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Proposed Integration of the Technical Regulations of Systems of Management of Operational Safety and Structural Integrity of Facilities, defined by the ANP of Brazil

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Abstract *— This article aims to analyze and integrate the main requirements of the Technical Regulations of the Operational Safety Management Systems (RTSGSO), Structural Integrity of Facilities (RTSGI), Terrestrial Pipelines (RTDT), Submarine Systems (RTSGSS) and Wells (RTSGIP) Producers and Injectors, defined by the National Petroleum Agency (ANP), to simplify implementation and integration with other Integrated Management Systems (SGI), such as Quality, Environment, Safety and Health at Work (QMS&ST) in the management of concessionaires and/or operators of oil and natural gas producing fields in Brazil. The methodology used was an exploratory and descriptive research, through a bibliographical review and documentary. As a result, the main requirements of the 5 (five) technical regulations of the operational safety and structural integrity management systems of the facilities, ground pipelines, subsea and well systems were integrated into a structured correspondence matrix model with 17 (seventeen) Management Programs of the RTSGSO, for implementation in the global management of concessionaires and/or operators of oil and natural gas producing fields. This way it was concluded that the matrix with the integration and correspondence of the ANP's technical regulations will simplify the implementation and integration with other management systems such as QMS&ST (SGI) in the global management of the concessionaire company or operator of oil and natural gas producing fields, and will also contribute to the development of data collection tools such as: checklists, to periodically perform diagnoses and/or performance evaluation of implementation and/or maintenance of the management systems applied in the exploration and production of oil and natural gas.*

Keywords *—* ***Exploration and Production of Petroleum. Management Systems. Operational Safety. Integrity of Facilities. National Petroleum Agency.***

I. INTRODUCTION

In the oil industry the process of exploration and production of oil and natural gas onshore and offshore is structured with activities and tasks of high risk for the safety of processes, operational and occupational, workforce, environment and heritage, which may characterize incidents and accidents such as fires, explosions, large oil, gas or high-salinity water leaks, with possibilities for deviations in quality, damage to employees' health, impacts on the environment, fauna , flora, with changes in the quality of water, soil and air, and heritage.

In this context, to ensure operational safety, facility integrity (reliability), environmental preservation and health of the workforce, the National Oil, Natural Gas and Biofuel Agency (ANP), the Brazilian oil industry regulatory body, has developed and issued resolutions and annexes with technical regulations for operational safety and facility integrity management systems to regulate, supervise and perform external audits on Brazilian concessionaires and / or operators of oil and natural gas producing fields.

The main Technical Regulations (RT) defined by the ANP are: Operational Safety Management System (RTSGSO); System Structural Integrity Management System (RTSGI); Terrestrial Pipelines (RTDT); Subsea Systems (RTSGSS) and Well Integrity Management System (RTSGIP).

In this way, this article aims to analyze and integrate the main requirements of the Technical Regulations of the Operational Safety Management Systems (RTSGSO), Structural Integrity of Facilities (RTSGI), Terrestrial

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Pipelines (RTDT), Subsea Systems (RTSGSS) and Wells (RTSGIP) Producers and Injectors, defined by the National Petroleum Agency (ANP), to simplify implementation and integration with other Integrated Management Systems (SGI), such as Quality, Environment, Safety and Health at Work (QMS & ST) in global management of concession companies and / or operators of oil and natural gas producing fields in Brazil.

II. LITERATURE REVIEW

2.1 Exploration and Production of Oil and Natural Gas in Brazil

The exploration and production of oil and natural gas (upstream) is one of the stages of the productive chain of the petroleum sector, with high added value, high risk, great economic impact and technological innovation in Brazil and a higher rate of return on investments (SOUZA, 2006 and SCHIAVI, 2016).

The Exploration and Production Operating Units in Brazil are structured with oil and natural gas fields onshore and offshore, some of these characterized as mature fields, because it has more than thirty years in operation, with can pose a risk of accidents and fluid leaks, with impacts on the safety and health of employees, the environment and quality.

For Thomas (2004), oil and natural gas exploration involves onshore and offshore exploration, drilling and exploration for oilfield / reservoir discoveries.

The production process is characterized by the activities of extraction of oil reserves through the processes of elevation, flow, collection, separation, treatment, storage and transfer of oil, treatment and injection of water, gas handling and processing (THOMAS, 2004 and MANÇÚ, 2018).

In order to minimize risks and regulate exploration and production activities in oil and natural gas fields, offshore and onshore in Brazil, the ANP defined as mandatory the implementation of the requirements of the Technical Regulations for Management of Operational Safety and Integrity of Facilities (RTSGSO, RTSGI, RTDT, RTSGSS and RTSGIP).

2.2 ANP Technical Regulations for the Exploration and Production of Petroleum and Natural Gas in Brazil

The ANP has as one of the main attributions to the promotion of bids for the concession of oil and natural gas blocks, as well as the activities of management, regulation, control of the contracts signed with the concessionary companies and the Union and definition of blocks for bidding, and in 2005 Law No. 11,097 expanded the ANP duties in regulating, regulating and supervising the activities of production, storage, distribution and resale of biodiesel, fuel of vegetable or animal origin, to be added to diesel.

The Technical Regulations RTSGSO, RTSGI, RTSGSS, RTSGSS and RTSGIP Technical Regulations aim to establish requirements and guidelines for implementation and operation, aiming at the operational safety and structural integrity of facilities, pipelines, subsea systems and wells producing and injecting, in the exploration and oil and natural gas production, as well as the protection of human life, the environment, the integrity of the Union's assets, third parties and the Contract Operator (ANP, 2007; ANP, 2010; ANP, 2011; ANP, 2015 and ANP, 2016).

2.2.1 Technical Regulation of the Operational Safety Management System (RTSGSO), published in 2007

The RTSGSO of the Oil and Natural Gas Offshore Drilling and Production Facilities is structured with 17 (seventeen) Management Practices (PGs), distributed between Chapters 2, 3 and 4, and Chapter 2 - Leadership, Personnel and Management structured with 9 (nine) PG; in Chapter 3 - Facilities and Technology with 5 (five) PGs, and in Chapter 4 - Operational Practices with 3 (three) PGs and requirements (Figure 1), which should be applied by the Concession Organizations (OCs) operating in Brazil.

The objective of RTSGSO is to establish requirements and guidelines for the implementation and operation of an Operational Safety Management System (OSMS), aiming at the operational safety of offshore drilling and oil and natural gas production facilities, with the objective of protecting human life and the environment (ANP, 2007).

2.2.2 Technical Regulation of the Structural Integrity Management System of Facilities (RTSGI), published in 2010

The Technical Regulation of the Facilities Integrity Management System (RTSGI) is structured in 03 (three) Chapters, where it presents in Chapter 1 the description of the general provisions, Chapter 2 the organization and operational safety and in Chapter 3 the guarantee of integrity of the installations (Figure 1). The RTSGI defines that the Concessionaire Organization (OC) of an onshore oil and natural gas field must guarantee Structural Integrity of Facilities and Operational Safety, from the design, installation, operation and maintenance of static equipment, pipelines and dynamic equipment, through the best practices of the oil industry, regulations, applicable standards and continuous improvement actions, to ensure the effectiveness of the activities and tasks under their responsibility (ANP, 2010).

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2.2.3 Terrestrial Pipeline Technical Regulation (RTDT), published in 2011

Technical Regulation of Terrestrial Ducts (RTDT) is to guarantee the Integrity and Operational Safety of Terrestrial Pipelines (Pipelines and Gas Pipelines) throughout the life cycle (ANP, 2011). To meet this objective of the regulation, the OCs that operate in Brazil must comply with all the requirements defined in Chapters II to X (Figure 1), from the design phase, construction, assembly, operation, inspection, maintenance structural integrity, emergency response and decommissioning, and pipelines already in operation, requirements should be applied in operation, inspection, maintenance of physical integrity, emergency response and decommissioning the operational safety of the Terrestrial Pipelines (Pipelines and Pipelines).

2.2.4 Technical Regulation of the Submarine System Management System (RTSGSS), published in 2015

The Technical Regulation of the Subsea System Management System (RTSGSS) is structured in the categories of management from 5 to 26 (*Fig. 1*), with their respective requirements of mandatory application and has the objective of managing the operational safety of Submarine Systems, as an essential factor for the reliability of the supply of petroleum, by-products and natural gas in the national market, as well as for the prevention or mitigation of possible accidents that can cause damages to people, facilities / processes and the environment, through the awareness of employees , with standardization of methods, mechanical integrity of equipment and teamwork, to perform a safe, incident-free operation (ANP, 2015).

2.2.5 Technical Regulation of Well Integrity Management System (RTSGIP), published in 2016

Meanwhile, the Technical Regulation of the Well Integrity Management System (SGIP) aims to guarantee the integrity of the wells by defining the responsibilities of oil and natural gas exploration and production companies and establishing operational safety and preservation requirements of the environment for drilling, completion, evaluation, intervention, production and abandonment of oil and natural gas wells (ANP, 2016).

The RTSGIP is structured in two Chapters, with Chapter 1 being the general provisions, divided into six topics, and Chapter 2 presents the 17 (seventeen) Management Practices (PG), mandatory application by the Brazilian Concession Organizations. The Technical Regulations of the ANP were approved by Resolutions: No. 43/2007 (RTSGSO); No. 02/2010 (RTSGI); No. 06/2011 (RTDT); (RTSGSS) and No. 46/2016 (RTSGIP), and are structured according to Figure 1.

ANP RESOLUTION No. 43/2007	**ANP RESOLUTION No. 02/2010**	**ANP RESOLUTION No. 06/2011**	**ANP RESOLUTION No. 43/2015**	**ANP RESOLUTION No. 46/2016**
Technical Regulation of the Operational Safety Management System (**RTSGSO**), of the Maritime Facilities of Perf. and Petroleum Production and Natural Gas	Technical Regulation of the Integrity Management System (**RTSGI**) Structural of Terrestrial Petroleum and Natural Gas Production Facilities	Technical Regulation of Terrestrial Ducts (**RTDT**) for Petroleum, Derivatives and Natural Gas Handling	Technical Regulation of the Subsea Systems Operational Safety Management System (**RTSGSS**)	Technical Regulation of the Integrity Management System of the Terrestrial and Marine Well Production Facilities (**RTSGIP**) for Oil and Natural Gas
CORRELATION OF THE REQUIREMENTS OF ANP TECHNICAL REGULATIONS				
RTSGSO	**RTSGI**	**RTDT**	**RTSGSS**	**RTSGIP**
1. Purpose	1. Introduction	1. Introduction	1. Introduction	1. Introduction
2. Definitions	3. Definitions	4. Definitions	2. Definitions	3. Definitions
3. Scope	4. Scope	6. Scope	3. Scope	4. Scope
		3. Scope		
4. Structure of Management Practices (PG)				
5. Operational Safety Documentation (DSO)	10. Documentation of Operational Safety (DSO)		4. Registration of Submarine Systems	
	5. Normative and Legal References	5. Normative and Legal References		
		2. Protocol of Responsibilities	5. Protocol of Responsibilities	
PG 1. Culture of Safety, Commitment and Managerial Responsibility	6. Organizational Structure, Qualification and Training	31. Organizational Structure	6. Culture of Safety, Commitment and Managerial Responsibility	Management Practice (PG) 1. Culture of Safety, Commitment and Managerial Responsibility
		32. Availability and Resource Planning		
PG 2. Staff Involvement		33. Employee Involvement	7. Involvement of the Work Force	PG 2. Involvement of the Work Force

CONTINUATION				
RTSGSO	**RTSGI**	**RTDT**	**RTSGSS**	**RTSGIP**
PG 3. Qualification, Training and Performance of Personnel	6. Organizational Structure, Qualification and Training	34. Identification of Critical Tasks	8. Qualification, Training and Performance of Work Force	PG 3. Competency Management
		35. Qualification Training		
PG 4. Work Environment and Human Factors			9. Working Environment and Human Factors	PG 4. Human Factors
PG 5. Selection, Control and Management of Contractors	6. Organizational Structure, Qualification and Training	36. Contratadas	10. Selection, Control and Management of Companies	PG 5. Selection, Control and Management of Companies

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CONTINUATION				
RTSGSO	**RTSGI**	**RTDT**	**RTSGSS**	**RTSGIP**
6. Monitoring and Continuous Improvement of Performance			11. Monitoring and Continuous Improvement of Performance	Management Practice # 6: Monitoring and Continuous Improvement of Performance
PG 7. Audits			12. Internal Audit	PG 7. Audits
PG 8. Information and Documentation Management	7. Information and Documentation		13. Information and Documentation Management	PG 8. Information and Documentation Management
PG 9. Incident Investigation	9. Emergency Plan		14. Incident Investigation	PG 9. Incidents
PG 10. Design, Construction, Installation and Deactivation	12. Installation Design	8. Project Documentation	20. Project	PG 10. Well Life Cycle Steps
	13. Installation Construction and Assembly	11. Construction and Assembly	21. Manufacturing and Installation	
		12. "As Built"	24. Reuse	
		13. Commissioning	25. Length of life	
	18. Deactivating the Installation	50. Temporary Deactivation	26. Decommissioning and Deactivation	
		51. Permanent Deactivation		
PG 11. Critical Operational Safety Elements	14. Critical Elements of Operational Safety	15. Operation	15. Critical Elements of Operational Safety	PG 11. Critical Elements of Well Integrity
PG 12. Identification and Risk Analysis	8. Identification and Risk Analysis	9. Risk Assessment	16. Risk Analysis	PG 12. Risk Analysis
PG 13. Mechanical Integrity	15. Inspeção de Equipamentos e Tubulações	16. Inspection	23. Integrity Management	PG 13. Well Integrity
	16. Equipment and Pipe Maintenance	17. Maintenance		
		25. Corrosion Control		
		26. External Corrosion Control		
		27. Internal Corrosion Control		
		28. Control of Atmospheric Corrosion		

CONTINUATION				
RTSGSO	**RTSGI**	**RTDT**	**RTSGSS**	**RTSGIP**
PG 13. Mechanical Integrity	16. Equipment and Pipe Maintenance	29. Time limits	23. Integrity Management	PG 13. Well Integrity
		38. Integrity Management Program		
PG 14. Planning and Management of Major Emergencies	9. Emergency Plan	41. Emergency Identification	18. Emergency Planning and Management	PG 14. Well Control Emergency Planning and Management
		42. Emergency Response Plan		
		43. Pipelines		
		44. Gas pipelines		
		45. Management of Response Resources		
		46. Communication of the Incident		
		47. Incident Investigation		
		48. Management of the Emergency Response Plan		
PG 15. Operational Procedures	17. Operation and Process	15. Operation	22. Operation	PG 15. Procedures
PG 16. Change Management		19. Change Management System	17. Change Management	PG 16. Change Management
PG 17. Safe Work Practices and Control Procedure in Special Activities		15. Operation	19. Safe Work Practices and Control Procedures in Special Activities	PG 17. Environmental Preservation
		8. Duct History Log		
		20. Signaling of Pipeline Ranges		
		22. Public awareness		
		23. Prevention of Third Party Damages		
		39. Basic Processes of PGI		

Fig. 1 - Matrix of Correspondence of the mandatory requirements of the Technical Regulations of the ANP

Source: Prepared by the author of ANP, 2007; ANP, 2010; ANP, 2011; ANP, 2015 and ANP, 2016.

The technical regulations defined by ANP correspond to their mandatory application requirements for integration and structuring in a single management system, with the objective of rationalizing resources, reducing bureaucracies and simplifying the process of unification with other management systems of the organization.

III. METHODOLOGY

The methodology used was an exploratory and descriptive research, through a bibliographical review and documentary research. According to Gil (2016) and Lacerda (2016), the exploratory research aims to develop, explain and modify concepts and ideas for the formulation of later approaches.

For Martins (2016), the bibliographic research is characterized by a survey of all the information related to the subject to be researched in academic articles and recognized books, being this practice common to almost all scientific works.

The documentary research seeks to research unedited material, such as letters, memoranda, written reports, formal studies, administrative documents, procedures, regulations, policies and organizational guidelines and others, increasingly available on the Internet. Documents can be evaluated in workplaces, internet sources, and archives and libraries (OLSEN, 2015).

IV. RESULTS AND DISCUSSION

An analysis and integration of the requirements of the 5 (five) Technical Regulations of the Management Systems of Operational Safety and Structural Integrity of the Facilities, Terrestrial Pipelines, Submarine and Well Systems (RTSGSO; RTSGI; RTDT; RTSGSS and RTSGIP) of ANP , using the structure and reference the Management Practices (PG's) 1 to 17 and other requirements of the RTSGSO.

The results of the integration of the main requirements of the ANP technical regulations are defined in the Figures 2 a 19. And this starts with the following items: integrated objective, definitions, systems comprehensiveness, inclusion obligation, updating of pipeline information in the submarine system registry, safety documentation (DSO), and procedure of the protocol of responsibilities, for the companies that operate a same duct.

The introductory phase of the ANP technical regulations (*Fig. 2*) is characterized by the obligation to

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comply with normative and legal references and the elaboration of technical documents (DSO), focusing on the safety and integrity of the facilities.

ANP RESOLUTION No. 43/2007 (RTSGSO); No. 02/2010 (RTSGI); No. 06/2011 (RTDT); 41/2015 (RTSGSS) AND No. 46/2016 (RTSGIP), DEFINED BY THE NATIONAL PETROLEUM, NATURAL GAS AND BIOFUELS (ANP) AGENCY IN BRAZIL		
TECHNICAL REGULATION (RT)	**REQUIREMENTS WITH REFERENCE TO RTSGSO**	**MAIN COMMON AND SPECIFIC PRACTICES MANAGEMENT AND OPERATIONAL**
RTSGSO / RTSGI / RTDT / RTSGSS / RTSGIP	1. Purpose	Implement a system for managing the safety and structural integrity of facilities, pipelines, submarine system and wells, maritime and terrestrial concession.
RTSGSO / RTSGI / RTDT / RTSGSS / RTSGIP	2. Definitions	Know the definition of terms of operational safety and integrity of facilities, pipelines, submarine system and wells, maritime and terrestrial concession.
RTSGSO / RTSGI / RTDT / RTSGSS / RTSGIP	3. Scope	Apply the technical regulations in the Exploration and Production facilities, pipelines, submarine systems and wells in land and sea.
RTSGSO	4. Structure of Management Practices (PG)	Implement RTSGSO's 17 Management Practices (PG) in the organization's global management and RTSGI, RTDT, RTSGSS and RTSGIP requirements.
RTSGSS	5. Subsea Systems Registry	The concessionaire or operator must include and update the information contained in existing and new pipelines in the Cadastre of Submarine Systems of ANP.
RTSGSO / RTSGI	6. Operational Safety Documentation (DSO)	The Concessionaire must submit to the ANP the Operational Safety (DSO) documentation for offshore and onshore concessions: 1-Correlation Matrix (MC); 2-Description of the Maritime Unit (DUM) and Terrestrial Unit (DUT); 3-Concessionaire Information Report (RIC) "sea"; 4-General arrangement of the installation; 5 - Installation Process Flowchart; 6-Electric classification of areas; and 7-List of Critical Elements of Operational Safety.
RTSGI / RTDT	7. Normative and Legal References	Comply with a list of standards, codes and good engineering practices.
RTDT / RTSGSS	8. Protocol of Responsibilities (PR)	Elaborate the PR when two or more companies are involved in the operation of pipelines or pipeline system with definition of responsibilities.

Fig. 2 - Integration of Technical Regulations, Requirements, Management Programs (PG) Main Management and Operational Practices
Source: Prepared by the author of ANP, 2007; ANP, 2010; ANP, 2011; ANP, 2015 e ANP, 2016.

The Management Practics (PG) 1 is characterized by a culture of security, commitment and managerial responsibilities through the definition of values and politics, organizational structure, responsibilities, qualifications and attributions of the workforce, communication system with the workforce and availability of resources to ensure operational safety (*Fig. 3*).

With the implementation of PG 1, the organization defines its course based on normative, legal and engineering best practices references, with attributions and responsibilities for the workforce, from the definition of values, political, objectives, goals, indicators performance, plan of action and availability of the resources needed to achieve them.

TECHNICAL REGULATION (RT)	**PG 1 - CULTURE OF SAFETY, COMMITMENT AND MANAGEMENT RESPONSIBILITY**	**MAIN COMMON AND SPECIFIC PRACTICES MANAGEMENT AND OPERATIONAL**
RTSGSO / RTSGI / RTDT / RTSGSS / RTSGIP	1.1 Objective	Define the values, the security Politics; organizational structure; responsibilities and attributions; process of communication and availability of resources.
	1.2 Values and Security Politics	The Installation Operator shall establish and disclose the values and the Safety Politics for the personnel involved in the Installation activities.
	1.3 Organizational Structure and Management Responsibility	Establish the organizational structure for the management of the Installation with regard to Operational Safety.
		Implement an organizational structure with responsibilities, qualifications and assignments, so that the Workforce.
		Ensure the effective participation of Installation Managers in activities related to Operational Safety.
		Define the assignments and responsibilities of the entire workforce in Operational Safety, including the management of the Facility and other employees.
	1.4 Communication System	Inform the workforce about the Politics, values, goals and plans to achieve the established performance for the operational safety of the facility.
		Establish reciprocal and continuous communication mechanisms between the Facility Management and the workforce in order to improve operational safety.
	1.5 Availability and Resource Planning	Plan and provide the necessary resources for the implementation and operation of the management systems and fulfill the other established requirements.

Fig. 3 - Integration of Technical Regulations, Requirements, Management Programs (PG) Main Management and Operational Practices
Source: Prepared by the author of ANP, 2007; ANP, 2010; ANP, 2011; ANP, 2015 e ANP, 2016.

The implementation of PG 2 (*Fig. 4*) aims to promote the involvement and participation of the workforce, with awareness activities, related information and conditions for the development, implementation and periodic review of procedures and / or safety management systems.

TECHNICAL REGULATION (RT)	**PG 2 - INVOLVEMENT OF PEOPLE**	**MAIN COMMON AND SPECIFIC PRACTICES MANAGEMENT AND OPERATIONAL**
RTSGSO / RTDT / RTSGSS / RTSGIP	2.1 Objective	Promote the involvement, awareness and participation of the workforce in the application of the SGSO.
	2.2 Participation of People	Establish conditions for the participation of the workforce in the development, implementation and periodic review of the SGSO.
		Promote awareness and information activities related to the SGSO.
RTSGI	2.3 Organizational Structure, Qualification and Training	Provide conditions for the participation of the Labor Force in the development, implementation and periodic review of procedures, work instructions and other documents.

Fig. 4 - Integration of Technical Regulations, Requirements, Management Programs (PG) Main Management and Operational Practices
Source: Prepared by the author of ANP, 2007; ANP, 2010; ANP, 2011; ANP, 2015 e ANP, 2016.

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For the organization to achieve the planned results, it becomes strategic to develop work environments, focused on team analysis and decision making, based on risk studies, incident and accident investigation, and lessons learned, as well as education, awareness and participation workforce, to provide greater commitment and operational discipline.

The definition of qualification, training and personnel performance, according to PG 3 (*Fig. 5*), is one of the most relevant programs to meet the goals and objectives of an organization, because it is concerned with the education and training of the workforce, to comply with the operational procedures critical and non-critical in a safe and efficacious manner.

TECHNICAL REGULATION (RT)	PG 3 - QUALIFICATION, TRAINING AND PERFORMANCE OF PEOPLE	MAIN COMMON AND SPECIFIC PRACTICES MANAGEMENT AND OPERATIONAL
RTSGSO / RTSGI / RTDT / RTSGSS	3.1 Objective	Ensure that the workforce performs its functions safely.
	3.2 Organizational Structure	Define the organizational structure of the facility, establishing the classification of functions and tasks related to the position held.
		Identify the levels of training, competence, skill and knowledge specific to the role.
	3.3 Training / Critical Tasks	Establish the training requirements so that your employees are able to perform the tasks related to the position held.
		Scale the training program according to the classification of duties and the tasks to be performed.
		Ensure that contractors establish the training requirements.
		Establish the qualification and training necessary to carry out the activities provided for in the operational procedures.
		Consideration should be given to: Awareness Training (workforce and visitors), General Training and Specialized Training.
		Maintain evidence that the workforce has received appropriate training to perform its functions and evaluate effectiveness.
RTSGIP	3.4 Competency Management	Establish, document and implement the workforce's responsibilities and responsibilities for Well Integrity Management.
		Identify and ensure academic training, levels of training, experience, skill and knowledge specific to each function of the Workforce.
		Establish, implement and document mechanisms to periodically evaluate the ability and competence of the Workforce.
	3.5 Training Logging and Verification	Establish, document and implement methodology for monitoring and recording Workforce training.
		Keep up to date the workforce's functional register in order to ensure traceability, validity of training and technical qualification.

Fig. 5 - Integration of Technical Regulations, Requirements, Management Programs (PG) Main Management and Operational Practices
Source: Prepared by the author of ANP, 2007; ANP, 2010; ANP, 2011; ANP, 2015 e ANP, 2016.

For the training of the workforce, proficiency analysis by function and activities is recommended, with the structuring of a training matrix of compulsory legal compliance courses and others defined by the organization.

In PG 4 (*Fig. 6*), the organization must implement resources that promote a good work environment, with mapping and analysis of the aspects considering the human factors, with awareness activities for the possible risks that can characterize an incident or an accident.

REGULAMENTO TECNICO (RT)	PG 4 - WORK ENVIRONMENT AND HUMAN FACTORS	MAIN COMMON AND SPECIFIC PRACTICES MANAGEMENT AND OPERATIONAL
RTSGSO / RTSGSS / RTSGIP	4.1 Objective	Promote an adequate working environment and consider human factors throughout the Installation lifecycle.
	4.2 Working Environment and Human Factors	Analyze aspects of the work environment by considering human factors in all phases of the Installation lifecycle.
		In the design, construction, installation and deactivation phases, codes and standards of aspects of work environment and human factors should be identified.
		In the operational phase, awareness of the workforce should be promoted in situations and conditions that may cause incidents.

Fig. 6 - Integration of Technical Regulations, Requirements, Management Programs (PG) Main Management and Operational Practices
Source: Prepared by the author of ANP, 2007; ANP, 2015 e ANP, 2016.

The work environment and human factors have a direct influence on the work pace and productivity of the workforce, based on their abilities, effort, working conditions, aspects of activities, stress levels and process stability.

For the process of selection, control and management of contractors defined in PG 5 (*Fig. 7*), the organization shall establish the criteria in a documented operational procedure, including the obligation to map training, conduct, evaluate effectiveness and control training records and awareness of the contracted workforce, as well as indicators for evaluating the performance of critical activities and tasks.

TECHNICAL REGULATION (RT)	PG 5 SELECTION, CONTROL AND MANAGEMENT OF CONTRACTORS	MAIN COMMON AND SPECIFIC PRACTICES MANAGEMENT AND OPERATIONAL
RTSGSO / RTSGI / RTDT / RTSGSS / RTSGIP	5.1 Objective	Establish criteria for selection and evaluation of contractors, considering aspects of operational safety in the activities covered by this Technical Regulation.
	5.2 Selection and Evaluation of Contractors	Establish criteria for selection and evaluation of performance of contractors, according to the risk of the activities to be carried out, that consider aspects of operational safety.
	5.3 Responsibilities of the Installation Operator	Establish the responsibilities of contractors related to Operational Safety.
		Ensure trained, educated employees about hazards and responsibilities regarding PRE / PEL and to report hazards identified at the facility.
	5.4 Training of Contractors	Evidence should be maintained that the contractor's employees have received adequate training in the performance of their duties in a safe manner.

Fig. 7 - Integration of Technical Regulations, Requirements, Management Programs (PG) Main Management and Operational Practices

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Source: Prepared by the author of ANP, 2007; ANP, 2010; ANP, 2011; ANP, 2015 e ANP, 2016.

Organizations that outsource their activities purposes or means should elaborate procedures with contracted company responsibilities, selection criteria, indicators, evaluation of performance of critical activities, quality control and actions of improvements, with data storage and traceability.

In PG 6 (*Fig. 8*), the process of monitoring and continuous improvement of the performance of the organization, where it is necessary to establish the operational safety objectives, with goals and performance indicators, period and critical analysis, with preventive and corrective actions and regular performance reviews.

TECHNICAL REGULATION (RT)	PG 6. MONITORING AND IMPROVEMENT OF PERFORMANCE	MAIN COMMON AND SPECIFIC PRACTICES MANAGEMENT AND OPERATIONAL
RTSGSO / RTSGSS / RTSGIP	6.1 Objective	Establish performance indicators and targets that assess the effectiveness of management systems and promote continuous improvement in safety.
	6.2 Safety Performance Indicators and Targets	Establish objectives and evaluate Operational Safety performance.
		Establish proactive and reactive Operational Safety performance indicators and regular performance reviews.
		Establish a system of corrective and preventive actions when there is insufficient performance.
	6.3 Monitoring	Establish and maintain documented procedures to regularly monitor and measure operations and activities that may cause incidents.
		Procedures should include recording information to track performance, operational controls, and compliance with targets.
		Establish means for periodic assessment of compliance with relevant safety legislation and regulations.

Fig. 8 - Integration of Technical Regulations, Requirements, Management Programs (PG) Main Management and Operational Practices

Source: Prepared by the author of ANP, 2007; ANP, 2010; ANP, 2011; ANP, 2015 e ANP, 2016.

The organization should systematize the monitoring and monitoring of the results with trained people, application of data collection instrument and update of performance indicators, with actions to ensure the effectiveness of management systems.

The internal and external audit process defined in PG 7 (*Fig. 9*) should be planned, conducted objectively and impartially. This is a process of evaluation of the effectiveness of implementation and operation of management systems, so for continuous improvement.

TECHNICAL REGULATION (RT)	PG 7. AUDIT	MAIN COMMON AND SPECIFIC PRACTICES MANAGEMENT AND OPERATIONAL
RTSGSO / RTSGSS / RTSGIP	7.1 Objective	The objective of this management practice is to evaluate the effectiveness of the implementation and operation of the ANP's technical regulations through audits.
		The audit may be internal or third party, considering all requirements of the regulations and performed in an objective and impartial manner.
	7.2 Audit Planning	Prepare an audit plan for the different phases of the Life Cycle of the facility and define the audit teams.
		The Audit plan should be designed to consider the management practices applicable to the life cycle phase of the facility.
		The audit plan should present the areas and activities to be audited.
		Previous audits, performance reviews, accident investigations and accident risks will be considered in the preparation of the audit plan.
		The composition of the audit team will be within the scope of the audit.
	7.3 Execution of the Audit	All necessary information will be made available to the audit team.
		Stipulate the audit cycle, considering a maximum term of two (2) years. In special situations the maximum period may be changed to 3 (three) years.
		The first audit in management practice No. 11 - Critical Elements of Operational Safety must be performed before the start of the operation.
		The first audit of the management system shall be carried out within one year after the start of the operation.

TECHNICAL REGULATION (RT)	CONTINUATION PG 7. AUDIT	MAIN COMMON AND SPECIFIC PRACTICES MANAGEMENT AND OPERATIONAL
RTSGSO / RTSGSS / RTSGIP	7.3 Execution of the Audit	For production facilities, the requirements established in management practice 10 - Project, Construction, Installation and Deactivation will be audited after completion of the project detail, but before the start of the operation.
		Practice # 4 - Work environment and human factors - should be audited in the design phase and checked periodically during the operation.
		The Operator of the Installation must have the reports of the audits carried out.
		The Installation Operator shall prepare the action plan for the treatment of nonconformities and disclose the actions in progress to the workforce.
	7.4 Evaluation of the Audit	The Operator of the Facility shall prepare the action plan for the treatment of nonconformities and disclose the actions in progress to the work force.

Fig. 9 - Integration of Technical Regulations, Requirements, Management Programs (PG) Main Management and Operational Practices

Source: Prepared by the author of ANP, 2007; ANP, 2010; ANP, 2011; ANP, 2015 e ANP, 2016.

The audits should be carried out by a multidisciplinary team, with specialist in the areas of audit scope, carried out in a maximum period of two (2) years, with elaboration of audit report, plan of action for the treatment of identified nonconformities, and disclosure of the actions in progress for the workforce involved in the activity.

In PG 8 (*Fig. 10*) defines the process of information and documentation management where the organization must define documented procedure for the development, updating, distribution, integrity control and guarantee of

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adequate access to the operational procedures of the production processes, information and documentation of the installation required to comply with the ANP's technical regulations.

TECHNICAL REGULATION (RT)	PG 8 INFORMATION AND DOCUMENTATION MANAGEMENT	MAIN COMMON AND SPECIFIC PRACTICES MANAGEMENT AND OPERATIONAL
RTSGSO / RTSGI / RTSGSS / RTSGIP	8.1 Purpose	The Operator of the Installation will define in its system of management, procedures of control and access to the documentation regarding the operational safety.
	8.2 Responsibilities in Information Management	Establish a documentation control system for the development, updating, distribution, control and integrity of the information and of all documentation necessary to comply with this Technical Regulation.
	8.3 Access to Information	Ensure adequate access of personnel to installation information and documentation that are relevant to this Technical Regulation.

Fig. 10 - Integration of Technical Regulations, Requirements, Management Programs (PG) Main Management and Operational Practices

Source: Prepared by the author of ANP, 2007; ANP, 2010; ANP, 2011; ANP, 2015 e ANP, 2016.

The information and documentation in an organization are strategic to the process of internal communication and decision making, to reach the objects and goals of the management systems of the ANP.

In order to comply with PG 9 (*Fig. 11*), of incident investigation, the organization shall establish a procedure with the guidelines and criteria for conducting the investigation of incidents that is affecting operational safety, reporting by the investigation team, corrective action plan for the basic causes, communication to the workforce of the facility and filing of the report for consultation of the ANP, when necessary.

TECHNICAL REGULATION (RT)	PG 9 INVESTIGATION OF INCIDENTS	MAIN COMMON AND SPECIFIC PRACTICES MANAGEMENT AND OPERATIONAL
RTSGSO / RTSGSS / RTSGIP	9.1 Purpose	The purpose of this management practice is to describe the requirements that must be considered in conducting the investigation of each incident.
	9.2 Procedures and Organization of Research	Prepare a procedure to investigate incidents with adverse consequences to the Operational Safety and include: team size and composition, criteria for conducting the incident, conducting interviews, collecting and identifying appropriate records and records.
		Conduct the investigation with strict observance of the legal impositions.
	9.3 Execution of Investigation	The investigation team shall commence work within 48 hours of the closure of the incident, except by force majeure.
		Prepare the incident investigation report.
	9.4 Corrective Actions	Prepare the incident investigation report.
RTSGI	9.5 Preventive Actions	The incident investigation report should be archived and always available for consultation by the ANP.

Fig. 11 - Integration of Technical Regulations, Requirements, Management Programs (PG) Main Management and Operational Practices

Source: Prepared by the author of ANP, 2007; ANP, 2010; ANP, 2011; ANP, 2015 e ANP, 2016.

Communication to the workforce of the installation of incident investigations and lessons learned is characterized as a process of awareness and continuous improvement for operational safety.

For the organization meeting the PG 10 (*Fig. 12*) must meet the criteria defined in the project and make acquisitions, according to standards, industry standards and good engineering practices, structure mandatory documentation and management on aspects that may pose risks to operational safety.

TECHNICAL REGULATION (RT)	PG 10. DESIGN, CONSTRUCTION, INSTALLATION AND DISABLED	MAIN COMMON AND SPECIFIC PRACTICES MANAGEMENT AND OPERATIONAL
RTSGSO / RTSGI / RTDT / RTSGSS	10.1 Purpose	The objective of this management practice is to describe the requirements of management systems to promote safety in the design, construction, installation and deactivation phases.
	10.2 Management and Organization	Meet project criteria to identify and consider industry standards, industry standards, and good engineering practices related to Operational Safety.
		Procurement of installation items and equipment must meet engineering standards, standards and best practices.
		At the design stage it should reduce human exposure to the consequences of eventual equipment or system failures.
	10.3 Safety in the Design, Construction, Installation and Deactivation Phases	Identify all aspects that could introduce operational safety risks.
		Identify the human factors and those related to the work environment and define ways to change design when identifying.
RTDT	10.4 "As Built"	In case of duct operation must have a procedure that guarantees the availability of the document "as built" in the construction and assembly phase.
RTDT	10.5 Commissioning	Provide the duct commissioning certificate (s), in accordance with legal regulations, after the completion of the construction and assembly services.
		The Commissioning certificate (s) must be properly archived and available for consultation throughout the life of the Duct.
		At the commissioning stage you should check if: the construction and equipment are in accordance with the project; the procedures for safety, operation, maintenance and inspection are up to date and adequate; the risk analysis was performed and the recommendations met; and if there was training for the qualification of all personnel involved.

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TECHNICAL REGULATION (RT)	CONTINUATION PG 10. DESIGN, CONSTRUCTION, INSTALLATION AND DISABLED	MAIN COMMON AND SPECIFIC PRACTICES MANAGEMENT AND OPERATIONAL
RTSGSS	10.6 Manufacture and installation of submarine system	For the mechanical integrity and operational safety of the subsea system, the minimum requirements for manufacturing, installation and commissioning must be established.
		Manufacturing and Installation must meet the requirements of standards and codes, best practices in the industry, conditions of the environmental license.
		Transport, Handling, Storage and Preservation of Materials, procedures for transportation, handling, storage, preservation and inspection of materials and the protection measure must be developed, implemented and documented. Welding must be developed, implemented and documented qualified procedure, with the requirements to be carried out in the welding processes.
		Launching, before starting the work, a contingency procedure for risk analysis scenarios should be developed, implemented and documented. To elaborate, implement and document submarine system launch procedures.
		Post-Laid Survey should perform underwater inspection with record post-release images and prepare Post-Laid Survey Report.
		Commissioning should establish, implement and document procedure for the Commissioning containing leak test and / or hydrostatic test and others.
		Commission Report should prepare a Commissioning Report, containing description and location of the part of the Submarine System and others.
		Manufacturing and Installation Documentation shall ensure that the "as built" documents generated during the manufacturing and installation phase are properly filed.
		For the mechanical integrity and operational safety of the subsea system, the minimum requirements for manufacturing, installation and commissioning must be established.
		Manufacturing and Installation must meet the requirements of standards and codes, best practices in the industry, conditions of the environmental license.

TECHNICAL REGULATION (RT)	CONTINUATION PG 10. DESIGN, CONSTRUCTION, INSTALLATION AND DISABLED	MAIN COMMON AND SPECIFIC PRACTICES MANAGEMENT AND OPERATIONAL
RTSGSS	10.7 Reuse	Undertake a new project, analyze the tensions and applied loads of the collection, the new launch and the operational phase in the new location.
		Perform and document integrity assessment of the reused Subsea System, remaining life and damages that may occur during collection.
		Ensure that static functions are not reused for dynamic functions and perform decommissioning.
		Elaborate, implement and document a procedure for the collection of the duct in order to preserve its integrity.
		The reuse report should contain the previous and current location of the Submarine part of the Submarine System, the physical limits, the result of the Integrity assessment, and others.
RTSGSS	10.8 Extension of life	Perform an assessment with risk analysis for life extension, Integrity assessment, operational history analysis, maintenance, monitoring and control of Corrosion, inspection, testing and testing, interventions and history of integrity and other assessments.
		The useful life extension report should include the location of the part of the Submarine System, with the physical limits, results of the evaluations, expected Corrosion rate and others.
		Determine new Security Envelope, review and adjust the integrity management program, operational procedures, maintenance, inspection, testing and testing, in accordance with the new conditions set out in the Security Envelope.
		Communication of the project life extension shall be made to the ANP at least 01 (one) year in advance.

TECHNICAL REGULATION (RT)	CONTINUATION PG 10. DESIGN, CONSTRUCTION, INSTALLATION AND DISABLED	MAIN COMMON AND SPECIFIC PRACTICES MANAGEMENT AND OPERATIONAL
RTSGIP	10.9 Well Life Cycle Steps	The well design must adhere to legal requirements, industry best practices, and project assumptions, with procedures and standards.
		In the construction of the well, carry out a technical meeting before well construction with the contractor, to review the well program, risk analysis and well delivery documentation (Well Handover).
		In the Production or Injection of the Well, it shall ensure that the operational parameters related to the elements of the CSB are monitored and managed, with limits for each operational parameter, contingency procedures if the limits of operational parameters are reached, with operational procedures for starting and stopping well, upgrade and passing of well delivery documentation (Well Handover).
		In the intervention of the well to elaborate, document and implement intervention program or procedure; detail the activities of the Intervention Stage with the participation of the Contractor, signed Intervention program, update and pass the well delivery documentation (Well Handover).
		In the Abandonment of the Well, they must guarantee the isolation of the intervals that present Flow Potential, current and future. In the Permanent Abandonment of wells, it is necessary to isolate the formations with Potential Flow connected by well drilling and others. In the ground well remove the equipment from the wellhead and cut the linings and the conductor at the level of the base of the well and update the documentation of well delivery (Well Handover);
		In the temporary abandonment of the well, it must guarantee the preservation of the integrity of the wellhead, in order to provide a safe return to the activities, establish an adequate periodic visual inspection program in the vicinity of the well, years, upgrade and pass well delivery documentation (Well Handover).

Fig. 12 - Integration of Technical Regulations, Requirements, Management Programs (PG) Main Management and Operational Practices

Source: Prepared by the author of ANP, 2007; ANP, 2010; ANP, 2011; ANP, 2015 e ANP, 2016.

From the design phase to the decommissioning phase, it becomes strategic to adopt practices of study of process risks, with analysis of the different scenarios, definition of causes and consequences, safeguards for protection and mitigation, with quantitative and qualitative evaluation criteria, recommendations, deadlines and responsible, monitoring and monitoring of performance indicators and records control.

The PG 11 (*Fig. 13*) is characterized by the identification, management and control of the critical elements of operational safety, such as: critical equipment, systems and procedures, defined as protection or mitigation safeguard, after analysis of causes and consequences for the scenarios analyzed.

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TECHNICAL REGULATION (RT)	PG 11. CRITICAL ELEMENTS OF OPERATIONAL SAFETY	MAIN COMMON AND SPECIFIC PRACTICES MANAGEMENT AND OPERATIONAL
RTSGSO / RTSGI / RTDT / RTSGSS	11.1 Purpose	Describe the requirements for identifying, managing, and controlling Critical Operational Safety Elements of the facility.
	11.2 Identification of Critical Elements of Operational Safety	Identify and describe the essential characteristics and functions of Critical Elements of Operational Safety: Critical Equipment; Critical Systems; and Critical Operational Safety Procedures, essential for safeguarding prevention or mitigation, where failure causes an accident.

TECHNICAL REGULATION (RT)	CONTINUATION PG 11. CRITICAL ELEMENTS OF OPERATIONAL SAFETY	MAIN COMMON AND SPECIFIC PRACTICES MANAGEMENT AND OPERATIONAL
RTSGSO / RTSGI / RTDT / RTSGSS	11.3 Management and Control of Critical Operational Safety Elements	Establish contingency procedures and approval and control system for degraded or non-operational Critical Equipment or Systems.
		Establish temporary measures with deadlines for lack of Critical Equipment or Systems due to failure, degradation or out of operation.
		Implement equivalent alternative controls; Reduction and limitation of production; isolation and shutdown of equipment, systems, installations.
RTDT	11.4 Operation	Identify equipment and systems critical for operational safety.
		Implement a maintenance and calibration program for the reliability of the critical equipment and systems of the Pipelines and their facilities.
RTSGIP	11.5 Critical Elements of Well Integrity	Identify Critical Elements of Well Integrity including Barrier Solidarity Sets (CSB); the equipment, systems and procedures responsible for activating the elements of the CSBs and monitoring the integrity of the CSBs and the Diverter System.
		Ensure at least 02 (two) independent CSBs (Primary and Secondary) or 02 (two) during Construction Stages throughout the Life Cycle of the Well.
		In the intervention and temporary abandonment of well assess the risks and apply mitigation and control measures, in order to maintain them at an ALARP level. Install a DHSV (SSSV) into the well as a CSB and periodically evaluate the non.
		The hydrostatic column of the fluid in the non.

Fig. 13 - Integration of Technical Regulations, Requirements, Management Programs (PG) Main Management and Operational Practices
Source: Prepared by the author of ANP, 2007; ANP, 2010; ANP, 2011; ANP, 2015 e ANP, 2016.

In the organization critical equipment and systems need management, control, maintenance plan and calibration, to guarantee their reliability.

In PG 12 (*Fig. 14*), for identification and risk analysis, the organization shall establish a procedure with methodology, criteria and guidelines for tool application, with the objective of identification, control measures and recommendations for mitigation and risk prevention.

TECHNICAL REGULATION (RT)	PG 12. IDENTIFICATION AND ANALYSIS OF RISK	MAIN COMMON AND SPECIFIC PRACTICES MANAGEMENT AND OPERATIONAL
RTSGSO / RTSGI / RTDT / RTSGSS / RTSGIP	12.1 Objective	Establish requirements for identifying and analyzing risks that can result in incidents to be conducted at different stages of the installation's life cycle through the use of recognized tools and documented results.
		Identify and analyze qualitative or quantitative risks, with the purpose of recommending actions to control and reduce incidents.
	12.2 Types of Risk Analysis	Define the scope considering the Critical Elements of Operational Safety, other analyzes of risks in the Installation or similar installations; historical analysis of incidents occurring in the Installation or similar ones; layout, human factors and external causes applicable; classify identified risks; identify the actions necessary for risk mitigation and prevention.
		Risk identification and analysis must be performed by a multidisciplinary team and approved by the person in charge of the Installation or by a person designated by the company or organization legally responsible for the Installation.
RTSGSO / RTSGI / RTDT / RTSGSS / RTSGIP	12.3 Methodology for Identification and Risk Analysis	Prepare the report of identification and analysis of risks with the objective, scope of the study, description of the Installation, part of the installation, system or equipment that will be submitted to the analysis; justification of the risk analysis methodology used; description of the risk analysis methodology used; risk identification and analysis; classification of risks; and recommendations and findings and make it available for consultation in audits, inspections or verifications.

TECHNICAL REGULATION (RT)	CONTINUATION PG 12. IDENTIFICATION AND ANALYSIS OF RISK	MAIN COMMON AND SPECIFIC PRACTICES MANAGEMENT AND OPERATIONAL
RTSGSO / RTSGI / RTDT / RTSGSS / RTSGIP	12.4 Execution of Risk Analysis	Implement corrective actions referring to the recommendations contained in the risk analysis. In case of changes in the implementation of these actions or in their rejection, they must justify their decisions, evidence that risks were systematically assessed.
	12.5 Elaboration of the Report of Identification and Analysis of Risks	Elaborate the report of identification and analysis of risks with the scope of the study, description of the installation, part of the installation, system or system that will be submitted for analysis; justification of the risk analysis methodology; description of the risk methodology used; risk identification and analysis; classification of risks; and recommendations and exits available for consultation in audits, inspections or verifications.
	12.6 Results	Implement corrective actions to the recommendations in the risk analysis. In the case of actions that require their action or their rejection, they must justify their decisions; evidence that risks were systematically assessed.

Fig. 14 - Integration of Technical Regulations, Requirements, Management Programs (PG) Main Management and Operational Practices
Source: Prepared by the author of ANP, 2007; ANP, 2010; ANP, 2011; ANP, 2015 e ANP, 2016.

Process risk studies are aimed at ensuring operational and personal safety, preserving the environment and meeting the legal requirements of regulatory agencies.

In PG 13 (*Fig. 15*), for the mechanical integrity of the installations, they must be inspected, tested and maintained in a planned and controlled manner, as defined in the manufacturers' manuals, procedures, standards and good engineering practices.

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TECHNICAL REGULATION (RT)	PG 13. MECHANICAL INTEGRITY	MAIN COMMON AND SPECIFIC PRACTICES MANAGEMENT AND OPERATIONAL
RTSGSO / RTSGI / RTDT / RTSGSS / RTSGIP	13.1 Purpose	Describe the requirements for inspections, tests and maintenance required for installation, systems, structures and equipment, for mechanical integrity.
	13.2 Materials Inspection, Testing, Maintenance and Procurement Planning	Establish plans and procedures for inspection, testing and maintenance, which contain clear instructions for the safe conduct of activities.
	13.3 Control of Activities	Document all activities related to mechanical integrity developed.
		Ensure that operating procedures, manuals, or any other document relating to the facility, systems, structures and equipment are accessible to maintenance personnel, where applicable.
		Establish quality assurance requirements in the execution of procedures. Change in project must have Change Management.
		Critical Operational Safety Equipment and Systems must be covered by inspection, testing, calibration and maintenance plans.
	13.4 Monitoring and Evaluation of Results	The Installation Operator will be responsible for monitoring and evaluating the results of inspections and tests.
RTDT / RTSGSS	13.5 Integrity Management Program	Establish, implement and document the Integrity Management Program (PGI) throughout the life cycle of the Submarine System.
		PGI should be a risk analysis; integrity assessment, monitoring of corrective and preventive actions and evaluation of PGI.
		Establish records management, control and traceability of integrity management, monitoring and operational control information.
		Update the designs and coordinates of the duct, the documentation of geological, geotechnical and oceanographic nature that represent a risk to integrity.

TECHNICAL REGULATION (RT)	CONTINUATION PG 13. MECHANICAL INTEGRITY	MAIN COMMON AND SPECIFIC PRACTICES MANAGEMENT AND OPERATIONAL
RTDT / RTSGSS	13.5 Integrity Management Program	Establish, implement and document program and procedures for monitoring and control of Corrosion of the Submarine System.
		Set deadline for finalizing and approving integrity management reports.
		Documentation should be based on technical recommendations, standards, standards, regulations and industry best practices.
		Control quality in the execution of activities and procedures.
		Ensure that activities are only performed after issuing the necessary licenses and authorizations.
		Keep all pipelines out of operation in maintenance or temporarily deactivated under safe conditions, with inspection and maintenance plans.
		Design, implement and document procedures for visual inspection, underwater inspection, instrumented PIG, water tightness test and hydrostatic test, integrity assessment, system and equipment functional verification, and vent system inspection, when applicable.
		Record in reports all the results obtained in inspections and actions.
		Analyze the results of integrity assessments.
		Implement quality control procedures and indicators.
		Ensure material traceability and Workforce certification.
RTSGI / RTDT	13.6 Inspection of Equipment and Piping	Implement systematic compliance with the Inspection Recommendations, establishing the classification, execution according to maximum deadlines defined in the classification A, B, C and D, and quality control, through inspections, tests and tests: A HIGH 10 DAYS; B HIGH 30 DAYS; C MODERATE 180 DAYS; D LOW 1 YEAR.
RTDT	13.7 Maintenance of Equipment and Piping	Elaborate and implement pipeline maintenance program to perform the necessary services for stabilization, containment, drainage and monitoring of the Pipeline Bands and adjacent areas, revised and updated whenever necessary, or at least every 3 (three) years.

TECHNICAL REGULATION (RT)	CONTINUATION PG 13. MECHANICAL INTEGRITY	MAIN COMMON AND SPECIFIC PRACTICES MANAGEMENT AND OPERATIONAL
RTDT	13.7 Maintenance of Equipment and Piping	Keep up to date the drawings of the construction and assembly of the Duct and of the location of the Strip, "as constructed" in a term not exceeding 180 (one hundred and eighty) consecutive days after completion of the works.
RTDT	13.8 Control of External and Internal and Atmospheric Corrosion	Implement a corrosion control program for the Duct, with limits in accordance with the Protocol of Responsibilities.
		Implement control of external corrosion of the Duct and metallic installations, buried or submerged, establishing procedures to control the installed anti-corrosion system.
		The external corrosion control must contain identification of the critical elements, procedures for monitoring the cathodic protection system.
		Resources needed for the monitoring and execution services, control of records, control and traceability of information.
		Implement control of internal corrosion of ducts and other metallic installations, with procedures to control the installed anti-corrosion system.
		The internal corrosion control must include identification of the critical elements, procedure for the determination of the corrosiveness of the transported products, procedures for the periodic passage of cleaning pigs.
RTSGIP	13.9 Well Integrity	Ensure well integrity throughout your Life Cycle.
		Establish, document and implement acceptance criteria, plans and procedures for inspection, verification, maintenance and monitoring of well integrity in compliance with industry best practices.
		Ensure that CSBs and other critical systems and equipment are functional, appropriate and available for use.
		Carry out the verification of the elements of the CSB, preferably, by means of test or by means of confirmation with a justification.
		Ensure that the cutting elements have the ability to cut tubular or cables down into the well.
		The cutting capacity information must be available to the relevant Workforce.

Fig. 15 - Integration of Technical Regulations, Requirements, Management Programs (PG) Main Management and Operational Practices

Source: Prepared by the author of ANP, 2007; ANP, 2010; ANP, 2011; ANP, 2015 e ANP, 2016.

The management of the mechanical integrity of the facilities, in order to anticipate, prevent, manage and mitigate the risks and exposures of the workforce to these conditions, with the elaboration of an integrity management program (PGI), with corrective, preventive and evaluation actions from the program.

For PG 14 (*Fig. 16*), the organization shall define an operational procedure with the emergency preparedness and response plan, with resources and response structure, including contractors providing emergency response services, accidental scenarios of risk installations, alarm systems, simulation exercises, report generation and action plan.

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TECHNICAL REGULATION (RT)	PG 14. LARGE EMERGENCY PLANNING AND MANAGEMENT	MAIN COMMON AND SPECIFIC PRACTICES MANAGEMENT AND OPERATIONAL
RTSGSO / RTSGI / RTDT /RTSGSS / RTSGIP	14.1 Purpose	Ensure proper planning and management of major emergencies that may occur during the installation operation.
	14.2 Emergency Situation Planning	Define the team responsible for drafting emergency plans, the qualification and experience of the team.
		Determine the size of the scenario considered and the complexity of the activity, installation, operation or undertaking to be analyzed.
		Identify from the analysis of Risks, the major emergencies and describe the associated accidental scenarios; evaluate the capacity of response to each scenario.
	14.3 Response to Major Emergencies	Establish the Emergency Plan for the Installation, which should contain the preparation and response procedures for emergencies.
		Define the features and response structure available in another location. The plan should indicate how structures and shared resources will be triggered.
		Establish a training program that includes emergency response team members and people exposed to accidental scenarios.
		The Plan should also include the identification of the Installation, legal responsible, description of access to the Installation, accident scenarios, warning systems, accident reporting, organizational response structure and others.
		Accidental "oil leak" hypothesis may be treated only in a specific emergency plan, such as "Shipboard Oil Pollution Emergency Plan" and / or other specific Emergency Plan.
	14.4 Management of Response Resources	Identify all response resources, including emergency systems and equipment, and contractor companies providing support services.
	14.5 Communication System	Establish reliable and effective communication and alarm systems, internal and external communication procedures, including regulatory agencies, government agencies and others.

Fig. 16 - Integration of Technical Regulations, Requirements, Management Programs (PG) Main Management and Operational Practices
Source: Prepared by the author of ANP, 2007; ANP, 2010; ANP, 2011; ANP, 2015 e ANP, 2016.

For effective response to a major emergency, a trained workforce is needed with specific training and participation in emergency simulation, with application of resources defined in procedure and with knowledge of the results.

PG 15 (*Fig. 17*) deals with the establishment of operational procedures with starting and stopping activities of the equipment, clear instructions, updated and made available on the operational fronts, for training and consultation of the workforce, to perform the tasks aimed at the safe operation of the facility.

TECHNICAL REGULATION (RT)	PG 15 - OPERATING PROCEDURES	MAIN COMMON AND SPECIFIC PRACTICES MANAGEMENT AND OPERATIONAL
RTSGSO / RTSGH / RTDT / RTSGSS / RTSGIP	15.1 Purpose	Describe the requirements that must be considered by the operational safety management system in establishing safe operating procedures.
	15.2 Elaboration and Control of Operational Procedures	Elaborate, document and control the operational procedures for the operations that are carried out in the installation, with clear and specific instructions for carrying out the activities, updated and available, for all personnel involved.
	15.3 Starting and Stopping Procedures	Establish and implement procedures for start-up and deactivation operations, with updated pre-operation information, where applicable.
	15.4 Simultaneous Operations	Specify the various categories and types of concurrent operations where there are considerable operational interfaces and when presenting new hazards that were not considered in the risk assessment.
		Implement an adequate and reliable communication system between remote points and the control room responsible for the operation of the Submarine System and pipelines.
RTSGI / RTDT	15.5 Operation Manual	Establish the Operation Manual considering existing processes, static, dynamic equipment, existing pipelines / pipelines; design features; limitations of equipment operation; specifications; safety critical elements; operational controls; and qualification of the work force for the execution of the operations, general description of the system, pipelines and the data of the equipment and process systems, the physicochemical and safety characteristics of the products, flowcharts, indication of the operational parameters of the project, launchers and (PMBOs), maximum operating pressures (PMO), volumes and temperature, procedures for starting and stopping equipment, procedures for switching redundant equipment, reference to the Emergency Plan , list of instruments, protection devices and alarms.
	15.6 Operational and Safety Records	Registering and controlling operational variables, evaluating and addressing abnormal operating conditions affects the operational safety, operation and structural integrity of static, dynamic and piping equipment.
RTDT / RTSGSS	15.7. Operation	Implement and document a Mutual Operation Procedure - PMO, with other companies or managements directly involved in the Operation of the Submarine System and Pipelines, in order to establish interfaces, actions and operational criteria.

Fig. 17 - Integration of Technical Regulations, Requirements, Management Programs (PG) Main Management and Operational Practices
Source: Prepared by the author of ANP, 2007; ANP, 2010; ANP, 2011; ANP, 2015 e ANP, 2016.

Operational procedures and data collection instruments should be objective and user-friendly because they are the primary documents used by the facility's workforce in the execution and recording of critical operational safety tasks.

For PG 16 (*Fig. 18*), all temporary or permanent changes must be analyzed, evaluated, managed and documented, with action to control the risks, approved by appropriate managerial level, communicate, train the workforce in the change of the standard and maintain records control.

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TECHNICAL REGULATION (RT)	PG 16. MANAGEMENT OF CHANGES	MAIN COMMON AND SPECIFIC PRACTICES MANAGEMENT AND OPERATIONAL
RTSGSO / RTSGI / RTDT / RTSGSS / RTSGIP	16.1 Purpose	Ensure that permanent or temporary changes to be made to the installation comply with the Safety Requirements as defined in the Technical Regulations and the relevant legislation.
	16.2 Types of Changes	Changes in operations, procedures, standards, facilities, equipment, systems or personnel should be evaluated and managed.
	16.3 Control Procedures	Implement a procedure to manage changes that may affect the Operational Safety considering the description of the proposed change, justification for the change and the project specification, when applicable; the assessment of hazards and the overall impact on activities, prior to the implementation of modifications, updating procedures and documentation affected by the change.
		Train and communicate to all staff whose work is impacted by change.
		The authorization for proposed changes should be issued by management level.
		The documented change must be archived and available for consultation for a minimum period of five (5) years.

Fig. 18 - Integration of Technical Regulations, Requirements, Management Programs (PG) Main Management and Operational Practices

Source: Prepared by the author of ANP, 2007; ANP, 2010; ANP, 2011; ANP, 2015 e ANP, 2016.

Change management seeks to identify the risks of changes to the operational safety and integrity of the facility, with the definition of actions by team of installation specialists and approval by management level, for the effectiveness of the change.

Safe work practices and control procedures in special activities defined in PG 17 (*Fig. 19*) are characterized by the application of the Work Permit (PT) and Risk Analysis (AR), according to a documented operational procedure, with guidelines for the emission, periodic verification of the critical services, closure, archiving of documentation and performance indicator, for monitoring and follow-up.

TECHNICAL REGULATION (RT)	PG 17. SAFE WORK PRACTICES AND CONTROL PROCEDURES IN SPECIAL ACTIVITIES	MAIN COMMON AND SPECIFIC PRACTICES MANAGEMENT AND OPERATIONAL
RTSGSO / RTSGI / RTDT / RTSGSS / RTSGIP	17.1 Purpose	Control and manage the risks to the Operational Safety during the special activities of the Installation, not contemplated.
	17.2 Work Permit	Establish a work permit system and other means of control to manage activities in hazardous areas.
		The work permit must be documented, with clear and concise authorization instructions and forms, controls, and work permits approved at the appropriate level by the facility manager.
		Work Permit information should be known to all involved in the execution of the service, keeping them in 3 (three) ways: one at the service location, one with the supervisor and the third at the office.
		Define the filing system for each type of Work Permit. PT's services in Critical Elements of Operational Safety must be maintained for at least two (2) years.
		The procedures for issuing the Work Permit must be reviewed and updated whenever necessary and filed, at least 3 (three) years. List the filing deadlines for each type of PT in the procedure.
	17.3 Monitoring	Monitor the performance of activities and ensure that work permits and controls are used until completion of work.
RTSGIP	17.4 Environmental Preservation	Prevent and minimize impacts to the environment and the risks to well integrity.
		Activities associated with the life cycle of the well should be supported by the environmental permits in effect issued by the environmental agencies.
		Wells temporarily abandoned should be protected by existing environmental permits. Wells permanently abandoned will not be required to prove environmental authorization.
RTSGIP	17.4 Environmental Preservation	Environmental authorizations should always be available for consultation on the land well locations during the execution of the Construction, Intervention and Abandonment activities, and in the maritime units during the execution of the Construction, Production, Intervention and Abandonment activities.

TECHNICAL REGULATION (RT)	CONTINUATION PG 17. SAFE WORK PRACTICES AND CONTROL PROCEDURES IN SPECIAL ACTIVITIES	MAIN COMMON AND SPECIFIC PRACTICES MANAGEMENT AND OPERATIONAL
RTSGIP	17.4 Environmental Preservation	Develop land lease project for the Construction, Production, Intervention and Abandonment Stages in order to preserve the environment.
		Prepare and implement inspection and maintenance plans for all Well Life Cycle Stages, except for Permanent Abandonment.
		Evaluate the uses of technologies, materials, equipment and products that prevent and minimize impacts to the environment.
		Use environmentally sound materials and products.
		The final destination of materials and equipment must occur in an environmentally correct manner.
		Solid wastes and effluents from the Well must have temporary storage, treatment and environmentally appropriate final disposal.
		Documentary record of the final destination of equipment and materials, treatment and final disposal of solid waste and effluents.
RTDT	17.5 Duct History Log	Keep updated historical records of each duct operated by him and filed in hard, GIS or other digital media, throughout the life of the duct.
		Updating Duct designs, both new and existing, must be completed within 180 (one hundred and eighty) days after the modification.
	17.6 Signaling of Pipelines	Install and maintain landmarks duct range limit, Duct signaling landmarks buried anode bed frameworks, frameworks for aerial surveillance, access plates indication, facility identification plates on the surface of the Strip and warning signs and guidance with Incident prevention information and messages addressed to neighboring communities.
RTDT	17.7 Public Awareness	Implement written program of public awareness and mobilization in order to maintain public authorities, companies with potential risk to neighboring Pipelines and communities tracks, informed and sensitized to the risks inherent in the operation of pipelines, disseminating preventive procedures for mitigation incidents, to control emergencies and for eventual abandonment of the affected area.

TECHNICAL REGULATION (RT)	CONTINUATION PG 17. SAFE WORK PRACTICES AND CONTROL PROCEDURES IN SPECIAL ACTIVITIES	MAIN COMMON AND SPECIFIC PRACTICES MANAGEMENT AND OPERATIONAL
RTDT	17.7 Public Awareness	Implement procedures to record the events related to Incidents with impact around the Pipeline Band;
		Hold meetings, meetings, personal contacts with neighbors of the Strip and contacts with municipal agencies, schools, companies and others.
		Implantation of a telephone line with free access, with 24-hour service, including weekends and holidays, with the disclosure of the number.
		Keep program documentation and records of community outreach and mobilization activities available.
	17.8 Prevention of Third Party Damages	Maintain damage prevention program by activities of Third parties involving works of any nature on, under or in the vicinity of the Duct Bands.
		The Third Party Activities Damage Prevention Program, the Third Party Interference Management Procedure and its documentation should be reviewed and updated as necessary, and archived for at least 3 (three) years.

Fig. 19 - Integration of Technical Regulations, Requirements, Management Programs (PG) Main Management and Operational Practices

Source: Prepared by the author of ANP, 2007; ANP, 2010; ANP, 2011; ANP, 2015 e ANP, 2016.

PT is a formal authorization issued by the work force involved in the operation, for the maintenance team to

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execute a preventive or corrective action service (OS) order, and the risk analysis (AR) actions in a safe manner.

V. FINAL CONSIDERATIONS

5.1 Conclusion

The matrix with the integration and matching of the ANP technical regulations will simplify the implementation and integration with other management systems such as QMS&ST (SGI) in the global management of concessionaire or operator of oil and natural gas fields, and will also contribute to the elaboration of data collection instruments of the type: interview script with open questions or affirmations, questionnaire with closed questions on a five-point Likert scale and checklists, to periodically perform diagnoses and/or evaluation of implementation performance and/or maintenance of management systems applied in the exploration and production of oil and natural gas.

5.2 Future research

The integration matrix of the 17 (seventeen) Management Practices and the common and specific requirements of the 5 (five) ANP technical standards will be integrated into the SGI (QMS&ST) management systems, with an interview script for managers, a questionnaire with five-point Likert scale questions and checklists to perform a diagnosis and / or evaluation of the performance of management systems practices in the perception of worker force in mature fields of the oil and gas exploration and production area in the Northeast of Brazil.

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