less in ambient air. The main source of PM2.5 in ships is the conversion of SOX and NOX, and it can be suspended in the air for a long time.
- Greenhouse gases are those gaseous components in the atmosphere that absorb and re-emit infrared radiation. CO2 is the main greenhouse gas emitted by cruise ships.

It is estimated that the global annual NOX, SO2 and PM2.5 emissions of ships in 2015 were 2×107, 9.7×106 and 1.5×106 tons, respectively (Johansson, Jalkanen & Kukkonen, 2017). Corbett et al. showed that the NOX emissions from ships account for more than 10% of the global anthropogenic NOX emissions (Corbett, 1999). Subsequent research shows that this proportion has rapidly increased to 15-30% in more than a decade (Corbett and Koehler, 2003; Eyring et al., 2010). Liu et al. pointed out that the NOX emissions related to ships in East Asia reached 2.8 Tg in 2013, which was twice that in 2001 (Liu et al., 2016). Research by Marelle et al. showed that ship emissions increased NOX and SO2 concentrations in coastal areas of Norway by 80% (Marelle et al., 2016).

In the analysis of aerosol samples in Shanghai Port, Zhao et al. indicated that the PM2.5 concentration emitted by ships ranges from 0.63 to 3.58 , accounting for 4.2% to 12.8% of the total PM2.5 in the region (Zhao et al., 2013). Recently, Wang et al. estimated that in the summer of 2016, emissions come from land and ship sources in the Shanghai Port, accounting for 36.4%, 0.7%, 5.1%, 0.9%, 5.9% of SO2, NO, NO2, O3 and PM2.5, respectively (Wang et al., 2019).

As for greenhouse gas emissions, some researchers believe that cruise ships only account for a small part, approximately 5% of the ship's emissions, and therefore, considering that cruise ships make very little contribution to climate change (Smith et

al., 2014). But on a per capita basis, cruise is one of the most energy-intensive forms of tourism (Eijgelaar et al., 2010). Also, the industry has developed rapidly, with a passenger capacity of 26.5 million in 2017 (CLIA, 2018). Between 2011 and 2016, demand increased by 21% (CLIA, 2018). New ships entering the market will add 110,000 berths from 2017 to 2019 based on existing capacity, and an additional 120,000 berths between 2020 and 2026 (CLIA 2017). Therefore, enough attention must be paid to the greenhouse gas emissions of the cruise.

2.3. Regulation for air emissions

The regulation of marine traffic pollutants is the subject of Annex VI of the MARPOL 73/78 issued by IMO. According to the current law, from January 1, 2015, ships trading in special areas, which is SECA, are allowed to use fuel with a sulfur content of up to 0.1%. Since January 1, 2012, the maximum sulfur limit in the SECA area has been reduced from 4.5% to 3.5% and will eventually be reduced to 0.5% from January 1, 2020. There are also plans to reduce SO2 emissions from ships. For instance, the EU Directive 2005/33/EC stipulates that all ships moored in ports should use fuel with a sulfur content of less than 0.1% by weight (Murena et al., 2018).

Similarly, the regulation of NOX emission control zones is becoming stricter. In October 2008, the MEPC revised the Annex VI of the MARPOL and decided to implement more serious NOX management standards in 2016. At the same time, the emission control zone, including SECA and NECA can also effectively reduce the production of PM2.5. MARPOL 73/78 also opened the door for cooperation between IMO and the UNFCCC and allow the two to cooperate in the exchange of information. So far, a framework system for reducing greenhouse gas emissions from the ship has been constructed: UNFCCC provides the legal framework, while IMO is the most suitable intergovernmental international organization to undertake this responsibility, and MEPC is the specific organization implementing agency (Puertocoruna,2020).

Besides, IMO has also formulated the International Convention on The Control of

Harmful Anti-Fouling Systems on Ships, 2001, and the International Convention for the Control and Management of Ships Ballast Water and Sediments, 2004 (Qin et al., 2019). Thus, higher requirements have been placed on the issue of ship emissions. At the end of the 20th century, international legislation on ship pollution was gradually strengthened. The governments of developed countries in the cruise industry such as Europe and America successively published a series of international conventions to regulate the pollution of international ships (Qin et al., 2019). For example, The Guidelines for Marine Strategic Framework in 2008 and the MVR rules in 2013 formulated by the European Union; The United States promulgated the Prevention of Ship Pollution Act in 2000; as well as China has formulated a series of policies in response to environmental problems caused by cruise. The Ministry of Transport issued the Green Port Rating Evaluation Standards in 2013, and then, the Notice on Printing and Distributing the Implementation Plan for Special Actions on Ship and Port Pollution Prevention (2015-2020) was also be issued in 2015 (Qin et al., 2019).

3. METHODOLOGY

This chapter first introduces the use of qualitative and quantitative methods to analyze research problems. Next, the related methods of data collection are proposed. In this paper, the data obtained from official documents and related interviews are used as the main source for research, and the data extracted from other scientific articles are used as auxiliary data. By combining these data to explain the research problem.

3.1. Qualitative and Quantitative research

This research is qualitative research that requires qualitative analysis to investigate and achieve a descriptive, summative, and explanatory research result. Regarding our research question, it is suitable to use a qualitative approach to explore these research questions. Because “qualitative research is suited for some types of questions, such as those that are in need of understanding or explanation of social phenomena and their context, complex, involving processes that occur over time, ill-defined, deeply rooted, sensitive, or entailing information that can only be collected from special individuals" (Brower et al. 2000; Ritchie 2003; Snape and Spencer 2003). Therefore, the qualitative approach is suitable for the application in this research, helping researchers get a descriptive answer.

According to the characteristics above, it is necessary to conduct a qualitative analysis to obtain the results of qualitative research. To achieve the purpose of our research and to answer our research questions, we tend to use some simple quantitative data that we collected to analyze to avoid drawing some overly subjective results. For example, in the data collection process, we did not only get text data, but also some numerical data, and the data regarding numbers that we collected mainly explains the fact intuitively, unlike other quantitative methods that require relative mathematical formulas. Besides, these data may be the results of another researchers’ study. Therefore, the quantitative data can also be described reasonably using qualitative analysis. Regarding the detailed

methods about data collection in this research, will be explained in detail in the following chapter (3.2).

In brief, the qualitative method plays a major role in our research, and the quantitative method is being used as a supplementary method to the qualitative method, which aims to help us to get objective analysis and research findings. Creswell and Clark indicated that mixed methods include quantitative and qualitative data, and the combination of the two methods facilitates a deeper understanding of the research questions, whether it is used in parallel or sequentially. While two types of data are used at the same time in a parallel design, one type of data will become the basis for collecting another type in sequential design. The combination of the two can be full or partial, which depends on whether the two methods are used at all stages of the research. Finally, quantitative and qualitative components play different roles in mixed methods research (Creswell and Clark 2007).

3.2. Data collection

3.2.1. Public and unpublished official documents as primary data

In this research, we collected many data in different ways. Among them, some primary data is relatively convenient to obtain. For instance, it is downloaded some materials related to our topic from official websites due these materials were public information that could be published in the authority report such as the Gothenburg port sustainability report 2017, 2018 etc. The public documents can also be information, such as the timetable for the arrival of cruise ships at the Gothenburg port. They can also be official news, regarding the call of cruise ships in the Gothenburg port breaking a new record. The content of the news contains some valid data and text that can be used to help us to analyze. Public data archiving refers to the collection and archiving of data in publications, to ensure that all online users can access them, which is more and more valued by journals (James et al., 2015).

As it is mentioned above, some of the primary data, such as some official reports, are relatively useful to obtain for the research. The content of these articles and news downloaded from the official homepage were almost general, which can be some articles regarding the project, or as a review. They often only play a role in explaining the facts, but they lack technical and specific data to support further analysis.

Therefore, to better explore the research topic, those data that are both technical and specific are often regarded as unpublished data from the relevant administrative staff of the Gothenburg port, such as the staff working in the Gothenburg port authority, the Swedish Maritime Administration, the Swedish transportation administration, waste operators that the Port works with as well as some cruise companies. Therefore, to obtain these unpublished data, various emails were sent to the staff who are working in relevant departments in these organizations.

3.2.2. Interview as primary data

The research collects some data as primary data through the way of having an interview, and the content of the verbal answer of the interviewee is the data we wanted to acquire. Interviews are one of the methods in data collection and can play a role in various types of qualitative research. If it is used alone to understand the significance of the contribution that people make to themselves and the social world, it can be regarded as an independent method from other qualitative methods. Interviews can also be combined with other data sources (Legard et al., 2003).

We targeted certain management staff who works for the port of Gothenburg. The jobs and work content of these management staff is needed to be related to the research topic. Since the research question is about the effects of cruise activities in the Gothenburg port regarding air emission. Through our understanding of some jurisdictions of the Port of Gothenburg, we determined that fourteen people were selected as our potential respondents, then we tried to contact these potential respondents via email and phone to ask if they would like to be interviewed by us. In the end, we tried to use face-to-face

interviews to meet these people who are willing to be interviewed by us. However, we had to consider the “non-response” scenario. The definition of non-response is non-respondents can distort the final results of any research project and if response rates are low or particular groups are unrepresented within the whole sample, valid conclusions cannot be drawn (Williamson,1981). Therefore, when no one of our potential respondents responds to our interview request, we can also collect data in other ways, such as observation and triangulation. These two types of data collection methods will be mentioned in the following chapters. In the end, only one of our four respondents returned to us to make the interview.

Back to the topic of the interview, we used the semi-structure interview in the interview. The reason is that the research uses the qualitative method and we needed to get explanatory and descriptive content from the respondent, so a semi-structure interview guides the respondent's answers to be detailed and complete, which can effectively allow us to use these answers for qualitative analysis. During the interview, we tried to start with “how”, “why”, “what” as a way of starting the interview questions. When the interviewee gave some answers, we also randomly added some sub-questions to guide the respondent to answer more specific occasions, and these random sub-questions also needed to start with “how” , “why” , “what” as much as possible, and sometimes we even needed to start with “ does” to get a more direct answer to some closed questions. The questions were asked in the interview are presented in the appendix 1 section to present that what has been done in the interview.

3.2.3. Other scientific articles as secondary data

Under the condition of getting the primary data, we wanted to make a further analyze the effect of air emission to the Gothenburg port hence we also needed some data from other scientific articles that have studied the same fact that alike with our research, but maybe have studied the subject in a different case. These scientific articles can be a study about gas pollution related to the environmental impact of cruise ships in ports in the other region. Some scientific articles have studied how the air emission generated

by cruise ships affects the port environment in other regions. Our data can also from scientific articles that calculate the air emissions from the cruise ship or draw some conclusions about whether the air emissions from the cruise ship exceed the environmental standards set by this port. Thus, we used the scientific articles similar to our research topic as well as the research results of these researchers as secondary data to compare and analyze with the primary data that we obtained from the interview and the official documents in addition to confidential information that we acquired from the Gothenburg Port Authority.

3.3. Research Quality

3.3.1. Validity

The validity of research refers to whether the intended object of measurement actually is measured or not. In qualitative research, the validity will be ensured if the informant is part of the problem area and if she/he is given the chance to speak freely on his/her own experience regarding the particular subject. Thus, validity is accomplished when using the method of non-coercing interviews with strategically carefully selected informants (Stenbacka, 2001). When conducting an interview, it is significant to ensure that the interviewee is well-chosen who have sufficient knowledge to answer questions in the interview (Collis and Hussey, 2013). In our case, the person from the Gothenburg port authority, who involved the interview is well-chosen when considered he is the right person to answer all questions that were asked to him during the interview. Therefore, we believe that we chose arguably the rightest person as our interviewee when considered the scope of the study is about the port of Gothenburg itself.

Furthermore, in research methodology literature, the measure of validity is mostly considered as either internal or external validity. Internal validity refers to ensuring consistency between the study itself and other recognized constructs whilst external validity refers to which any research findings can be generalized to other settings in sense of the applicability of findings beyond the group that was investigated in the study

(Amaratunga et. al., 2002). In our case, various both academic and non-academic articles are investigated regarding air emission derives from cruise vessels in the port of Gothenburg. The interview is also made to ensure the validity of the study and some confidential documents, regarding air emission in the Gothenburg port area, are obtained as well. In this way, the numerical data (air emission) is obtained from the port of Gothenburg. Besides, with the involvement of numerical data into the qualitative research method, we believe that external validity is also ensured due to the applicability of our findings to further researches.

3.3.2. Reliability

The reliability of research refers to the ability of the measurement method to produce the same research result and outcome over and over again (Stenbacka, 2001). The main idea of reliability is that of repeatability of results or observations (Golafshani, 2003). In other words, the credibility of the findings of the research can be ensured if the study is reliable. In qualitative research with an interpretivist approach, the concepts of reliability seem to be less significant regarding the situation where findings and results mostly stem from interviews with personal judgements and beliefs. However, reliability is still one of the most significant decisive parameters in qualitative research regarding the credibility of the research (Collis and Hussey, 2013).

In our case, a semi-structured interview with the interviewee from the Gothenburg port authority was made. The issues on standardization between interviews and a convenient sampling scenario are not the issue for the study since our sampling size only one when it comes to the interviews. Therefore, we believe that the questions and the structure of the interview matched with the intended outcome whereby the questionnaire and follow up questions were planned and prepared beforehand. As it has already been mentioned in the limitations part, relying on only one person's information could make the reliability of the study questionable, however, the questions that are asked in the interview are presented in the appendix. The entire text of the interview is not presented due to confidentiality.

4. ANALYSIS

This chapter aims to shed some light on the effects of cruise vessels on the Gothenburg port area from the perspective of air emission by presenting actual numbers that are obtained from the Gothenburg port authority. Besides, the chapter analyses air emission derives from cruise vessels in the Gothenburg port area by illustrating specific figures and tables as well as analysing international regulations and their effect on cruise activities in the Gothenburg port area.

4.1. The fuel consumption of the cruise vessels for different phases of operation

There are four main operating modes of vessels regarding the location of a vessel where they may be named as; at sea, in the harbour area, maneuvering, and at the quay. This means that a vessel can either be transported at open sea, it may be in the harbour area, it may be berthing towards the quay or it may be docked at the quay.

In the case of cruise vessels, the impact is more or less the same due to air emissions, not the same when ships are traveling at open sea and when they are docked at the quay. While cruise ships are traveling, their need becomes significant regarding keep everything going to keep traveling. Hence, the impact of air emission will be more hazardous when cruise ships are docked at the quay because cruise ships become closer to people that may be affected. Since ships burn more fuel while they are traveling at the open sea, the impact of CO2 will be larger. On the other hand, in the case of berthing and docking at the quay, cruise vessels have an impact on the local environment. (The interview, 2020).

In the case of having a large number of people that need to access the energy, food and etc. then there is always a negative environmental impact. Moreover, the extent of

impacts can be compared with each other, for instance, if a cruise vessel is at the port state then the impact would mainly arise from heating the vessel in addition to noise impact that comes from heating the fuel and the vessel itself. Consequently, cruise vessels have to burn their fuel to keep the vessel going hence burning fuel has always a negative environmental impact (The Interview, 2020).

Specifically, cruise vessels cannot shut down their auxiliary engines regardless of at which operating modes that they are into. Hence, cruise vessels cannot shut down their auxiliary engines while they are docked at the quay due to the vessel needing to keep working its auxiliary engines to keep the fresh air inside, keep the heating and electricity going and, etc.

The situation of keeping the auxiliary engines running can be perceived as "keep the hotel going". Therefore, the auxiliary engines are, in general, larger in cruise vessels compared to other types of vessels (The Interview, 2020).

Table 1. Estimated power output (as a proportion of installed engine power) at different operating modes (Port of Gothenburg, 2020)

	At sea	In the harbour area	Maneuvring	At quay
Main Engine	80%	20%	20%	0%
Auxiliary Engine	30%	40%	50%	40%

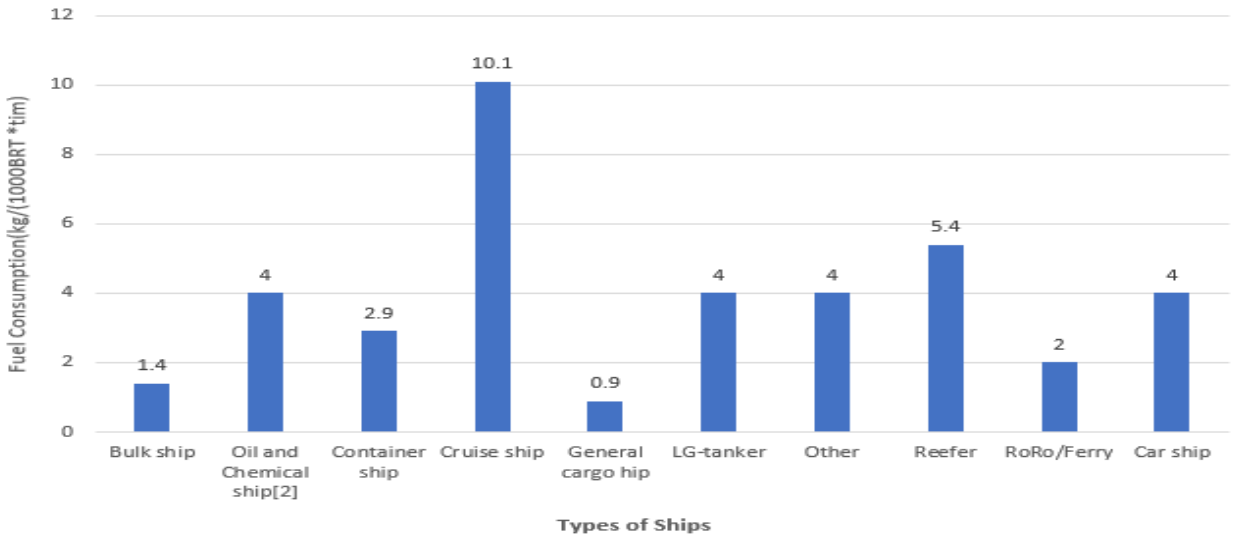
Source: Own elaboration

Table 1 presents the estimated power output at different operating modes of vessels. For a few vessels, the power of the main engine is predicted, based on the type of vessel and size in accordance with the statistics produced by IMO. On the other hand, for many vessels, there is no information on installed effects on auxiliary engines in Sea-web. Hence, the installed power for auxiliary engines is estimated based on empirical relationships developed by Sjöbris et al. (2005) for different types of vessels. All auxiliary engines are assumed to be high speed. The power output is necessary to be

known in order to make the calculation. In the end, the power output of main and auxiliary motors varies in different operating modes (Port of Gothenburg, 2020).

In light of previous paragraphs, the fuel consumption of cruise vessels is another significant factor regarding the negative environmental impacts arising from cruise vessels. To illustrate the position of cruise vessels among other types of vessels, Figure 4 is presented below. The size of engines of different vessels is partially taken into consideration by measuring their fuel consumption in only one-hour period time instead of fully including the size differences of engines and vessels. Hence, the table must be evaluated by considering the average fuel consumption in one hour for the particular vessel, not in the general form (Port of Gothenburg, 2020)

Figure 4. Fuel consumption in boilers for different phases of operation namely at anchor, in the port area, maneuvering and at quay (Port of Gothenburg, 2020)



Source: Own elaboration

The fuel consumption in boilers for different phases of operation is presented above. Cruise vessels burn 10,1 GRT fuel in their boilers per hour which is the highest proportion in the table by far. The reason for this was presented at the beginning of this section regarding the necessity of cruise vessels to keep running their auxiliary engines

to keep everything in order to either travel at open sea, producing electricity and heat for the passengers onboard even the cruise ship is docked at the quay. As stated in the previous paragraph, the table must be evaluated regardless of including size differences among vessels and their engines (Port of Gothenburg, 2020).

4.2. SECA and NECA viewed holistically

Table 2 shows the definition of SECA regulations that were applied by IMO[1] under the scope of regulation 14[2].

Table 2. Definition of SECA regulations (IMO, Regulation 14, 2020)

The sulphur cap outside of SECA	The sulphur cap inside of SECA
4.50% m/m[3] prior to 1 January 2012	1.50% m/m prior to 1 July 2010
3.50% m/m on and after 1 January 2012	1.00% m/m on and after 1 July 2010
0.50% m/m on and after 1 January 2020*	0.10% m/m on and after 1 January 2015

Source: Own elaboration

As Table 2 stated, the sulphur cap was lowered from 1% to 0,1% in the year 2015, as required by IMO's regulation 13[4]. Since compared to other modes of transport namely air and rail transport, shipping is far more energy efficient. The regional studies show that ship emissions are the major source of air pollution in Europe, specifically in coastal, often densely populated, areas. Regarding health-related external costs arising from shipping between the years 2000 and 2020, it is predicted that there will be a 36% reduction as a result of emission reductions in the North Sea and the Baltic Sea with the introduction of SECA (Karl et al., 2019). However, it is expected that health-external costs will increase in Europe due to an expected increase in ship traffic between the

[1] IMO; International Maritime Organization

[2] Requirements for control of emissions from ships by MARPOL (International Convention for the Prevention of Pollution from Ships), Sulphur oxides (SO_x)

[3] Sulphur limits expressed in terms of % m/m – that is by mass

[4] Requirements for control of emissions from ships by MARPOL, Nitrogen oxides (NO_x)

years 2000 and 2020 (Jonson et al., 2015), (Karl et al., 2019).

According to the interviewee, there is always an option for companies when it comes to choosing whether shipping companies opt to control their extent of pollution that they cause to the environment namely air pollution, noise pollution and, etc. Companies can opt for the type of fuel that they use. In that sense, they can opt for cleaner fuel to have less impact on the environment. Some vessels are choosing LNG instead of oil that diminishes air emissions in terms of SOx and NOx. In the end, it is possible to avoid some pollution but there always be an impact, it cannot entirely be prevented. On the other hand, since in the Gothenburg area, a vessel has to have a considerably low level of sulphur due to SECA regulations which are promulgated by IMO across the world, it is rare to see when a vessel violates the rules, especially in Sweden. However, if a ship violates the official regulations then the Transport Agency of Sweden National Level, would start to make an inspection on the ship. In the case of cruise quays, the municipality that has an environmental office follows up if vessels whether fulfilling the requirements or not (The Interview, 2020).

Unlike SECA, the Nitrogen emission control area (NECA) is not in force for Europe. Currently, NECAs exist only in the North America area. It was adopted in 2010, and it has been in force since 2011. In the case of the Baltic Sea and the North Sea areas NECA will be in force in 2021; in accordance with the IMO's target of lowering NOx emissions from ships. Table 3 illustrates the definition of NOx regulations.

Table 3. Definition of NOx regulation (IMO, Regulation 13, 2020)

Tier	Ship construction date on or after	Total weighted cycle emission limit (g/kWh) n = engine's rated speed (rpm)		
		n < 130	n = 130 - 1999	n≥ 2000
I	1 January 2000	17.0	$45 \cdot n^{(-0.2)}$ e.g., 720 rpm – 12.1	9.8
II	1 January 2011	14.4	$44 \cdot n^{(-0.23)}$ e.g., 720 rpm – 9.7	7.7
III	1 January 2016	3.4	$9 \cdot n^{(-0.2)}$ e.g., 720 rpm – 2.4	2.0

Source: Own elaboration

Regarding the introduction of NECA for the North Sea region, it is expected that NOx emissions from ships will be reduced by almost 80% in 2040. One of the significant effects of NECA could be explained as the reduction in particulate nitrate (PM 2.5). With the introduction of NECA in the Baltic Sea region, ship-generated (PM 2.5) is expected to reduce by 72% in the year 2040. On the other hand, if NECA is not implemented in the Baltic Sea in 2021, then the amount of reduction is expected to be only 48% (Karl et al., 2019).

According to the interviewee, the international regulations such as SECA and NECA are being applied by the national port agency for the Port of Gothenburg. When he asked to state his opinion on how the Port of Gothenburg handled the NOx emissions throughout the years without the introduction of NECA in the Baltic Sea region, he stated that this is a matter of fact that it can be handled in both national and international levels. Thus, the Port of Gothenburg is responsible only to check whether vessels are fulfilling their requirements or not and the rest is taken care of by the Swedish National Port Agency (The Interview, 2020).

4.3. Air Emissions from cruise industry in the Gothenburg Port area

Since the growth of the cruise industry has led to some escalating concerns regarding its environmental impact, the results specify that cruise shipping activities produce continually increasing air emission (air pollution) in ports over recent years (Zhen et al., 2018), (Dragovic et al., 2018). Cruise vessels, in general, utilize heavy oil namely fossil fuels, which includes a complex compound and produces more detrimental substances, such as sulphides. Hence, cruise ship-generated emissions entail diverse risks and hazards for the environment (Zhen et al., 2018). Moreover, the necessity of utilizing heavy oil in cruise vessels mostly derives from the need of excessive energy demand whilst cruise vessels emit considerably more carbon emissions and utilize more fuel per p-km than economy class aviation (Maragkogianni et al., 2015).

According to the interviewee, the proximity of the environmental impact determines the actual extent of the impact, for instance, when it comes to noise pollution, its impact is close to the actual quay. When it comes to the SOx and NOx (air pollution), the overall impact will be a bit larger. If the quay is located in the city centre which the Port of Gothenburg has two different cruise quays where one is located in the city centre (American cruise terminal) whilst the other located a bit farther from the city centre (Arendal cruise terminal). Thus, as the quay is getting closer to the city centre, evidently, its effects gradually increase. Also, if it comes to CO_2 emissions, then the impact does not only affect the city centre and the port area, but its effects turn out to be global (The Interview, 2020).

Regarding the previous paragraph, in harbour cities, shipping activities entail an issue of great acuteness for urban pollution, inducing environmental problems affecting both human health and the local environment. Specifically, cruise vessels can be a vital parameter for deteriorating air pollution in ports (Maragkogianni et al., 2015).

4.3.1. The strategy of the Gothenburg Port regarding Air Emission

The port of Gothenburg has been seriously taking air emission in consideration for a long time by putting environmental targets to itself each year. The port had three different environmental targets for the year 2018 namely "reducing the port's climate impact, reducing the port's local environmental impact, and having an efficient use of resources". Only the third target succeeded. For the other two environmental targets, although the company's goals have been achieved, the goal for vessels' emission remained at the very same level as in previous years. (Sustainability report, 2018).

The Port of Gothenburg has its own way to separate the different environmental impacts that arise from different types of vessels where they use different environmental permits for different quays. The requirements from the environmental office of the municipality vary for different quay and different types of transport. For instance, there is one specific permit for the cruise quay and there is another particular permit for container quay that follows, evidently, different rules and different permits. The Port of Gothenburg also uses a specific scoring system to base its discounts on. Hence, it is a different scoring system for different modes of ships. The cruise vessel, for instance, gets different scoring than a container vessel. Thus, depending on what type of vessel visits the port then the regulations become different on an international level (The Interview, 2020). That is how the Port of Gothenburg knows what types of vessels have to what extent environmental impact both on the port area and the environment.

According to the interviewee, the port of Gothenburg is willing to help the vessels by providing a discount on the port fee as long as the vessels are fulfilling certain requirements and following the international regulations (Port of Gothenburg, 2020). Although the port of Gothenburg has not been able to provide the onshore power supply[5] for cruise vessels yet, the port is considering finding a solution to provide the power supply for the demands of cruise vessels. The port has provided the onshore

[5] Power supply: It has crucial environmental gains such as CO_2 emissions decrease dramatically whilst SO_2 and NO are diminished to a minimum.

power supply for other types of vessels. On the other hand, the port of Gothenburg helps vessels to get access to new fuels whenever vessels choose to utilize a different type of fuel (The Interview, 2020).

For instance, in a situation where a vessel chooses to utilize LNG[6], methanol, batteries, etc. In the end, the port of Gothenburg's strategy to mitigate the environmental impacts arise from shipping activities can mainly be stated as discounts, technical assistance, access to better fuels and so on (The interview, 2020). Consequently, ports could play a key role as a means of serving as energy hubs providing both shore-side electricity and infrastructure for storing and providing alternative fuels to vessels when it is requested (Mjelde et al., 2019).

4.3.2. Port fee discounts in the Gothenburg Port

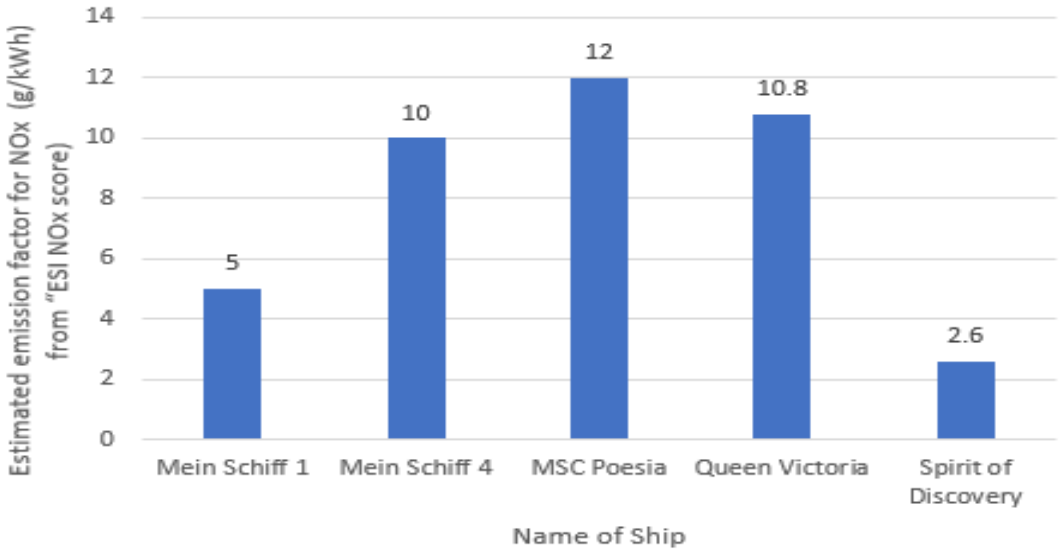
In light of the previous section, 156 ships were rewarded with a port tariff discount in 2018. Besides, almost 7000 vessels were registered with ESI[7], which helps as a useful tool for many ports around the globe. On the other hand, 5 cruise vessels were rewarded with such port tariff discount in 2019 by the Port of Gothenburg. Figure 5 illustrates the cruise vessels that were taken the port- fee discount under the utilization of ESI/CSI[8] programmes (Sustainability report, 2018), (Port of Gothenburg, 2020).

[6] Liquified natural gas

[7] *ESI*; Environmental Shipping Index, it is a voluntary tool that currently comprise a formula-based evaluation of vessels' NOx and SOx emissions.

[8] *CSI*; Clean Shipping Index, it is an independent and holistic labelling system of vessels' environmental performance.

Figure 5. The illustration of cruise ships that were taken port-fee discount under the utilization of ESI/CSI programmes in 2019 (Port of Gothenburg,2020)



Source: own elaboration

The cruise vessels that received a discount on the port fee in accordance with the ESI and CSI programs in the year 2019 is presented above. Furthermore, regarding the calculations that the port makes, the port uses an "ESI NOx score" that balances the values of NOx emissions from all engines on board depending on the specific emissions of the engines and their maximum power (The port of Gothenburg, 2020).

Since it is not possible to determine how much the "NOx ESI score" derives from auxiliary engines or main engine, the port has assumed that all points in the first place must be attributed to the main engines on board. If the ESI score is higher than the maximum for the engine power present on the main motor, the port assumes that the auxiliary motors have also been provided with some type of NOx reducing measure. In these cases, the port is looking for information regarding the specific vessel and transmit relevant information in the own database (The port of Gothenburg, 2020), (The Interview, 2020).

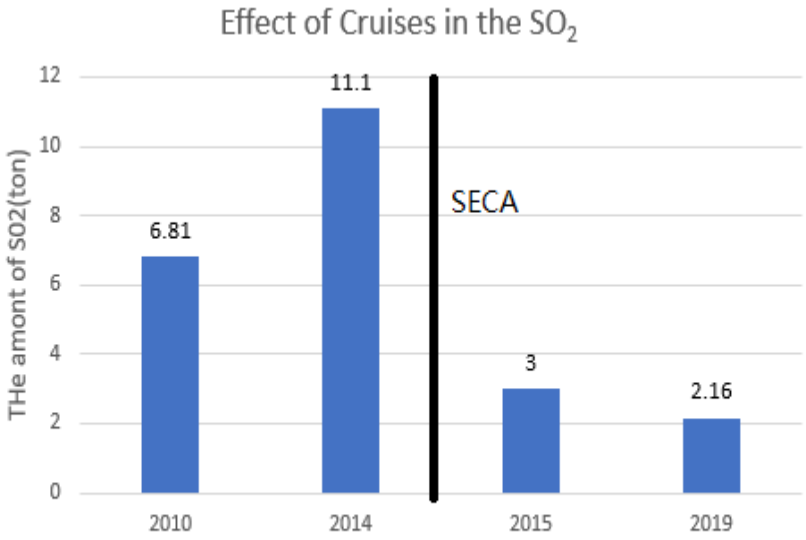
4.3.3. The hazardous gas emissions[9] arise from cruise vessels in the Gothenburg port area

In light of the literature review, there are four main detrimental gases arise from cruise vessels in the Gothenburg port area that could be named as SO_2, NOx, PM and. CO_2. The bar charts will be shown below regarding the status of these hazardous gases in the last decade in the Gothenburg port area. These four hazardous gases will be presented respectively. On the other hand, the numbers are shown in the analysis chapter is obtained from the Gothenburg port authority. The methodology is used to calculate these numbers has developed over the years by the port authority, and hence the results may not be evident from year to year. Therefore, these numbers are compiled by the authors of the thesis to show an indication of the magnitude of the emissions, and they should, therefore, be treated as indicative rather than conclusive.

The bar chart is presented below regarding the status of SO_2 that derived from cruise vessels in the last decade in the Gothenburg port area.

[9] SO_2, NO_x, PM and CO_2

Figure 6. The status of SO_2 that derived from cruise vessels in the last decade in the Gothenburg port area



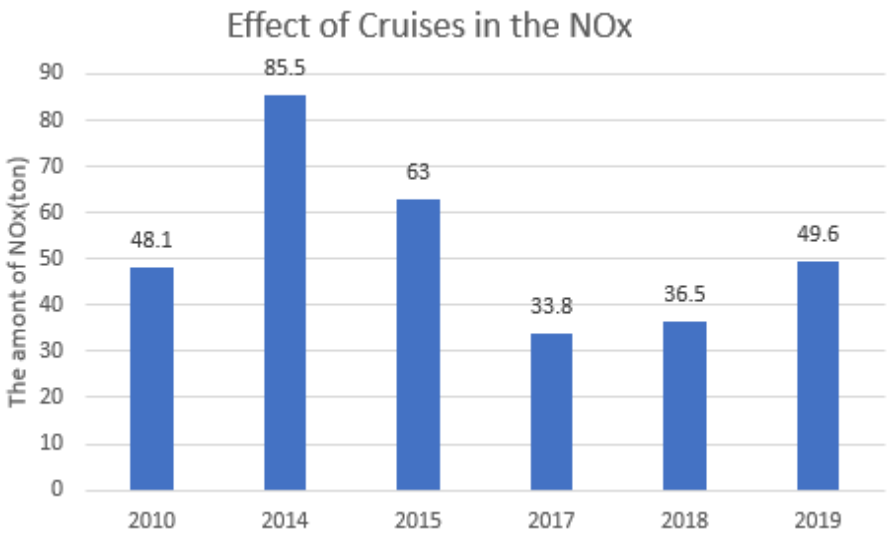
Source: Own elaboration

As can be seen above, the figure depicts what extent of SO_2 emission derived from cruise vessels in the Gothenburg port area since the year 2010. In the year 2010, the amount of sulphur dioxide was 6,81 tons whilst this amount was dramatically increased by 11,1 tons in the year 2014. The year 2015 can be seen as an important year for the maritime industry regarding the introduction of newer SECA regulation in Europe which lowered the sulphur cap from 1% to 0.1% inside a SECA. This can be seen from Figure 6, that until the year 2015, the amount of sulphur was 6,81 tons in 2010 and 11,1 tons in 2014, however, with the inclusion of the newer SECA regulation, these amounts were dramatically decreased to only 3.0 tons in 2015 which means the amount of sulphur decreased by approximately 73% compared the year before (2014) and it reduced by approximately 81% in last five years' time frame (Port of Gothenburg, 2020), (The Interview, 2020). The reason why SECA regulations have shown as a black vertical line is to present this relationship between SECA regulations and its effects on sulphur emissions for cruise vessels in the port of Gothenburg. Consequently, SECA

regulations have a huge impact on both environment and hazardous gas emissions arise from vessels by promulgating a cap for vessels in Europe.

Regarding NOx emissions, figure7 is presented below to illustrate how have NOx emissions that derived from cruise vessels been in the Gothenburg port area in the last decade.

Figure 7. The status of NOx emissions that derived from cruise vessels in the Gothenburg port are in the last decade



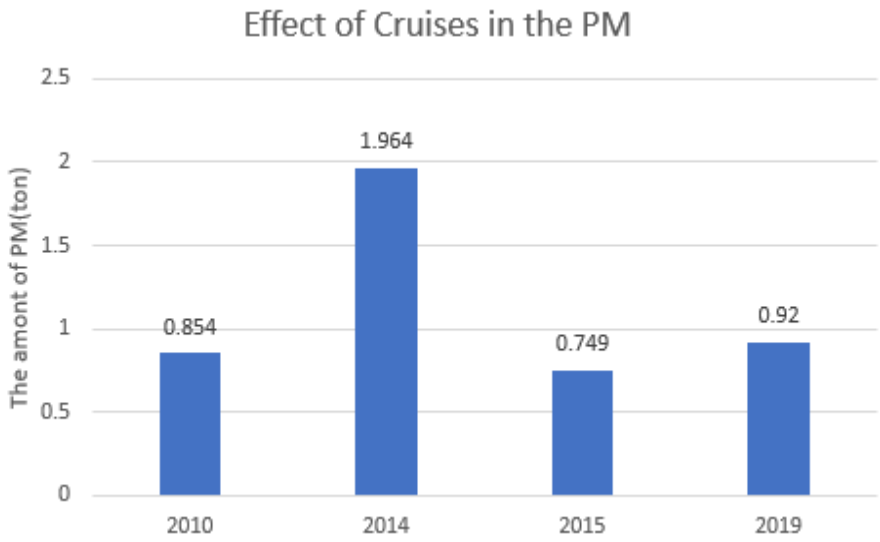
Source: Own elaboration

Unlike SECA regulations, NECA will be implemented in Europe by the year 2021 which means that there will not be any international regulations regarding NOx in Europe until the next year. From this perspective, it is harder to explain NOx related issues in European ports since there has been no international regulation for it such as SECA (Aulinger et al., 2015). On the other hand, the status of NOx derived from cruise vessels in the port of Gothenburg in the last decade can still be presented to some extent. As can be seen above, there are fluctuations for NOx in the Gothenburg port since the year 2010. In the year 2010, the total amount of NOx emission was 48.1 tons whilst this amount had dramatically increased by the year 2014 by 85.5 tons. Alike with Figure 7,

there is a significant decrease in the year 2015. On the other hand, it is not known the actual reason of the decrease since there was no international regulation for NECA in the year 2015, however, SECA regulations were implemented in the year 2015 for Europe hence this may be the reason however there is not sufficient information to relate these two statements (The Interview, 2020), (Port of Gothenburg, 2020).

Particulate Matter (PM) is another detrimental gas emission derives from cruise vessels in the Gothenburg port area. Thus, Figure 8 regarding PM is presented to illustrate the status of PM in the last decade in the Gothenburg port area.

Figure 8. The status of PM derives from cruise vessels in the port of Gothenburg area in the last decade.

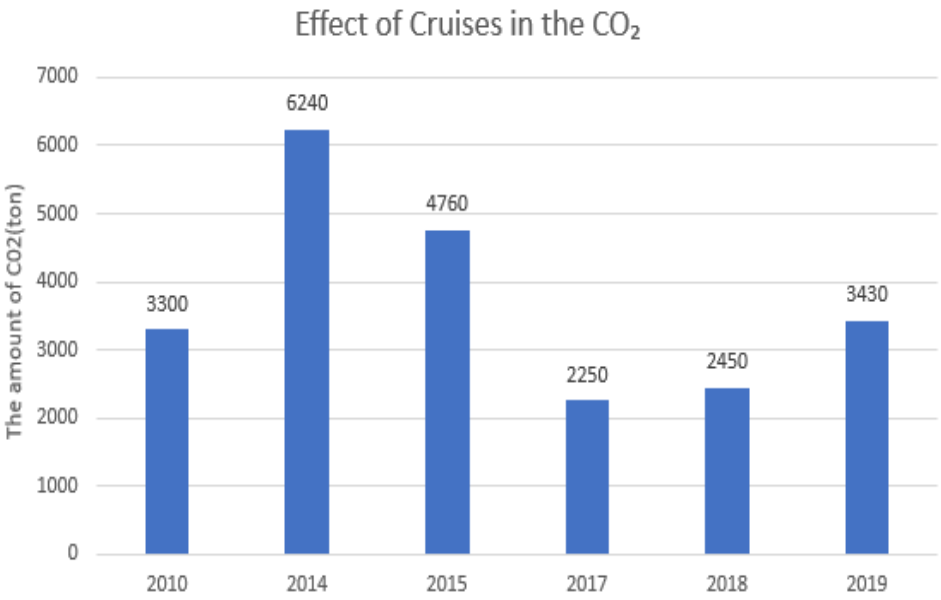


Source: Own elaboration

Since International Maritime Organization (IMO) agreed to diminish PM emission derives from shipping activities by regulating the sulphur in ship fuels, then after the most recent SECA regulations that were applied in the Baltic Sea, the North Sea, and the English Channel with stringent caps for sulphur in ship fuels. Furthermore, most of the sulphur in ship fuels (95-99 %) transform to sulphur oxides (SOx), after burning process whilst the rest is transformed to particulate sulphate (SO4), which is one of the main components of the PM (Kalli et al., 2013). Thus, the dramatic decrease in PM

emissions between the years 2014 and 2015, in Figure 8, can be related to SECA regulations from that perspective.

Figure 9. The status of CO2 derives from cruise vessels in the port of Gothenburg area in the last decade.



Source: Own elaboration

As can be seen above, CO_2 release increased between the years of 2017 and 2019 due to the increase in the number of actual calls in the port of Gothenburg. With this way, the fuel consumption also proportionally increased. Hence, CO_2 is of general interest for the Port of Gothenburg since it is an indication of the amount of fuel used by various vessels and due to the fact that all other types of emissions, but CO_2 are somehow proportional to fuel consumption. In general, there are fluctuations in the amount of CO_2 in the specified time frame (Port of Gothenburg, 2020).

5. CONCLUSION

The research conducted, in this paper, found out that cruise vessels cause negative environmental impact by discharging hazardous gases, namely SO_2, NOx, PM, and CO_2, into the air. Researchers have reviewed a mass of articles and papers in advance of setting the research question which is "How the cruise activities affect the port of Gothenburg in the perspective of air emission?". In general, these articles present a negative attitude when discussing the impact of cruise activities on ports from the perspective of air emission.

With the recognition of this fact, the researchers found out that the answer to the research question is cruise vessel activities cause negative environmental impacts on the Gothenburg port area when considering the status of previously presented hazardous gases that derive from cruise activities in the Gothenburg port area. However, although the status of these hazardous gases, SO_2, NOx, PM, and CO_2, is presented at some extent, further researches should be conducted to enlighten this subject in a more detailed perspective.

Besides, it is worth mentioning that there is COVID-19 brake out in the world and the world's economy is affected. As to the cruise industry in the port of Gothenburg, the cruise season is postponed to the beginning of July instead of starting in mid-May (Port of Gothenburg, 2020). This situation may mitigate the air emission effects from cruise vessels on the port of Gothenburg, and hence it is significant to investigate this correlation between this pandemic and its effects on both the cruise industry and the Gothenburg port as further researches.

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7. APPENDIX

Interview questions

1) When considering the environmental impacts derived from cruise shipping activities, does it affect only the port of Gothenburg area, or the port area and its periphery or somehow does it affect the entire city of Gothenburg?

2) Do cruise ships being more detrimental to the environment while they are berthing or docking at the quay compared to when traveling at open sea?

3) Do cruise ships still produce negative environmental impacts while they are docked at the quay?

4) Do cruise ships shut down their engines while they are at the port state?

5) Could shipping companies control the extent of pollution that they cause such as air emissions?

6) What would happen if shipping companies violate the official regulations of the port?

7) If cruise ships do not follow the rules, then could the port of Gothenburg forbid them to visit the port ever?

8) Does the Gothenburg port accept every call from cruise shipping companies?

9) Does the port of Gothenburg know how many cruise ships it will have on a yearly basis?

10) How does the Gothenburg port track the number of cruise ships? Do you use any specific software to handle it?

11) In general, does the port of Gothenburg have any specific parameters regarding the prospect cruise ships or do cruise companies choose you to visit? How does this situation happen?

12) Does the port of Gothenburg have any minimum & maximum limits in terms of size of the cruise ships and the number of cruise passengers onboard?

13) What is the plan of Gothenburg port to mitigate the effects of air emission derive

from cruise activities?

14) How had the port of Gothenburg handled the situation of nitrogen emissions throughout the years when considering NECA (Nitrogen emission control area) will be applying for the Baltic Sea and the North Sea areas starting from the year 2021?

15) Why was the cruise vessel banned from the Gothenburg port authority that it can no longer enter the Gothenburg port after it docked at the America Cruise terminal in 2018?

16) Do you think has the port of Gothenburg developed itself as a port compared to the past in terms of cruise shipping business and operation?

17) How did the idea of adopting the cruise shipping business in the port of Gothenburg come into the reality?

18) When considering the negative environmental impacts derived from cruise shipping activities in the perspective of air emission, in one hand we have the recognition of the city however on the other hand we have these negative environmental impacts on the port and the city. What do you think of this situation where the actual call numbers for cruise industry prone to be decreased for the last couple years due its negative environmental impacts on both cities and the planet itself?

19) Where do you see the position of the port of Gothenburg when compared to big players such as port of Barcelona, port of Rotterdam etc? What would your score be for the port of Gothenburg on a scale from 1 to 10 in terms of greatness?