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DESIGN	ESUP								
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CHECK	IGORG								
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## 1. INTRODUCTION

The Preliminary Hazard Analysis (PHA) is a structured inductive technique used to identify hazards and accidental situations, their possible causes and consequences; qualitatively assess their risks; analyze existing safeguards and propose recommendations, when necessary, for risk reduction.

In the execution of PHA, the requirements of the National Agency for Petroleum, Natural Gas and Biofuels – ANP; Regulatory Standards (NRs) of Labor Secretary of the Ministry of Economy; Petrobras standard N-2782 - Applicable Techniques to Industrial Risk Analysis; and Safety Engineering Guidelines - DR-ENGP-M-I-1.3 shall be complied with.

This Technical Specification (TS) complements the hazard identification requirements of standard N-2782 and Safety Engineering Guidelines DR-ENGP-M-I-1.3, in force on the date of signature of the contract. It also aims at guiding the development of PHA and the execution of its respective report.

The risk assessment related to the hazards identified in the PHA shall be used to make decisions regarding the adoption of prevention and control measures necessary to maintain the risks in accordance with the tolerability criteria established in the N-2782 standard and Safety Engineering Guidelines DR-ENGP-M-I-1.3.


## 2. PURPOSE

This specification has the following objectives:

- 2.1 Define scope and criteria for conducting PHA for project phases of Concept Design, Basic Design, Detailing Design and Assisted Operation of Maritime Floating and Fixed Production Unit, hereinafter referred to as the Unit. This TS can optionally be used as a guide in the Unit Operation phase.
- 2.2 Guide the dynamics for the planning, development and follow up of the analysis by the parties involved and final approval thereof.
- 2.3 Define the model, minimum content and minimum requirements for submission of the PHA report.

## 3. ESCOPE

- 3.1 The PHA analysis shall cover hazardous events whose causes are originated in the Unit analyzed or in external causes inherent in its operation, identifying the main risk situations and establishing control measures considering both component or system failures and possible operational errors or maintenance (human faults).
- 3.2 The analysis shall seek primarily to identify hazards in the Unit, not intended to be used to implement operational improvements.


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### 3.3 General

- 3.3.1 The final PHA report shall be issued in Portuguese (Brazil). If the contractual language of the project is English, the report shall also be issued in English.
- 3.3.2 Analyzes shall be based on the data, released by Petrobras, contained in the design documentation of the Unit used as reference, according to this TS.
- 3.3.3 If pending or incomplete information is identified in the project documents, prior to the PHA or during its development, the PHA Consulting shall request them from the Designer. These requests shall be informed to Petrobras.
- 3.3.4 The Project Designer is responsible for searching and obtain all information necessary to carry out the PHA in administration, whether public or not, including engineering documentation, updated technical data, technical standards and applicable legislation. If the project is executed internally at Petrobras, the department responsible for the project will have the same responsibility as the Designer.
- 3.3.5 The final report of PHA shall contain the complete list of reference documents, indicating the revision used in the analysis. It is PHA Leader's responsibility the verification of completeness of the list of documents.
- 3.3.6 It is the responsibility of the Designer to carry out the management of change of the reference documents for the realization of the PHA and the consideration of its impacts (changes) in the analysis. All changes shall be informed and approved by Petrobras.
- 3.3.7 The final PHA report shall be submitted to formal approval by Petrobras.

## 4. DEFINITIONS

- 4.1 Safety Barriers - All physical and non-physical means designed to prevent, control or mitigate accidental events. Barriers include project safeguards, safety and operational procedures.
- 4.2 Causes - Event initiating an incident that can result from equipment failures, human errors, unforeseen changes in operating conditions, external factors, among others.
- 4.3 Scenario - Specific sequence of unintended events that have undesirable consequences.
- 4.4 Effects - Consequences from an accidental scenario, which may affect the persons, environment, asset and image of the Company.
- 4.5 PHA Consulting - Responsible for the execution of PHA, which may be a contracted company, either by Designer or Petrobras. It can be also an internal Petrobras workforce.

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- 4.6 Frequency - Physical quantity indicating the number of occurrences of an event in a given time interval.
- 4.7 Detection modes - Devices, systems or other means already existing in Unit or provided in the design, used to identify the occurrence of the accidental scenario. Examples: alarms, fire and gas detectors, through visual, auditory, olfactory, etc.
- 4.8 Assisted Operation - Support activity to the operation and maintenance teams to ensure that the operation start up is the safe continuation of the pre-operation and operation phases.
- 4.9 Hazard - Condition or property inherent in a substance, an activity, a system or a process, with potential to cause harm to people, environment, asset or image of the Company.
- 4.10 Designer - company responsible for the elaboration of the engineering project, which may be conceptual design, basic design or executive design, being Petrobras itself or contracted company.
- 4.11 Recommendations - proposed measures to prevent the occurrence of the accidental event or mitigate its consequences, whenever the existing safeguards are considered insufficient.
- 4.12 Risk - Combination of the expected frequency of occurrence of an accidental scenario with the severity of its consequence.
- 4.13 Safeguard - Any device, system or action, already planned in the project or existing in the Unit, capable of interrupting the chain of events that occurs from an initiating event, reducing the probability of occurrence of the undesirable scenario or reducing the severity of its consequences.
- 4.14 Severity - Represents the magnitude of the consequences of each of the accidental scenarios.

## 5. REFERENCE DOCUMENTATION

- 5.1 As inputs for the elaboration of PHA, the following documents shall be considered, in its most up-to-date version and with status of RELEASED by Petrobras at SIGEM or another electronic document management system defined in a contract. The revision of each document to be used shall be clearly indicated in the analysis report.
- a) Process Flow Diagrams (PFDs);
  - b) Process and Instrumentation Diagrams (P&IDs)
  - c) Cause and effect matrixes;
  - d) Safety data sheets;

e) General arrangement of the Unit and the specific equipment layout of accommodations, process plant; utilities and hull compartments such as engine room, pump room, bow compartments;

**Note:** In arrangement drawings, the location of equipment with its respective identification (TAGs) must be indicated, including also the location of: pipe racks, risers arrival, diving areas, cranes and laydown areas, helideck, helicopters refueling stations, chemical storage, offloading stations, among others. The arrangements must have the wind rose with the indication of prevailing winds, north of design and true north.

f) Metocean Data;

g) Safety Plan that indicates the installation/location of Fire and Gas detectors - F&G, firefighting system, escape routes, lifesaving appliances, muster stations, passive fire protection, etc.;

h) Hazardous areas classification plan;

i) Mechanical handling of the Unit;

j) Risk Analysis Reports already performed for the Unit, including those carried out for hull systems and subsea systems.

k) Updated 3D Model available. If there is no 3D Model in the project, only 2D layout drawings will be used.

l) Subsea arrangement;

m) Material Safety Data Sheet (MSDS).

5.2 Additional documents shall be provided for the identification of the following aspects of the project:

a) Containment and drainage for equipment handling flammable / combustible liquid and hazardous substances (toxic, corrosive).

b) Location of air intakes for closed spaces; process equipment vents; flammable / combustible / chemicals product storage vents, as well as discharges of internal combustion equipment (turbomachinery). All hot surfaces must be indicated (equal to or greater than 60°C).

c) Type of floor that separates the decks (plated or grid floor);

5.3 Depending on the design phase for which the PHA is being prepared, some of the documents cited above may not be available. In this case, Petrobras shall be consulted about its relevance to the preparation of the study.

5.4 The documentation must be available to the PHA leader and to the participants at least 10 days before the analysis start date.

**6. REQUIREMENTS FOR THE PARTICIPATING TEAM DEFINITION**

The following are the main requirements for professionals involved in PHA:

6.1 The PHA must be elaborated by a multidisciplinary team involving professionals from the Designer and Petrobras. The Designer team shall be formed by professionals involved in the project and that are experienced in the area they represent, with representatives of the following disciplines: process, instrumentation/automation and control, safety, mechanics, electrical and naval\*. Petrobras team may be composed of professionals from all disciplines cited or in part, however, there shall be full participation of safety, process, operation, maintenance and submarine systems professionals\*.


\* Applicable when the analyzed system interfaces with naval or submarine systems.

6.2 The analysis leader shall have formal training in the PHA tool and the PHA leadership activity. The leader shall also have participated in, at least, five (5) PHA meetings, two (2) as a leader, for offshore production Units.

6.3 The defined PHA team shall have composition, function and attributions performed as follows:

Table 1 - Basic composition of the PHA team

<b>Function</b>	<b>Activities</b>
<b>Coordinator</b>	Professional of the Designer responsible for the event and who shall: <ul style="list-style-type: none"> <li>• organize the team;</li> <li>• gather up-to-date information, such as P&amp;IDs, technical specifications, etc.</li> <li>• distribute material to the team;</li> <li>• schedule meetings.</li> </ul>
<b>PHA Leader</b>	Professional of the PHA Consulting who knows the technique, responsible for: <ul style="list-style-type: none"> <li>• comply with the schedule of planned meetings;</li> <li>• explain the technique to be employed to the other participants, facilitate meetings and define its progress status;</li> <li>• ask participants for pending from the previous meetings;</li> <li>• prior evaluation of the documentation to be used in the analysis, defining the sections to be evaluated;</li> <li>• preparing the final analysis report.</li> </ul>
<b>Participants</b>	Professionals of the Designers/Suppliers and Petrobras, who have knowledge about the design of the Unit or system to be analyzed, or experience acquired in similar systems/Units. At least one representative from each discipline shall have at least 3 years' experience in the area they represent. Each discipline shall have a professional with this experience, not necessarily the same professional, for full-time participation during PHA.
<b>Specialists</b>	Professionals from the Designer, Suppliers or even Petrobras who have advanced knowledge about specific equipment, technologies or systems that can participate on demand, according to the need.

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## 7. PLANNING

Prior to the PHA, a planning stage shall occur, when shall be defined the objectives and scope of the analysis, the schedule of the meetings, the identification of the necessary documentation, the location of the meetings and the team involved, in accordance with item 6.

In addition, invitations shall be sent and all the documentation to be used shall be previously available to the participants.

The language for conducting and recording PHA meetings shall be defined.

During planning, all interfaces between systems shall be identified, which shall be included in PHA scope, in order to guarantee their integrated analysis.

## 8. METHODOLOGY

The PHA methodology shall follow the guidelines in Annex D of standard N-2782 and the aspects presented below:

### 8.1 Regarding the premises that shall be adopted:

- a) All scenarios, observations and recommendations raised during the basic design shall be re-evaluated in the detailing design, considering the treatment given to the recommendations of the previous phases of the project.
- b) All systems of the Unit that have relevant hazards shall be included in the analysis. For those considered not relevant, the reasons for not including them in the analysis shall be technically justified.
- c) The documents of systems considered as a "package" shall be included in the documentation of the analysis in the detailing design phase, or in an earlier stage, if the "package" information is already available.
- d) Hazards related to tasks or procedures shall not be evaluated in the PHA of the Unit's design phase. These shall be evaluated in the operational phase.
- e) The Unit shall always be divided into systems, and consideration shall be given to the interfaces between Topside, naval systems (oil transfer, loss of containment at FPSO pump room, other marine systems which may be sources of hazards) and subsea systems (eg, leakage between surface SDV and riser balcony, considering the impacts of such leaks to the integrity of the Unit).
- f) The analysis shall verify possible interfaces between analyzed systems and other modules / packages. Whenever this is not possible, depending on the design phase (eg documentation not available for a package systems), a note shall be included in the reports informing and justifying why the interfaces are not verified. In the case of the example, the note shall inform that this analysis will be carried out in the next phase of the project.



- g) PHA shall not consider causes that depend on the occurrence of two or more simultaneous events. However, these causes may be considered if there are reported accidental scenarios with consequences of critical or catastrophic severity, as defined in N-2782.
- h) In cases of assisted operation, visual or auditory detections can be considered as effective detection modes.
- i) All possible operation modes of the process plant shall be considered.
- j) Hazards related to new technologies, unusual process conditions in the industry or unknown to the analysis team shall be evaluated considering the precautionary principle. This principle can be described as the adoption of special caution in cases of dangers linked to technical and scientific uncertainties in processes, technologies or innovative operations, with little known impacts and little evaluated by previous risk analyzes. In addition, this principle must be observed when the associated risk can not be assessed with sufficient confidence for decision making, depending on the level of uncertainty as to the possibility of undesirable events and harmful effects to people or environment.

### 8.2 Regarding accidental scenarios:

- a) In the context of PHA, an “accidental scenario” is defined as a group formed by the identified hazard, its causes and each of its effects. An example of a possible accidental scenario would be: large release of toxic substance (hazard) due to pipe rupture (causing) leading to the formation of a toxic cloud (effect) and causing damage to people, environment, asset and image (severity);
- b) According to the PHA technique, accidental scenarios shall be classified into frequency categories, which shall be estimated considering the performance of existing or planned preventive safeguards. It shall be considered the frequency of the accidental scenario and not that of the initiating event. In some situations, the frequency of the accidental scenario may be different, for example, in relation to people, asset or environment. In these cases, these scenarios shall be deployed and recorded on different lines.
- c) Accident scenarios shall also be classified into categories of severity, which allow an assessment of the physical effects consequences’ magnitude (over pressure, toxic concentration, thermal radiation, etc.). Severity shall be estimated considering the presence of mitigating safeguards, existing or foreseen in the project.

### 8.3 Regarding safeguards:

- a) Actions such as use of personal protective equipment (PPE), operating procedures, maintenance plans and training, shall not be considered safeguards, except when these are specifically created to prevent/mitigate the dangerous scenario under analysis.

b) Alarm that allows the response of the operator for the control action of the accidental scenario can be considered as safeguard. Other alarms shall only be considered as a detection mode.

c) An alarm with response from the operator shall be considered a safeguard under the following additional conditions:

- The alarm and the respective on-site response devices are independent of the initiating cause of the accidental scenario;
- The action taken is effective to minimize risk without exposing the responding operator.

#### 8.4 Regarding hazards identification

The hazards identified in the analysis shall be listed in the "HAZARD" field of the PHA worksheet (APPENDIX A). Examples of hazards to be considered:

- Small release of flammable liquid (eg leakage on flanges, connections, etc.);
- Large release of flammable liquid (eg line rupture, equipment, etc.);
- Small release of flammable gas (eg leakage on flanges, connections, etc.);
- Large release of flammable gas (eg: lines ruptures, equipment, etc.);
- Small release of toxic gas (eg leakage on flanges, connections, etc.);
- Large release of toxic gas (eg: line rupture, equipment, etc.);
- Presence of flammable mixture in the gas line;
- Dropped objects;
- Impacts during loads handling;
- Loss of anchorage;
- Small release of chemical product;
- Large release of chemical product;
- Presence of substance subject to spontaneous combustion;
- Stability of the Unit;
- Collision.

#### 8.5 Regarding causes identification

For each identified hazard, their respective causes shall be related. These causes can comprehend inherent failures of equipment (leaks, ruptures, instrumentation failures, etc.), as well as human errors during execution, testing, operation, or maintenance.

#### 8.6 Regarding consequences identification

For each accidental scenario identified, the possible consequences shall be listed. For example, for a scenario of small gas release, the possible effects could be fire and explosion, among others.

#### 8.7 Regarding frequency identification

The frequency categories allow an assessment of the frequency of the accidental scenario and not of the initiating event. In order to classify the frequency of the

accidental scenario, the performance of existing or planned preventive safeguards shall be considered. The frequency of accidental scenarios shall be classified according to the following table:

Table 2 - Frequency of accidental scenario

<b>A EXTREMELY REMOTE</b>	<b>B REMOTE</b>	<b>C NOT LIKELY</b>	<b>D PROBABLE</b>	<b>E FREQUENT</b>
Conceptually possible, but with no references in the industry (Never occurred worldwide)	Not expected to occur, although there are references in similar facilities in the industry (Already occurred at least once worldwide)	Not likely of occurring during the life time of a group of similar units (already occurred at least once at Petrobras)	Possible of occurring once during the Unit life time	Possible of occurring many times during the Unit life time

**8.8 Regarding severity identification**

Each accidental scenarios identified shall be classified into severity categories that provide a qualitative indication of the severity level regarding its consequences. The severity of the consequences shall be assessed for damages to people, assets, environment and the image of the company's department responsible for the asset and Petrobras. For this categorization, the risk tolerance matrix presented in Table 2 of N-2782 and Annex I of the Safety Engineering Guidelines shall be used.

NOTE: Depending on the objectives of the PHA, it may be unnecessary to consider all dimensions: personal safety, asset, environment and image.

**8.9 Regarding risk definition**


8.9.1 The risk analysis is performed via Risks Matrix (Table 2 of N-2782) through combination of the frequency and severity categories, which provides a qualitative indication of the risk level for each scenario identified upon the analysis.

8.9.2 The defined risk level can be Tolerable, Moderate or Not Tolerable. The term "Not Tolerable" may be replaced by the term "Intolerable" without prejudice to understanding. Adoption of measures is expected for each risk level to have the desired effect, as Table 3 of N-2782.

8.9.3 Management actions for risks classified as "Not Tolerable" and "Moderate" category IV and V.

The scenarios with a "Not Tolerable" risk level in any of the dimensions for people, assets, environment and image indicate that additional control measures and / or mitigating actions shall be adopted to reduce risks.

The scenarios with a "Not Tolerable" and "Moderate" risk levels, of Severity Categories IV and V for people and asset shall be evaluated by consequences analysis for the definition of protections to be adopted in the project (type of protection, quantity, location).

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The PHA team, when identifying scenarios classified with severity IV and V, shall consult the existing consequence analysis of this project to verify if these scenarios are already quantitatively analyzed.

In the final review of the PHA, before start of operation, the risk classification shall be revised considering the adoption of preventive or mitigating measures.

#### 8.10 Regarding recommendations, additional comments and notes

Recommendations are proposed measures to prevent the occurrence of the accidental scenario or mitigate its consequences whenever the existing safeguards are considered insufficient.

Recommendations shall be clear, concise, well-defined and preceded by action verb. Terms such as planning, designing, elaborating, identifying, specifying, installing, etc. shall be complemented by conclusive actions.

For each recommendation originating from the PHA, the company or organization responsible for its implementation shall be identified. The planning and management of recommendations shall take into account the risks classification for the definition of their prioritization.

The designer shall manage the implementation of these recommendations generated in the analysis, including the impact on the revision of reference documents used in the PHA. If any recommendation is not implemented, or an alternative solution is indicated, it shall be justified and submitted to Petrobras' approval.

Observations are complementary information that can be recorded in order to clarify the scenario analyzed, without, however, requiring any action.

Further comments are general or specific information that may contribute to clarification of aspects considered in the analysis, but which do not fit as recommendations or observations.


The PHA recommendations will be identified as Rxxx, the observations will be identified as Oxxx, and the additional comments will be identified as Cxxx, where xxx corresponds to the sequential numbering.

## 9. REQUIREMENTS FOR PHA MEETINGS

Meetings shall follow as described below:

### 9.1 Planning Meeting

The scope of this meeting is to summarize the project to be assessed, define the objectives and scope of the contracted analysis, as well as evaluate and make the necessary adjustments in the work schedule proposed by the PHA Consulting, where the minimum agenda shall be:

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- Define Petrobras, designer and executor of PHA teams (preparation of list of participants to issue invitations);
- Clarifications on objectives and scope of the analysis;
- Prior analysis of all necessary documentation for the execution of the PHA and elaboration of hold list, if any, to be completed by the Designer;
- Presentation of proposal meetings schedule by the PHA Consulting and evaluation regarding the project schedule;
- Definition of locations, resources needed and duration of meetings;
- Participants: Representatives of Petrobras, designer and PHA Consulting (mandatory participation of the PHA leader).

## 9.2 Initial PHA meeting and others study development meetings

At the initial PHA meeting, the Leader shall address the following topics:

- Safety briefing;
- Participants presentation
- Presentation of analysis objective and scope;
- Presentation of the meetings schedule;
- Brief presentation of the methodology and premises;
- Short description of the Unit;
- Presentation of a summarized historical analysis of incidents occurring in the Unit or others similar installations;
- Description of the systems to be analyzed.
- The others PHA meetings shall address the following topics:
  - Presentation of new participants, if any;
  - Description of the systems to be analyzed;

Participants: Professionals from Petrobras, designer and PHA Execution (including the PHA Leader), as defined in item 6 of this TS.


## 10. PHA REVIEW

The PHA shall be reviewed in the following cases:

- At each project phase;
- When there are changes in the project that lead to new accidental scenarios and/or change the risks previously considered. This analysis shall be carried out by the Project Designer with the participation of Petrobras;
- When Petrobras detects systemic or critical deviations from reports in relation to this specification;
- In the pre-operation phase; and during operation, according to Petrobras's safety management standards.

## 11. REPORT CONTENT

The PHA report shall be issued according to N-1710 and N-381, it shall be issued within five (5) days after the conclusion of the meetings.

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The PHA Report shall include at least the following items:

1. Purpose and scope of the analysis;

Description of the objectives, the scope covered by the analysis, and the structure of the report.

2. List of participants

The list of participants shall contain the general data of each participant (full name, company, department, position, contact email, project discipline representing and time of experience in it).

3. Executive summary

4. Introduction

The introduction shall contain the description of the Unit, description of the analyzed systems, considering modes of operation, and any relevant aspects related to the analysis.

5. Justification and description of the PHA technique

6. List of documents

All the documents that were used for the analysis with their respective revisions shall be listed.


7. Historical Analysis

Evidence shall be presented that the occurrence of accidental scenarios in similar units, especially Petrobras, with the respective NCTR, when applicable, were used for definition of scenarios and classification of their frequency. International database events can be used, considering the applicability of the data to the project (facility type and complexity, sea conditions, modes of operation of the unit / equipment, etc.).

The historical analysis shall be presented to all participants on the first meeting day, before the start of PHA.

References that can be used to elaborate the historical analysis:

- a) *Hydrocarbon Release Data Base (HCRD - HSE)*
- b) *WOAD -World Offshore Accident Database -*  
<https://www.dnvgl.com/services/world-offshore-accident-database-woad-1747>
- c) *Report Blowout and Well Release Characteristics and Frequencies, 2014 - SINTEF Technology and Society - Safety Research 2014-12-30;*
- d) *Accident Statistics for Floating Offshore Units on the UK Continental Shelf 1980-2005. HSE Research Report RR 567 2007;*

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- e) *Process Release Frequencie*, OGP 2010;
- f) *Accident Statistics for Fixed Offshore Units on the UK Continental Shelf 1980-2005, HSE Research Report RR 566 2007-*  
<http://www.hse.gov.uk/research/rrhtm/rr566.htm>
- g) Non-compliance Treatment Report (NCTR) from Petrobras.

8. Analysis Development

9. Assumptions defined for the analysis.

10. Information on the hazardous substances involved;

In this item, shall be reported which hazardous substances involved in the analysis (those in which the loss of containment resulted to the scenarios analyzed). The characteristics and risks that such substances may offer to people, asset and environment shall be identified.

11. List of recommendations

It shall be presented in a table to allow management of the implementation of the recommendations. It shall be listed in this table, the responsible for each recommendation as well as the corresponding scenario number.

12. List of observations

It shall be displayed in a table, with the corresponding scenario number.


13. Additional considerations

These shall be presented in a table along with the identification of those responsible.

14. Conclusions

It shall contain, at least, the following information:

- a) Total systems and scenarios evaluated;
- b) Total of scenarios classified as Tolerable, Moderate and Not Tolerable, considering the aspects people, asset, environment and image;
- c) Total number of recommendations and observations;
- d) Identification of interfaces between Naval and Subsea disciplines, indicating the PHA scenarios in which such interfaces were analyzed. The studies of Naval and Subsea disciplines that also contain analysis of these interfaces shall be related, when applicable.
- e) Statistics of the scenarios for each aspect considered (people, asset, environment and image).

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f) Identification of scenarios for elaboration of safety critical elements list:

- All the safeguards of scenarios classified with severity IV and V for dimensions People and Environment; and severity V for Image and Asset shall be considered as safety critical elements. After consolidating the critical elements of the PHA scenarios, the safety critical elements list may be complemented by other elements defined by technical criteria or other analyzes that identify other safety functions relevant to the Installation.

- The elements are considered critical when essential to prevent or mitigate risks or, in case of its failure, it may cause or contribute to the occurrence of an operational accident.

15. References used in the analysis.

16. ANNEXES

A. Filled out PHA worksheets

All completed worksheets shall be presented, as shown in Figure D.2 of N-2782. The scenarios shall be numbered in order to facilitate their identification, considering that scenarios related to different systems of the Facility cannot have the same numbering.

B. Documents analyzed

An annex shall be included in the report with all analyzed P&IDs, including their identified and highlighted segments, among other relevant documents.

C. Signed presence list.

The daily presence lists (morning and afternoon) shall be attached, which must be signed by the participants in each of the meetings. The lists shall inform which systems were analyzed at each meeting.

D. List of Barriers.

A list of barriers shall be annexed to the final report, which lists their respective safety barriers for each of the accidental scenarios and classifies them as preventive or mitigating barriers.