|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **طرح نگهداشت و افزایش تولید 27 مخزن** | | | | | | |
| **SIL REPORT FOR BINAK B/C MANIFOLD EXTENSION**  **نگهداشت و افزایش تولید میدان نفتی بینک** | | | | | | |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| D01 | OCT. 2022 | FI | A.Baghaei | M.Fakharian | M.Mehrshad |  |
| D00 | JUL. 2022 | IFI | A.Baghaei | M.Fakharian | M.Mehrshad |  |
| **Rev.** | **Date** | **Purpose of Issue/Status** | **Prepared by:** | **Checked by:** | **Approved by:** | **CLIENT Approval** |
| **Class:3** | | **CLIENT Doc. Number:** **F0Z-707341** | | | | |
| **Status:**  **IDC: Inter-Discipline Check IFC: Issued For Comment IFA: Issued For Approval AFD: Approved For Design**  **AFC: Approved For Construction AFP: Approved For Purchase AFQ:** Approved For Quotation  **IFI: Issued For Information**  **AB-R: As-Built for CLIENT Review AB-A: As-Built –Approved**  **FI: Final Issue** | | | | | | |

**REVISION RECORD SHEET**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **PAGE** | **D00** | **D01** | **D02** | **D03** | **D04** |
| **1** | X | X |  |  |  |
| **2** | X | X |  |  |  |
| **3** | X |  |  |  |  |
| **4** | X |  |  |  |  |
| **5** | X |  |  |  |  |
| **6** | X |  |  |  |  |
| **7** | X |  |  |  |  |
| **8** | X |  |  |  |  |
| **9** | X |  |  |  |  |
| **10** | X |  |  |  |  |
| **11** | X |  |  |  |  |
| **12** | X |  |  |  |  |
| **13** | X |  |  |  |  |
| **14** |  |  |  |  |  |
| **15** |  |  |  |  |  |
| **16** |  |  |  |  |  |
| **17** |  |  |  |  |  |
| **18** |  |  |  |  |  |
| **19** |  |  |  |  |  |
| **20** |  |  |  |  |  |
| **21** |  |  |  |  |  |
| **22** |  |  |  |  |  |
| **23** |  |  |  |  |  |
| **24** |  |  |  |  |  |
| **25** |  |  |  |  |  |
| **26** |  |  |  |  |  |
| **27** |  |  |  |  |  |
| **28** |  |  |  |  |  |
| **29** |  |  |  |  |  |
| **30** |  |  |  |  |  |
| **31** |  |  |  |  |  |
| **32** |  |  |  |  |  |
| **33** |  |  |  |  |  |
| **34** |  |  |  |  |  |
| **35** |  |  |  |  |  |
| **36** |  |  |  |  |  |
| **37** |  |  |  |  |  |
| **38** |  |  |  |  |  |
| **39** |  |  |  |  |  |
| **40** |  |  |  |  |  |
| **41** |  |  |  |  |  |
| **42** |  |  |  |  |  |
| **43** |  |  |  |  |  |
| **44** |  |  |  |  |  |
| **45** |  |  |  |  |  |
| **46** |  |  |  |  |  |
| **47** |  |  |  |  |  |
| **48** |  |  |  |  |  |
| **49** |  |  |  |  |  |
| **50** |  |  |  |  |  |
| **51** |  |  |  |  |  |
| **52** |  |  |  |  |  |
| **53** |  |  |  |  |  |
| **54** |  |  |  |  |  |
| **55** |  |  |  |  |  |
| **56** |  |  |  |  |  |
| **57** |  |  |  |  |  |
| **58** |  |  |  |  |  |
| **59** |  |  |  |  |  |
| **60** |  |  |  |  |  |
| **61** |  |  |  |  |  |
| **62** |  |  |  |  |  |
| **63** |  |  |  |  |  |
| **64** |  |  |  |  |  |
| **65** |  |  |  |  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **PAGE** | **D00** | **D01** | **D02** | **D03** | **D04** |
| **66** |  |  |  |  |  |
| **67** |  |  |  |  |  |
| **68** |  |  |  |  |  |
| **69** |  |  |  |  |  |
| **70** |  |  |  |  |  |
| **71** |  |  |  |  |  |
| **72** |  |  |  |  |  |
| **73** |  |  |  |  |  |
| **74** |  |  |  |  |  |
| **75** |  |  |  |  |  |
| **76** |  |  |  |  |  |
| **77** |  |  |  |  |  |
| **78** |  |  |  |  |  |
| **79** |  |  |  |  |  |
| **80** |  |  |  |  |  |
| **81** |  |  |  |  |  |
| **82** |  |  |  |  |  |
| **83** |  |  |  |  |  |
| **84** |  |  |  |  |  |
| **85** |  |  |  |  |  |
| **86** |  |  |  |  |  |
| **87** |  |  |  |  |  |
| **88** |  |  |  |  |  |
| **89** |  |  |  |  |  |
| **90** |  |  |  |  |  |
| **91** |  |  |  |  |  |
| **92** |  |  |  |  |  |
| **93** |  |  |  |  |  |
| **94** |  |  |  |  |  |
| **95** |  |  |  |  |  |
| **96** |  |  |  |  |  |
| **97** |  |  |  |  |  |
| **98** |  |  |  |  |  |
| **99** |  |  |  |  |  |
| **100** |  |  |  |  |  |
| **101** |  |  |  |  |  |
| **102** |  |  |  |  |  |
| **103** |  |  |  |  |  |
| **104** |  |  |  |  |  |
| **105** |  |  |  |  |  |
| **106** |  |  |  |  |  |
| **107** |  |  |  |  |  |
| **108** |  |  |  |  |  |
| **109** |  |  |  |  |  |
| **110** |  |  |  |  |  |
| **111** |  |  |  |  |  |
| **112** |  |  |  |  |  |
| **113** |  |  |  |  |  |
| **114** |  |  |  |  |  |
| **115** |  |  |  |  |  |
| **116** |  |  |  |  |  |
| **117** |  |  |  |  |  |
| **118** |  |  |  |  |  |
| **119** |  |  |  |  |  |
| **120** |  |  |  |  |  |
| **121** |  |  |  |  |  |
| **122** |  |  |  |  |  |
| **123** |  |  |  |  |  |
| **124** |  |  |  |  |  |
| **125** |  |  |  |  |  |
| **126** |  |  |  |  |  |
| **127** |  |  |  |  |  |
| **128** |  |  |  |  |  |
| **129** |  |  |  |  |  |
| **130** |  |  |  |  |  |

# CONTENTS

[1.0 INTRODUCTION 4](#_bookmark0)

[2.0 SCOPE 4](#_bookmark1)

[3.0 NORMATIVE REFERENCES 5](#_bookmark2)

* 1. [INTERNATIONAL CODES AND STANDARDS 5](#_bookmark3)
  2. [THE PROJECT DOCUMENTS 5](#_bookmark4)

[4.0 PURPOSE 5](#_bookmark5)

[5.0 SIL STUDY OVERVIEW 5](#_bookmark6)

[6.0 PROCEDURE 6](#_bookmark7)

[7.0 SIL STUDY OUTCOMES 6](#_bookmark8)

[8.0 ATTACHMENTS 7](#_bookmark9)

* 1. [ATTACHMENT A – TEAM MEMBERS 7](#_bookmark10)
  2. [ATTACHMENT B – LIST OF DRAWINGS 9](#_bookmark11)
  3. [ATTACHMENT C – NODE LIST 10](#_bookmark12)
  4. [ATTACHMENT D – SIF DESCRIPTION 11](#_bookmark13)
  5. [ATTACHMENT E – SIL WORKSHEETS 12](#_bookmark14)

# 1.0 INTRODUCTION

Binak oilfield in Bushehr province is a part of the southern oilfields of Iran, is located 20 km northwest of Genaveh city.

With the aim of increasing production of oil from Binak oilfield, an EPC/EPD Project has been defined by NIOC/NISOC and awarded to Petro Iran Development Company (PEDCO). Also PEDCO (as General Contractor) has assigned the EPC-packages of the Project to "Hirgan Energy - Design and Inspection" JV.

As a part of the Project, construction of well location, access road, wellhead facilities (with electric power supply) for W007S shall be done. In addition, construction of new flowline from aforementioned well location to Binak B/C unit (with extension of relevant manifold) are in the Project scope of work.

## GENERAL DEFINITION

The following terms shall be used in this document.

CLIENT: National Iranian South Oilfields Company (NISOC)

PROJECT: Binak Oilfield Development – Construction of Well Location, Wellhead Facilities, Electrification Facilities, Flowlines for W007S and Extension of Binak B/C Manifold

EPD/EPC CONTRACTOR (GC): Petro Iran Development Company (PEDCO)

EPC CONTRACTOR: Joint Venture of : Hirgan Energy – Design &

Inspection(D&I) Companies

VENDOR: The firm or person who will fabricate the equipment or material.

EXECUTOR: Executor is the party which carries out all or part of construction and/or commissioning for the project.

THIRD PARTY INSPECTOR (TPI): The firm appointed by EPD/EPC CONTRACTOR (GC)

and approved by CLIENT (in writing) for the inspection of goods.

SHALL: Is used where a provision is mandatory.

SHOULD: Is used where a provision is advisory only.

WILL: Is normally used in connection with the action by CLIENT rather than by an EPC/EPD CONTRACTOR, supplier or VENDOR.

MAY: Is used where a provision is completely discretionary.

# 2.0 SCOPE

The scope of SIL study covers all P&IDs for Extension of Binak B/C Manifold. The list of

P&IDs is presented in appendix B.

# NORMATIVE REFERENCES

## INTERNATIONAL CODES AND STANDARDS

* + - IEC 61511:2016 Functional Safety – Safety Instrumented Systems for

the Process Industry Sector

## THE PROJECT DOCUMENTS

* + - BK-W007S-PEDCO-110-PR-DG-0001 ESD Block Diagram
    - BK-W007S-PEDCO-110-PR-DG-0002 Cause & Effect Diagram

# 4.0 PURPOSE

The purpose of this document is to provide the results of “SIL Study” for **Binak Oilfield Development – Extension of Binak B/C Manifold**.

The objective of SIL study is to identify the target Safety Integrity Levels (SIL) of all the typical instrumented safety-related loops defined as trip interlocks, i.e. safety instrumented functions (SIF) leading to a safe status for people and to a safe state of the process and assets. The results obtained for target SIL of SIF’s then can be used for the design and procurement of the safety instrumented systems and planning of proof test intervals of safety instrumented systems.

# 5.0 SIL STUDY OVERVIEW

SIL study was performed along with HAZOP Study meetings which were conducted in two sessions on June 25 & 26, 2022 held in Neyshekar Hotel main meeting hall, Ahvaz.

A team comprising of experts from different disciplines of National Iranian South Oilfields Company (NISOC), Petro Iran Development Company (PEDCO) and Hirgan Energy Company conducted the study with a third-party HAZOP/SIL Chairman and Scribe. The list of team members is presented in appendix A.

Piping and Instrumentation Diagrams (P&ID’s) for Extension of Binak B/C Manifold are listed in appendix B. Each P&ID is used in one or more nodes that is mentioned in the drawing report.

The node list generated during HAZOP Study was also used for SIL Study. Total 2 SIFs were identified and studied. The list of nodes and SIFs in each node is presented in appendix C.

Appendix D describes SIFs in each node and the Target SIL results, and appendix E consists of detailed SIL Worksheets of the study.

# 6.0 PROCEDURE

The SIL Study was performed according to the Risk Graph methodology defined by the SIL Procedure Document “BK-GNRAL-PEDCO-000-GE-PR-0003”.

# 7.0 SIL STUDY OUTCOMES

A total of 2 SIF’s were identified as safety critical systems and assessed. The resulting SIL study worksheets and SIL targets are shown in appendix E. Where multiple scenarios were analyzed, the highest value of SIL is selected for the regarding SIF. Following table shows the distribution of Target SIL’s.

|  |  |
| --- | --- |
| **SIL Target No. of SIF’s** | |
| **Not Safety Related** | 0 |
| **SIL A** | 0 |
| **SIL 1** | 1 |
| **SIL 2** | 1 |
| **SIL 3** | 0 |
| **SIL 4** | 0 |
| **Total** | 2 |

# ATTACHMENTS

## ATTACHMENT A – TEAM MEMBERS

|  |  |  |  |
| --- | --- | --- | --- |
| **First Name** | **Last Name** | **Company** | **Expertise** |
| S.Mehdi | Ashrafian | NISOC | Project Manager |
| Shamsolah | Bahadori | NISOC | Construction Manager |
| Fatemeh | Ghodsi | NISOC | Head of I&C |
| Mohammad | Torfi | NISOC | Process |
| Sahar | Saba | NISOC | Process |
| Niloofar | Rezaei Baba ahmadi | NISOC | Process |
| Mohammad Reza | Cheraghchi | NISOC | Process |
| Fazel | Moafi | NISOC | Instrument |
| Behzad | Zandian | NISOC | Instrument |
| Peyman | Sarvarian | NISOC | Mechanic |
| Hojjat | Jafarpour | NISOC | Mechanical |
| Faride | Parvin | NISOC | Mechanical |
| Mohammad | Khamisi | NISOC | HSE |
| Mohammad | Shirali | NISOC | Commissioning |
| Ali | Hamidan | NISOC | Commissioning |
| Naji | Hamid | NISOC | Commissioning |
| Khodadad | Kavosi | NISOC | Commissioning |
| Reza | Gholgheysari | NISOC | Process Engineer |
| Mobin | Saeedi | NISOC | Instrument |
| Mohammad | Bakhshi Mohammadi | Gachsaran NISOC | Production Engineer |
| Shahram | Valizadeh | Gachsaran NISOC | Production Engineer |
| Vahid | Mussavi | Gachsaran NISOC | Production Engineer |
| Mohammad | Fakoor | PEDCO | Process Engineer |
| Farshid | Amiri | PEDCO | Piping Lead Engineer |
| Hadi | Mozaffari | PEDCO | Electrical Engineer |
| Mahdi | Karimi | PEDCO | Head of Electrical Department |
| Pouria | Bavarsad | PEDCO | Piping Engineering |
| Sadegh | Gharacheh | PEDCO | Process |
| Morteza | Taherkhani | PEDCO | Head of I&C |
| Sepideh | Akbari | PEDCO | I&C Engineer |
| Sasan | Faramarzpour | PEDCO | Head of Process and Safety Department |
| Pouya | Maleki | PEDCO | Process Engineer |
| Mehdi | Sadeghian | PEDCO | Surface Manager |
| Vahid | Abdeshadi | PEDCO | Project Engineer Manager |

|  |  |  |  |
| --- | --- | --- | --- |
| **First Name** | **Last Name** | **Company** | **Expertise** |
| Masoud | Asgharnejad | Hirgan Energy | Engineering Manager |
| Mohsen | Aryafar | Hirgan Energy | Process |
| Saeed | Ghanbari | Hirgan Energy | Process |
| Parisa | Hajisadeghi | Hirgan Energy | Head of I&C |
| Mohammad | Fakharian | Hirgan Energy | Project Manager |
| Ali | Baghaei | HAZOP Consultant | Process Safety |
| Firoozeh | Khosravi | HAZOP Consultant | Process Safety |

* 1. **ATTACHMENT B – LIST OF DRAWINGS**

|  |  |  |
| --- | --- | --- |
| **Drawing No.** | **Drawing Title** | **Place(s) Used** |
| BK-W007S-PEDCO-110-PR-PI- 0001\_D01 | Extension of Binak B/C Manifold (6 sheets) | Nodes: 1 |

* 1. **ATTACHMENT C – NODE LIST**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Nodes** | **Color** | **Drawings** | **SIF Initiator** | **Target SIL** |
| 1. Extension of Binak B/C Manifold | Yellow | BK-W007S-PEDCO-110-PR- PI-0001\_D01 | 1. PALL-1701A | SIL 1 |
| 2. PAHH-1701A | SIL 2 (with recommendation) |

* 1. **ATTACHMENT D – SIF DESCRIPTION**

Node: 1. Extension of Binak B/C Manifold

|  |  |  |
| --- | --- | --- |
| **SIF Initiator** | **Description** | **Target SIL** |
| 1. PALL-1701A | will activate ESD | SIL 1 |
| 2. PAHH-1701A | will activate ESD | SIL 2 (with recommendation) |

## ATTACHMENT E – SIL WORKSHEETS

Node: 1. Extension of Binak B/C Manifold SIF Initiator: 1. PALL-1701A

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Causes** | **Consequences** | **Safeguards** | | **Risk Graph-Safety** | | | | | **Risk Graph-Asset** | | | | **Risk Graph- Environment** | | | | **Recommendat ions** |
| **Protection Layer** | **Category** | **C** | **F** | **P** | **W** | **SIL** | **C** | **P** | **W** | **SIL** | **C** | **P** | **W** | **SIL** |
| 1. Upstream flow line rupture | 1. Possibility of reverse flow from manifold and increased waste of product, severe environmental effect and possibility of fire | 1. FAL-1701A | Non-IPL | SC | FA | PB | W1 | SIL 1 | AA | PB | W1 | SIL a |  |  |  |  |  |
| 2. Wellhead will be closed on flow line pressure loss | Non-IPL |
| 3. Check valve is considered | Non-IPL |
| 4. PALL on other flow lines will close regarding ESDV | Non-IPL |

Node: 1. Extension of Binak B/C Manifold SIF Initiator: 2. PAHH-1701A

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Causes** | **Consequences** | **Safeguards** | | **Risk Graph-Safety** | | | | | **Risk Graph-Asset** | | | | **Risk Graph- Environment** | | | | **Recommendat ions** |
| **Protection Layer** | **Category** | **C** | **F** | **P** | **W** | **SIL** | **C** | **P** | **W** | **SIL** | **C** | **P** | **W** | **SIL** |
| 1. FCV-1701A closed more by a failure in any elements of its control loop | 1. Increased pressure upstream of valve with possibility of damage, fire and personnel injury | 1. FAL-1701A (dependent) | Non-IPL | SC | FB | PA | W2 | SIL 2 | AC | PA | W2 | SIL 2 |  |  |  |  | 1. Relocate PRV-1701A to upstream of FCV- 1701A with class 600#. Also provide procedure that always one manual valve of flow lines to manifolds A/B shall be open. |