



OPERATION AND MAINTENANCE MANUAL

VOLUME I (GENERAL EQUIPMENT)

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Hengyi Industries Sdn Bhd
恒逸实业（文莱）有限公司

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Safety Management System

安全管理制度

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 HENGYI	Hengyi Industries Sdn Bhd 恒逸实业（文莱）有限公司			
	Safety Management System 安全管理制度的			
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1 Purpose 目的

This System is hereby formulated in order to apply scientific safety management methods, identify and evaluate various risks, take effective risk reduction measures, improve process management and control and prevent production safety accidents.

采用科学的安全管理方法，识别、评价各类风险，制定有效风险削减措施，加强过程管控，杜绝生产安全事故，特制定本制度。

2 Scope of Application 适用范围

This System is applicable to all departments of the Company. 本制度适用于公司各部门

3 Terms and Definitions 术语和定义

3.1 Hazards: it refers to roots or states which may cause personal injury and health damage. 危险源(Hazards): 指可能导致人体受伤、健康损害的根源或状态。

3.2 Major hazards: it refers to hazardous chemicals produced, handled, used and stored for a long time or temporarily and the quantity of hazardous chemicals exceeds the critical quantity of units. Unit indicates one (set of) plant, facility and place or several (sets of) production plants and places belonging to the same production and operation company and of which the edge distance is smaller than 500m. 重大危险源(Major hazards): 指长期或临时地生产、搬运、使用和储存的危险化学品，且危险物品的数量等于或超过临界量的单元，单元指一个（套）的装置、设施和场所，或同属于一个生产经营单位且边缘距离小于 500m 的几个（套）生产装置、场所。

3.3 Hazard identification: it refers to a process to identify hazards and make sure their properties. 危险源辨识: 识别危险源的存在并确定其特性的过程。

3.4 Risk: it refers to the possibility that a dangerous incident or a harmful exposure occurs, together with the seriousness of the consequential injury or health damage. 风险: 发生危险事件或有害暴露的可能性，与随之引发的受伤或健康损害的严重性的组合。

3.5 Health damage: it refers to the confirmable bad conditions of body or spirit caused or worsened by work activities and (or) work-related situations. 健康损害: 可确认由工作活动和（或）工作相关状况引起或加重的不良身体或精神状态。

3.6 Risk assessment: it refers to a process to evaluate risks due to hazards, judge sufficiency of existing control measures and confirm whether the risk is acceptable. 风险评价 (Risk assessment): 指评估由危险源导致的风险、考虑现有控制措施的充分性,并确定风险是否可接受的过程。

3.7 Hazardous chemical: it refers to combustible, explosive, toxic, harmful and corrosive chemicals causing injuries or damages to personnel, facilities and environment, including

explosives, compressed gases, liquefied gases, combustible liquids, combustible solids, spontaneous combustible articles, flammable articles when being wet, oxidizers, organic peroxides, toxics and corrosives. 危险化学品：指具有易燃、易爆、有毒、有害及腐蚀性，对人员、设施、环境造成伤害或损害的化学品，包括爆炸品、压缩气体、液化气体、易燃液体、易燃固体、自燃物品和遇湿易燃物品、氧化剂和有机过氧化物、有毒品、腐蚀品等。

3.8 High risk work: it refers to work which may endanger operators and surrounding facilities, including hot work, work in confined space, blind plate vacuum pumping operation, work at heights, hoisting work, temporary power supply, earthwork, work with road closed, maintenance and repair work, radiography operation, and scaffolding erection and dismantling during production and maintenance in the area within the jurisdiction of the Company. 高风险作业：指公司所辖区域内生产、检修过程中可能涉及的动火、进入受限空间、盲板抽堵、高处作业、吊装、临时用电、动土、断路、设备检维修、射线、脚手架搭设与拆除等，对作业者及周围设施安全可能造成重大危害的作业。

3.9 Critical installations and key points: it refers to process plants for producing, storing and using combustible, explosive, highly toxic, corrosive, high-temperature, high-pressure, vacuum, cryogenic and hydrogenation articles, and tank farms, loading and unloading platforms (stations), oil depots and warehouses where explosion and fire may occur, and utility systems which are critical to production safety. 关键装置及重点部位：指生产、储存、使用易燃易爆、剧毒、易腐蚀、高温、高压、真空、深冷、临氢等工艺装置以及可能形成爆炸、火灾场所的罐区、装卸台（站）、油库、仓库等，对生产安全起关键作用的公用工程系统。

3.10 Production area: it refers to an area covering the main plant area, west warehouse area, east and west jetties and pipe rack between main plant area and west warehouse area (excluding traffic routes). It is divided into a main production area and an auxiliary production area. 生产区域：指由主厂区、西库区、东、西码头、主厂区到西库区管廊所辖的区域（不含交通道路），分为主要生产区域和辅助生产区域。

3.11 Main production area: it refers to an area made of process plants or facilities for producing toxic, corrosive, explosive, combustible and combustion-supporting articles, including the area covering process plant, compressor house, tank group, pump house, oil jetty, system pipe rack, loading and unloading platform, filling station, torch, boiler, circulating water field, sewage farm, thermal power plant and sea water desalination facility. 主要生产区域：指由生产毒害、腐蚀、爆炸、燃烧、助燃物质的工艺装置或设施组成的区域，包括工艺装置及压缩机房、罐组、泵房、油码头、系统管廊、装卸站台、充装站、火炬、锅炉、循环水场、污水处理场、热电厂、海水淡化等设施组成的区域。

3.12 Auxiliary production area: it refers to an area covering the plant front area (including office building, center control building, laboratory building, main fire station and maintenance building), warehouse of the whole plant, traffic route within the production area, office building of west jetty and fire station. 辅助生产区域：指厂前区（包括办公楼、中控楼、化验楼、主消防站、维保楼所辖区域）、全厂仓库、生产区内交通道路、西码头办公楼和消防站等所辖区域。

3.13 Fire and explosion protection area: it refers to an area covering the area within the enclosure of plant area of the Company (including production plant, tank farm, loading platform and jetty) and the area within 10m from the equipment and pipeline proper with combustible and explosive gas and liquid and connected equipment and pipelines outside the plant area. 防火防爆区域：指公司生产厂区围墙以内包括生产装置、储罐区、装车栈台、码头等以及延伸到厂

区外含有易燃易爆气体、液体的设备、管道本体及与之相连接的其它设备管道附近 10m 以内的区域。

4 Management Responsibilities 管理职责

4.1 Specified administrative authority 归口管理部门

4.1.1 HSE Dept. is responsible for preparation and amendment of this System and monitoring of implementation of this System by all departments. HSE 管理部负责制（修）定本制度并监督检查各部门的执行情况。

4.1.2 Be responsible for organization of identification, assessment and control of hazards during production, organization of identification, assessment, registration, recording and verification of major hazards, and urging all departments to implement management and control measures against major hazards. 负责组织生产过程的危险源辨识、评价和控制；组织开展重大危险源辨识、评估、登记建档、备案、核销等工作，督促各部门落实重大危险源安全管控措施。

4.1.3 Be responsible for monitoring of high risk work and handling and implementation of work permit, and summarization and review of applications for work permits of all departments. 负责对高风险作业过程、作业许可证办理及执行情况进行监督检查；负责各部门作业许可申请的汇总、审查。

4.1.4 Be responsible for organizing preparation of MSDS of hazardous chemicals of the Company, urging all departments to make records of hazardous chemicals, and monitoring production, storage, use, business, transportation and disposal of hazardous chemicals. 组织编制公司危险化学品 MSDS，督促各部门建立危险化学品档案，并对危险化学品生产、储存、使用、经营、运输、废弃处置等环节进行安全监管。

4.1.5 Be responsible for preparation of standards and management requirements of portable combustible and toxic gas alarm and monitoring of use and maintenance of the portable combustible and toxic gas alarm. 负责制定便携式可燃及有毒气体报警仪配备标准及管理要求，对全厂便携式可燃及有毒气体报警仪的使用、维护过程进行安全监管。

4.2 Collaborative management departments 协同管理部门

4.2.1 Scheduling & Dispatch Dept. 计划调度部

4.2.1.1 Be responsible for hazard identification, risk assessment and control during production and process technology management. 负责生产、工艺管理过程的危险源辨识、风险评价和控制。

4.2.1.2 It is the supervision department of blind plate vacuum pumping operation and is responsible for review of process technology schemes referred in operations with various risks. 是盲板抽堵作业的专业监管部门，负责各项风险作业所涉及的工艺技术处理方案的审核。

4.2.1.3 Be responsible for “one certificate and one label” management of three agents (catalyst, solvent and additive) used in plant production, preparation of instructions on storage and use, and monitoring of implementation of the instructions. 负责装置生产过程中使用的三剂

“一书一签”的管理，并制定储存、使用的操作规程并监督执行。

4.2.2 Equipment Management Dept. 机械动力部

4.2.2.1 Be responsible for organization of hazard identification, risk assessment and control during equipment and facility management. 负责组织设备设施管理过程中的危险源辨识、风险评价和控制。

4.2.2.2 Be responsible for preparation of management regulations on high risk work such as earthwork, hoisting work, temporary power supply, scaffolding erection and dismantling, and maintenance and repair work, approval of repair schemes referred in high risk work permit, and work monitoring and management. 负责制定动土、吊装、临时用电、脚手架搭设与拆除、设备检维修等高风险作业管理规定；负责高风险作业许可证所涉及的检修施工方案的审批和作业过程的监督管理。

4.2.2.3 Be responsible for verification, maintenance, scrapping and updating of the portable alarm, and assessment of missing or damage of the alarm due to misuse and improper management. 负责便携式报警仪的检定、维修、报废、更新工作，对报警仪因使用不当、管理不严造成遗失或损坏进行考核。

4.2.3 Other functional departments 其他职能部门

Be responsible for hazard identification, assessment, control and safety management within the responsibilities. 负责本部门职责范围内的危险源辨识、评价和控制及安全管理工作。

4.3 Executive departments 执行部门

4.3.1 The executive departments refer to various production operation departments. 各生产运行部门为执行部门。

4.3.2 Be responsible for hazard identification and risk assessment during production of the department, confirmation of risk list, preparation and implementation of risk control measures, organization and participation of risk management training, and mastering of basic risk identification methods. 负责本部门生产过程的危险源辨识与风险评价，确定风险清单，制定和落实风险控制措施；组织和参与风险管理培训，掌握基本风险辨识方法。

4.3.2 Be responsible for routine inspection, maintenance and monitoring of major hazards and critical installations and key points of the department. 负责本部门重大危险源、关键装置和重点部位的日常检查、维护和监控。

4.3.3 Be responsible for management of production, storage, use, loading and unloading, transportation and disposal of hazardous chemicals of the department, establishment of records of hazardous chemicals, and regular implementation of emergency exercise of site disposal of hazardous chemicals. 负责本部门危险化学品的生产、储存、使用、装卸、运输、废弃处置的管理；建立危险化学品台账和档案，定期开展危险化学品现场处置应急演练。

4.3.4 Be responsible for applying for high risk work permit, giving technical disclosure to the working department (organization), reviewing the construction scheme of working department (organization), notifying the risk at the work site, organizing the working department (organization) to jointly carry out risk identification, and preparing and taking risk reduction

measures. 负责高风险作业许可证申请，向作业部门（单位）进行安全技术交底，审查作业部门（单位）施工方案；告知作业现场风险，组织作业部门（单位）共同开展风险辨识，制定落实风险削减措施。

5 Management Content 管理内容

5.1 Management principles and content 管理原则及内容

5.1.1 Follow the principle of “one in charge shall assume the responsibilities” and “territorial management” for safety management, use a scientific and effective hazard identification and risk assessment method to identify various risks for the Company, prepare effective control measures and management schemes, and prevent accidents. 安全管理原则遵循“谁主管、谁负责”和“属地管理”的原则，运用科学有效的危险源辨识和风险评价方法识别出公司各类风险，制定有效的控制措施及管理方案，预防事故的发生。

5.1.2 The management content includes management of hazard identification and risk assessment, major hazards, high risk work, hazardous chemicals, critical installations and key points. 管理内容包括：危险源辨识及风险评价、重大危险源、高风险作业、危险化学品、关键装置和重点部位管理等。

5.2 Hazard identification and risk assessment 危险源辨识和风险评价

5.2.1 Management requirements 管理要求

All departments shall organize hazard identification and risk assessment, confirm the risk level, prepare and take risk control measures as per the following requirements: 各部门应按照下列要求组织开展危险源辨识与风险评价，确定风险等级，制定并落实风险控制措施：

5.2.1.1 Organize hazard identification and risk assessment in daily management at least once a year; 每年应至少组织一次日常管理活动的危险源辨识与风险评价；

5.2.1.2 Organize plant and process hazard analysis at least once every three years; 每三年应至少组织一次装置工艺危害分析；

5.2.1.3 Organize hazard identification and risk assessment of in-service equipment and facilities at least once a year; 每年应至少组织一次对在役设备设施的危险源辨识与风险评价；

5.2.1.4 Organize hazard identification and risk assessment of various work in normal production at least once a year; 每年应至少组织一次正常生产过程中各项作业活动的危险源辨识与风险评价；

5.2.1.5 Before each key operation, maintenance and repair of key equipment and facilities, and shutdown and overhaul of plants in daily production, the responsible department shall organize hazard identification and risk assessment; 日常生产活动中各种关键操作、关键设备设施以及检维修作业、装置停工大修等作业活动前，均应由该项活动主管部门组织进行危险源辨识和风险评价；

5.2.1.6 For any change to process and technology, equipment and facility, material and management, the application department or competent department of change shall organize hazard identification and risk assessment before making changes. Refer to HSE

Comprehensive Management System for details; 发生工艺技术、设备设施、材料、管理等变更活动时，变更申请部门或主管部门应在变更实施前组织进行危险源辨识与风险评价，具体参照《HSE 综合管理制度》；

5.2.1.7 Hazard identification and risk assessment of new, reconstructed and expanded projects shall follow relevant provisions of Bruneian Government. 新、改、扩建设项目的危险源辨识与风险评价按文莱政府有关规定执行。

5.2.1.8 In production and other relevant activities, all departments and their staff shall conduct hazard identification and risk assessment and control as per the specified time, period and method and be responsible for the results. 各部门及员工在从事生产作业和其它相关活动时，应按规定时间、周期、方法进行危险源辨识、风险评价和控制，并对其结果负责。

5.2.2 Hazard identification and risk assessment method 危险源辨识和风险评价方法

5.2.2.1 Hazard identification method 危险源辨识方法

(1) Job hazard analysis (JHA) 工作危害分析 (JHA)

For maintenance and repair, various regular work, startup and shutdown, and various general permitted work. 用于检维修作业、各类常规作业、开停车过程、各类一般许可作业等。

(2) Safety check list analysis (SCL) 安全检查表分析 (SCL)

For intrinsic safety check of equipment and facilities. 用于设备设施本质安全检查。

(3) Hazard and operability analysis (HAZOP) 危险与可操作性分析 (HAZOP)

For safety review of production process of new, reconstructed and expanded facilities. 用于新、改、扩建设设施生产工艺安全审查。

(4) Hazard identification analysis (HAZID) 危险源识别分析 (HAZID)

For hazard identification analysis in the design stage. 用于设计阶段危险源辨析。

(5) Quantitative risk assessment (QRA) 量化风险评价 (QRA)

For identification of potential risks in the design stage and quantitative analysis of probability of occurrence and possible consequences of potential risks. 用于设计阶段识别潜在危险，对潜在危险发生的概率及可能造成的后果进行量化分析。

5.2.2.2 Risk assessment method 风险评价方法

A risk matrix method is used generally. 风险评价方法一般采用风险矩阵法。

5.2.3 Risk assessment report 风险评价报告

5.2.3.1 Preparation of risk assessment report 风险评价报告编制

(1) HSE Dept. shall summarize and review the results of hazard identification and risk assessment reported by all departments before each December, summarize the work of hazard identification and risk assessment conducted within the year, and report to HSE management committee. The risk assessment report shall include assessment object and scope, assessment process and organization, identification and assessment method used, assessment result, key risk control measures, and removal and control conditions of major hidden dangers occurring last year. HSE 管理部每年 12 月前汇总和评审各部门的上报危险源辨识、风险评价结果，对年内所开展的危险源识别和风险评价工作进行总结并上报公司 HSE 管理

委员会。风险评价报告的内容包括：评估对象及范围，评估过程及组织，采用的识别、评价方法，评估结果及重大风险控制措施，上年度重大隐患的消除、控制等情况；

(2) After being approved by the leader in charge of the Company, the risk assessment report shall be used as the basis for preparing HSE operation scheme, objective and index, technical modification and measure, safety input and education and training for the next year, and be regarded as one input material of management review. 上述风险评价报告交公司主管领导审批后，作为编制下年度 HSE 工作计划、目标指标、技改技措、安全投入、教育培训的依据，并作为管理评审的输入材料之一；

(3) Refer to HSE Comprehensive Management System for risks to be rectified. 对于评价出的风险，需要立项整改的，参照《HSE 综合管理制度》执行。

5.3 Major hazard 重大危险源

5.3.1 Identification, recording and assessment of major hazards 重大危险源的辨识、建档与评价

5.3.1.1 The identification range covers tank farm, warehouse area, production place, pressure pipeline, boiler and pressure vessel. 辨识范围包括贮罐区、库区、生产场所、压力管道、锅炉、压力容器等。

5.3.1.2 HSE Dept. shall organize relevant department to identify major hazards for the Company as per Identification of Hazard Installations for Hazardous Chemicals (GB18218-2009). HSE 管理部组织相关部门按 GB18218-2009 《危险化学品重大危险源辨识》识别和确定公司重大危险源。

5.3.1.3 Recording material of major hazards 重大危险源存档资料

- (1) Table of basic characteristics of major hazards; 重大危险源基本特征表；
- (2) Identification and classification record of major hazards; 重大危险源辨识、分级记录；
- (3) All MSDSs involved; 涉及的所有危险化学品安全技术说明书；
- (4) Regional location map, layout plan, process flow diagram and main equipment list; 区域位置图、平面布置图、工艺流程图、主要设备一览表；
- (5) Safety system of major hazards, measure description, detection and inspection results; 重大危险源安全系统、措施说明、检测、检验结果；
- (6) Setting of safety warning signs at places of major hazards; 重大危险源场所安全警示标志的设置情况；
- (7) Name of principal of critical installations and key points of major hazards; 重大危险源关键装置、重点部位负责人名称；
- (8) Accident emergency rescue plan, exercise plan and summary of major hazards; 重大危险源事故应急救援预案、演练计划和总结；
- (9) Risk assessment report of major hazards. 重大危险源风险评估报告。

5.3.1.4 HSE Dept. shall organize safety assessment of major hazards once every three years and submit the safety assessment report. HSE 管理部对重大危险源每 3 年组织 1 次安全评价，并提交安全评价报告。

5.3.2 Monitoring and management of major hazards 重大危险源监控与管理

5.3.2.1 All departments shall identify hidden dangers of major hazards regularly and rectify the hidden dangers immediately. Refer to HSE Comprehensive Management System for specific requirements. 各部门应定期对重大危险源进行隐患排查，对发现的隐患应立即整改，具体要求参照《HSE 综合管理制度》。

5.3.2.2 Equipment Management Dept. shall make use and inspection records of relevant equipment and facilities (including safety accessories) of major hazards, and inspect and detect the equipment and facilities of major hazards regularly. 机械动力部应建立重大危险源相关设备设施（包括安全附件）的使用、检验档案或台帐，并定期对重大危险源的设备设施依据检测周期进行检验、检测。

5.3.2.3 Obvious safety warning signs must be set at the site of major hazards, and the combustible and toxic gas detection and alarming system shall achieve real-time monitoring. Information of possible accident consequences and emergency measures shall be given to relevant organizations and personnel timely. 重大危险源现场必须设置明显的安全警示标志，对可燃气体、有毒气体检测报警系统应做到实时监控。对可能发生的事故危害、应急措施等信息及时告知相关单位和人员。

5.4 Management of hazardous chemicals 危险化学品管理

5.4.1 Classification of hazardous chemicals 危险化学品分类

Main hazardous chemicals in materials of the Company include crude oil, sodium hydroxide, sulfuric acid, hydrochloric acid and other auxiliary chemicals. 公司原料中的主要危险化学品有：原油、氢氧化钠、硫酸、盐酸和其他化工助剂等。

Main hazardous chemicals in products (including intermediate products) mainly include naphtha, gasoline, kerosene, liquefied petroleum gas, propylene, benzene, methylbenzene, dimethylbenzene, hydrogen and fuel gas. 产品中的危险化学品（含中间产品）主要有：石脑油、汽油、煤油、液化石油气、丙烯、苯、甲苯、二甲苯、氢气、燃料气等。

5.4.2 Management requirements of hazardous chemicals 危险化学品管理要求

5.4.2.1 Scheduling & Dispatch Dept. shall organize preparation of technical documents such as operation instructions and process cards as per the production process, technology, equipment characteristics, and hazard of material, auxiliary material and product. 计划调度部根据生产工艺、技术、设备特点和原、辅助材料、产品的危险性组织编制操作规程、工艺卡片等技术文件。

5.4.2.2 HSE Dept. shall organize general inspection of hazardous chemicals each year and urge all operation departments to make records of hazardous chemicals. HSE 管理部每年组织对危险化学品进行普查，并督促各运行部建立危险化学品档案。

5.4.2.3 HSE Dept. shall provide personal protective equipment and first-aid equipment to the operation departments as per hazard characteristics of hazardous chemicals and monitor the monitoring points of occupational hazard factors at the workplace of hazardous chemicals regularly. HSE 管理部根据危险化学品的危险特性为运行部配备个人防护用品、急救器材等应急

装备，并对危险化学品作业场所职业病危害因素监测点进行定期监测。

5.4.2.4 All operation departments must participate training on knowledge of hazardous chemicals of the Company, and staff shall be familiar with information on safety technology of hazardous chemical involved in the post to ensure stable operation and personal safety in production, storage, use, transportation and disposal of hazardous chemicals. 各运行部必须参加公司危险化学品知识培训，员工应熟悉本岗位涉及的危化品安全技术信息，以保证危险化学品生产、储存、使用、运输、废弃处置等环节的平稳操作和人身安全。

5.4.2.5 Before using hazardous chemicals, the staff must know and grasp relevant MSDS and safe operation instructions of hazardous chemicals, take relevant precautionary measures and prevent personal injuries. 员工使用危险化学品时，必须了解和掌握相应危险化学品安全技术说明书和安全操作规程有关内容，并采取相应的防范措施，避免发生人身伤害事故。

5.4.2.6 The operation departments shall use and store hazardous chemicals as per the following requirements: 运行部门使用和储存危险化学品应满足以下要求：

(1) Hazardous chemicals that may cause combustion, explosion, chemical reaction or generation of toxic gas when exposed to moisture and heat, shall not be stored in the open air or at the place with moisture, rainwater or stagnant water. 遇水、热、潮湿易燃烧、爆炸或发生化学反应、产生有毒有害气体的危险化学品不得存放在露天、潮湿、漏雨或低洼易积水的地方；

(2) Hazardous chemicals that may cause combustion, explosion, chemical reaction or generation of toxic gas when exposed to sunshine or heat, shall be stored at a cool and ventilated place. Do not be close to the heat source. The temperature at the storage place shall not be higher than the spontaneous ignition point and melting point of hazardous chemicals. Combustible barreled liquid with a flash point lower than 45°C shall not be stored in the open air. 日光照射或受热易燃烧、爆炸或产生有毒有害气体的危险化学品应存放在阴凉通风的地方，禁止靠近热源，存放处的温度不得高于物品的自燃点和熔点。闪点在 45°C 以下的桶装易燃液体不得露天存放；

(3) Hazardous chemicals whose chemical property or protection method and method of extinguishing are mutually contradicted, shall not be stored in the same warehouse. Radioactive substances and other hazardous chemicals shall not be stored in the same warehouse. Oxidizers and combustibles and explosives shall not be stored in the same warehouse. Spontaneous combustible articles or articles which are combustible when exposed to moisture shall not be stored in the same warehouse together with combustibles and explosives. 化学性质与防护、灭火方法相互抵触的危险化学品，不得在同库存放。放射性物品不得与其它危险化学品同库存放，氧化剂不得与易燃易爆物品同库存放，能自燃或遇水燃烧的物品不得与易燃易爆品同库存放；

(4) The warehouse with hazardous chemicals shall be provided with corresponding fire fighting facilities and protective equipment as per the fire protection rules. 储存危险化学品的仓库，根据消防规范和规定，配备相应的消防设施和防护器材。

5.4.2.7 Commercial Dept. shall provide or obtain MSDS and safety label of hazardous chemicals timely as per production and sales. 商务部应按产、销，及时提供和获取危险化学品产品安全技术说明书及安全标签。

5.4.2.8 Procurement, use, storage and transportation of highly toxic chemicals and precursor chemicals shall comply with relevant laws and regulations of Bruneian Government. 涉及采购、使用、储存、运输剧毒和易制毒化学品应执行文莱政府的相关法律法规。

5.4.2.9 "Five twos" system shall be implemented for highly toxic substances: namely, managed by two people, received and dispatched by two people, transported by two people, unlocked by two people and used by two people. 剧毒品的管理应实行双人保管、双人收发、双人运输、双锁和双人使用的“五双”管理。

5.4.3 Transportation of hazardous chemicals 危险化学品运输

5.4.3.1 Operation departments and Commercial Dept. shall be responsible for safety management of ex-factory process of transportation of hazardous chemicals of the department. 运行部和商务部负责本部门危险化学品运出出厂过程的安全管理。

5.4.3.2 Materials & Supplies Dept. shall be responsible for transportation safety management of hazardous chemicals before transporting from the warehouse to the area within the jurisdiction of operation department. 物资装备部负责仓库至运行部门管辖区域前危险化学品的运输安全管理。

5.4.3.3 Port and Storage Dept. shall be responsible for safety management of hazardous chemicals of loading and unloading platform, and giving the safety label of product to the delivery personnel. 港储部负责装卸车栈台危险化学品的安全管理，产品的安全标签发放到提货运输人员。

5.4.3.4 Personnel and vehicles for transporting hazardous chemicals must comply with relevant laws and regulations of Brunei and hold corresponding transportation and operation qualifications. 运输危险化学品的人员和车辆必须遵守文莱国家相关法律法规要求，并持有相应运输和操作资质。

5.5 Safety management of warehouse 仓库安全管理

5.5.1 Materials in the warehouse must be stored as per requirements. Materials at the storage yard shall be classified as per their characteristics. Materials in the warehouse shall be put on shelves or placed on the ground with cushions. The normal-temperature warehouse shall be dry to prevent dampness of materials. Electric appliances and equipment in the warehouse shall be inspected and maintained regularly to ensure completeness. 进库物资必须按要求存放，堆场的物资应根据物资的特性进行分类，库内放置的物资根据实际情况上架或下垫存放，应保持常温库的干燥，避免物资受潮。库内电气、设备应定期检查维护，确保处于完好状态。

5.5.2 For materials to be stored in a constant-temperature warehouse, control the temperature and humidity in the warehouse to store the materials at a proper temperature, and inspect regularly. 对需在恒温库保管的物资要控制好库内的温度和湿度，使物资在适宜的温度下存放，并定期进行检查。

5.5.3 Follow the principle of special warehouse for storage as per classifications, and store materials based on specified type, specified warehouse and specified personnel. The warehouse keeper must grasp knowledge on safety protection and emergency disposal of materials under his/her supervision. 仓库应根据专库分储的原则，做到定品种、定库房、定人员进行保管，仓库保管人员须了解所管物品的安全防护及应急处置相关知识。

5.5.4 The enclosure and gate of warehouse shall be provided with an alarm system and a

camera operating 24h a day, and 24h-on-duty full-time guards shall be appointed. 仓库围墙和大门应设有报警系统和摄像装置，并 24 小时工作，配备专职保卫人员 24 小时值勤。

5.5.5 No smoking in the warehouse area. Do not bring matches or lighters to the warehouse area. Do not use firing equipment such as electric heating furnace and heating appliance. If necessary, strictly implement the approval procedures of hot work of the Company. 仓库区内严禁吸烟，不准将火柴、打火机等火种带入库区。不准设置电热炉、电热器等明火设备，若必须使用时，须严格执行公司动火审批手续。

5.5.6 Lightning protection facilities, wires, lighting and fire fighting facilities of the warehouse shall be inspected regularly; the water pressure shall be stable and comply with the requirement; and the fire fighting equipment shall be kept and maintained by specially-assigned personnel. 仓库的避雷设施、电线、照明、消防设施要定期检查，水压稳定合乎要求；消防器材要专人保管、维护。

5.5.7 Personnel, vehicles and materials entering and leaving the warehouse area must be in strict accordance with Security Management System. All ex-warehouse materials must be provided with a valid certificate from the warehouse keeper and can be delivered only after the security guard checks the name, specification, model and quantity. 进出库区的人员、车辆和物资必须严格执行公司《治安保卫管理制度》，所有出库物资必须凭库管员开具的有效证件，经安保人员核物质名称、规格型号及数量与实物相符后放行。

5.6 Critical installations and key points 关键装置和重点部位

5.6.1 HSE Dept. shall organize Scheduling & Dispatch Dept. and Equipment Dept. to define critical installations and key points. 关键装置和重点部位由 HSE 管理部组织计划调度部、设备等等有关部门进行界定。

5.6.2 Critical installations and key points shall be subject to management of contact point of company leader, namely, the company leader shall be responsible for contacting (contracting) critical installations and key points. The contact person shall be confirmed through discussion of HSE management committee. 关键装置和重点部位实行公司领导干部联系点管理，即由公司领导联系（承包）关键装置和重点部位。联系人由公司 HSE 管理委员会讨论确定

5.6.3 The contact person of critical installations and key points shall carry out at least one HSE activity at the contact point each quarter. The activity may include HSE activity of team, HSE inspection, urging to solve potential accident and HSE work instruction. The operation department shall record the participation condition timely and feed back to HSE Dept. 关键装置和重点部位联系人每季度至少到联系点进行一次 HSE 活动，活动形式包括参加班组 HSE 活动、HSE 检查、督促治理事故隐患、HSE 工作指示等。所在运行部应及时记录参加活动情况并反馈至 HSE 管理部。

5.6.4 HSE management committee shall assess and issue the contacting (contracting) condition of company leader once every half a year. HSE 管理委员会每半年对领导干部联系（承包）情况进行 1 次考核和公布。

5.6.5 Daily management of critical installations and key points shall be subject to level-to-level management and monitoring of functional department, operation department and team. 关键装置和重点部位的日常管理实行职能部门、运行部和班组分级管理与分级监控原则。

5.6.6 When critical installations and key points are regarded as major hazards of the

Company, follow the management requirements of major hazards. 关键装置和重点部位列为公司重大危险源时，还应按照重大危险源管理要求执行。

5.7 Management of high risk work 高风险作业管理

5.7.1 High risk work shall be subject to the principle of “one in charge shall assume the responsibilities” and “confirmation level by level and process control”. High risk work mainly includes hot work, work in confined space, blind plate vacuum pumping operation, work at heights, hoisting work, temporary power supply, earthwork, work with road closed, maintenance and repair work, radiography operation, scaffolding erection and dismantling, and work in fire and explosion prevention areas. 高风险作业实行“谁主管、谁负责”、“逐级确认、过程控制”的原则。高风险作业主要包括动火、进入受限空间、盲板抽堵、高处、吊装、临时用电、动土、断路、设备检维修、射线探伤、脚手架搭设与拆除、防火防爆区域和检维修作业等。

5.7.2 Refer to HSE Comprehensive Management System for management of work permit. 作业许可证管理见《HSE 综合管理制度》。

5.8 Requirements of high risk work 高风险作业要求

5.8.1 Before the work, the working department (organization) and application department shall identify possible hazards in the work and prepare corresponding safety measures. 作业前，作业部门（单位）和申请部门一起对作业可能存在的危险源进行辨识，制定相应的安全措施。

5.8.2 Before the work, the working department (organization) shall give safety technical disclosure to personnel involved in the work, mainly including: 作业前，作业部门（单位）应对参加作业的人员进行安全交底，主要内容如下：

5.8.2.1 Possible hazards at the work site and in the work and specific safety measures to be taken; 作业现场和作业过程中可能存在的危险源及应采取的具体安全措施；

5.8.2.2 Use methods and precautions of personal protective equipment in the work; 作业过程中所使用的个体防护器具的使用方法及使用注意事项；

5.8.2.3 Knowledge on accident prevention, risk avoiding, escape, self-aid and mutual aid; 事故的预防、避险、逃生、自救、互救等知识；

5.8.2.4 Relevant accident case and experience and lessons. 相关事故案例和经验、教训。

5.8.3 Before the work, the application department shall carry out the following work: 作业前，申请部门应进行如下工作：

5.8.3.1 Isolate, clean and replace the equipment and pipeline to ensure that the safety requirements of hot work and work in confined space are met; 对设备、管线进行隔离、清洗、置换，并确认满足动火，进入受限空间等作业的安全要求；

5.8.3.2 Take corresponding safety measures against radioactive sources; 对放射源采取相应的安全处置措施；

5.8.3.3 Disclose underground concealed work at the work site; 对作业现场的地下隐蔽工程进行交底；

5.8.3.4 Provide eyewash equipment and spraying facility at the workplace with corrosive mediums; 腐蚀性介质的作业场所应配备洗眼器和喷淋设施；

5.8.3.5 Provide required lighting plants at the workplace for night work. 夜间作业场所应设置

满足要求的照明装置。

5.8.4 Before the work, the application department and working department (organization) shall inspect jointly and confirm that equipment and processes meet the safety requirements. In addition, the following requirements shall be met: 作业前,申请部门和作业部门(单位)共同检查,确认设备、工艺处理等满足安全要求,同时还需符合如下要求:

5.8.4.1 The fire fighting access and traffic lane at the work site shall be unblocked, and sundries affecting work safety shall be removed; 作业现场消防通道、行车通道应保持畅通;影响作业安全的杂物应清理干净;

5.8.4.2 The ladder, handrail, platform and cover plate at the work site shall be complete and firm, and the temporary facility shall be safe; 作业现场的梯子、栏杆、平台、盖板等设施应完整、牢固,采用的临时设施应确保安全;

5.8.4.3 Take effective protective measures for pit, well, ditch and hole which may endanger safety at the work site, set a warning sign and provide a red warning light at night. The power supply of electric appliance on the operating equipment can be cut off reliably, and a lock shall be arranged at the power switch, hanging a warning board; 作业现场可能危及安全的坑、井、沟、孔洞等应采取有效防护措施,并设警示标志,夜间应设警示红灯;作业设备上的电器电源应可靠断电,并在电源开关处加锁并加挂安全警示牌;

5.8.4.4 Gas protection plants, fire fighting equipment, communication equipment and lighting equipment in the work shall be complete; 作业使用的气体防护器具、消防器材、通信设备、照明设备等应完好;

5.8.4.5 Scaffolds, hoisting machinery, electric and gas welding tools and portable electric tools used in the work shall comply with the work safety requirement, and the handheld and mobile electric tools with a voltage higher than the safe voltage shall be provided with an earth leakage protection plant. 作业使用的脚手架、起重机械、电气焊用具、手持电动工具等各种工器具应符合作业安全要求;超过安全电压的手持式、移动式电动工器具应配有漏电保护装置。

5.9 Hot work 动火作业

5.9.1 Scope of hot work 动火作业范围

5.9.1.1 Unconventional work which may generate open fire directly or indirectly, including but not limited to: 能直接或间接产生明火的非常规作业。包括但不限于:

(1) Electric welding, gas welding, braze welding, plastic welding and other welding and cutting; 电焊、气焊、钎焊、塑料焊等焊接切割;

(2) Work with spark produced by electrothermal treatment, electric drill, polishing, sandblasting, pneumatic pick, breaking, hammering, blasting and ferrous metal striking; 电热处理、电钻、打磨、喷砂、风镐及破碎、锤击、爆破、黑色金属撞击等产生火花的作业;

(3) Blast burner, furnace, electric furnace, liquefied gas furnace, hot bend, asphalt boiling, sand frying and other hot work; 喷灯、火炉、电炉、液化气炉、煨管、熬沥青、炒沙子等明火作业;

(4) Arrangement of fuel oil machinery in the production area such as generator with power source and air compressor with power source; 在生产区域内设置自带动力源的发电机和自带动力源的空气压缩机等燃油机械设备;

(5) Use of non-explosion-proof electric appliance in the flammable and explosive area. 在易燃易爆危险区域使用非防爆的电器设备等。

5.9.1.2 As per the hazard level of location of hot work, hot work in the plant is divided into special grade, Grade I and Grade II. 动火作业根据动火部位危险程度，装置内动火分为三级：特级动火、一级动火、二级动火。

(1) Special-grade hot work includes but not limited to: 特级动火包括但不限于以下情况：

1) Hot work on the proper of container, equipment and pipeline with combustible and explosive or flammable and toxic mediums without displacement; 在带有易燃易爆或可燃、有毒介质的容器、设备、管线等设备不置换直接在本体上动火作业；

2) Hot work such as electric welding, tapping, cutting and heat treatment of equipment, container and pipeline with flammable and toxic mediums or high-temperature high-pressure mediums under pressure shall be managed as per special-grade hot work; 可燃、有毒介质或高温高压介质的设备、容器、管线上带压进行电焊、开孔、切削、热处理等热工明火作业按特殊动火作业管理；

3) Required hot work at locations of industrial sewage well and sewage (contaminated-oil) tank with possible combustible and explosive or flammable and toxic mediums shall be managed as per special-grade hot work; 可能存在易燃易爆或可燃、有毒介质工业下水井、污（油）水池等部位确属生产需要必须进行的动火作业按特殊动火处理；

4) Hot work in the fire dike of spherical tank farm of liquid hydrocarbon under normal operation; 正常运行的液态烃球罐区防火堤内的动火作业；

5) Hot work directly generating open fire in the area stretching from the edge of oil tanker parking at the quay berth outwards by 35m; 码头泊位油轮停靠时从油轮边缘起向外延伸 35m 以内区域的直接产生明火的动火作业；

6) First hot work in the plant after shutdown, overhaul and qualified process treatment; 装置停车大检修，工艺处理合格后装置内的第一次动火；

7) For special-grade hot work, director of the operation department shall organize relevant functional department and hot work department (organization) to jointly conduct risk assessment. Prepare and implement a operation scheme (safety measures) and an emergency plan, and carry out hot work upon approval of the director of the operation department. 特殊动火必须由运行部部长牵头，组织相关职能部门及动火作业部门（单位）共同进行风险评价；制定可靠的工作方案（安全措施）及应急预案并有效落实，经运行部部长审批后方可动火。

(2) Grade-I hot work includes but not limited to: 一级动火包括但不限于以下情况：

1) Process production plant area in production; 处于生产状态的工艺生产装置区；

2) Within the fire dike of hazardous chemical warehouse, various tank farms, pipe rack and combustible gas and combustion-supporting gas tank farms (area 15m away from the tank wall of industrial sewage well and sewage tank without fire dike); 危险化学品库、各类油罐区、管廊、可燃气体及助燃气体罐区防火堤内（工业下水井、污水池、无防火堤的距罐壁 15 米以内的区域）；

3) House, loading area, washtrough station, laboratory or machine room containing combustible liquid, combustible gas, combustion-supporting gas and toxic medium; 可燃液体、可燃气体、助燃气体及有毒介质的房屋、装卸区和洗槽站、实验室或机房；

4) Hot work for container, pipeline and equipment in the normal production plant for storing and delivering combustible, explosive and toxic liquids and gas, where the container, pipeline and

equipment are subject to isolation and process treatment; 正常生产装置内储存、输送易燃易爆、有毒液体和气体的容器、管线、设备等进行了隔离且进行工艺处理合格后进行的动火作业;

5) No. 1 and No. 2 areas in the operation/production plant based on explosive gas atmosphere and area II based on explosive dust atmosphere; 运行生产装置内按照爆炸性气体环境划分属于 1、2 区的区域, 爆炸性粉尘环境划分属于 II 区的环境;

6) Area within 35m-70m from the edge of oil tanker when an oil tanker parks at the quay berth; main parking platform area in front of the berth while no oil tanker parks at the quay berth; 码头泊位油轮停靠时, 从油轮边缘向外延伸 35m 以外至 70m 以内的区域; 泊位无油轮停靠时, 泊位前沿主靠平台区域;

7) Hot work at the archives room, library, data room and network computer room with combustibles piled up. 档案室、图书馆、资料室、网络机房等易燃物堆积场所使用热工、明火的作业。

(3) Grade-II hot work includes but not limited to: 二级动火包括但不限于以下情况:

1) Hot work in the plant which is subject to shutdown, overhaul and qualified process treatment, confirmation of organization and maintenance acceptance organized by Scheduling & Dispatch Dept. and safe implementation of first hot work, shall be managed as per Grade-II hot work; 装置停工大修, 工艺处理合格, 经计划调度部组织生产转检修验收确认后并安全实施了第一次动火作业的装置内动火, 可以按二级动火管理;

2) Hot work for container and pipeline which are transported to a safe place, are subject to purging, and pass hot work analysis; 运到安全地点, 并经吹扫处理后动火分析合格的容器、管线动火;

3) Other temporary hot work other than Grade-II hot work and special-grade hot work. 不属于一级动火和特殊动火的其它临时动火。

5.9.2 Requirements of hot work 动火作业要求

5.9.2.1 Besides the above requirements, the special-grade hot work shall comply with the following provisions: 特殊动火作业在符合上述要求的同时, 还应符合以下规定:

(1) Hot work under pressure and without displacement is not allowed under the condition of unstable production; 在生产不稳定的情况下不应进行带压不置换动火作业;

(2) Prepare the operation scheme and implement safety precautions in advance and ask a full-time fire brigade to monitor at site when necessary; 应预先制定作业方案, 落实安全防火措施, 必要时可请专职消防队到现场监护;

(3) The operation department shall give a previous notice to Scheduling & Dispatch Dept. and relevant departments, so as to take corresponding emergency measures timely under abnormal conditions; 运行部门应预先通知计划调度部及相关部门, 在异常情况下能及时采取相应的应急措施;

(4) Work at a positive pressure and keep good ventilation and exhaust at the work site; 应在正压条件下进行作业, 作业现场通排风良好;

(5) For special-grade hot work, inspect surrounding gas at the site continuously and record the inspection data every two hours. 特级动火需要保证现场持续监测周围环境气体情况, 并且间隔 2 小时记录一次检测数据。

5.9.2.2 For special-grade, Grade I and Grade II hot work, one permit is only for hot work at

one location. Hot work shall be monitored by one person from the application department (as the main guardian) and one person from the working department (organization); for Grade II hot work during overhaul, one guardian can monitor hot work at three locations at most within the same plant area and on the same working plane. 特级、一级和二级动火，实行一张许可证只限一处动火，动火实行双人监护，申请部门和作业部门（单位）各派一人，以申请部门监护人为主；大检修期间的二级动火，一名监护人可同时监护同一装置区域内、同一作业面的动火，原则上最多不准超过 3 处。

5.9.2.3 No hot work is allowed during shutdown purging and start-up. The floor drain, drainage port, well, exhaust pipe and pipeline of production sewage system must be sealed or covered tightly. Do not conduct combustible solvent cleaning and painting at the same time within 30m in the same hot work area. 装置停工吹扫及投料开车过程中，严禁一切明火作业；生产污水系统的地漏、排水口、各类井、排气管、管道等必须封严盖实；在同一动火区域 30 米范围内不应同时进行可燃溶剂清洗和喷漆等施工作业。

5.9.2.4 If special work such as work in confined space, temporary power supply and work at heights is involved in the hot work, corresponding special work safety permits shall be handled. 动火作业涉及进入受限空间、临时用电、高处作业等专项作业的，还须办理相应的专项安全作业许可证。

5.9.2.5 If an adjacent plant is involved in the hot work, the applicant shall contact the person from adjacent department, jointly take safety measures and make comments in the column of interested party of hot work safety permit. 动火作业涉及相邻装置时，申请人与相邻部门人员联系，共同采取安全措施并在动火安全作业许可证相关方栏内签署意见。

5.9.2.6 Evacuation, purging, displacement, analysis, removal and arrangement of blind plate, arrangement of isolation barrier, preparation of fire fighting equipment, and blocking of oily sewage well and floor drain among process safety measures, shall be proposed and implemented by local departments. 工艺安全措施中的排空、吹扫、置换、分析，拆加盲板、设置隔离屏障，消防器材的准备，含油污水井、地漏封堵等措施，均由属地部门提出并安排落实。

5.9.2.7 In case of any of the following, any one may propose a requirement of stopping the work immediately; the guardian shall withdraw the work permit immediately upon confirmation and inform the approver of the termination reason of permit; and a new permit is required for continuing the work: 发生下列任何一种情况时，任何人可以提出立即终止作业的要求，监护人确认后应立即收回作业许可证，并告知批准人许可证终止的原因，需要继续作业应重新办理：

(1) Work environment, content or condition change; 作业周边环境、内容和条件发生变化；

(2) Hot work is inconsistent with the requirements in operation scheme; 动火作业与作业计划的要求不符；

(3) Worker at site discoveries major potential safety hazards which may cause personal injuries. 现场作业人员发现重大安全隐患，有可能造成人身伤害的情况。

5.9.2.8 The operation department shall arrange a warning line in the hot work area and prohibit irrelevant personnel or vehicles of hot work entering the hot work area, and the application department shall arrange a fire fighting truck and medical equipment when necessary based on the risk level of work. 作业部门在动火施工区域应设置警戒，严禁与动火作业无关人员或车辆进入动火区域，申请部门根据作业的风险程度，必要时配备消防车及医疗救护设备和器材。

5.9.2.9 If a fixed hot work area is required at the safe place within the production area, an

Application Form of Fixed Hot Work Area shall be filled in by the application department, reviewed by Scheduling & Dispatch Dept., reviewed against safety assessment by HSE Dept., and submitted to the leader in charge for approval. 在生产区域内安全有保障的地点如需设置固定动火区，由申请部门填写《固定动火区申请表》，经计划调度部审核、HSE 管理部进行安全评估审核后报主管领导批准。

5.9.2.10 The fixed hot work area must meet the following safety requirements: 固定动火区的设置须满足以下安全要求:

(1) It shall be arranged at upwind or crosswind direction of yearly minimum frequency wind direction in the combustible and explosive area, so as to prevent combustible gas from spreading to the fixed hot work area during normal evacuation or in case of leakage; 设置在易燃易爆区域全年最小频率风向的上风或侧风方向，在生产正常放空或发生泄漏事故时，能保证可燃气体不会扩散到固定动火区；

(2) It shall be at least 30m away from the combustible and explosive plant, warehouse, tank farm, equipment, device, pit, drainage ditch and well covered by water, and the fire separation distance shall be met; 距易燃易爆的厂房、库房、罐区、设备、装置、阴井、排水沟、水封井等不应小于 30m，并符合防火间距要求；

(3) Do not store combustibles and other sundries in the fixed hot work area. Prepare and take fire prevention measures, arrange obvious marks, provide sufficient fire fighting equipment, and confirm the person responsible for fire control; 固定动火区不准存放可燃物及其他杂物，应制定并落实完善的防火措施，设置明显的标志，配备足够数量的灭火器材，落实防火责任人；

(4) andle fixed hot work procedures for the hot work in the fixed hot work area. The application department shall be responsible for safety management of hot work and monitor implementation of various safety measures of hot work by the hot work organization and personnel; 固定动火区内动火作业办理固定动火手续，由申请部门负责动火安全管理，监督检查动火单位和人员落实区内各项动火作业安全措施；

(5) HSE Dept. shall monitor the safety management condition of hot work in the fixed hot work area, urge the responsible department or organization to conduct hot work safety management, organize one comprehensive safety assessment for safety management condition of hot work in the fixed hot work area every three months, and cancel the arrangement of fixed hot work area when it fails to pass the assessment or the environment changes. HSE 管理部负责对固定动火区的动火作业安全管理状况进行监督检查，督促责任部门或单位做好安全动火管理；每 3 个月对固定动火区的动火作业安全管理状况组织进行一次综合安全评估，评估不合格或环境发生变化时则取消固定动火区设置。

5.9.3 Gas analysis requirements 气体分析要求

5.9.3.1 Hot work must be subject to combustible gas analysis and detection and can be carried out only after passing gas analysis. Sampling points for hot work analysis shall be typical. For hot work in large equipment, sample the upper, middle and lower sections. For hot work on long material pipeline, sample in sections in the completely isolated area. 动火作业必须进行可燃气体分析检测，气体分析合格后方可进行动火作业；动火分析的取样点要有代表性，在较大的设备内动火，应采取上、中、下取样；在较长的物料管线上动火，应在彻底隔绝区域内分段取样。

5.9.3.2 For hot work outside the equipment, conduct environment analysis within 10m from the hot work point. The competent person receiving gas analysis training shall use a portable gas detector to complete environment detection and fill the analysis result in the hot work safety permit. 在设备外部动火,应至少在动火点 10m 范围内进行环境分析,经气体分析培训合格人员使用便携式气体检测仪完成环境检测工作,分析结果填入动火安全作业许可证。

5.9.3.3 For first hot work of equipment, pipeline and container after being purged and effectively isolated, gas analysis and detection shall be conducted by Quality Analysis Dept. After the first safe hot work, while the effective isolation measure and safe environment are not changed, gas detection of follow-up hot work shall be completed by the competent person of operation department receiving gas analysis training, and the analysis result shall be filled in the hot work safety permit. 设备、管道、容器等经确认吹扫合格、有效隔离后首次动火作业时,气体检测分析工作由质量检验部进行检测分析。经首次安全动火作业后,在有效隔离措施和安全环境未发生改变情况下,后续动火作业的气体检测工作由运行部通过气体分析培训合格人员完成环境气体检测工作,并将分析结果填入动火安全作业许可证。

5.9.3.4 The time interval between hot work analysis and hot work shall not exceed 30min; if the field condition fails to allow, the time interval may be extended but shall not exceed 60min; the analysis and detection report if any must be attached at the upper left of front of hot work safety permit stub; if the work is stopped for more than 60min, sampling analysis shall be conducted again; hot work analysis shall be conducted before each hot work; and the special hot work shall be monitored at any time. 动火分析和动火间隔不应超过 30 分钟,如现场条件不允许,间隔时间可适当放宽,但不应超过 60 分钟,采用分析检测报告单的,必须附在动火安全作业许可证存根正面左上方;作业中断时间超过 60 分钟,应重新取样分析,每项动火前均应进行动火分析;特殊动火作业期间应随时进行监测。

5.9.3.5 If there are toxic and harmful mediums at the location of hot work, detect and analyze the concentration of these mediums, take corresponding safety measures if the content exceeds the specified standard, and note in the column of "supplementary safety measures" in the hot work safety permit. 动火部位存在有毒有害介质的,应对其浓度做检测分析,若其含量超过规定的标准,应采取相应的安全措施,并在动火安全作业许可证"补充安全措施"一栏注明。

5.9.3.6 For gas analysis of hot work against gas in the confined space, monitor in real time in the confined space with a portable gas detector, stop the hot work in case of any abnormality, treat again and sample and analyze. In case of bladder sampling of gas in the confined space, the analysis sample shall be kept for at least 8h after obtaining the analysis result. 对受限空间内的气体进行动火气体分析时,要求在受限空间内使用便携式气体检测仪实时监测,出现异常应停止动火,重新处理后再采样分析;如果需要对受限空间内气体进行球胆采样待分析结果出来后,采样分析样品至少要保留 8 小时。

5.9.3.7 Acceptable standard of gas analysis of hot work 动火气体分析合格标准

(1) After gas analysis with the combustible gas detector, that the concentration of gas to be detected is not higher than 20% of lower explosive limit (LEL) of gas is acceptable; 使用可燃气体检测仪进行气体分析时,被测的气体浓度小于或等于气体爆炸下限 (LEL) 的 20%为合格;

(2) After gas analysis by other means, when the lower explosive limit (LEL) of combustible gas is not lower than 4%, that the analysis and detection data is lower than 0.5% (volume percentage) is acceptable; when the lower explosive limit (LEL) of combustible gas is lower than 4%, that the analysis and detection data is lower than 0.2% (volume percentage) is

acceptable. 使用其他分析手段进行气体分析时,可燃气体爆炸下限 (LEL) 大于等于 4%时,分析检测数据小于 0.5% (体积百分数);为合格;可燃气体爆炸下限 (LEL) 小于 4%时,分析检测数据小于 0.2% (体积百分数)为合格。

(3) For production and storage facilities such as equipment and pipeline which contain or contained hazardous chemicals, and production equipment in areas A and B, completely isolate them from the production system, clean, displace, sample, analyze and then conduct hot work. 凡在盛有或盛装过危险化学品的设备、管道等生产、储存设施及处于甲、乙类区域的生产设备上动火作业,应将其与生产系统彻底隔离,并进行清洗、置换,取样分析合格后方可作业。

5.10 Work in confined space 进入受限空间作业

5.10.1 Definition and scope of work in confined space 受限空间作业的定义和范围

Confined space refers to closed or semi-closed facilities and places in the production area having limited entrance and exit, poor ventilation, possible combustible and explosive or toxic and harmful substances, oxygen deficit and threats to health and life of personnel entering the space. It includes various towers, kettles, grooves, tanks, hearths, boiler barrels, pipelines, containers, basements, inspection shafts, pits (pools), sewers, ditches, pits, wells, pools, culverts, cabins, underground concealed works and closed containers, as well as equipment, facilities and places not in use for a long time or with poor ventilation, easily causing accumulation of toxic and harmful gas and oxygen deficit. The confined space is divided into general confined space and special confined space generally. 受限空间是指生产区域内,进出口受限,通风不良,可能存在易燃易爆、有毒有害物质或缺氧,对进入人员的身体健康和生命安全构成威胁的封闭、半封闭设施及场所。如各类塔、釜、槽、罐、炉膛、锅筒、管道、容器以及地下室、窰井、坑(池)、下水道、沟、坑、井、池、涵洞、船舱、地下隐蔽工程、密闭容器。长期不用的设施或通风不畅的场所等一切通风不良、容易造成有毒有害气体积聚和缺氧的设备、设施和场所。受限空间分为一般和特殊两种状态;

5.10.1.1 General confined space 一般受限空间

(1) There are actual or potential risks of toxic and harmful gases, mechanical or electrical injuries; 存在或可能产生有毒有害气体、机械、电气等危害;

(2) There are or will be materials that may bury the worker;存在或可能产生掩埋作业人员的物料;

(3) Internal structures that may trap the worker, e.g. stationary equipment or walls inclined inward.内部结构可能将作业人员困在其中(如内有固定设备或四壁向内倾斜收拢)。

5.10.1.2 Special confined space 特殊受限空间

(1) Interior of the confined space cannot be conditioned as required through purging, steaming or replacing. It is impossible to cut off or install blind plates on the pipelines or valves leading to the confined space. 受限空间内无法通过工艺吹扫、蒸煮、置换处理达到合格,与受限空间相连的管线、阀门无法断开或加盲板;

(2) Concentration of oxygen in the working space cannot be maintained at an acceptable level. Concentration of the toxic or harmful substances in the space is higher than the maximum allowable value specified in Occupational Exposure Limits for Hazardous Agents in the Workplace. 无法保证作业空间内部的氧气浓度合格,有毒有害物质高于工作场所有害因素职业

接触限值的最高容许浓度。

5.10.1.3 Some areas or places do not fit the definition of confined space but may still contain potential hazards similar to those of a confined space. They shall be managed as per work in confined space and include but not limited to the following: 有些区域或地点不符合受限空间的定义, 但具有进入受限空间时发生的潜在危害, 应按进入受限空间作业管理, 包括但不限于以下几种情况:

(1) In a circle dyke with vertical wall higher than 1.2m, the worker is exposed to physical or chemical hazards and toxic and harmful gas heavier than air, and there are no stairs to the top inside and outside the circle dyke. 高于 1.2 米的垂直墙壁围堤, 作业者身体暴露于物理或化学危害, 比空气重的有毒有害气体之中, 且围堤内外没有到顶部的台阶;

(2) The excavation or channelling is deeper than 1.2m or headers of the workers are below the ground surface in work, and there is no evacuation passage. 动土或开渠深度大于 1.2 米或作业时人员的头部在地面以下, 没有撤离通道;

(3) Inert gas purging may generate gas hazard near the access of the space and this spot can be deemed as confined space (during entry preparation and entry, gas detection shall be performed, the range of the hazardous area near the access shall be confirmed and isolation blocks and warning signs shall be set to prevent accidental entry). 用惰性气体吹扫空间, 可能在空间开口处附近产生气体危害, 此处可视为受限空间 (在进入准备和进入期间, 应进行气体检测, 确定开口周围危害区域的大小, 设置隔离区域和警示标志, 防止误入)。

5.10.2 Safety management of work in confined space 进入受限空间作业安全管理

5.10.2.1 Before the work, conduct hazard risk analysis, prepare a special plan for work with a high risk (define safety responsibilities of the principal, guardian and worker at site), and prepare an emergency plan. 作业开始前, 首先进行危害风险分析, 对较大风险性作业应制定专项方案, 方案中应明确现场负责人、监护人、作业人安全职责, 制定应急预案。

5.10.2.2 The process, equipment and HSE engineers of operation department of confined space shall give the safety director, guardian, worker and emergency rescue worker at site of working department (organization) special safety training or safety notice, including risky and hazardous factors and safety precautions of the work, details of operation scheme, proper use of detectors and labor protection appliances, and emergency treatment measures. Corresponding records shall be made. 受限空间所属运行部工艺、设备和 HSE 工程师对作业部门 (单位) 现场安全负责人、监护人、作业人、应急救援人员等进行专项安全培训或安全告知, 内容包括所从事作业危险有害因素和安全防范措施、作业方案具体内容、检测仪器劳动防护用品正确使用、紧急情况下应急处置措施等, 并应做好相关记录。

5.10.2.3 Before the work in confined space, a blind plate shall be provided or a pipeline section shall be removed to isolate the pipeline and valve connected. Do not use the means of water seal or valve closing to replace blind plate installation or pipeline removal. An obvious warning board shall be hung at the blind plate. After the power supply of electric equipment in the confined space is cut off, a lock shall be arranged at the power switch, hanging a warning board. 在进入受限空间作业前, 与其相连的管线、阀门应加盲板断开或拆除一段管道进行隔绝, 不能用水封或关闭阀门等代替安装盲板或拆除管道, 盲板处应挂醒目的安全警示牌, 受限空间内用电设备的电源有效切断后应在电源开关处上锁并加挂警示牌。

5.10.2.4 Take the following measures to keep good ventilation in the confined space: 应保持受限空间空气流通良好, 可采取如下措施:

(1) Open the manhole, handhole, feed opening, blast gate and smoke opening connected to atmosphere for natural ventilation; 打开人孔、手孔、料孔、风门、烟门等与大气相通的设施进行自然通风;

(2) When necessary, use a fan for forced ventilation or air supply through pipeline. Before air supply through pipeline, the guardian of production and operation department shall analyze and confirm the medium and air source in the pipeline. During normal operation, do not use the industrial air in the production plant for air supply. 必要时, 应采用风机强制通风或管道送风, 管道送风前应生产运行部门监护人应对管道内介质和风源进行分析确认, 正常作业时禁止使用生产装置内的工业风进行送风。

5.10.2.5 Before the work, clean or displace the confined space as per characters of materials in the confined space, analyze and detect the oxygen content. For the confined space with possible combustible gas and toxic and harmful gas, analyze and detect the combustible gas and toxic and harmful gas, and meet the following requirements: 作业前, 应根据受限空间盛装(过)的物料特性, 对受限空间进行清洗或置换, 必须对氧含量进行分析检测, 对可能存在可燃气体、有毒有害气体的受限空间, 还必须进行可燃气体、有毒有害气体分析检测, 并达到如下要求:

(1) The oxygen content is 19.5%-21% generally and it shall not be higher than 23.5% in oxygen-enriched environment; 氧含量一般为 19.5%~21%, 在富氧环境下不应大于 23.5%;

(2) The content of toxic and harmful gas shall not be higher than the value specified in Occupational Exposure Limits for Hazardous Agents in the Workplace. Refer to Table 1 for occupational exposure limits for common toxic and harmful chemicals (only for reference): 有毒有害气体含量不超过工作场所有害因素职业接触限值, 常用有毒有害化学物质职业接触限值见下表 1 (仅供参考):

Table 1 Occupational hazard exposure limits 表 1 职业危害接触限值

S/N 序号	English name 中文名	Occupational exposure limit (mg/m ³) 职业接触限值 (mg/m ³)		
		Maximum allowable concentration (MAC) 最高容许浓度 (MAC)	Time-weighted average allowable concentration 时间加权平均容许浓度	Allowable concentration for short-term exposure 短时间接触容许浓度
1	Hydrogen sulfide 硫化氢	10	—	—
2	Ammonia 氨	—	20	30
3	Benzene 苯	—	6	10
4	Carbonic oxide 一氧化碳	—	20	30
5	Carbon dioxide 二氧化碳	—	9000	18000
6	Methylbenzene 甲苯	—	50	100
7	Sulfur dioxide 二氧化硫	—	5	10

8	Liquefied petroleum gas 液化石油气	—	1000	1500
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(3) The concentration of combustible gas shall comply with Article 5.9.3.7 of this System. 可燃气体浓度要求同本标准 5.9.3.7 条规定。

5.10.2.6 Strictly monitor the gas concentration in the confined space as per the following requirements: 应对受限空间内的气体浓度进行严格监测，监测要求如下：

(1) For work in confined space such as equipment, pipeline, container and well hole with actual or possible combustible, toxic and choking mediums, upon confirmation of qualified purging and effective isolation, first gas detection and analysis shall be completed by Quality Analysis Dept. and the analysis result shall be filled in the work permit. The worker in the confined space (besides corresponding labor protection appliances) shall be provided with at least one (four-in-one) portable gas detector for detecting LEL, O₂, H₂S and CO continuously. In case of abnormality warning, stop working immediately and leave the working space. 进入可能存在或产生可燃、有毒、窒息介质的设备、管道、容器、井洞等受限空间作业，在确认吹扫合格、有效隔离后首次气体检测分析工作由质量检验部完成，并将分析结果填入作业许可证。受限空间作业人员（采取相应劳动防护装备除外）至少配备一台（四合一）能检测 LEL、O₂、H₂S、CO 四种气体的便携式气体检测仪持续检测，发生异常报警，应立即停止作业并撤出作业空间；

(2) For the confined space of semi-open environment such as equipment, pipeline, foundation pit and culvert without combustible and toxic mediums, gas detection and analysis shall be conducted by the competent person with a qualified portable gas detector, and the analysis result shall be filled in the work permit. 没有盛装过可燃、有毒介质的设备、管道、基坑、涵洞等半敞开环境的受限空间的气体检测分析工作由经过气体检测培训合格的人员使用合格的便携式气体检测仪完成气体检测工作，并将分析结果填入作业许可证；

(3) During construction, the guardian shall detect the gas environment in the confined space every two hours. 施工作业过程中由监护人每间隔 2 小时检测一次作业空间的气体环境是否合格；

(4) Within 30min before the work, conduct gas sampling analysis of the confined space and enter the confined space only after passing the analysis. If the field condition fails to allow, the time interval may be extended properly but shall not exceed 60min. 作业前 30 分钟内，应对受限空间进行气体采样分析，分析合格后方可进入；如现场条件不允许，间隔时间可适当放宽，但不应超过 60 分钟；

(5) While brushing with the paint containing volatile solvents, analyze continuously and take forced ventilation measures; continuously monitor the confined space where harmful substances may be released, stop working immediately if the monitoring and analysis result changes, evacuate, dispose the site, and continue the work after passing sampling analysis. 涂刷具有挥发性溶剂的涂料时，应做连续分析，并采取强制通风措施；对可能释放有害物质的受限空间，应连续监测，如监测分析结果有明显变化，应立即停止作业，撤离人员，对现场进行处理，在取样分析合格后方可恢复作业；

(6) If the work is stopped for more than 60min, conduct sampling analysis again. 作业中断时间超过 60 分钟时，应重新进行取样分析。

5.10.2.7 Take the following protective measures for work in confined space: 进入下列受限空间作业应采取如下防护措施：

(1) If the confined space with combustibles and explosive or toxic mediums and oxygen deficit, fails to comply with the requirement after cleaning or displacement, wear anti-static work clothes and work shoes and an isolated protecting mask, use an explosion-proof LV lamp and an explosion-proof tool, and tie a life line when necessary. 易燃易爆、缺氧或有毒的受限空间经清洗或置换达不到要求的，应穿防静电工作服及工作鞋，佩戴隔离式防护面具，使用防爆型低压灯具及防爆工具，必要时拴带救生绳；

(2) For the confined space with corrosive mediums such as acids and alkalis, wear acid/alkali-resistant work clothes, work shoes and gloves. 酸碱等腐蚀性介质的受限空间，应穿戴防酸碱工作服、工作鞋、手套等防腐蚀护品；

(3) For the confined space with noise, wear earplugs or earmuffs. For the confined space with dust, wear a dustproof mask and a dustproof eye patch. 产生噪声的受限空间，应配戴耳塞或耳罩等防噪声护具。产生粉尘的受限空间，应配戴防尘口罩、眼罩等防尘护具；

(4) For the confined space with a high temperature, wear articles for high temperature protection, and take protective measures when necessary such as ventilation, thermal insulation and provision of communication equipment. 高温的受限空间，进入时应穿戴高温防护用品，必要时采取通风、隔热、佩戴通讯设备等防护措施；

(5) For the confined space with a low temperature, wear articles for low temperature protection, and take protective measures when necessary such as heating and provision of communication equipment. 低温的受限空间，进入时应穿戴低温防护用品，必要时采取供暖、佩戴通讯设备等措施。

5.10.2.8 Safety requirements of lighting and power supply: 照明及用电安全要求如下：

(1) The lighting voltage of confined space shall not be higher than 36V; the lighting voltage for work in wet and narrow container shall not be higher than 12V; when there were explosive liquids and gases in the work environment before, an explosion-proof flashlight or explosion-proof portable safety lamp with voltage not higher than 12V; and the transformer of portable lamp shall not be arranged in or on the container. 受限空间照明电压应小于或等于36V，在潮湿容器、狭小容器内作业照明电压应小于等于12V；当作业环境原来盛装爆炸性液体、气体等介质的，则使用防爆电筒或电压 $\leq 12V$ 的防爆安全行灯，行灯变压器不应放在容器内或容器上；

(2) In the wet container, the worker shall stand on the insulation board, and the metal container shall be earthed reliably. 在潮湿容器中，作业人员应站在绝缘板上，同时保证金属容器接地可靠。

5.10.2.9 Before the work, the worker must fully know the work content, place, time and requirements as well as hazard factors and safety precautions in the work; while the safety measures are implemented, work permit is handled and the guardian agrees, the worker may enter the confined space to work. 作业前作业人必须充分了解作业内容、地点、时间、要求，熟知作业中的危害因素和安全防范措施；安全措施应经落实确认、办理了作业许可，经监护人同意后，作业人方可进入受限空间内作业。

5.10.2.10 Tools and materials carried with by the worker must be registered. Do not carry with any non-work tools and instruments to the confined space. After the work, these tools and instruments may be brought to the confined space. Do not throw materials, tools and instruments in the work. Do not take off the protecting mask in the toxic and oxygen-deficient environment. Do not supply oxygen or oxygen-enriched air to the confined space. Check

workers and work tools and instruments while leaving the confined space and then deliver for acceptance. 作业人员所带的工具、材料须进行登记，禁止携带作业器具以外的物品进入受限空间。作业结束后，进入受限空间；作业中不应抛掷材料、工器具等物品；在有毒、缺氧环境下不应摘下防护面具；不应向受限空间充氧气或富氧空气；离开受限空间时应清点作业人员和作业工器具，确认无误后，方可交验。

5.10.2.11 Provide a certain amount of emergency rescue equipment and fire fighting equipment outside the confined space, set a warning board at the entrance, and keep the entrance unblocked for access and rescue and evacuation. 在受限空间外配备一定数量符合规定的应急救护器具和灭火器材，入口处设置安全警告牌，且确保出入口畅通，便于人员出入和抢救疏散。

5.10.2.12 Send signals to the guardian immediately and leave the site in case of abnormality or suffocation in the work. In case of abnormal change to the safety measure in the work, stop working immediately and then enter the confined space again after the safe working condition is fulfilled via treatment. 作业中如发现情况异常或感到不适和呼吸困难时，作业人立即向作业监护人发出信号，迅速撤离现场，安全措施如在作业期间发生异常变化，立即停止作业，待处理并达到安全作业条件后，方可再进入受限空间作业。

5.10.2.13 In case of any change to the work content and environment condition, a new permit is required. Confirm the environment conditions and safety measures again and continue the work. Do not enter the confined space without the work permit and approval of the guardian. 当作业内容和环境条件变更时，需重新办理作业许可，应重新对环境条件和安全措施予以确认，合格后才能继续作业。无作业许可和监护人，禁止进入受限空间作业。

5.10.2.14 Under special conditions, the worker may wear a long-tube mask or an air respirator. Check the tightness of long-tube mask, prevent the long ventilation tube from being pressed, arrange the air suction port at the uptake of fresh air, and appoint a specially-assigned person for supervision. In case of an accident, give an alarm immediately. The rescue worker must wear qualified protective devices and one worker shall stay outside the equipment for contact. Do not rescue blindly. 在特殊情况下，作业人员可戴长管式面具、空气呼吸器等，但佩戴长管面具时，一定要仔细检查其气密性，同时防止通气长管被挤压，吸气口应置于新鲜空气的上风口，并有专人监护。发生事故时，应立即报警，抢救人员必须佩戴合格的防护器具进入设备，并至少有一人在外部做联络工作，禁止盲目施救。

5.10.2.15 For forced risky work violating the regulations, failure to implementation of safety measures and absence of the work guardian, the worker has the right to refuse the work and report to the superior department. 对违反本规定的强令冒险作业、安全措施不落实、作业监护人不在场等情况作业人有权拒绝作业，并向上级报告。

5.10.2.16 For the work in confined space featured in big difficulty, high labor intensity and long time, work shift shall be applied. 难度大、劳动强度大、时间长的受限空间作业应采取轮换作业方式。

5.11 Work at heights 高处作业

5.11.1 Scope of work at heights 高处作业的范围

Work at heights refers to the work at heights with falling possibility, where the work height or falling height (h) is at least 2m (inclusive). As per the specific work height, it is divided into

Grade I ($2\text{m} \leq h \leq 5\text{m}$), Grade II ($5\text{m} < h \leq 15\text{m}$), Grade III ($15\text{m} < h \leq 30\text{m}$) and special grade ($h > 30\text{m}$). 高处作业是指作业高度或坠落高度 (h) 在 2 米以上 (含 2m), 有坠落可能的高处位置进行的作业。按照具体作业高度分为一级 $2\text{m} \leq h \leq 5\text{m}$, 二级 $5\text{m} < h \leq 15\text{m}$, 三级 $15\text{m} < h \leq 30\text{m}$ 和特级 $h > 30\text{m}$ 。

5.11.2 Objective hazard factors directly causing falling include the following eight factors: 直接引起坠落的客观危险因素分为 8 种:

5.11.2.1 Wind power above Level 5 (wind speed 8.0m/s); 阵风风力五级 (风速 8.0m/s) 以上;

5.11.2.2 High-temperature work of Level II or above; II 级或 II 级以上的高温作业;

5.11.2.3 Work in contact with cold water up to 12°C ; 接触冷水温度等于或低于 12°C 的作业;

5.11.2.4 Work with inadequate light and poor visibility in the operation site; 作业场所光线不足或能见度差;

5.11.2.5 Work with a distance from the charged body with dangerous voltage less than that specified in Table 2: 作业活动范围与危险电压带电体距离小于表 2 的规定:

Table 2 Distance between the work and charged body with dangerous voltage 表 2 作业活动范围与危险电压带电体的距离

Voltage class of charged body with dangerous voltage (kV) 危险电压带电体的电压等级/kV	≤ 10	35	63-110	220	330	500
Distance (m) 距离/m	1.7	2.0	2.5	4.0	5.0	6.0

5.11.2.6 Work on swinging platform, not one a plane or only one a very small plane, namely rectangular plane with any side less than 500mm, circular plane with diameter less than 500mm or other planes with similar dimensions resulting in difficulty of the worker to keep posture normal; 摆动, 立足处不是平面或只有很小的平面, 即任一边小于 500mm 的矩形平面、直径小于 500mm 的圆形平面或具有类似尺寸的其他形状的平面, 致使作业者无法维持正常姿势;

5.11.2.7 Work in environment with toxic gas or oxygen content less than 19.5%; 存在有毒气体或空气中含氧量低于 19.5% 的作业环境;

5.11.2.8 Work in environment which may cause disaster accidents or work for salvage of emergency disaster accidents. 可能会引起各种灾害事故的作业环境和抢救突然发生的各种灾害事故。

5.11.3 Work at heights without any objective hazard factor listed in 5.11.2 shall be graded as per method A in Table 3. Work at heights with any objective hazard factor listed shall be graded as per method B in Table 3. 不存在 5.11.2 列出的任一种客观危险因素的高处作业按表 3 规定的 A 类法分级。存在下项列出的一种或一种以上客观危险因素的高处作业按表 3 规定的 B 类法分级。

Table 3 Classification of work at heights 表 3 高处作业分级

Classification method 分类法	Height of work at heights (m) 高处作业高度/m			
	$2 \leq h \leq 5$	$5 < h \leq 15$	$15 < h \leq 30$	$h > 30$
A	I	II	III	IV
B	II	III	IV	IV

5.11.4 Grade-I work at heights includes the work on a slope with gradient greater than 45 degrees. 一级高处作业包括在坡度大于 45 度的斜坡上实施的高处作业。

5.11.5 Grade-II and Grade-III work at heights also includes the following: 二级、三级高处作业还包括以下情形:

5.11.5.1 Work at heights performed at or around hatchways (hoisting openings), pits, wells, pools, ditches, holes, etc.; 在升降（吊装）口、坑、井、池、沟、洞等附近进行高处作业；

5.11.5.2 Work at heights performed around combustible, explosive, poisonous and burnable regions or rotating equipment; 在易燃、易爆、中毒、易灼伤的区域或转动设备附近的高处作业；

5.11.5.3 Work at heights performed in chemical containers, equipment and overhead pipes without platforms and guardrails, including towers, cauldrons, ovens, canisters, etc.; 在无平台、无护栏的塔、釜、炉、罐等化工容器、设备及架空管道上进行的高处作业；

5.11.5.4 Work at heights performed in equipment, including towers, cauldrons, ovens, canisters, etc.; 在塔、釜、炉、罐等设备内进行的高处作业；

5.11.5.5 Work at heights performed near the evacuation pipeline or stack and equipment which discharge toxic and harmful gas and dust. 在临近排放有毒、有害气体、粉尘的放空管线或烟囱及设备的高处作业。

5.11.6 Special-grade work at heights includes the following work: 特级高处作业包括下列情形的高处作业：

5.11.6.1 Work at heights with strong wind of wind power of Level 6 (wind speed of 10.8m/s); 在阵风风力为六级（风速 10.8m/s）及以上情况下进行的强风高处作业；

5.11.6.2 Work at heights in the high temperature or low temperature environment; 在高温或低温环境进行的异温高处作业；

5.11.6.3 Work at heights in rainy days; 在降雨时进行的雨天高处作业；

5.11.6.4 Work at heights at night using artificial lighting outdoors; 在室外完全采用人工照明进行的夜间的高处作业；

5.11.6.5 Work at heights performed under conditions of approaching or contacting electrified body; 在接近或接触带电体条件下进行的悬空高处作业；

5.11.6.6 Work at heights performed without footholds or firm footholds. 在无立足点或无牢靠立足点条件下进行的悬空高处作业。

5.11.7 Classification of work permits of work at heights 高处作业作业许可分级

Work permit is required for the work at heights and it comprises general work permit and special work permit: 高处作业必须办理作业许可，高处作业许可分一般和特殊两种：

5.11.7.1 General work at heights covers Grade I, Grade II, Grade II and Articles 5.11.4 and 5.11.5. 一般高处作业包括 I、II、III级和 5.11.4 和 5.11.5 所涵盖的内容。

5.11.7.2 Special work at heights covers special grade and Article 5.11.6. 特殊高处作业包括特级和 5.11.6 所涵盖的内容。

5.11.8 Safety management of work at heights 高处作业安全管理

5.11.8.1 Personnel with hypertension, heart disease, anemia, epilepsy and psychosis shall not be engaged in work at heights. 凡患高血压、心脏病、贫血病、癫痫病、精神病以及其他不适于高处作业的人员，不得从事高处作业。

5.11.8.2 The worker shall be familiar with knowledge on work at heights and master operation skills. 作业人员应熟悉高处作业应知应会的知识，掌握操作技能。

5.11.8.3 The work applicant of operation department and working department (organization)

shall give necessary safety education to the worker, including safety knowledge of the work and treatment and rescue methods for possible accident in the work. 运行部作业申请人与作业部门（单位）对作业人进行必要的安全教育，内容包括所从事作业的安全知识、作业中可能发生的意外情况的处理和救护方法等。

5.11.8.4 For special work at heights, the working department (organization) shall prepare an emergency plan, specifying the escape route and rescue method of worker in emergency, and lifesaving appliances and fire fighting equipment provided at site. The field personnel shall be familiar with the emergency plan. 特殊高处作业时，作业部门（单位）应制定应急预案，内容包括：作业人员紧急状况时的逃生路线和救护方法，现场应配备的救生设施和灭火器材等。现场人员应熟知应急预案的内容。

5.11.8.5 The worker for work at heights shall wear a full-body double-hook safety belt which shall comply with the principle of “hanging at the place higher than working surface”. The safety belt shall be tied to fixed members above construction work areas and shall not be tied to parts with sharp edges. Enough clearance shall be left below tie-off points of safety belts. For the work at heights near electrified body, use insulating tools or wear voltage-sharing clothes. For special work at heights, carry with communication tools. 高处作业人员应配戴全身式双挂大钩安全带，安全带应高挂低用。安全带系挂在施工作业处上方的牢固构件上，不得系挂在有尖锐棱角的部位。安全带系挂点下方应有足够的净空。带电高处作业应使用绝缘工具或穿均压服。特殊高处作业还应佩戴通讯联络工具。

5.11.8.6 For work at heights, appoint a specially-assigned person for supervision, set a safety warning area and do not take a rest at the work place. 高处作业应设专人监护，应设安全警戒区，作业人员不应在作业处休息。

5.11.8.7 For work performed near the evacuation pipeline or stack and equipment which discharge toxic and harmful gas and dust, contact with relevant personnel of the workshop in advance, confirm the contact way, take effective safety precautions, and provide necessary standard protective equipment for workers (such as air respirator and filtered gas mask). 在临近排放有毒、有害气体、粉尘的放空管线或烟囱等场所进行作业时，应预先与车间有关人员取得联系、确定联络方式，并采取有效的安全防护措施、为作业人员配备必要且符合规范标准的防护器材（如空气呼吸器、过滤式防毒面具或口罩等）。

5.11.8.8 For work performed at light materials such as color plate roof, asbestos tile and corrugated board, arrange and fasten firm scaffolds and take anti-skid measures for the scaffold. 在彩钢板屋顶、石棉瓦、瓦棱板等轻型材料上作业，应铺设牢固的脚手板并加以固定，脚手板上要有防滑措施。

5.11.8.9 Take reliable anti-skid measures for work in rainy days; do not conduct work at heights of Grade IV, climbing in the open air and work in the air in rough weather such as strong wind of Level 5 or above and heavy fog; check the safety facility after typhoon and rainstorm and solve problems immediately once being found. 雨天作业时，应采取可靠的防滑措施；遇有5级以上强风、浓雾等恶劣气候，不应进行IV级高处作业、露天攀登与悬空高处作业；台风、暴雨后，应对作业安全设施进行检查，发现问题立即处理。

5.11.8.10 Put the tools, materials and parts for the work in a tool bag, tie a safety rope to the tool, and tie the safety rope to the wrist of worker. Put the tool in the tool jacket (bag) after use. Do not hold any material while going up and down. Do not throw any tool, material and other articles. Take anti-falling measures for sliding and rolling tools and materials on the scaffolds.

作业使用的工具、材料、零件等应装入工具袋，工具在使用时应系有安全绳，并将工具的安全绳套系在作业人员的手腕上，不用时将工具放入工具套（袋）内上下时手中不应持物，不应投掷工具、材料及其他物品。易滑动、易滚动的工具、材料堆放在脚手架上时，应采取防坠落措施。

5.11.8.11 Do not conduct up-and-down cross operation generally at the same falling direction. If cross operation is needed, arrange a safety protection layer in the middle. Arrange two protection layers for the cross operation with falling height greater than 24m. For the work performed together with other work, go up and down as per the specified route. Do not conduct up-and-down vertical work. Or take reliable isolation measures for up-and-down vertical work required. 在同一坠落方向上，一般不得进行上下交叉作业，如需进行交叉作业，中间应设置安全防护层，坠落高度超过 24 米的交叉作业，设双层防护。与其他作业交叉进行时，应按指定的路线上下，不应上下垂直作业，如果确需垂直作业应采取可靠的隔离措施。

5.11.8.12 Temporary removal or change of the safety protection facility due to the work shall be approved by the relevant principal, corresponding precautions shall be taken, and the safety protection facility shall be recovered immediately after the work. 因作业必需，临时拆除或变动安全防护设施时，应经相关负责人同意，并采取相应的防护措施，作业后应立即恢复。

5.11.8.13 Sufficient lighting shall be provided for the work at heights at night and lighting in the explosion-proof area shall meet the requirement of explosion-proof grade. In case of any abnormality, the worker shall send signals timely and leave the site quickly. 夜间高处作业应有充足的照明，防爆区域的照明满足防等级要求。作业人员在作业中如果发现异常情况，应及时发出信号，并迅速撤离现场。

5.11.8.14 Before continuing the stopped work at heights, confirm the environment conditions and safety measures again. If the work content and environment condition change, handle a new safety permit of work at heights. 当高处作业中断后继续作业前，应重新对环境条件和安全措施予以确认，当作业内容和环境条件变化时，需要重新办理高处安全作业许可。

5.12 Radiography operation 射线作业

5.12.1 For radiography operation within the Company such as radiography testing and maintenance of radioactive level gage, handle the radiography operation safety permit before 16:00 of the day. If the working condition, place and environment change, stop working and obtain a new permit. 凡在公司范围内进行射线探伤、放射性料位计检修等射线作业，必须在当日 16:00 前提前办理完毕射线安全作业许可证，如果作业条件、地点及环境等发生变化，必须立即停止作业，重新办理许可证。

5.12.2 The radiography operation shall be conducted by two competent persons; each person shall be provided with one individual dose alarm and a individual dose gage; and the radiation dose shall be controlled as per the national and international standards. 射线作业由至少 2 名具备作业资质的人员进行，每名人员配备一台个人剂量报警仪和个人剂量计，遵照国家或国际防护标准控制辐射剂量。

5.12.3 The radiography operation shall start from 20:00 at the earliest and end at next 6:00 at the latest on principle; the effective time shall not exceed 10h; for radiography operation to be conducted in the daytime under special conditions, the operation team must handle the radiography operation safety permit at least two hours in advance. 射线作业时间原则上规定每天最早晚上 20:00 开始，最晚次日凌晨 6:00 结束；有效时间不超过 10 小时；对于特殊情况下确

实需要在白天进行的射线作业，作业单位必须提前至少 2 小时办理完毕射线安全作业许可。

5.12.4 Before the radiography operation, set a safety protection area – supervision area, use a warning tape/rope to isolate the area, and arrange a hazard mark and protection facility; hang obvious warning boards at all directions of the supervision area, write “Caution! Ionization radiation!” on the warning boards in Chinese and English, and provide international radioactivity marks with fluorescence effect; and install warning lights at all directions and entrance fence for night work. 射线作业前，必须划出安全防护区域——监督区，使用符合规范的警戒带/绳进行隔离，并设置危险标志和防护设施：在监督区域的各个方向悬挂明显警告牌，警告牌上用中英文写上“当心，电离辐射”，有国际通用放射性标志，并具备荧光效果；夜间作业在每个方向及入口围栏上安装警示灯。

5.12.5 Before the radiography operation, the operation team must inform the affected departments, organizations and personnel, clean the site, confirm there are no irrelevant personnel in the supervision area, and start work. 射线作业前，作业单位必须通知影响范围内的部门和单位或人员，同时进行现场清场，确认监督区范围以内没有无关人员之后方可开始作业。

5.12.6 For M-RT radiography operation, appoint at least one guardian at the periphery of supervision area for supervision; for other radiography operations, appoint at least two guardians. 对于 M-RT 射线作业，至少安排 1 名监护人员在监督区外围进行监护；其他射线作业，至少安排 2 名监护人员在监督区外围进行监护。

5.12.7 HSE Dept. shall check use and storage of radiation devices at site and alarm condition of supervision area, record the result and handle the actions against rules. HSE 管理部随时对现场射线装置的使用、保管及监督区的警戒状况进行检查，记录检查结果，对违反规定的行为严肃处理。

5.12.8 The principle on duty or foreman on duty of the operation department shall check the supervision area with a detector to confirm whether the radiation dose in the supervision area meets the standard. 运行部值班负责人或当班班长对现场监督区使用检测仪器进行复核检查，以确定监督区的辐射剂量是否符合标准。

5.12.9 During the radiography operation, in case of any failure of the radiation device, the operation team shall report to the operation department, Equipment Management Dept., Scheduling & Dispatch Dept. and HSE Dept. timely, and prepare measures for preventing situation expansion. 射线作业期间，射线装置出现故障，作业单位要及时报告运行部、接卸动力部、计划调度部及 HSE 管理部，并制定防止事态扩展的措施。

5.12.10 After the operation, radioactive isotopes or radiation devices shall be returned to the source base at the day. The place where temporary storage should be set in special circumstances, shall be checked and confirmed by the HSE Dept. and Equipment Management Dept. and provided with radioactive signs, and designated personnel shall be assigned to take charge of the protection. 作业完毕后，放射性同位素或射线装置于当天运回源库。特殊情况设临时储存的场所，应经 HSE 管理部及机械动力部检查确认，设置放射性标志，指定专人负责保护。

5.12.11 Instructions and requirements on filling of radiography operation safety permit: 射线安全作业许可的填写说明和要求：

5.12.11.1 Fill the name of operation demand department in the column of “applicant organization” and fill the name of person responsible for the operation from the operation demand department in the column of “applicant”; “申请单位”填写作业需求部门名称；“申请人”填写作业需求部门负责人组织本次作业的人员；

5.12.11.2 Fill the full name of operation team of the radiography testing in the column of "operation team" and fill the name of specific principal at site in the column of "field principal"; "作业单位" 填写负责本次射线探伤作业的作业单位的全称; "现场作业负责人" 必须为作业当天现场的具体负责人;

5.12.11.3 The column of "workplace" shall be filled correctly with contents such as plant name, equipment item number and road name, and the column of "work content" shall be filled clearly with contents such as "flaw detection of welded junction of pipeline"; "作业地点" 须填写准确、具体, 如装置名称、设备位号、道路名称等部位; "作业内容" 须填写清楚, 不模糊, 如 "进行管道焊口探伤";

5.12.11.4 Fill the type of radioactive source used for the operation in the column of "type of radioactive source" and mark the type of ray (γ ray or X ray), fill the code of radioactive source in the column of "source code", and fill the actual source strength in the column of "source strength"; "放射源类型" 须填写作业当天使用的放射源类型, 同时注明其射线类型属于哪种, 如 γ 射线或 X 射线; "源编码" 填写所使用的放射源的编码; "源强度" 须根据实际的源的强度如实填写;

5.12.11.5 Fill the name of person responsible for the radiography operation in the column of "worker", and fill the access permit number and work safety certificate number of each worker; "作业人员" 填写负责进行本次射线作业的人员姓名, 同时填写每名作业人员的入场证号、作业安全资格证号;

5.12.11.6 Fill the name, access permit number and phone number of full-time safety guardian from the working department in the column of "guardian"; "监护人员" 填写作业单位指派的专职安全监护的人员姓名及入场证号, 并填写其手机号码;

5.12.11.7 "Work safety measures" must be confirmed by the working department one by one to ensure all working conditions are met; "作业安全措施" 必须由作业单位进行逐项确认, 确保所有作业条件都具备;

5.12.11.8 The column of "organization affected by radiography operation" shall be signed and confirmed by the principal of informed organization; "射线作业影响范围单位" 一项由被告知单位负责人签字确认;

5.12.11.9 After the work, the field principal of organization in the work area (foreman on duty of the operation department generally) or the work applicant shall check the site clearing and recovery condition, and sign in the column of "completion acceptance" for confirming closure of the work safety permit. 作业完毕后, 由作业所属区域单位现场负责人 (运行部一般为当班班长) 或作业申请人对现场清场恢复情况进行检查, 并在 "完工验收" 一栏上签字确认本次安全作业许可证关闭。

5.12.12 Handling procedures of radiography operation permit and announcement requirements 射线作业许可的办理程序和通告要求

5.12.12.1 The operation team shall report the radiography operation scheme to the operation department in advance and apply for the radiography operation safety permit at the day of operation. In principle, application for the radiography operation safety permit submitted after 16:00 will not be handled at the day; 作业单位的射线作业计划提前报告运行部, 并在作业当天申办射线安全作业许可, 原则上对 16:00 后提交到运行部的射线安全作业许可申请当天不予受理;

5.12.12.2 The operation team shall hold the radiography operation safety permit and go to relevant organizations for signature as per the sequence of approval procedures, and ask for approval and registration by HSE engineers of each operation department before 16:30. Upon signature of the field principal of affected department (foreman on duty of operation department generally), conduct the operation as per the approved time; 作业单位持射线安全作业许可, 按照审批程序的先后到涉及的相关单位进行签字, 并于 16: 30 之前到各运行部 HSE 工程师处进行审批登记, 作业开始前由影响范围单位现场负责人 (运行部一般为当班班长) 签字确认后, 方可按批准时间作业;

5.12.12.3 The HSE engineer of operation department shall send all radiography operations of the department at the day to relevant personnel (including principals of operation department, production dispatch department and Equipment Maintenance Dept., and issuer of online information notice) via e-mail before 17:00, and paste the announcement form of radiography operation on the bulletin board of central control room and maintenance station; 运行部 HSE 工程师将在 17:00 前将当天本部门所有射线作业以邮件的形式发送至相关人员 (包括运行部、生产调度、设备检修部相关负责人、网上信息通知公告发布人) 进行通告, 同时将射线作业通告表在中控室、维修站的公告栏处进行张贴;

5.12.12.4 Principals of operation department, production dispatch department and Equipment Maintenance Dept. shall check the announcement of radiography operation every day and inform the operator and maintenance personnel timely before the work; 运行部、生产调度、设备检修部相关负责人每天定时查看当日射线作业通告, 并在作业开始前及时通知操作人员及维保人员;

5.12.12.5 The indoor operator of operation department shall check the announcement of radiography operation in the central room every day and inform the foreman, field operator and Equipment Maintenance Dept. of the announcement timely before the work. 运行部的内操人员每天定时查看中控室张贴的射线作业通告, 并在作业开始前将通告内容及及时通知班长、外操及设备检修部。

5.13 Work with road closed 断路作业

5.13.1 Before the work, the work application organization shall prepare a traffic organization scheme together with its competent department and handle a permit for work with road closed. 作业前, 作业申请单位应会同本单位相关主管部门制定交通组织方案, 办理断路作业许可证。

5.13.2 The operation team shall arrange traffic warning signs at the junction of road closed and relevant roads, and set traffic warning facilities such as barrier, road work warning light and guidance sign near the work area. 作业单位应根据需要在断路的路口和相关道路上设置交通警示标志, 在作业区附近设置路栏、道路作业警示灯、导向标等交通警示设施。

5.13.3 For the work at fixed location on the road requiring 2h for daytime and 1h for night at most, if a field traffic command is present, warning boards may not be arranged as long as corresponding traffic warning facilities are arranged in the work area (namely, traffic cones or barriers are arranged for daytime and traffic cones or barriers and road work warning lights are arranged for night). 在道路上进行定点作业, 白天不超过 2 h、夜间不超过 1 h 即可完工的, 在有现场交通指挥人员指挥交通的情况下, 只要作业区设置了相应的交通警示设施, 即白天设置了锥形交通路标或路栏, 夜间设置了锥形交通路标或路栏及道路作业警示灯, 可不设标志牌。

5.13.4 Road work warning lights shall be arranged for work at night or in rainy and foggy days. The warning light shall be provided with a safe voltage. The height shall be 1.5m and shall not be less than 1.0m. The warning light can emit continuous, twinkling or rotary red light which can be viewed from 150m. 在夜间或雨、雾天进行作业应设置道路作业警示灯，警示灯设置采用安全电压，设置高度应离地面 1.5 m，不低于 1.0 m。应能发出至少自 150 m 以外清晰可见的连续、闪烁或旋转的红光。

5.13.5 After the work with road closed, the operation team shall clean the site and remove the traffic warning facilities such as barrier, road work warning light and guidance sign at the work area and road junction. The organization applying for work with road closed shall check and ask relevant department to recover the traffic. 断路作业结束后，作业单位应清理现场，撤出作业区、路口设置的路栏、道路的作业指示灯、导向标等交通警示设施，申请断路单位应检查核实，并报告有关部门恢复交通。

5.14 Safety of maintenance and repair work 检维修作业安全

5.14.1 Before delivering the plant for maintenance and repair, the operation department shall conduct self-inspection. Equipment Management Dept. (each discipline department) shall organize and HSE Dept. and Scheduling & Dispatch Dept. shall participate in safety confirmation of shutdown maintenance and repair. 装置交付检修前，运行部先进行自检。机械动力部（各专业部门）负责牵头组织，HSE 管理部、计划调度部参加，进行装置停工交付检修安全确认。

5.14.2 During maintenance, safety principals and full-time (part-time) safety officers of various levels must conduct safety monitoring and check at the maintenance site, and relevant work shall be subject to management of high-risk work. 检修期间各级安全负责人、专（兼）职安全人员必须到检修现场进行安全监督检查；相关作业按高风险作业管理要求执行。

5.14.3 Safe and civilized maintenance 安全文明检修

5.14.3.1 The maintenance personnel shall alternate work with rest to prevent any accident due to over fatigue; 检修人员安排要注意劳逸结合，防止过度疲劳发生意外事故的发生；

5.14.3.2 Industrial refuses shall be piled up at the specified place; spontaneous combustible and flammable substances such as ferrous sulfide sorted out shall be treated properly and transported quickly to prevent a fire due to spontaneous combustion and ignition; 工业垃圾应按指定地点集中堆放，不得随意乱倒、乱放，对清理出的硫化亚铁等自燃、易燃物质要妥善处理，并迅速联系外运，防止自燃、引燃引起火灾；

5.14.3.3 The construction work must meet the requirements of completing purging and displacement of hot work, maintaining the equipment part clean, keeping the lubricating grease used up, finishing construction of the shift, and keeping materials used up and the site clean upon completion.; 施工作业必须做到“三净”、“二清”（三净：动火吹扫置换要净，检修安装设备机件要净，使用润滑油脂要净；二清：当班施工当班清、工完料净场地清）；

5.14.3.4 Cancel the temporary protection measures at the removed handrail and damaged platform after construction; 对拆除的栏杆、损坏的平台处加临时防护措施，施工结束后应恢复原样；

5.14.3.5 Do not throw articles, tools and sundries from height; 禁止高空抛扔物件、工具和杂物;

5.14.3.6 Do not use gasoline or volatile solvent to wash machines, fittings, vehicles, hands and work clothes; 禁止使用汽油或挥发性溶剂洗刷机、配件、车辆和洗手、洗工作服;

5.14.3.7 Do not discharge waste oil and toxic and harmful substances to the sewer, open trench and ground. 严禁将污油、有毒有害物质排入下水道、明沟和地面。

5.14.4 Safety requirements of startup after maintenance 检修后开工安全要求

5.14.4.1 Before startup of plant, the department shall confirm the startup condition after maintenance; 装置在开工前, 部门对检修交付开工条件进行确认;

5.14.4.2 The operation department shall prepare a startup scheme and submit it to the relevant functional department for review and the company leader for approval. In addition, organize training on maintenance changes for the operator and make the operator familiar with requirements of purging time, procedure, quality, safety and environmental protection of plant startup; 运行部编制开工方案,报相关职能部门审核, 公司领导审批。同时对检修变更内容组织操作人员进行培训, 使操作人员熟知装置开工吹扫时间、步骤、质量、安全、环保等要求;

5.14.4.3 Before startup, completely check safety facilities such as ventilation facility, communication facility, fire fighting equipment, ladder, platform handrail, combustible gas alarm, safety valve and lighting facility, and ensure that they are in good condition; 开工前对通风、通讯、消防、梯子、平台栏杆、可燃气体报警器、安全阀、照明等安全设施进行全面检查, 须处于完好状态;

5.14.4.4 The maintained pressure vessel, storage tank and pipeline must be subject to pressure test, leakage test and tightness test as per relevant provisions; the transmission equipment shall be subject to individual commissioning; and the safety device shall be subject to commissioning and resetting. The equipment, pipeline, instrument and interlock not tested shall not be put into production; 通过检修的压力容器及贮罐等设备、管线, 须按规定进行试压、试漏、气密性试验, 传动设备进行单体试车, 安全装置调试复位。未经试验的设备、管道、仪表和联锁等不能投入生产;

5.14.4.5 Before charging materials, the closed equipment and pipeline receiving combustible and explosive materials must be subject to gas displacement and removal and arrangement of blind plate as per process requirements. The operation department shall appoint one specially-assigned person to review one by one. 接受易燃易爆物料的密闭设备和管道, 进入物料前须按工艺要求进行气体置换, 盲板拆装, 运行部应指定专人逐个复查确认,不得遗漏。

5.14.4.6 While delivering combustible and explosive materials, strictly control hot work and passage of vehicles. 引易燃易爆物料时, 严格控制动火作业、车辆通行。

5.15 Safety management of fire and explosion prevention areas 防火防爆区域安全管理

5.15.1 Management principles 管理原则

5.15.1.1 A hot work permit must be obtained for non-productive temporary hot work in the fire and explosion prevention areas as per the management requirement. 防火防爆区域使用非生

产性临时明火作业，必须按照管理规定办理动火手续。

5.15.1.2 The person without a valid certificate shall not enter the fire and explosion prevention areas. The person entering the fire and explosion prevention areas shall not use the safety and fire fighting equipment, communication facility, process pipeline, equipment, valve, underground pipeline and various cables without permission. 禁止无有效证件者进入防火防爆区域，进入防火防爆区域不得擅自动用安全、消防设施，通讯设施、工艺管线、设备、阀门、地下管线和各种电缆等。

5.15.1.3 Temporary facilities such as temporary work shed and machine and tool box shall not be stored in the fire and explosion prevention areas of plant during production. 生产运行期间装置防火防爆区域内禁止存放暂设工棚、工机具箱等临时设施。

5.15.1.4 Temporary motor vehicle entering the fire and explosion prevention areas shall be provided with required flame arrestors and travel along the specified route. A work permit shall be handled in advance for the construction machinery; the electric bicycle shall not enter the area; and the guard shall check completeness of fire extinguisher (electrostatic grounding wire). 临时机动车辆进入防火防爆区域的，佩戴合格的阻火器，按指定路线行驶。施工机械应提前办理作业许可，电瓶车禁止入内，门卫应对灭火器（静电接地线）佩戴及完好情况进行检查。

5.15.1.5 Do not park motor vehicles in the fire and explosion prevention areas for a long time (unless the motor vehicles park in the car shed and garage). For temporary parking, do not block the fire fighting access and do not park at the emergency exit or evacuation exit. 机动车辆禁止长时间停放在防火防爆区域（在车棚、车库的除外）。临时停放时，不能堵塞消防通道，不能停放在安全出口或疏散通道上。

5.15.1.6 Do not burn the garbage or carry out accident exercise involving hot work in the fire and explosion prevention areas. 防火防爆区域内禁止焚烧垃圾、进行有明火作业内容的事故演练。

5.15.1.7 Greening in the fire and explosion prevention areas shall not block the fire fighting access. Do not plant trees with much grease. Do not plant hedge plants or thick shrubs between the plant, tank group and surrounding fire lane to prevent accumulation of explosive mixed gas. 防火防爆区绿化不得妨碍消防通道，不宜种植含油脂较多的树木，装置、罐组与周围消防车道之间，不宜种植绿篱或茂密的灌木丛，防止积聚爆炸性混合气体。

5.15.1.8 Any organization and person shall not move or damage various fire signs, notice boards and safety warning boards in the fire and explosion prevention areas. 任何单位和个人不得擅自移位或损坏防火防爆区域内的各种消防标志牌、提示牌、安全警示等标牌。

5.15.1.9 No smoking! Do not carry non-explosion-proof electronic equipment or store explosives in the fire and explosion prevention areas. 防火防爆区域内禁止吸烟、携带非防爆电子设备，严禁存放爆炸物品。

5.15.2 Safety technical requirements of fire and explosion prevention 防火防爆安全技术要求

5.15.2.1 Workers of producing, using and managing combustible and explosive chemicals shall grasp MSDS. 生产、使用和管理易燃易爆化学危险物品的工作人员，应熟悉掌握 MSDS。

5.15.2.2 The warehouse for storing combustible and explosive substances shall have a fire resistance rating not lower than Grade II and have good ventilation and cooling conditions. For the production location where combustible and explosive substances are used, the storage

amount shall not exceed the usage amount of the shift. 贮存易燃易爆物品的仓库，耐火等级不低于二级，有良好的通风散热条件。使用易燃易爆物品的生产部位，贮存量不得超过当班的使用量。

5.15.2.3 Hazardous substances shall be classified as per properties and stored in the special warehouse. Obvious marks indicating the name, property, fire prevention measure and fire extinguishing method shall be arranged. In addition, sufficient fire fighting equipment shall be provided. Substances of which the property is in conflict with the fire extinguishing method shall not be stored in the same warehouse. 贮存危险物品应按照性质分类，专库存放，并设置明显的标志，注明品名、特征、防火措施和灭火方法，配备足够的消防器材。性质与灭火方法相抵触的物品不得混存。

5.15.2.4 In the plant or warehouse for producing and storing combustible and explosive substances, do not conduct hot work or carry fire sources. The electric equipment, switch, lamp and circuit must comply with electrical explosion-proof requirements. Workers shall not wear shoes with nails and clothes made of chemical fibers. Non-staff shall not enter. 生产贮存易燃易爆物品的厂（库）房等场所，严禁动用明火和带入火种，电器设备、开关、灯具、线路必须符合电气防爆要求。工作人员不准穿带钉子的鞋和化纤衣服，非工作人员严禁进入。

5.15.2.5 Set over-temperature, over-pressure and other testing instruments, sound and/or light alarms, safety interlocks and other facilities for the parts of process plants which are likely to cause a fire or explosion. 在工艺装置上在可能引起火灾、爆炸的部位，应充分设置超温、超压等检测仪表、报警（声、光）和安全联锁装置等设施。

5.15.2.6 The equipment which may cause over-temperature, over-pressure and fire and explosion hazards due to reaction materials, shall be provided with automatic and manual emergency pressure relief and discharge devices. 因工艺反应物料造成超温、超压、可能引起火灾、爆炸危险的设备，应设置自动和手动紧急泄压排放处理等装置。

5.15.2.7 Arrange a flame arrestor at the outlet of flammable gas (vapor) blowdown pipe and a stop valve at the location for operation, so as to cut off the gas source in case of a fire at the outlet of blowdown pipe. A joint of extinguishing pipe shall be arranged at the bottom of blowdown pipe. 应在可燃气体（蒸气）的放空管出口处设置阻火器，在便于操作的地方设置截止阀，以便在放空管出口处着火时，切断气源灭火。放空管最低处应装设灭火管接头。

5.15.2.8 While delivering combustible materials, control the flow rate properly as per the pipe diameter and electrical resistivity of medium, and prevent from generating static electricity. Anti-static measures of equipment and pipeline shall comply with relevant national management regulations. 输送易燃物料时，应根据管径和介质的电阻率，控制适当的流速，尽可能避免产生静电。设备、管道等防静电措施，符合国家管理有关规定要求。

5.15.2.9 Do not clean the maintenance equipment with combustible, explosive and volatile substances such as gasoline and fuel oil. 维修检查设备机件，严禁使用汽油、燃料油等易燃易爆、易挥发物品清洗。

5.15.2.10 Substances to be prevented to expose to moisture (acetylene) and sunshine (oxygen bottle and liquid ammonia storage tank), shall not be stored in the open air, so as to prevent any fire and explosion accident due to moisture or sunshine. 对怕潮（如乙炔）、怕晒（氧气瓶、液氨储槽）等物品，不得露天存放，以免因受潮或暴晒而发生火灾、爆炸事故。

5.15.2.11 Load and unload combustible and explosive substances stably. Do not knock or remove the seal with a tool which may generate spark. 装卸和操作易燃易爆危险物品应稳装、

稳卸，严禁用产生火花的工具敲打和起封。

5.15.2.12 Do not store combustible and flammable liquids such as alcohol in the office and locker room. 办公室和更衣室内不准存放酒精等易燃、可燃液体。

5.15.2.13 Do not arrange buildings and structures or store materials at the fire separation and fire fighting access. 禁止在防火间距、消防通道内搭设建筑、构筑物或堆放各类物资。

5.16 Management of high-temperature work 高温作业管理

5.16.1 Work environment 作业环境

5.16.1.1 Take ventilation, dehumidification and cooling measures at the closed or semi-closed workplace. While heat sources (furnace and steam equipment) affect operations of the staff, take heat insulation measures. 对封闭、半封闭的工作场所，采取通风和除湿降温措施，当热源（炉子、蒸汽设备等）影响员工操作时，采取隔热措施。

5.16.1.2 At high-temperature workplace, a rest room with good ventilation shall be provided. The indoor temperature in the room with an air conditioner shall be kept at 24-28°C. 高温作业场所应设有工作休息室，室内有良好的通风，设有空调的室内气温保持在 24~28°C。

5.16.1.3 The narrow room in high-temperature environment shall be provided with good heat insulation measures, making the indoor heat radiation intensity smaller than 700W/m² and temperature not higher than 28°C. 对于高温环境中的狭小房室，应有良好的隔热措施，使室内热辐射强度小于 700W/m²、气温不超过 28°C。

5.16.1.4 For high-temperature and strong heat radiation work, take effective heat insulation measures such as water curtain, water tank for heat insulation or heat screen as per the process, water supply and indoor microclimate. For the high-temperature ground or wallboard where staff will stay or approach to frequently, the average surface temperature shall not be higher than 40°C and the maximum instantaneous temperature should not be higher than 60°C. 高温、强热辐射作业应根据工艺、供水和室内微小气候等条件采用有效的隔热措施，如水幕、隔热水箱或隔热屏等。员工经常停留或靠近的高温地面或高温壁板，其表面平均温度不应 >40°C，瞬间最高温度也不宜 >60°C。

5.16.2 Work time 作业时间

5.16.2.1 For the post involving extremely high temperature, work in turns and shorten the continuous work time. 高温超标严重的岗位，采取轮换作业等办法，尽量缩短一次连续作业时间。

5.16.2.2 For high-temperature work, the staff shall arrange the work time properly, work in turns, increase the rest time in high-temperature work environment, reduce the labor intensity, and reduce outdoor work in high-temperature hours. 从事高温作业的员工，应采取合理安排工作时间、轮换作业、适当增加高温工作环境下的休息时间、减轻劳动强度、减少高温时段室外作业等措施。

5.16.2.3 The worker returning to work after heatstroke shall follow the rest system as follows: the time ratio of conducting the original high-temperature work at the first day is 40%; and the time ratio is increased by 20% each day until completely conducting the high-temperature work at the fourth day. 中暑后返回岗位的作业人员应按如下方式调整休息制度：第一天开始接触原高

温作业的时间比率为 40%，之后每天递增 20%的热接触时间，直到第四天时方可完全接触。

5.16.3 Individual protection 个体防护

5.16.3.1 Staff shall wear protective articles properly, including protective gloves, shoes, protective glasses, protective clothing against heat and mask. 员工正确佩戴防护用品，如防护手套、鞋、防护眼镜、隔热服、面罩等；

5.16.3.2 The Company shall provide sufficient and hygienic heatstroke-prevention drinks and first-aid medicines to staff engaged in high-temperature work. 公司应为高温作业的员工供给足够的、符合卫生标准的防暑降温饮料及配备足量的中暑急救药品。

5.16.3.3 Heatstroke-prevention measures during high-temperature outdoor work in summer: 在夏季高温室外作业期间，应采取的防中暑措施：

(1) Drinking water: drink water regularly and actively (one small cup of water every 20min). Ensure the water is hygienic and not polluted by chemicals or other substances. 饮水：定期主动喝水（建议每 20 分钟喝一小杯水，少量多次），而非等到感觉口渴才喝水。同时确保茶水卫生、未被化学品或其他物质污染。

(2) In principle, do not arrange high-temperature work for the staff with heatstroke at the day. Have a rest. 原则上发生中暑当天不再安排高温作业，建议休息。

5.17 Handling management 装卸车管理

5.17.1 Tanks and other vessels used for transportation of hazardous chemicals shall be manufactured by producers with qualifications for special equipment and shall be used only when they are tested by qualified departments and pass such test. Meanwhile, it shall provide all safety accessories including pressure gage, liquidometer, safety valve, relief valve and emergency shut valve, and external accessories of tanks shall be equipped with reliable protective measures so as to ensure that goods loaded will not be subject to “running, emitting, dropping and leaking”. Semi-fixed mobile tank cars must have fixed pedestal which shall be tightened with bolt (they are not allowed to load and transport gases and oxidizing agents). 用于危险化学品运输工具的罐（槽）以及其他容器，应由具有特种设备资质的生产企业生产，并经有资质的部门进行检测、检验合格，方可使用。同时应根据不同货物的需要配备压力表、液位计、安全阀、泄压阀、紧急切断阀等各种安全附件，罐（槽）外部的附件应有可靠的防护措施，保证所装货物不发生“跑、冒、滴、漏”。半固定活动式槽车必须有固定底座并用螺栓固定（不得装运气体和氧化剂）。

5.17.2 Drivers of hazardous chemicals shall carry valid qualification certificates with themselves and hold Vehicle Permit of the Company. 危险化学品驾驶员必须随车携带有效的资质证件，并持有公司《车辆通行证》。

5.17.3 If variety of products handled will change, it must clean or replace handling vehicles and mix of oil products is prohibited. 装卸车辆在改装装卸品种前，必须经清洗或置换合格，不得混装油品。

5.17.4 Handling vehicles must line up in assigned waiting area in order and be subject to safety inspection of all departments concerned of the Company. 装卸车辆必须在指定待装区域按序排队，并接受公司各相关部门的安全检查。

5.17.5 Handling vehicles entering the Company shall operate in accordance with relevant regulations of Port and Storage Dept. 进入公司装卸车辆装卸作业按港储部装卸车相关规定执行。

5.17.6 Requirements for handling personnel 装卸人员要求

5.17.6.1 Drivers and supercargoes must know automobile emergency disconnection devices well, and understand nature and hazard property of hazardous chemicals loaded and transported as well as treatment measures in case of emergency. 驾驶员和押运员必须熟悉掌握汽车紧急切断装置，了解所装运危险化学品的性质、危害特性和发生意外事故时的处置措施。

5.17.6.2 Drivers and supercargoes are strictly forbidden to enter production area of the Company with kindling material and use non-anti-explosion communication tools like Cellphone and Beep-Pager in production area. 驾驶员和押运员严禁携带火种进入公司生产区，并不得在生产区使用手机和呼机等非防爆通讯工具。

5.17.7 Handling operation must comply with relevant handling regulations of Port and Storage Dept. 装卸作业须遵循港储部装卸车相关规定。

5.18 Portable combustible and toxic gas alarm 便携式可燃及有毒气体报警仪

5.18.1 Configuration standards for portable hydrogen sulfide alarm 便携式硫化氢报警仪配置标准

5.18.1.1 No. 1-4 Refinery Depts., Utilities Dept. and Port and Storage Dept. shall provide one portable hydrogen sulfide alarm for each HSE Engineer, and posts with hydrogen sulfide hazard shall be equipped with such alarm based on 100% of external operators (including crew leader and vice crew leader), in order to guarantee usage during the period of patrol and operation. 炼油一到四部、公用工程部、港储部 HSE 工程师每人配备便携式硫化氢报警仪 1 台，有硫化氢危害的岗位按照外操人数（包括班长、副班长）的 100% 配备，以保证巡检和作业时使用。

5.18.1.2 HSE Engineers of Power Dept., Electrical Operation Dept., Instrument Control Dept., Quality Analysis Dept. and Equipment Maintenance Dept. shall be equipped with no more than two alarms and teams where corresponding post holders belong to shall be provided with 1-3 alarms for field maintenance and sampling based on distribution of hydrogen sulfide gas in each operation area. 热电部、电气部、仪控部、质量检验部、设备检修部 HSE 工程师配备不多于 2 台，根据各作业区域硫化氢气体的分布情况，相应岗位人员所在班组配置硫化氢报警仪 1~3 台，供现场维修、采样等作业使用。

5.18.1.3 All operation departments shall also be equipped with 2-5 standby hydrogen sulfide alarms in order to ensure that no impact on production safety is exerted when alarms are sent for maintenance. 各运行部门为保证在报警仪送维修时不影响安全生产，还应配置 2~5 台备用硫化氢报警仪。

5.18.1.4 HSE Dept. shall provide moderate number of hydrogen sulfide alarms in accordance with scope of management and responsibilities of managerial personnel of all disciplines. Gas protection vehicle of fire brigade shall be equipped with one hydrogen sulfide alarm. In order to

ensure that production safety will not be influenced when several alarms of operation departments are sent for maintenance, HSE Dept. shall provide additional five standby hydrogen sulfide alarms in an unified manner. HSE 管理部应按各专业管理人员的管理范围、职责，配备适量的硫化氢报警仪。消防队气防车至少应配备硫化氢报警仪 1 台。为保证运行部门在多台仪表同时送维修时不影响安全生产，HSE 管理部再统一配置备用硫化氢报警仪 5 台。

5.18.2 Configuration standards for portable combustible gas detection alarm 便携式可燃气体检测报警仪配置标准

All operation departments and HSE Dept. may be provided with appropriate number of portable combustible gas alarms in accordance with hot work frequency in normal production. Gas protection vehicle of fire brigade shall be equipped with at least one combustible gas alarm. Specific number shall be submitted by each operation department to HSE Dept. in a truthful manner according to its actual demands. 各运行部、HSE 管理部可以根据正常生产时的动火作业频度，配置适量的便携式可燃气体报警仪。消防队气防车至少应配置便携式可燃气体报警仪 1 台。具体数量由各运行部根据实际需要按实提报给 HSE 管理部。

5.18.3 Configuration requirements for other detection alarms 其它检测报警仪配置规定

All operation departments shall, based on distribution of toxic and harmful gases in their own plants, identify their hazards and submit their demands for configuration of alarms. Gas protection vehicle of fire brigade shall be equipped with more than one toxic and harmful gas detection alarms frequently used in the Company. 各运行部根据本装置有毒有害气体的分布情况，识别其危害，提请配备报警仪需求。消防队气防车应配备公司内其它各种常用的有毒有害气体检测报警仪 1 台以上。

5.18.4 Management of portable hydrogen sulfide alarm 便携式硫化氢报警仪的管理

5.18.4.1 Operation Dept. shall establish portable hydrogen sulfide alarm account, include such establishment into the scope of duty shift, and ensure such account are complete and available. 运行部负责建立便携式硫化氢报警仪台账，并纳入交接班范围，确保完好备用。

5.18.4.2 Operation Dept. shall promptly submit incomplete alarms to Instrument Control Dept. for examination and maintenance. 运行部发现报警仪不完好应及时报送仪表控制部检查维护。

5.18.4.3 Instrument Control Dept. shall be responsible for examination, maintenance and repair of portable hydrogen sulfide alarm, establish maintenance records, conduct regular calibration, and post signs. 仪表控制部负责便携式硫化氢报警仪检查维护、维修，建立维护记录，定期进行检定，并张贴标识。

5.18.4.4 HSE Dept. shall establish portable hydrogen sulfide alarm account of the Company and monitor and examine conditions of alarms. HSE 管理部负责建立本企业便携式硫化氢报警仪台账，对报警仪的完好状况进行监督检查。

5.19 Hydrogen sulfide prevention 硫化氢防范

5.19.1 All personnel having access to hydrogen sulfide hazard area shall carry portable hydrogen sulfide alarms and protection devices as required. 所有进入硫化氢危害区域的人员必须按要求携带便携式硫化氢报警仪和防护器具。

5.19.2 It is imperative to select appropriate protective devices based on working environment of different posts; it is allowed to use filter gas defense devices when concentration of hydrogen sulfide is below 50mg/m³ and use isolated respirator when concentration of hydrogen sulfide is below 50mg/m³ or within areas subject to media leakage and unclear concentration. 根据不同岗位的工作环境选用合适的防护器具，当硫化氢浓度低于 50mg/m³ 时可以使用过滤式防毒用具，在硫化氢浓度大于 50 mg/m³ 或发生介质泄漏、浓度不明的区域内应使用隔离式空气呼吸器。

5.19.3 When entering hydrogen sulfide hazard area for patrol, operators shall conduct individual protection well and carry portable hydrogen sulfide alarm. In case of operation in hydrogen sulfide hazard area, it shall wear isolated respirator, set up warning signs around operation points and assign special personnel for monitoring. 操作人员进入硫化氢危害区域巡检，应做好个体防护，携带便携式硫化氢报警仪。在硫化氢危害区域作业，应佩戴隔离式空气呼吸器，作业点周围设置警示标示，并有专人监护。

5.19.4 When construction and maintenance personnel of contractors enter hydrogen sulfide hazard area to work, operation departments where they belong to shall organize construction contractors to conduct risk identification and notification of hydrogen sulfide hazards in operation area, and provide necessary protective devices and emergency rescue facilities. 承包商施工检修人员进入硫化氢危害区域作业时，所在作业部应组织施工承包商对作业区域硫化氢危害进行风险识别和告知，配备必要的防护器具和应急救护设施。

6 Inspection and Supervision 检查与监督

6.1 HSE Dept. shall supervise and inspect implementation of safety management conducted by all departments, and hold departments and personnel failing to act as required accountable in accordance with relevant assessment regulations of the Company. HSE 管理部负责监督检查各部门安全管理执行情况，对未按要求执行的部门和人员，按照公司相关考核规定追究有关人员责任。

6.2 Related functional departments shall inspect and assess acts in violation of regulations based on their respective responsibilities. 相关职能部门按照职责分工对出现的违章行为进行检查并给予考核。

7 Associated Procedures and Records 关联程序及记录

7.1 Associated procedures 关联程序

7.1.1 Safety Management Procedure HYBN-T2-08-0014-2018-1 安全管理程序
HYBN-T2-08-0014-2018-1

7.1.2 Management Procedures for Hazard Identification and Evaluation
HYBN-T2-08-0015-2018-1 危险源识别与评价管理程序 HYBN-T2-08-0015-2018-1

7.1.3 Management Procedure for Major Risk (Hazard) HYBN-T2-08-0016-2018-1 重大风险
(危险源)管理程序 HYBN-T2-08-0016-2018-1

7.1.4 Management Procedure for Key Plants and Major Parts HYBN-T2-08-0017-2018-1 关键装置和重点部位管理程序 HYBN-T2-08-0017-2018-1

7.1.5 Management Procedure for Fire and Explosion Prevention Areas HYBN-T2-08-0018-2018-1 防火防爆区域管理程序 HYBN-T2-08-0018-2018-1

7.1.6 Management Procedure for Hazardous Chemicals HYBN-T2-08-0019-2018-1 危险化学品管理程序 HYBN-T2-08-0019-2018-1

7.2 Associated records 关联记录

7.2.1 List of Operation Activities HYBN-T6-08-2001-001-2018

作业活动清单 HYBN-T6-08-2001-001-2018

7.2.2 Record of Job Hazard Analysis (JHA) HYBN-T6-08-2002-001-2018

工作危害分析 (JHA) 记录表 HYBN-T6-08-2002-001-2018

7.2.3 Safety Check List (SCL) Analysis Record HYBN-T6-08-2003-001-2018

安全检查 (SCL) 分析记录表 HYBN-T6-08-2003-001-2018

7.2.4 List of Process Analysis Steps and Nodes HYBN-T6-08-2004-001-2018

工艺分析步骤、节点清单 HYBN-T6-08-2004-001-2018

7.2.5 Directory List of Preliminary Deviations HYBN-T6-08-2005-001-2018

初步偏差目录清单 HYBN-T6-08-2005-001-2018

7.2.6 Analysis Record for Hazard and Operability Analysis (HAZOP) HYBN-T6-08-2006-001-2018 危险和可操作性研究 (HAZOP)

分析记录表 HYBN-T6-08-2006-001-2018

7.2.7 Control List for Moderate Risks or Above HYBN-T6-08-2007-001-2018

中度级以上风险控制清单 HYBN-T6-08-2007-001-2018

7.2.8 List of Equipment and Facilities HYBN-T6-08-2008-001-2018

设备设施清单 HYBN-T6-08-2008-001-2018

7.2.9 Census Form for Chemicals HYBN-T6-08-2009-001-2018

化学品普查表 HYBN-T6-08-2009-001-2018

7.2.10 Registration Form for Hazardous Chemicals HYBN-T6-08-2010-001-2018

危险化学品登记表 HYBN-T6-08-2010-001-2018

7.2.11 Special Hot Work Permit HYBN-T6-08-2011-001-2018

特级动火作业许可证 HYBN-T6-08-2011-001-2018

7.2.12 Level 1 Hot Work Permit HYBN-T6-08-2012-001-2018

一级动火作业许可证 HYBN-T6-08-2012-001-2018

7.2.13 Level 2 Hot Work Permit HYBN-T6-08-2013-001-2018

二级动火作业许可证 HYBN-T6-08-2013-001-2018

7.2.14 Permit for Work in Confined Space HYBN-T6-08-2014-001-2018

受限空间作业许可证 HYBN-T6-08-2014-001-2018

7.2.15 Permit for Work at Heights HYBN-T6-08-2015-001-2018

高处作业许可证 HYBN-T6-08-2015-001-2018

7.2.16 Permit for Radiography Operation HYBN-T6-08-2016-001-2018

射线作业许可证 HYBN-T6-08-2016-001-2018

7.2.17 Permit for Work with Road Closed HYBN-T6-08-2017-001-2018

断路作业许可证 HYBN-T6-08-2017-001-2018

7.2.18 Application Form for Fixed Hot Work Area HYBN-T6-08-2018-001-2018

固定动火区申请表 HYBN-T6-08-2018-001-2018

8 Supplementary Rules 附则

8.1 This System is under the jurisdiction of HSE Dept. 本制度由 HSE 管理部归口管理。

8.2 This System is drafted by HSE Dept. 本制度起草部门：HSE 管理部。

8.3 HSE Dept. is responsible for the interpretation of this System.

本制度解释权归 HSE 管理部拥有。

8.4 Revision, preparation and approval of this System are shown in table 4.

本制度版本编制和审批情况见表 4：

Table 4 Revision, preparation and approval of document 表 4 文件版本编制和审批情况

1	2018-05-01	Ding Zaishan 丁再山	Xiao Chunbao 肖春宝	Chen Liancai 陈连财
Revision 版本	Issued date 颁布日期	Prepared by 编 制人	Reviewed by 审核人	Approved by 批准人

9 Appendices 附件

Appendix 1 Job Hazard Analysis (JHA) Method

附件 1 工作危害分析 JHA 方法

Appendix 2 Safety Checklist (SCL) Method

附件 2 安全检查表法 SCL 方法

Appendix 3 Hazard and Operability Analysis (HAZOP) Method

附件 3 危险和可操作性研究 HAZOP 方法

Appendix 4 Risk Assessment Criteria

附件 4 风险评价准则

Appendix 1 附件 1

Job Hazard Analysis (JHA) Method 工作危害分析 JHA 方法

1 Division of identification and analysis units 辨识分析单元划分

It shall, at the level of Operation Dept. and functional departments, allocate business backbones to divide and identify analysis units of operations of the Operation Dept. and their departments level by level. Operation Dept. shall classify its operations and prepare list of operations mainly based on operational procedure (on the basis of work instruction). Functional departments shall classify their operations and prepare their lists of operations mainly based on their functions (on the basis of job responsibilities). The results of the division of the above identification and analysis units (operations) must be reviewed and determined by leadership of Operation Dept. or functional departments. 以运行部和职能部门为单元，抽调业务骨干对所在运行部或职能部门的作业活动进行逐级划分辨识分析单元。其中运行部主要按照操作流程（以作业指导书为基础）进行作业活动划分，编制作业活动清单。职能部门主要按照部门职能（以岗位职责为基础）进行作业活动划分，编制部门工作活动清单。上述辨识分析单元（作业活动）划分的结果须经所在运行部或职能部门领导审核确定。

2 Identification of job hazards 岗位危险源辨识

2.1 All departments shall prepare and distribute lists of operations to all teams. 各部门将编制的作业活动清单下发各班组。

2.2 Crew leaders shall use pre-shift meeting, routine meeting or team event to organize all post holders to participate in discussion which shall cover: accuracy and completeness of lists of operations issued, major hazards and risk of each operation, and extent of such risks. Relevant activities shall be put into crew safety activity record. 班组长利用班前会，班务会或班组活动的组织各岗位员工参加讨论，讨论内容包括：下发的作业活动清单是否准确是否完善、各项作业活动中主要存在的危险源和风险，风险的大小。相关活动登载进入班组安全活动记录。

2.3 After crew-based discussion, each employee shall identify hazards and risks of her or his work and fill identification results in Job Hazard Analysis (JHA) Record. 班组讨论后，每个岗位员工针对自身工作活动识别危险源和风险，并将结果填写到《工作危害分析（JHA）记录表》。

2.4 Crew leaders shall collect results of hazard identification and risk assessment made by employees and report them to Operation Dept. 班组长汇总员工危险源和风险评价的结果上报运行部。

3 Department-level hazard identification and risk assessment 部门危险源辨识与风险评价

3.1 Staff composition 人员构成

Operation Dept. shall allocate backbone employees to form the hazard identification and risk assessment team which is composed of safety officer, technicians (process and equipment), field managerial personnel and experienced operators. These participants shall be representative and have rich practice experience and they shall cover working activities of all crews in Operation Dept. 运行部抽调骨干组成危险源辨识与风险评价小组，包括安全员、技术

员（工艺、设备）、现场管理人员，有经验的岗位操作员工等。人员要有代表性，要覆盖本运行部的各班组工作活动，参与人员的实践经验需丰富。

3.2 Hazard identification for department-level operations 部门作业活动危险源辨识

3.2.1 HSE Engineer of a department shall collect hazard and risk identification forms submitted by all crews and use them as the basis for their hazard identification and risk assessment. 部门 HSE 工程师汇总各班组上报的危险源和风险识别表，作为部门危险源辨识与风险评价的基础。

3.2.2 Members of department-level hazard identification and risk assessment team shall discuss each operation and operation step based on list of operations and conduct hazard identification. Identification results shall be included in Job Hazard Analysis (JHA) Record. 部门危险源辨识与评价小组成员针对按照作业活动清单，对每项作业活动和作业步骤逐项讨论，进行危险源辨识。辨识结果列入《工作危害分析（JHA）记录表》。

Appendix 2 附件 2

Safety Checklist (SCL) Method 安全检查表法 SCL

1 Division of Identification and Analysis Units 1 辨识分析单元划分

The list of facilities and equipment shall be prepared according to the main areas and facilities and equipment, with the department as a basic unit. The results of the division of the above identification and analysis units (equipment) must be reviewed and determined by the leader of the department in charge. 以部门为基础单元，按照主要区域和设施设备，编制设施设备清单。上述辨识分析单元（设备）划分的结果须经所在部门领导审核确定。

1.1 Make statistics and analysis, and prepare the list of equipment and facilities of the department; 统计、分析，并编制本部门的设备设施清单；

1.2 Note in the statistical process that equipment and facilities with the same or similar performance and functions can be combined. 在统计过程中注意、相同或类似性能、功能的设备设施可以合并。

2 Preparation of the Safety Checklist 安全检查表的编制

2.1 The equipment safety checklist of the industry (or the department) can be used for reference or referenced. 可借鉴、引用本行业（或本部门）的设备安全检查表。

2.2 Where there is no corresponding safety checklist, a safety checklist shall be prepared as required below. 无相应的安全检查表则应按如下要求编制安全检查表。

2.2.1 The checklist used shall be based on the principle of professional HSE checklist (for professional check), and supplement the contents in the corresponding daily HSE checklist; 使用的检查表应为专业性 HSE 检查表为原则（专业检查用），补充相应的日常 HSE 检查表的内容；

2.2.2 The check items shall be divided for the first level according to the workplaces and areas of the units, such as pump houses, tank farms, duty rooms, etc.; 检查项目应依据单位的工作场所、区域做一级划分，如泵房、如罐区、如值班室等；

2.2.3 The critical equipment, key large-scale equipment and facilities can also be divided into the first-level check items, such as boilers, oil tanks, etc.; 如果是重点设备、大型关键设备设施，也可划分为一级检查项目，如锅炉，如油罐等；

2.2.4 The check points shall be divided on the equipment and facilities within the workplace and area for division of the secondary level, in which the equipment shall be divided with the pipeline valve as the demarcation point. 关于检查点的划分，应在该工作场所、区域内的设备设施进行二级划分。其中设备划分应以管线阀门为分界点；

2.2.5 The division of check points shall be defined point by point specific to the main components, instruments, valves, auxiliary facilities, etc. of the equipment and facilities; 检查点的划分应针对该设备设施的各主要部件、仪表、阀门、辅助设施等逐项明确；

2.2.6 The check standards shall be developed in accordance with the way of the checklist preparation, which can be briefly described as “from far to near, from top to bottom, and from outside to inside”. 检查标准则应按照编制检查表的方式进行检查标准制定，概略描述就是“由远及近、由上及下，由外及里”。

3 Intrinsic Safety Checking of Equipment and Facilities 设备设施本质安全排查

The department shall organize the equipment and facilities maintenance and management personnel to derive possible deviations according to the equipment safety checklist (i.e. the contents violating relevant check standards and requirements in the safety checklist, which is the unsafe status of the equipment and facilities). 部门组织设备设施维护和管理人员，根据设备安全检查表导出可能存在的偏差（即违背安全检查表中相关检查标准、要求的内容，此即为物的不安全状态）。

3.1 Aimed at the above-identified hazards, the possible harmful consequences shall be defined, mainly accidents, equipment and property losses, which shall be specifically described in accordance with the relevant national accident classification standards. 针对上述辨识出的危险源，明确其可能产生的危害后果，主要是事故、设备、财产损失，具体按照国家有关事故分类标准进行描述。

3.2 The appropriate safety management and control measures corresponding to the hazards shall be investigated and verified, in which the corresponding specific terms shall be found out mainly from the safety management rules and regulations, the safety operation regulations, the safety inspection procedures and the equipment management systems so as to have knowledge about the possible corresponding loopholes or undefined points. 查证对应该危险源的相应安全管理、控制措施，其中重点从安全管理规章制度、安全操作规程、安全检修规程、设备管理制度中查找相应的明确条款，从而了解可能存在的相应漏洞或未明确的地方。

3.3 The safety checklist of the department shall be prepared according to the above hazard identification. 根据以上危险源辨识情况，编制完成本部门的安全检查表。

The intrinsic safety risks of the equipment and facilities shall be discussed and identified item by item through the method of safety checklist, the identification results of which shall be filled into the Safety Checklist (SCL) Analysis Record of the department. 采用安全检查表法逐项讨论，识别设备设施本质安全风险，辨识结果填入部门《安全检查表（SCL）分析记录表》。

Appendix 3 附件 3

Hazard and Operability Analysis (HAZOP) Method 危险和可操作性研究 (HAZOP) 方法

1 Composition of the Analysis Group 分析组的组成

1.1 The HAZOP analysis group shall consist of at least 4 people. Generally speaking, the analysis group of 5 to 7 people is more ideal. It shall include the group leader, recorders and personnel familiar with the process design and operation. HAZOP 分析组最少由 4 人组成，一般来说，5~7 人的分析组比较理想。包括：组长、记录员及熟悉过程设计和操作的人员。

1.1.1 Group leader: a senior engineer with experience in industrial safety and practical hazards and operability analysis; 组长：应具备工业安全和实际进行危害及可操作分析经验的资深工程师担任；

1.1.2 Process engineer: familiar with basic process design, process and production operation methods; 工艺工程师：熟悉基本工艺设计、流程、生产操作方法；

1.1.3 Equipment engineer: with relevant equipment knowledge and experience; 设备工程师：具备相关设备知识和经验；

1.1.4 Instrument engineer: familiar with the knowledge and experience related to instrument control system; 仪表工程师：熟悉仪表控制系统相关知识和经验；

1.1.5 HSE engineer: having knowledge of laws and regulations and standards related to HSE; HSE 工程师：了解 HSE 相关的法律法规和标准；

1.1.6 Production operators: with certain experience in practical production operation. 生产操作人员：具备一定的实际生产操作经验。

2 Determination of Analysis Object, Purpose and Scope 确定分析对象、目的和范围

2.1 The purpose, object and scope of the analysis must be as clear as possible. 分析的目的、对象和范围必须尽可能的明确。

2.2 The analysis object is usually determined by the person in charge of the device or the project, with assistance from the organizer of the HAZOP analysis group. 分析对象通常是由装置或项目的负责人确定的，并得到 HAZOP 分析组的组织者的帮助。

2.3 The analysis shall be carried out as per the correct direction and established goals, and the dangerous consequences to be considered shall be determined. 应当按照正确的方向和既定目标开展分析工作，而且要确定应当考虑到哪些危险后果。

3 Acquisition of Required Information 获取必须的资料

Prior to the HAZOP analysis, the following information or data must be collected: 在进行 HAZOP 分析工作之前，必须收集下列资料或数据：

3.1 P&ID diagram—key for HAZOP analysis, which must be accurate; P&ID 图—HAZOP 分析的关键，必须准确；

3.2 Important information of HAZOP analysis; HAZOP 分析的重要信息；

3.3 The physical, chemical and hazardous characteristics of hazardous materials; 危险物料的物理、化和危险特性；

- 3.4 Process description, material and energy balance; 工艺说明, 物料和能量平衡;
- 3.5 Equipment design information, material texture and structure; 设备设计信息, 材质、结构;
- 3.6 Arrangement plan or layout plan of the device; 装置布置或平面布置图;
- 3.7 Process flow diagram (PED); 工艺流程图 (PED);
- 3.8 Previous accident information, inspection reports and operation records. 以往事故信息、检查报告、操作记录。

4 Turning of Information into Appropriate Tables and Setting of Analysis Order 将资料变成适当的表格并拟定分析顺序

4.1 In order to make the analysis process orderly, the organizer of the analysis group usually develops detailed plans before the analysis meeting and must take a certain time to determine the best analysis procedure based on the specific analysis object. 为了让分析过程有条不紊, 分析组的组织者通常在分析会议开始之前要制定详细的计划, 必须花一定的时间根据特定的分析对象确定最佳的分析程序。

4.1.1 Continuous process: updated drawings, Directory of Preliminary Deviations and worksheet. 连续过程: 已更新的图纸, 初步偏差目录, 工作表。

4.1.2 Intermittent process: operating procedures. 间歇过程: 操作程序。

5 Arrangement of HAZOP Analysis Meeting HAZOP 分析会议安排

Each analysis node shall take an average of 20 to 30 minutes; and each device shall be assigned for 2 to 3 hours. 每个分析节点平均需 20~30 分钟; 每个设备分配 2~3 小时。

5.1 The duration of each meeting shall not exceed 4-6 hours (preferably in the morning), and the analysis meeting shall be held in a continuous manner. 每次会议持续时间不要超过 4~6 小时 (最好安排在上午), 而且分析会议应连续举行。

5.2 It is better to divide the device into several relatively independent areas. After each area is discussed, the meeting group shall make appropriate modifications and then continue the analysis and discussion for the next area. 最好把装置划分成几个相对独立的区域, 每个区域讨论完毕后, 会议组作适当修整, 再进行下一区域的分析讨论。

5.3 As for large-scale devices or technological processes, it can be conducted simultaneously by forming multiple analysis groups, with the organizer of an analysis group acting as the coordinator who shall first divide the process into several relatively independent parts and then assign them to each group to complete. 对于大型装置或工艺过程, 可以考虑组成多个分析组同时进行, 由某个分析组的组织者担任协调员, 协调员首先将过程分成相对独立的若干部分, 然后分配给各个组去完成。

6 Implementation of HAZOP Analysis Meeting HAZOP 分析会议实施

For HAZOP analysis, process drawing or operation procedures shall be divided into List of Systematic Analysis Nodes or Steps and Directory List of Preliminary Deviations, and then guide words shall be used for finding out the dangers during the process. The result is: HAZOP 分析需要将工艺图或操作程序划分为《系统分析节点或步骤清单》、《初步偏差目录清单》, 然后用引导词找出过程的危险。得到的结果为:

6.1 Causes, consequences, protective devices and recommended measures of deviations;
差的原因、后果、保护装置、建议措施；

6.2 More information is needed for further analysis of deviations. 需要更多的资料才能对偏差进行进一步的分析。

Analysis Record for Hazard and Operability Analysis (HAZOP) is formed by the results above.
上述结果形成《危险和可操作性研究（HAZOP）分析记录表》

Appendix 4 附件 4

Risk Assessment Criteria 风险评价准则

1 Risk refers to the combination of possibility and consequence of a certain hazardous incident. 风险是发生特定危害事件的可能性及后果的结合。

$$R = L \times S$$

2 In the formula above: R—risk degree; L—occurrence possibility of incident; S—severity of incident consequence 上式中: R—风险度; L—事件发生的可能性; S—事件发生后后果严重性

Table 5 L-Refer to Table Below for the Occurrence Possibility of Incident 表 5 L-事件发生的可能性可参照下表制定

Grade 等级	Criteria 标准
5	No preventive, monitoring and control measures are take at site, or no danger is detected, or a similar accident or incident occurs once a week. 在现场没有采取防范、监测、控制措施, 或危害的发生不发现, 或一周发生一次类似事故或事件
4	The occurrence of hazards is not easy to be detected, with no detection system on the site no monitoring conducted, or control measures have been taken on the site but they have not been effectively implemented or the control measures are improper, or a similar accident or incident occurs no more than three times within a month. 危害的发生不容易被发现, 现场没有检测系统, 也未信做过任何监测, 或在现场有控制措施, 但未有效执行或控制措施不当, 或一月发生三次以内类似事故或事件
3	No protective measures (such as protective devices, personal protective equipment, etc.) are taken, or they are not implemented in strict accordance with the operation procedure, or the occurrence of hazards is easy to be detected (with monitoring system on the site), or monitoring has ever been conducted, or a similar accident or incident occurs once every six months. 没有保护措施(如没有保护装置、没有个人防护用品等), 或未严格按操作程序执行, 或危害的发生容易被发现(现场有监测系统), 或曾经做过监测, 或半年发生一次类似事故或事件
2	A hazard shall be monitored regularly once it is detected in time, or prevention and control measures are taken on the site and can be effectively implemented, or a similar accident or incident occurs once a year. 危害一旦能及时发现, 并定期进行监测, 或现场有防范控制措施, 并能有效执行, 或一年发生一次类似事故或事件
1	The sufficient and effective prevention, control, monitoring and protection measures are taken, or the employees have a very high awareness of safety and health and can strictly implement the operation procedures. It's highly impossible that a similar accident or incident might occur. 有充分、有效的防范、控制、监测、保护措施, 或员工安全卫生意识相当高, 严格执行操作规程, 极不可能发生事故或事件

Table 6 Discrimination criteria on severity of event consequences 表 6 S-事件后果严重性判定准则

Grade 等级	Legal, regulatory and other requirements 法律、法规 及其他要求	Person 人	Property loss (10 ⁴ yuan) 财 产损失/万 元	Environment al pollution and resources consumption 环境污染资 源消耗	Unplanned shutdown 非计划停 工	Enterpris e image 企业形象
5	Violation of laws, regulations and standards 违反法律、法 规和标准	Triggering the death of one or more persons 造成 1 人及 以上死亡	>50	Major environment al pollution at sea and on the PMB island 海上、 PMB 岛上重 大环境污染	Parking for more than 12 hours 停 车 12 小时 以上	Significan t internatio nal and domestic impact 重大国际 国内影响
4	Potential violation of regulations and standards 潜在违反法 规和标准	Triggering serious injuries of one or more persons 造 成 1 人及以 上重伤	>25	Severe pollution within the company 公 司内严重污 染	Parking for 6-12 hours 停 车 6-12 小 时	Domestic impact of Brunei 文莱国内 影响
3	Inconformity with the safety policies, systems, provisions and other rules of the superior company or the industry 不符合上级 公司或行业 的安全方针、 制度、规定等	Triggering minor wounds and chronic diseases 造成轻伤、 慢性病	>10	Moderate pollution within the company 公 司内中等污 染	Parking for 1-6 hours 停 车 1-6 小时	Regional impact 地区影响
2	Inconformity with the safety operation	Slight injuries and intermittent discomfort	<10	Pollution within the scope of a device 装置	Parking within 1 hours 停 车 1 小时	Environm ent of the company and PMB

	procedures and provisions of the company 不符合公司的安全操作程序、规定	轻微受伤、 间歇不舒服		范围内污染	以内	island 公司及 PMB 岛上环境
1	Complete conformity 完全符合	No casualty 无伤亡	Damage free 无损失	No pollution 没有污染	No shutdown 没有停工	No damage to the image 形象没有受损

Table 7 R-Discrimination Criteria on Risk Level 表 7 R-风险等级判定准则

Risk degree 风险度	Level 等级	Action/control measures to be taken 应采取的行动/控制措施	Implementation period 实施期限
20~25	Significant risk 巨大风险	Halt operation before hazards have been weakened by measures. Assess improvement measures. 在采取措施降低危害前，不能继续作业，对改进措施进行评估	Immediately 立刻
15~16	Major risk 重大风险	Take emergency measures to lower the risks. Set up operation control programs. Examine, measure and evaluate the risk regularly. 采取紧急措施降低风险，建立运行控制程序，定期检查、测量及评估	Immediate or recent rectification 立即或近期整改
9~12	Moderate 中等	It is suggested to establish goals and operation specifications and strengthen training and communication. 可考虑建立目标、建立操作规程，加强培训及沟通	Governance within 2 years 2年内治理
4~8	Acceptable 可接受	It is suggested to establish the operation specifications and the operation instruction. Check implementation condition on a regular basis. 可考虑建立操作规程、作业指导书但需定期检查	Governance at the time of both conditions and funds ready 有条件、有经费时治理
<4	Slight or negligible risk 轻微或可忽略的风险	Control measures are not required, but record shall be kept, and attention shall be paid to avoid the escalation of the risk. 无需采用控制措施，但需保存记录，加以注意，避免风险等级上升	

Tale 8 Risk Matrix 表 8 风险矩阵

Frequently (ly/time) 频繁 (ly/ 次)	L5	E	D	B	A	A
More (5y/time) 较 多 (5y/次)	L4	E	D	C	B	A
Occasionally (20y/time) 偶尔 (20y/次)	L3	E	E	D	C	B
Rarely (100y/time) 很少 发生 (100y/次)	L2	E	E	E	D	C
Unlikely (1000y/time) 不太 可能 (1000y/次)	L1	E	E	E	E	D
Class 类别	S1	S2	S3	S4	S5	
	Negligible 可忽略	Slight 轻微	Major 严重	Significant 重大	Disastrous 灾难性	
Risk level 风险级别	Negligible risk 忽略风险	Acceptable 可接受	Moderate 中等	Major risk 重大风险	Significant risk 巨大风险	
Risk level code 风险等级代码	I	II	III	IV	V	
Color code 颜色标示						
Requirements for rectification measures 对整改措施要求	No requirement 没有要求	Additional safety measures may be considered. 可以考虑增加安全措施	Administrative measures shall be provided and internal engineering measures shall be taken where possible. 提供行政措施, 尽可能采用内工程措施	Safety measures must be provided and at least one engineering measure be provide. 必须提供新的安全措施, 提供至少一项工程措施	Protection LOPA analysis must be made, and safety measures be taken. 必须进行保护 LOPA 分析, 采取安全措施	

