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CASE STUDY

Remote audit in the times of COVID-19: a successful process safety initiative

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ABSTRACT

Goal: This paper presents a case study in which the practice of Internal Process Safety Audit of the studied company needed to develop a system of remote audits during the COVID-19 pandemic.

Design / Methodology / Approach: The system was analyzed in the light of recent theoretical references, having all its phases described, as well as its results and future prospects.

Results: The systematic approach involved the development of specific procedures for planning and carrying out audits using a digital platform. The practice was implemented from March 2020 through August 2021. It was approved by the National Agency for Petroleum, Natural Gas and Biofuels (ANP) and is currently used as a reference for other operators in oil and gas exploration and production (E&P) in Brazil.

Limitations of the investigation: The choice of a unique case study, restricted to a practice adopted since the beginning of the pandemic, brought some theoretical-methodological limitations. The authors chose to adopt participant observations due to the inclusion of one of the authors in the process of conducting the audits.

Practical implications: The main contribution of this study focuses on the results of the critical analyses carried out to find the strengths and opportunities for improvement that could be adopted by organizations that have similar processes.

Originality / Value: The added value of this study refers to the scope of the remote audit, as it is about Process Safety. The studies presented so far refer mostly to remote certification audits or maintenance of the quality management system, with emphasis on ISO 9001.

Keywords: Remote Audit; Safety Processes; Pandemic; COVID-19.

INTRODUCTION

Historically the chemical industry and specifically the branch of oil and natural gas has been leading in numerous process accidents that despite bringing huge losses for all stakeholders, also came with lessons to be learned, such as a set of legal requirements that elevated risk management practices to another level (Chen et al., 2021). The accident of the Deepwater Horizon platform owned by the company Transocean contracted by British Petroleum (BP), occurred in April of 2010, in the Gulf of Mexico, was one of the events that contributed the most to the development of legal requirements in order to make the industry safer.

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Fox and Lefsrud (2021), Nieves-Zárate (2021) highlight the economic impacts imposed by the Regulatory Agencies on the local operators arising from the application of fines and interdictions in facilities that present non-conformities in their operational processes.

Among the most adopted legal requirements in this type of industry, the performance of Internal Process Safety Audits stands out, as a way to prevent and mitigate the risks associated with the existing critical processes. (Lou et al., 2021)

Most oil and gas producing countries have government agencies which regulate and supervise operations by establishing minimum requirements that must be adopted so that companies operate their facilities with adequate levels of safety (Yin, 2021).

To meet the legal requirements and other obligations established by the stakeholders involved, the operators have been adopting methodologies, tools and risk management techniques, with the objective of establishing a systematic identification, analysis, assessment and treatment of the risks and of their processes.

Fiorentini (2021) highlights the importance of process audits in order to identify the quality of risk analyses performed and the integrity of respective barriers and safeguards that should maintain current risks under control.

The oil and gas industry underwent intense demands and suffered operational restrictions imposed by the pandemic. They require a plan of contingency quite robust in order to handle more than just production within the parameters required by the petrol industry. Thus, the following central research question arises: How to meet the legal requirements of regulatory bodies regarding the practice of internal auditing of Process Safety, with restrictions related to social distance and limitations on entry into industrial facilities

Being as it is, the objective of this work is to present a case study in which the Internal Process Safety Audit of the studied company needed to develop a system of remote audits during the COVID-19 pandemic, due to the restrictions imposed by public health agencies for social distancing.

THEORETICAL LITERATURE FRAMEWORK

In this section, aspects related to audits which are carried out in different contexts are discussed, as well as their characteristics and their role in mitigating business risks.

Audits and security process

Carpentier and Suret (2021), studying 173 major industrial accidents in the world from 1959 until 2017, highlight that the initiative to promote audits in industrial facilities arose from the demands of the insurance companies, due to impacts generated by indemnity claims and consequent fall in stock market valuations.

A study by Crepaldi (2019) points to an interesting initiative that was probably the most complete report of an internal audit. According to the author, The Worshipful Company of Pewterers, founded in England by 4 partners in 1854 , examined the accounts and the operational activities of an English mining company throughout its entire production process and sales.

The practice of internal audits of management has existed in a structured way since the creation of International Organization for Standardization (ISO). It was founded to integrate standards from developed countries such as England into a single international standard. According to International Organization for Standardization (1997) it was based on the integration of international standards aimed at the industrial area using industry parameters of developed countries such as England, United States

and Canada. Subsequently, the ISO world headquarters moved to the city of Geneva (Switzerland) in 1949.

According to Enneking et al. (2020) Audits or inspections were initially restricted to manufacturers and suppliers of goods, when one or more interested parties sought to know an organization, inspect the facilities and verify the adequacy of management to the established requirements. Subsequently, initiatives emerged from the audited organization, in order to identify possible non-conformities beforehand.

Alves et al. (2021) highlight the crisis and risks associated with businesses during COVID-19 pandemic. Risks inherent to the businesses considered by the risk management project and facilities in operations had not foreseen the emergence of a pandemic and thus did not prepare contingency plans for its control and mitigation.

The safety operations of these businesses could have been compromised if monitoring and control practices such as audits, assessments, verifications and inspections were not performed due to restrictions imposed by the government agencies, in relation to social distancing.

In this sense, remote process security audits play an important role continuing to identify vulnerabilities. They allow those responsible for the audited facilities to deal with the risks even in the face of access restrictions to the workforce and other parties interested in the audited facilities.

Auditing and its characteristics

The term audit is often confused with other processes such as assessment, verification and inspection. Despite having similar characteristics, for the purpose of this study, the following definitions were established by the authors Johl et al. (2021) in their studies on transparency, compliance and management audits.

Table 1 summarizes the main differences.

Table 1. Differences between verification and evaluation processes

Type	Definition
Assessment	Process aimed at evaluating/verifying a certain environment, activity, product or service, with a focus on identifying conformities with established requirements, in a preventive manner. There are visual inspections that are based on the observance and instrumental inspections that use measuring equipment of destructive and non-destructive nature.
Verification	Process normally performed after the occurrence of any event that has resulted in loss or damage. The objective is to identify the possibilities and hypotheses of how the event occurred. It is focused on examination and verification.
Audit	Systematic, documented and independent process for obtaining audit evidence and evaluating it objectively to determine the extent to which audit criteria is met.
Inspection	Process carried out by a professional representing an inspection body, which may be a Regulatory Agency or a government entity focused on inspection and legal compliance.

Source: Johl et al. (2021).

When it comes to Audits, ISO 19011: 2018 Guidelines for auditing management systems establishes at least three main types of audits for system management (International Organization for Standardization, 2018). Table 2 presents the established definitions.

Table 2. Types of Audit

TYPES OF AUDIT	SCOPE
First Party Audit	Audit performed by an organization on itself. It is carried out by an internal team with the objective of preventively verifying the compliance of the management system with the requirements established by the organization itself or by other interested parties.
Second Party Audit	Audits conducted by one organization over another for the purpose of verifying compliance with established requirements. This includes audits performed by customers on their current or potential suppliers or other business partners.
Third Party Audit	Audits performed by an independent third party that has no direct interest in the audit results. These can be certification audits and also audits for international recognition such as quality awards and other qualifications where independence and autonomy are required.

Source: ISO 19011 (2018).

Only 186 case studies involving the practice of remote audits were identified in the indexed databases. The specific bibliography on the subject is largely restricted to third party certification processes (ISO Standards) that focus primarily on documentary evidence regarding field audits.

Security process in the pandemic

Rodrigues et al. (2021) emphasizes the risks associated with the safety aspects of the process, since accidents or any other adverse event, imply a production stoppage, loss of profit, non-compliance with supply contracts and fines from business partners and regulatory bodies.

As Khan (2021) suggests, the consequences of the pandemic in the market and in the production systems involved with exploration, production and commercialization of oil and gas are not yet fully known and adequately evaluated. The crisis aggravated the existing difficulties in the local productive arrangements (APL), giving visibility to the fragile support of the supply chain of goods and services. The pandemic revealed the inability of many companies to manage the crisis, keeping their operations well managed from the point of view of sustainability in its broadest sense, across environmental, business, social and economic dimensions.

Iqbal et al. (2021) highlight the need for safe practices in projects, commissioning, operation and decommissioning of industrial facilities. In this sense, remote process safety audits play an important role in the pandemic, as the scope involves the entire life cycle of the enterprise.

Beale (2021) points out that even with different types of restrictions such as access to facilities and difficulty in physically inspecting processes, remote audits are an important initiative to ensure compliance of the systems under analysis.

Sands et al. (2021) reports the advantages of digital technologies support the participation of geographically dispersed people, contributing to greater integration of the teams involved.

Eulerich et al. (2021) draw attention to an interesting aspect aimed at significantly reducing the costs associated with the logistics of the teams involved. Remote audit largely eliminates travel and accommodation expenses.

Serag and Daoud (2021) note that remote auditing favors the participation of more people at a given time, since team members can participate through various electronic devices, requiring only the existence of a videoconferencing application.

Ghosh and Abeysiriwardhane (2021) suggest that even after the end of the pandemic, many organizations will choose to maintain the remote audit system, as they understand that the cost-benefit ratio is very efficient and meets the requirements of interested parties.

Serrano and Wellbrock (2021) point out that the pandemic brought a disruptive movement in the audit process characterized by the intense interactivity promoted by the home office. The authors point out how the possible interference of the family context during the interviews, such as the unexpected appearance of a child, a pet or any other element common to people's homes, actually contribute to greater empathy and humanization of the auditing practice, traditionally formal and stressful for the audited teams.

The ANP (Agência Nacional do Petróleo, Gás Natural e Biocombustíveis, 2020) in its Annual Operational Safety Report mentions the need to carry out remote audits:

> "The year 2020 was marked by the Covid-19 pandemic, which demanded a different approach, both from the E&P sector and from SSM, in conducting its activities. Provisional changes in the regulatory framework, such as those provided by the ANP Resolution No. 816/2020 and 820/2020, and the performance of remote audits, were implemented, so that risk control - necessary to safeguard human life, the environment and assets – was maintained during the state of emergency". (Agência Nacional do Petróleo, Gás Natural e Biocombustíveis, 2020, p. 1)

Considering the context of the COVID-19 pandemic and the implications on its workforce, the company preemptively extended remote work with the objective of reinforcing its commitment to protecting life and health. This measure considered the assessment of safety and health conditions on site for administrative and operational areas. It took into account the external (government guidelines) and internal environment (evolution of confirmed cases), while implementing preventive barriers for COVID-19.

The vast majority of the company's employees are working remotely with the purpose of reducing exposure to the virus and ensuring the health and safety of workers.

In a normal scenario, internal audits would take place in person, with the on-site participation of auditors and key personnel in the operating units. In the past, only by exception, would audits take place remotely, with the full consent of regulatory and supervisory bodies. This practice – remote audits – has also been carried out by regulatory and inspection bodies (ANP, Navy and IBAMA) and the results have been satisfactory.

Every year, the ANP's Operational Safety and Environment Superintendence (SSM) issues an Annual Operational Safety Report on oil and natural gas exploration and production activities. In 2020, the ANP presented the results of operational safety of exploration and production activities (E&P) of oil and natural gas, in compliance with the attribution provided by ANP Ordinance No. 265/2020. Regarding remote audits, the report points out some very significant elements.

> "[..] from the understanding of which management practices can be remotely audited, enabling more frequent and targeted monitoring, through specific and punctual actions, which require less time. In addition, the resource economy is observed, with the absence of travel to the installation site, more time for the verification of non-conformities recorded in previous years by the ANP and, due to the new focus of the audits, a better knowledge of the results obtained by the management of critical elements carried out by regulated agents. In short, although remote audits have some natural limitations, imposed by the absence of inspectors at the facilities, this model will add an important regulatory oversight option, to be improved and applied in the 'post-pandemic'". (Agência Nacional do Petróleo, Gás Natural e Biocombustíveis, 2020, p. 15)

The realization of remote audits, in the current context and in view of future opportunities, was considered very advantageous and a very interesting option. The system

adopted by the company, which is the focus of the case study presented in this paper, incorporated several good practices presented by regulatory and supervisory bodies based on their external audits, assessments and inspections. This study reported a systematic way of conducting first-party remote audits, with a focus on Process Safety.

METHODOLOGY

This research is of a basic nature where a qualitative, exploratory and descriptive approach was implemented. The choice fell on a Case Study involving the operational experience of one of the authors during the COVID-19 pandemic.

The strategy of adopting a single case study favored a more comprehensive and contemporary approach to the organizational impacts caused by the COVID-19 Pandemic in the systematic internal Process Safety audits of a Brazilian company. The authors chose to adopt participant observation due to the inclusion of one of the authors in the process of conducting the audits. To conceptually support the analysis, the Scopus database was used to prioritize frontier research literature published between 2020 and 2021.

According to Suela et al. (2021), bibliometric studies carried out on reputable scientific bases analyze and quantify scientific advancements in a given field of knowledge, through its relevance and timeliness. Thus, it is possible to understand the development of an area of knowledge and identify research trends and gaps for future investigations.

For Gil (2008), the case study is a deeper and more detailed approach to a given event, in order to expand knowledge and understanding of its nature. In the approach adopted by Yin (2015), the case study serves a revealing purpose, as it brings information that can be shared among other researchers, preserving important characteristics of an organizational process.

Creswell and Creswell (2021) recommend that the choice of the case be guided by a structured method, which will support the decision-making process in prioritizing the necessary information.

According to Suela et al. (2021), bibliometric studies carried out on reputable scientific basis are used to quantify and analyze scientific production in a given field of knowledge for its relevance and timeliness. In this way, it is possible to understand the development of an area of knowledge and identify research trends and gaps for future investigations.

The selected database was Scopus because it has a huge and recognized collection of documents from high-impact journals for the scientific community.

The search strategy adopted in this bibliometric research was initiated by the combination of keywords and Boolean operators involving the expressions “Remote Audit”, “Process Security”, “Pandemic”, “COVID-19”. The research sought to prioritize the keywords associated with the title of the article, considering that this is a case study, with a well-defined scope. The strategy of limiting the search only to the year 2021 was adopted, focusing on frontier literature and because it was understood that this would be a period in which there were already studies with a greater degree of maturity on the subject.

CASE STUDY

This section presents the case study of an internal process safety audit for a company in the oil and gas sector. It is composed of the profile of the company, a presentation of the applicable technical regulations, the systematic approach for conducting process security audits, and a description of the characteristics of the remote audits adopted by the research company.

Profile of the researched company

The case study profiles an integrated Brazilian oil company, which engages in exploration, production, refining, sale and generation of energy. It has unequivocal expertise in exploration and production in deep and ultra-deep waters as a result of nearly 50 years in the development of Brazilian offshore basins, becoming a world leader in this segment.

The scope of Process Safety audits covers the entire life cycle of the enterprise, including its own and joint venture oil and gas exploration and production facilities, onshore and offshore, refineries, thermoelectric plants, building facilities and the operational bases in Brazil.

The technical regulations of the National Agency for Petroleum, Natural Gas and Biofuels (ANP) have similar requirements, establishing that Operators must carry out internal Process Safety audits. Figure 1 shows the timeline and scope of each ANP technical regulation.

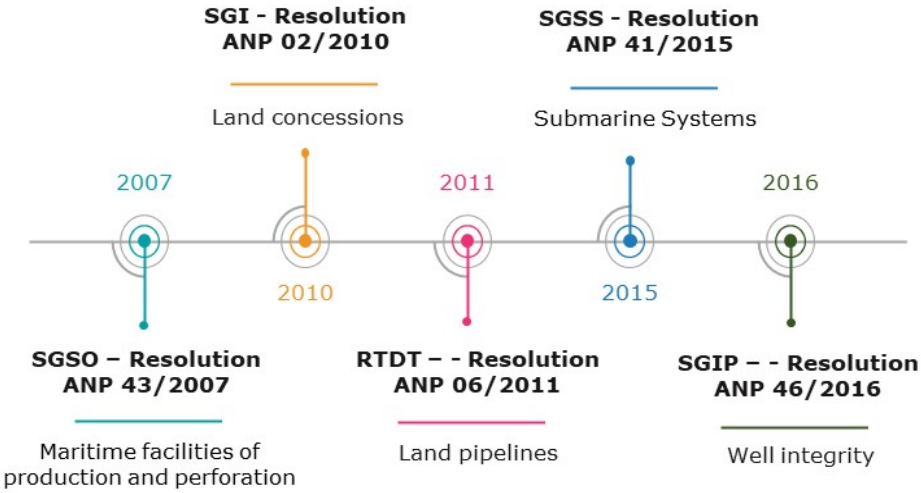

Figure 1. Timeline and the scope of each regulation
Source: Authors (2021).

Figure 2 shows the application of the Technical Regulations by type of Installation.

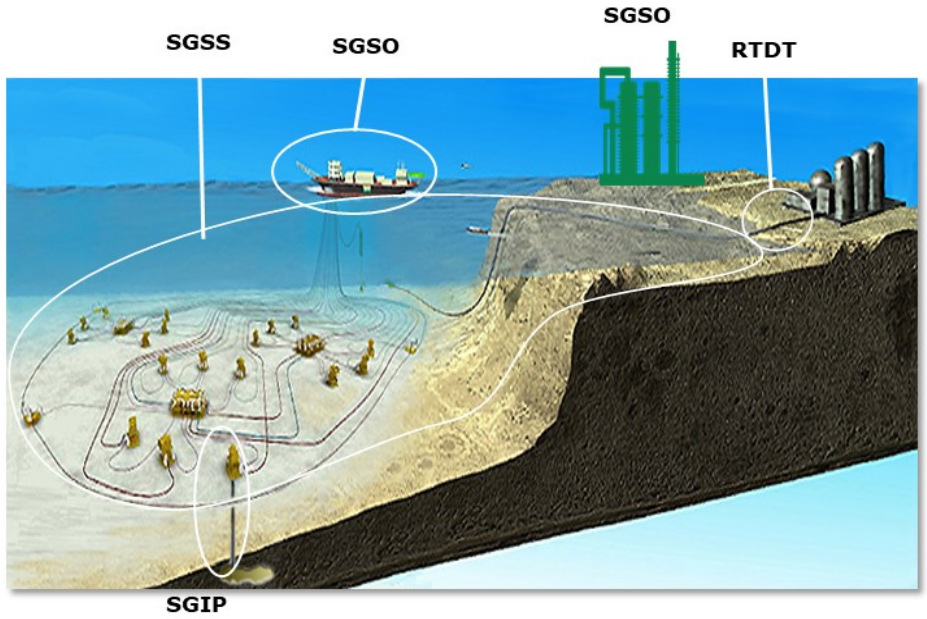

Figure 2. Technical regulations by type of installation
Source: The Authors (2021).

Table 3 presents a correlation of requirements from three technical regulations applicable to the operational processes of the studied company. Note that even with different descriptions, the three selected regulations indicate the need to carry out Internal Audits.

Table 3. Requirement Correlation

SGSO	SGSS	SGIP
Technical Regulation of the Operational Safety Management System (SGSO) of Maritime Installations for Drilling and Production of Oil and Natural Gas	Technical Regulation of the Subsea Systems Operational Safety Management System (SGSS)	Technical Regulation of the Well Integrity Management System (SGIP)
PG7 - AUDITS	**12. INTERNAL AUDIT**	**PG7 - AUDITS**
"The objective of this management practice is to create and apply mechanisms to assess the effectiveness of the implementation and operation of the safety management system, seeking compliance with the requirements contained in this Technical Regulation, through the execution of audits."	"The purpose of this management practice is to establish and apply mechanisms to assess the effectiveness of the implementation and function of the operational safety management system, determining whether they are in compliance with company policy and requirements contained in this Technical Regulation, through the execution of an audit"	The objective of this management practice is to establish and apply mechanisms to assess the effective implementation and functioning of the Well Integrity Management.

Source: The authors (2021).

The case study describes the Process Safety Internal Audit Process.

The Internal Audit process is risk-based and aims to:

- Verify compliance with the requirements established in the Process Safety Management System of the studied company and other applicable legal requirements;
- Verify the effectiveness of the implementation of the Management Practices of the Technical Regulations of the National Agency for Petroleum, Natural Gas and Biofuels (ANP), being the instrument for meeting the audit management practice (PG-07);
- Identify operational and management weaknesses in order to reduce the risk of accidents and incidents;
- Promote learning and continuous improvement of Process Safety performance.

The audit process is carried out on a sampling basis and as comprehensive as possible, so that the results can represent the larger scope of audits. The findings found during the audit process are part of this sample. To ensure that the auditors are in compliance with the legal requirements required by the technical regulations of the ANP, the studied company established a set of guidelines and assumptions establishing specifications related to the audit requirements, scope, audit team profile, stages, cycle and annual program audit trail. The main assumptions and guidelines are presented below.

Requirements

The audit is based on constant requirements of:

a) Guidelines, Standards and Norms of the studied company;
b) Technical Operational Safety Regulations established by the ANP;
c) Legal Process Safety requirements applicable to the activities of the studied Company;
d) National and international norms subscribed by the studied Company.

Scope

Internal Process Safety Audits apply to:

a) Own facilities eligible as auditable by regulatory bodies;

b) Other facilities/projects whose Process Safety occurrences are appropriate for the Company studied and that are defined in the audit schedule.

Dimensions and Themes

Figure 3 shows the dimensions that are part of the scope of internal audits:

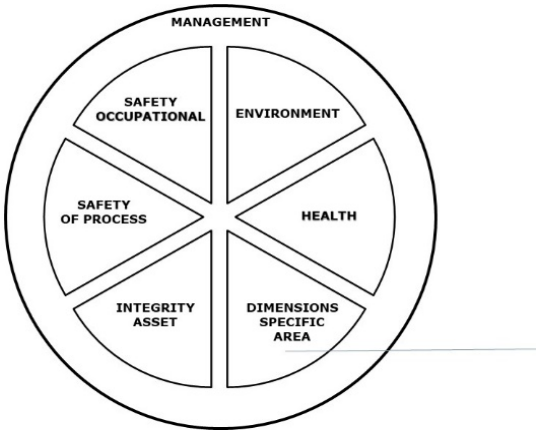

Figure 3. Dimensions that are part of the scope of internal audits

Source: The Authors (2021).

The technical control board are responsible for each sector and must:
a) Develop and update the Checklists for the sector under its responsibility;
b) Appoint the internal auditors in each sector under its responsibility to the Process Safety Assessment and Control Management, both for training and for carrying out audits;
c) Provide guidance for training internal auditors in the Checklists under their responsibility;
d) Provide guidance and clarify doubts regarding the requirements of the Checklists, when requested by the internal auditors and, eventually, by the areas to be audited;
e) Provide technical support to internal auditors for any assessment of objective evidence presented by the audits during the audit, which, in the auditors' understanding, does not meet the applicable requirements;
f) Analyze non-compliance appeals, as established in corporate procedures;
g) Analyze requests to postpone the deadline for handling non-conformities, when requested by the responsible area.
h) Review requirements on a scheduled basis and process for amendments.
Auditors Profile
The auditors must have the following profile to participate in the audits:

Lead Auditor

a) Have experience as an auditor in Process Safety audits or similar background;
b) Know the Internal Audit Process of Process Safety Management;
c) Participated in the training "Training of Auditors for Safety, Environment and Health Management Audit";
d) It is desirable to have attended and been approved in the training courses of Lead Auditor (Lead Auditor) recognized by a national or international organization, focused on the standards of Environmental Management Systems (ABNT NBR ISO 14001) or Safety Management Systems and Health (ISO 45001);

e) Knowledge of the ABNT NBR ISO 19011 standard - Guidelines for auditing management systems;
f) Ability to take decisions assertively and with the necessary agility;
g) Ability to articulate and negotiate, managing conflicts and building partnerships, guided by ethical, legal and technical precepts;
h) Ability to manage people and work as a team;
i) Ability to communicate verbally and in writing;
j) Successfully engage with leadership

Audit Stages (in-person and remote)

The audit process is carried out in stages with deadlines established as per Table 4.

Table 4. Steps and deadlines

STEPS	DEADLINES (BUSINESS DAYS)
Define Team	40
Formalize Evaluation	40
Elaborate Evaluation Plan	15
Evaluate Previous Documentation	1
Elaborate Preliminary Report	5
Analyze Preliminary Result	10
Publish Final Report	20

Source: The Authors (2021).

Audit Cycle

The audit process is carried out in cycles according to criteria established by legal requirements, area performance and activity risk, according to Table 5.

Table 5. Definition of audit cycles

Cycle	Areas
2 Years	Operational Installations (Production Platforms, Rigs, Subsea Systems, Pipes, Refineries, Thermals, Onshore Concessions and Engineering Projects
3 Years	Support Vessels, Administrative and Operational Support Facilities (e.g. administrative buildings, workshops and warehouses), Exploration and Logistics.

Source: The Authors (2021).

For facilities that operate under the ANP's operational safety regime, the audit cycle must include all the Management Practices of the ANP Regulations.

In the case of Refineries, the cycle must include such practices in at least 30% of the refinery units, except for refineries with up to 5 process and auxiliary units.

In E&P, for well auditing, the grouping must be based on risk. For the audit of marine wells, the possibility of the audit contemplating the SGIP to be carried out together with the SGSS audit must be evaluated. For onshore well auditing, the possibility of the audit contemplating the SGIP to be carried out in conjunction with the operational safety audit of onshore concessions must be evaluated.

Audit Program

To meet the requirements regarding the biennial cycle of internal audits, the company in this study prepares, together with representatives of each board, an annual program that

covers the integrated construction of a schedule, the dimensions to be audited and the composition of teams for each audit and their respective lead auditors. Next, the main related aspects will be presented.

Annual Audit Schedule

The Unit to be audited must designate, as Focal Point of the Process Safety Management Internal Audit Process, a qualified professional and a backup who works in the Process Safety area, formalizing this appointment to the responsible management.

For installations covered by the ANP's operational safety regimes, the express consent of the ANP is incumbent in order to carry out audits entirely in a remote fashion, thus complying with Management Practice No. 07 of the RT-SGSO. For other installations, the consent of the corporate area managing the process is necessary.

The schedule must include the facilities under the operational safety regime of the ANP, including if necessary, chartered facilities or with contracting strategies in the modalities of EPC (Engineering, Procurement and Construction), BOT (Build, Operate and Transfer) or BOOT (Build , Own, Operate and Transfer), among others that the corporate area managing the process deems pertinent.

The schedule must be prepared considering the following criteria:

a) Corporate, legal or regulatory requirements;
b) Occurrences of fatal accidents and other accidents such as the onset of fire in the facilities, in the year prior to the start date of the preparation of the audit schedule;
c) Interdiction of installation by regulatory bodies;
d) Stage of the installation/enterprise life cycle;
e) Previous results of internal and external audits;
f) Schedule of programmed stops;
g) Occurrences of Process Safety complaints registered in the official channels of the studied Company;
h) Size and complexity

Audit Team

The composition of the audit team must be specified, considering:

a) The scope of the audit;
b) The size and complexity of the facility;
c) Critical elements for operational safety;

The corporate area managing the process must define, for each individual audit, criteria for sizing the minimum team, considering the established requirements, as well as negotiating the participation of auditors with the allocation management, according to the annual audit schedule.

The Business Unit should preferably provide the same number of auditors that it will require in its audits, considering its cycle.

The corporate area managing the process must disclose the Audit Program (Schedule and Teams) to the parties involved.

After the formalization of the audit team, if the appointed auditor cannot participate on the established date, the allocation management must appoint a qualified substitute. Except for unforeseen reasons (illness, distancing, allowed licenses by law), the request to cancel the auditor's participation must occur within 45 (forty-five) days before the date of the audit and must be validated by the employee's manager.

Remote Audits

Considering the context brought by the COVID-19 Pandemic, the studied company established a system for carrying out Remote Audits via the Microsoft Teams© digital platform.

Microsoft Teams© is an application for conducting videoconferences used by the studied company. It has some features that make remote work more interactive. The entire workforce

has access through a user key and password. It has the functionality of chat (online chats) like other similar applications such as Google Meet©, Zoom© and Cisco Webex©, among others.

Two teams are created in Microsoft Teams©. The first one contains the team of interlocutors (audited) of the studied company along with internal or external auditors (ANP, Navy, IBAMA, etc.). The second contains only the support team of the company studied to ensure that all logistics and document supply are centralized and guarantee traceability.

A critical success factor is ensuring that there are two focal points following the chat in Microsoft Teams© during the audit and asking the auditors that any requests for documents and meetings are always made through the chat, using the tagging feature (@focal point 1 and @focal point 2)

After the end of the audit, all files are recorded and sent in a compressed form to the teams of Auditors. If external auditors confirm receipt and absence of pending issues, the Audited team focal point closes the audit in Microsoft Teams©.

RESULTS AND DISCUSSIONS

In this section, some results obtained with the performance of Internal Process Safety Audits in the period from January 2019 to May 30, 2021 were presented.

Figure 4 shows the number of external audits carried out by the ANP and the number of internal audits carried out by the studied company.

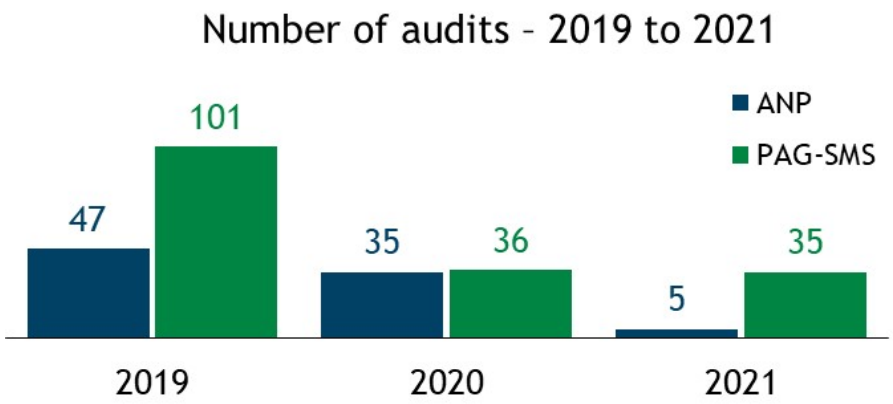

Figure 4. Number of audits – 2019 to 2021

Source: The Authors (2021).

Note that the number of internal process security audits is always higher than the number of external audits. In 2019, it was more than double. In 2020, due to the pandemic, the audits were postponed to the 2nd semester, without impairment to the fulfillment of legal obligations by the studied company. This postponement received the consent of the ANP, which approved the proposal to carry out remote audits by the studied company. In 2021, due to the persistence of the pandemic and the maintenance of biosafety protocols, the audit schedule was maintained in the remote mode, following the same system guidelines established in 2020.

Table 6 shows the numerical distribution of internal audits by board of the studied company. The greater concentration in Directorate 1 is due to the nature of its operations, focused on Exploration and Production (E&P). The other areas follow the audit cycle schedule established by the regulatory body.

It is noteworthy that, in Directorates 3 and 4, the studied company does not have legal obligations to carry out process audits, yet it does, because it understands that this initiative brings a huge gain from the point of view of process safety with a focus on sustainability of all its ventures, facilities and activities.

Table 6. Distribution of audits performed

	PAG-Internal Process Safety Audits		
	2019	**2020**	**2021 (until 30th of May)**
DIRECTORATE 1	**75**	**28**	**30**
DIRECTORATE 2	**16**	**2**	**1**
DIRECTORATE 3	**7**	**6**	**4**
DIRECTORATE 4	**3**	**0**	**0**

Source: The Authors (2021).

Figure 5 shows the absolute number of findings in each of the audits performed. There is a high number of findings in internal audits, far exceeding the number of findings in external audits (ANP). This phenomenon shows signs that internal audits may be adopting a more detailed and in-depth approach, as internal auditors have a more integrated knowledge of the management model, adopted practices, procedures and the corporate system implemented.

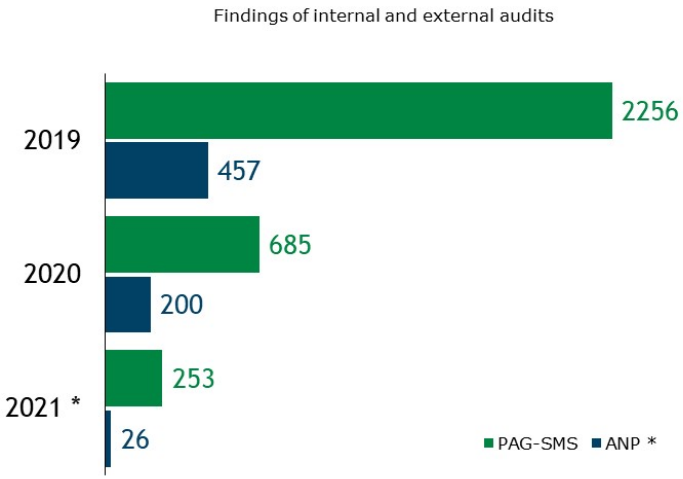

Figure 5. Findings of internal and external audits

Source: The authors (2021).

The results presented show signs that remote audits have become an interesting alternative to maintain the continuity of the Internal Process Safety Audits. Despite the limitations imposed by remote work, the studied company maintained its legal commitments with regulatory bodies and proactively identified audit findings that contributed to the improvement of its management systems.

These indications reinforce the findings in the literature pointed out by the researched authors. Beale (2021), Sands et al. (2021), Eulerich et al. (2021), Serag and Daoud (2021), Ghosh and Abeysiriwardhane (2021) and Serrano and Wellbrock (2021) researching in different countries, processes and distinct cultures, pointed out in their studies identified positive aspects with the application of remote audits in light of the COVID-19 pandemic.

Many authors highlight behavioral changes caused by the Pandemic and remote work. In this case study, a team of auditors showed interest in maintaining and working remotely in hybrid fashion (remote and in person), performing audits on the spot when strictly necessary. Similarly, some authors such as Lindström and Flou (2021) mention in their research that many employees involved have shown this type of interest, despite reporting an extensive workday, higher than that established in their contracts. During the interviews carried out, it was found that 45% of the auditors extended their working hours for periods exceeding 12 and 14 hours a day in their homes.

Another behavioral change mentioned by Loscalzo (2021) shows a strong correlation with adaptive processes. The authors highlight a significant increase in productivity, once the time of relocation has been eliminated and the space for lunch and rest were adjusted in accordance with the organizational and personal demands.

According to Galanti et al. (2021), some personnel of the workforce interviewed, report ed working even in their traditional hours of rest, starting their activities earlier and concluding their workday after the conventional working hours. In-person audits showed a significant increase in productivity and a reduction in deadlines in some cases. Some auditors who, under normal conditions, performed one on-site audit per month, started to perform two remote monthly audits, on their own initiative.

Eales et al. (2021) highlight the effect of permanent connection, where remote work can favor the removal of fragile statutory and regulatory barriers, promoting the removal of a defined timeframe for a workday, as well as the suppression of rest breaks or meals. It was found that 30% of the interviewed auditors sent messages, files or read documents outside of work hours in order to carry out the planned remote audits. These behavioral changes, as suggested, corroborate what the authors mention about the workforce adapting in the pandemic, even if it impacts their quality of life or family relationships. When questioning the benefits of remote work, all the interviewed auditors mentioned flexibility as a positive factor.

The studies of Venkatesh et al. (2021) emphasize how remote work can have impacts on the mental health of employees, possibly related to the pressure for results, urge to meet deadlines and the consequent demand for a greater number of work hours.

Regarding the quality of life at work, there is a tendency for organizations to seek strategies to reduce or mitigate the adverse effects that remote work can bring. In this sense, Costa and Barlach (2021) highlight benefits such as offering gym memberships, mindfulness sessions, yoga, psychological therapy, computer equipment and subsidies for the purchase of ergonomic furniture. In the studied company, online psychosocial assistance, virtual medical services and an agreement with a comprehensive health platform were offered, as well as access to virtual classes and applications for physical activities, meditation and therapy.

CONCLUSION

The purpose of this study was to present a successful experience of implementing a system for conducting Remote Process Safety Audits in a Brazilian energy company.

The choice of a unique case study, restricted to a practice adopted since the beginning of the pandemic, brought some theoretical-methodological limitations. The authors chose to adopt participant observation due to the inclusion of one of the authors in the process of conducting the audits. This strategy gave way to the possibility of closely monitoring each process and activity as it was taking place. The researcher directly involved in the audit, built some comparisons between all the remote audits studied, he had the opportunity to weekly monitor each of the 29 audits in 2020. The auditor gathered information throughout all the planned steps, allowing the construction of the method based on the elements that should be observed and the observer's positioning. This choice had its limits, such as the restrictions imposed by the social context and its complexity of remote work, as well as the worldview of the researcher and other auditors involved. In this case, the study restricted possible generalizations within the same environment where the practice was observed and may have offered limited replication and generalization in other contexts.

The initiative took place during the COVID-1 pandemic, due to restrictions imposed by social distancing, recommended by public health agencies. The system involved the elaboration of specific procedures for planning and carrying out audits through a digital platform. The practice implemented in the period from March 2020 to August 2021 was approved by the National Agency for Petroleum, Natural Gas and Biofuels (ANP) and is currently used as a reference for other operators in oil and gas exploration and production (E&P) areas in Brazil. The main contribution of this study are the results of the critical analyses carried out in relation to the strengths and opportunities for improvement, identified in the process of continuous refinement of the management system which can be adopted by organizations that have similar processes.

From the point of view of positive results achieved, the practice has been shown to adequately meet the legal requirements established by regulatory bodies (ANP, Navy and IBAMA). The initiative allowed the monitoring and control of the studied company's management system thus continuing the practice of internal audits, creating possibilities to verify, even remotely, the integrity of the barriers and the risk management inherent to the process.

The use of digital platforms such as Microsoft Teams© favored the participation of specialists from the company's technical areas. In face-to-face audits, these corporate technical references would find it difficult to contribute to the process, generating doubts, analyzing evidence, and interacting with the audit teams and the audited. In this sense, remote audits brought a considerable gain, since many technical issues can be pacified during the audit, without the need for the use of claims and resources, when there is no consensus.

This type of strategy and other initiatives that emerged during the pandemic proved to be very beneficial for the management system of the studied company. According to authors such as Tokarz et al. (2021), the pandemic will bring countless unexpected opportunities for organizations, even after the reduction or elimination of the imposed restrictions.

The degree of maturity in the use of telecommunication technologies during the pandemic irrevocably expanded the use of distance communication for all stakeholders. What was a limitation became an interesting opportunity.

The auditor gathered information throughout all the planned steps, allowing the construction of the method based on the elements that should be observed and the observer's positioning. This choice had its limits, such as the restrictions imposed by the social context and its complexity of remote work, as well as the worldview of the researcher and other auditors involved. In this case, the study restricted possible generalizations within the same environment where the practice was observed and may have offered limited replication and generalization in other contexts.

Regarding opportunities for improvement, the remote audit system restricts the performance of audit teams since on-site verifications are extremely important to identify non-conformities that can only be verified in person. The alternative to work around this limitation is the use of images (photos and videos) requested during audits. In these synchronous interviews, evidence of the integrity and functioning of the systems and equipment of the audited facility is presented, through updated records during the audits.

For future research proposals, it is recommended to deepen the discussion around the critical success factors of remote audits, and for strategies to prepare the auditees to receive the audits. The audit team has greater experience in conducting all stages of the audit, in particular conducting interviews. On the other hand, there are some indications that the audited team, when not carrying out interviews in a dedicated manner, present difficulties related to the understanding of the objectives, or having adequate interaction with the auditors, especially in moments when consensus is not reached.

Considering the changes caused by the pandemic and its implications on the workforce, it could be said that some changes imposed by remote work brought significant benefits to all stakeholders involved. From an organizational point of view, cost reductions associated with the optimization of space, infrastructure, resources, and provisioning physical workspaces

were highlighted. From the perspective of workforce management, organizations should seek alternatives to reduce or mitigate side effects such as emotional distancing from the team and organizational culture, change of focus associated with delivering results to the detriment of physical presence and other impacts associated with low productivity, which can affect the intended results.

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