 <b>КазМұнайГаз</b> <small>NATIONAL COMPANY ҰЛТТЫҚ КОМПАНИЯСЫ</small>	<b>JSC “National Company “KazMunayGas”</b>	
<b>Title: Corporate Standard for Process Safety Management of JSC NC “KazMunayGas” Group</b>		
<b>Document type: IMS Corporate Standard</b>	<b>No. KMG-ST-3679.2-13</b>	<b>Page 1 of 35</b>
Developed by: _____ B. Azhgaliyev _____ 2020	Checked by: K. Saktaganov _____ _____ 2020	Approved by the Resolution of the Board of Directors of JSC NC "KazMunayGas" dated _____ 2020 Minutes No.____

## 1. PURPOSE AND GENERAL PROVISIONS

1.1. Purposes of this corporate standard for process safety management of JSC NC “KazMunayGas” Group (the Standard) are to:


- 1) establish uniform requirements and effective approaches to implement and maintain process safety management system (PSM) in facilities of the KMG Group to manage and prevent major catastrophic Incidents (Accidents, Incidents, Fires and Injuries);
- 2) maintain integrity of assets and process equipment;
- 3) develop and establish safe operational rules, standards and procedures in accordance with Statutory Requirements, industry standards, best international PSM practices and approaches;
- 4) identify process Risks/Hazardous and Harmful Occupational Factors and employ relevant measures to prevent or mitigate them;
- 5) avoid damage to and loss of life and health of Employees and population, environment, financial and legal implications, property and assets, reputation and image.

1.2. PSM process is a combination of engineering and managerial elements designed to prevent catastrophic Incidents resulting in collapse of structures, explosions, fires, destructive emissions and releases of hazardous substances (chemicals, oil and oil products) associated with loss of containment of process equipment. Such engineering and managerial elements surpass the demands to workplace safety management, as they affect people, property and environment.

1.3. PSM is based on providing a simple and consistent approach for the KMG Group, defining key actions and procedures to be implemented properly to ensure integrity of process operations, including administrative, engineering, operational and human factors.


1.4. This Standard has been developed under Statutory Requirements, KMG Development Strategy-2028, JSC NC “KazMunayGas” Health and Safety Policy, Environmental Policy, Golden Rules – Health and Safety Code of Conduct for JSC NC “KazMunayGas” Employees, JSC NC “KazMunayGas” Group Health, Safety and Environment Leadership and Commitment Code and MS, ISO 9001:2015, ISO 14001:2015, ISO 45001:2018 (ST RK ISO 45001-2019), PSM Recommendations of OSHA, IOGP, and is an internal document of the KMG Group.

### Philosophy

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The PSM structure is based on the following philosophy:

- 1) to demonstrate HSE and PPM commitment of managers on all levels;
- 2) to develop, implement and update documented (written) HSE information identifying workplace/facility Risks/Hazardous and Harmful Occupational Factors, equipment and technologies to be used in Processes and Production Processes;
- 3) to evaluate workplace/facility Risks/Hazardous and Harmful Occupational Factors and identify potential sources of accidental emissions/releases (spills), identify any previous emission(s), which had the potential for catastrophic consequences, and evaluate how their range affects health of Employees, population and environment;
- 4) to consult with Employees and their representatives on how to develop and conduct assessments of Risks/Hazardous and Harmful Occupational Factors, Incident prevention plans;
- 5) to establish a system to respond to the results of assessments of workplace/facility Risks/Hazardous and Harmful Occupational Factors, and revision frequency to address emergency prevention, mitigation and response;
- 6) to develop, implement and update written work procedures for hazardous production facilities, including procedures for each operating phase, operating limitations in accordance with Statutory HSE Requirements;
- 7) to provide documented/written process safety and environment information for Employees, Contractors/Subcontractor and other stakeholders;
- 8) to train Employees, Contractors/Subcontractors in effective emergency response procedures in accordance with Statutory Requirements and internal documents of the KMG Group;
- 9) to establish a quality assurance programme to ensure that initial process equipment and technology, maintenance materials and spare parts are fabricated and installed consistent with design specifications;
- 10) to establish a maintenance system for critical Equipment to ensure Process and Operation safety, including written procedures, Employee training, inspections and tests of equipment to ensure Mechanical Integrity;
- 11) to conduct pre-start safety checks of all new or modified process equipment;
- 12) to establish and implement a documented (written) procedure to manage change to organisation, technology and equipment, processes and personnel;
- 13) to investigate each Incident, which has resulted in or could have resulted in severe consequences in the workplace/facility, with findings and recommendations to avoid future re-occurrence (equipment checks, review of actions of Employees, who maintain equipment/unit, where required, making changes to the valid procedures and instructions etc.);
- 14) to conduct PPM Compliance Audits, define corrective and preventive actions and take immediate measures within the established periods;

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15) to introduce best safety practices, promptly correct all unsafe behaviours and unsafe conditions.

## 2. SCOPE

2.1. This Standard is intended to be applied throughout the KMG Group, and has been developed to ensure safety and eliminate Process and Operations threats, and is equally applicable to production and operation Facilities (oil and gas production, refining and transportation), and to service operations (construction, well workover, power distribution, storage of oil and oil products, filling stations) according to scope and complexity of operations.

2.2. This Standard is not superseding the valid MS, but establishes which areas shall be covered by MS and, where required, identifies gaps compared to expectations for each MS element to establish any area for improvement.

2.3. The requirements hereof are mandatory for Employees, Contractors/Subcontractors and are applicable to all Contractors/Subcontractors of KMG Organisations, which provide services and carry out work, including any associated work and services for Facilities.

2.4. KMG Organisations may apply this Standard as established by developing and approving a similar Standard or bringing internal documents in line with the Standard. Requirements hereof shall not be lowered, when included in similar standards and internal documents of a KMG Organisation.

2.5. Responsibility of Contractor employees to observe the requirements hereof is stipulated by the relevant contracts. It is the responsibility of KMG Management, Heads of Business Lines, Heads of Business Areas, Chief Executive Officers of KMG Organisations, Line Managers to define such obligations for Contractors in contracts for work or services, as required hereby.

## 3. DEFINITIONS AND ABBREVIATIONS

This Standard features the following definitions and abbreviations:

<b>KMG</b>	Joint-Stock Company "National Company "KazMunayGas"
<b>KMG Group</b>	KMG and legal entities with fifty percent or more of voting shares (interests) directly or indirectly owned or held in trust by KMG, as well as legal entities whose activities KMG is entitled to control
<b>Accident</b>	Destruction of buildings, facilities and/or technical devices, uncontrolled explosion and/or release of hazardous substances
<b>Compliance audit</b>	A consistent, independent and documented process to obtain and objectively evaluate audit evidence to




	establish compliance with the audit criteria
<b>Barrier</b>	Protections designed to reduce the likelihood of realisation of a potential hazard or mitigate its consequences
<b>PPS</b>	Production process safety
<b>H&amp;S</b>	Health and safety
<b>Gas hazardous work</b>	Work in gas environment or work, which can release gas
<b>Health and Environment Department (H&amp;ED)</b>	A KMG business unit in charge of HSE
<b>Environmental pollution</b>	Emission of pollutants, radioactive materials, production and consumption waste into the environment as well as impact of noise, vibrations, magnetic fields and other harmful physical effects on the environment
<b>Statutory requirements</b>	Requirements of legal regulations and concessions, including international conventions, standards and treaties, and interstate agreements
<b>Lagging indicator</b>	An indicator to evaluate the degree and actual consequences in the risk management system, reflecting one or more obstacles (barriers) at the same time
<b>Incident</b>	A failure or damage of technical devices used at a hazardous production facility, as well as a deviation from the process conditions of a hazardous production facility
<b>HSE&amp;SD Committee</b>	Health, Safety, Environment and Sustainable Development Committee of the KMG Board of Directors
<b>Committee</b>	Health, Safety and Environment Committee of KMG/a KMG Organisation
<b>Safety critical elements</b>	Barriers and controls associated with process safety (hardware - piping operation, emergency shutdown or shutoff valves, etc.)
<b>Safety critical equipment</b>	Equipment or a part of equipment, control system or protection, which can lead to a hazardous situation or an accident as a result of a single fault
<b>Line Managers</b>	Managers, engineers and technicians of the KMG Group Organisations, who directly manage the work (chief geologists, chief mechanics, chief power engineers, heads of areas/shops), and managers of other services
<b>Mechanical integrity</b>	Management of critical process equipment, which ensures that equipment is designed, manufactured, installed and maintained so that to fulfil the required functions. Mechanical integrity is one of the important PPS objectives and covers assets/facilities/equipment and actions to ensure that such assets/facilities/equipment are designed, manufactured, installed, operated and maintained so that to ensure reliability and safety for




	people and environment
<b>Risk and hazard assessment techniques</b>	Tools and techniques used for risk assessment or assistance with the risk assessment process. Risks can be assessed with different degrees of depth and detail, using one or more techniques, from simple to complex ones. Format and result of the assessment shall meet the risk criteria developed as part of establishing the context
<b>Permit to work</b>	A written instruction of a KMG Organisation to conduct work safely, which is applicable to highly hazardous operations and specifies all necessary safety measures and persons in charge of safe work
<b>Injury</b>	Exposure of an employee to a harmful and/or hazardous occupational factor in the process of his/her job duties or employer assignments, which resulted in a work-related injury, sudden health impairment or poisoning of the employee causing a temporary or permanent disability or death
<b>Facility</b>	Buildings, structures, premises, process equipment — oil refining units, drilling units and drilling equipment, gas and oil pump stations and pipelines, tank farms, utilities and landfills, other technical devices, vehicles and special machinery used in operations and located in the territories (contract territories) of the KMG Group
<b>Hot work</b>	Process operations associated with open flame, sparking and heating to a temperature, which can ignite gas, combustible liquids, materials and structures (electric welding, gas welding, gasoline/kerosene cutting, soldering, sparking metal machining, etc.).
<b>Hazardous occupational factor</b>	A physical phenomenon emerging during accidents, incidents in hazardous production facilities and social infrastructure facilities, which inflicts harm/damage to individuals and legal entities, environment
<b>Operational control</b>	Actions or activities intended to manage (monitor, prevent and mitigate) material aspects and Risks
<b>Leading indicator</b>	An indicator to evaluate the degree and actual consequences in the risk management system, reflecting effective maintenance of the risk management system
<b>HSE</b>	Health, Safety and Environment business area, which includes such areas as: occupational safety, health and workplace hygiene, workplace sanitation, industrial, fire and transportation safety, emergencies, environment protection (emissions, discharges and waste management), rational use of natural resources (water, flora and fauna)




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<b>Failure</b>	Malfunction in equipment performance, with one or more defects present
<b>Risk Assessment</b>	Determination of the quantitative and/or qualitative indicator for the identified risk by assessment of its probability and potential damage for KMG
<b>Contractor</b>	An individual or a legal entity, which provides work/services under contract with a KMG Organisation
<b>Fire</b>	Uncontrolled burning, which creates hazard, inflicts harm to life and health of people, physical damage to individuals and legal entities, society and state interests
<b>Loss of Primary Containment, LOPC</b>	Unplanned or uncontrollable release of material from the primary containment including non-toxic and incombustible materials (such as steam, hot condensate, nitrogen, compressed CO <sub>2</sub> or compressed air)
<b>Safe Operating Limits, SOL</b>	Process parameters as established by design, which can lead to an accident if deviated from
<b>Incident</b>	Any unexpected event, which occurred as a result or in the process of production activities of the KMG Group Organisation, which resulted or could result in a work-related accident, fire, explosion, crash, traffic accident or any other event, which has effect on business and reputation of the KMG Group
<b>Production process</b>	A combination of processes and other activities as required for production; work operations including job activities and functions of employees
<b>Industrial safety (IS)</b>	State of protection of individuals and legal entities, environment against harmful effects of hazardous occupational factors
<b>Employee</b>	An individual employed by a KMG Organisation and working under an employment contract
<b>Workplace</b>	A place, where an employee stays temporary or permanently to perform his/her duties during work
<b>Risk</b>	A probability that an adverse event may occur, which will adversely affect: the ability to ensure the proper quality - for the quality management system; the ability to achieve strategic goals successfully - for the risk management system, health of KMG employees - for the health and safety system;
<b>KMG Management (Executives)</b>	The Chairman and members of the Management Board
<b>Head of Business Line</b>	A Deputy Chairman of the Management Board leading a relevant Business Line: Exploration and Production, Oil Transportation and International Projects, Gas Transportation and Marketing, Refining and

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	Petrochemistry, Strategy Investments and Business Development, Economics and Finance
<b>Head of Business Area</b>	A Head of structural unit leading a relevant Business Area: Economics and Finance, Strategy, Human Resources Management, Corporate Security, Health and Environment, Legal, Risk Management, Transformation
<b>Heads of Business Units</b>	Directors of departments, divisions, services, supervision and analytical centres (which are not included as a part of the department)
<b>HSE Service</b>	A business unit of the KMG Group Organisation, which is responsible for HSE business or, if there is no such unit, an employee, who coordinates HSE activities of structural units within the KMG Group Organisation
<b>KMG Business Units</b>	Business units, which coordinate KMG activities in oil and gas production, transportation, refining and marketing of oil, major production assets, oil service
<b>MS</b>	Health, Safety and Environment Management System in JSC NC "KazMunayGas" Group
<b>Subcontractor</b>	An individual or legal entity, which carries out certain work under a contract with Contractor to perform the latter's obligations to KMG/a KMG Organisation
<b>Process</b>	A part of production process, which contains targeted actions to change and/or define the condition of a work subject
<b>Process regulations</b>	A document, which establishes the procedure of a process or individual process stages (operations), conditions and process of production, safe work conditions to be approved by the technical manager
<b>Process Safety Management, PSM (for the purposes of this Standard)</b>	Application of a process management and control system (programmes, procedures, audits, assessments) so that to define, understand and control process risks/hazards to prevent process safety Incidents
<b>Management of Change (for the purposes of this Standard)</b>	The process of managing scheduled changes (temporary or permanent), which affect PPS performance and MS in general, such as changes to Statutory Requirements, operations, procedures, equipment and technologies, organisational chart, products and services, knowledge and information about hazards and associated HSE risks/hazards
<b>Emergency</b>	A situation in the specific area resulting from an accident, disaster or catastrophe, which have caused or may cause death of people, damage to health, environment and facilities, considerable financial losses and disturbance to living conditions of the population

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<b>OSHA</b>	Occupational Safety and Health Administration
<b>IOGP</b>	International Association of Oil & Gas Producers

## 4. RESPONSIBILITY

4.1. **KMG Management, Heads of Business Lines, Heads of Business Areas, Chief Executive Officers of KMG Organisations**, within their authority, shall be responsible for:


- 1) Safety of Employees, Contractors/Subcontractors against Risks/Hazardous and Harmful Occupational Factors associated with Processes and Productions Processes at the Facilities in accordance with Statutory Requirements;
- 2) Prevention and avoidance of PS Incidents;
- 3) Initiation, implementation, performance and provision of necessary resources (finance, materials and manpower) for the PSM system in KMG Organisations;
- 4) Management of Compliance Audits as required hereby;
- 5) Introduction and implementation of a PSM performance evaluation system as required hereby;
- 6) Introduction of best PSM practices in a KMG Organisation.

4.2. **Line Managers** shall be responsible for:

- 1) Control and monitoring of how subordinate Employees, Contractors/Subcontractors follow and fulfil the requirements hereof at all stages of Processes and Productions Processes at the Facilities they manage or control;
- 2) Control and monitoring over implementation of the PSM system in a KMG Organisation as required hereby;
- 3) Compliance of Employees with HSE competences within the PSM structure;
- 4) Management and implementation of Risks/Hazardous and Harmful Occupational Factor Assessments, Incident Prevention Plans, consulting with Employees and their representatives;
- 5) Timely notification of Employees, Contractors/Subcontractors and other stakeholders about potential HSE Risks/Hazardous and Harmful Occupational Factors;
- 6) Provision of documented (written) process safety and environmental information as required hereby to Employees, Contractors/Subcontractors;
- 7) Participation in the first party and second party Compliance Audits in a KMG Organisation as required hereby;
- 8) Participation in PSM performance evaluation in a KMG Organisation as required hereby.

4.3. **KMG Business Units**, within their authority and competence, shall be responsible for:



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- 1) Control and monitoring over introduction of, compliance with this Standard in the KMG Group;
- 2) Participation in management of PSM processes in the KMG Group;
- 3) Control and monitoring over introduction of this PSM Standard considering the nature of activities and specifics of Processes and Production Processes at the Facilities of the subordinate KMG Organisations;
- 4) Procedural guidelines for updating similar standards so that they meet the requirements hereof;
- 5) Participation in PSM system performance evaluation in the KMG Group as required hereby;
- 6) Participation in updating and improving hereof.

4.4. **H&ED** shall be responsible for:


- 1) Control and monitoring over introduction of, compliance with this Standard in the KMG Group;
- 2) Participation in management of PSM processes in the KMG Group;
- 3) Participation in PSM system performance evaluation in the KMG Group as required hereby;
- 4) Procedural guidelines and preparation of suggestions to introduce best available PSM practices;
- 5) Updating and improving this Standard with involvement of KMG Business Units.

4.5. **HSE Service** shall be responsible for:

- 1) Participation in management of PSM processes in a KMG Organisation;
- 2) Participation in Risk/Hazardous and Harmful Occupational Factors Assessment at all stages of Processes and Production Processes at the Facilities;
- 3) Participation in the first party and second party Compliance Audits in a KMG Organisation as required hereby;
- 4) Participation in PSM system performance evaluation in a KMG Organisation as required hereby;
- 5) Preparation of suggestions, together with H&ED, to introduce best available PSM practices;
- 6) Control and monitoring over compliance herewith.

4.6. **A KMG Group Employee** shall be responsible for:

- 1) Compliance with Statutory HSE Requirements and requirements hereof at all stages of Processes and Production Processes at the Facility;
- 2) Timely notification of the supervisor about Risks/Hazardous and Harmful Occupational Factors at all stages of Processes and Production Processes at the Facility.

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## 5. DESCRIPTION

### 5.1. GENERAL APPROACH TO PROCESS SAFETY MANAGEMENT

#### 5.1.1. Process safety management model

Financial stability, optimisation of costs and assets, work safety are among the key initiatives of KMG Development Strategy - 2028 to improve performance, cost effectiveness and quality, and to achieve consistent improvements in maintaining continuous operation and effectiveness of the KMG Group production assets.

According to internal HSE documents, KMG prioritizes life and health of employees over results of work activities, prevention of Risks/Hazardous and Harmful Occupational Factors, prevention of Environmental Pollution, exercises zero tolerance towards loss and damage due to Incidents.

KMG development is aimed at building and implementing a PSM model, which covers all aspects of the KMG Group activities: Organisation – People – Processes – Technologies, as specified in (KMG-F-2543.3-13/ ST-3679.2-13).

#### 5.1.2. Structure and elements of process safety management

The PSM structure defines the necessary actions to ensure integrity of the KMG Group operations, measures to take, understand and implement such actions.

The PSM structure includes three levels:

1) Priorities. There are key high-level components within the PSM structure: Organisation – People – Processes – Technologies;

2) Elements. Fourteen elements have been identified among the priorities, which define the key aspects of Processes and Production Processes, and which the KMG Group properly fulfils to ensure integrity;

3) Expectations. Each element contains certain expectations, which clearly define actions necessary for correct implementation to meet intentions of each element.

#### 5.1.3. Process safety management priorities

##### 5.1.3.1. Leadership and Safety Culture Enhancement


The priority includes 2 elements, which establish that the KMG Group defines, informs about the level of PSM effectiveness and performance it is ready to accept and ensure the necessary resources to achieve the required PSM level:

1) Leadership and commitment;

2) Training and competences.

##### 5.1.3.2. Identification and Assessment of Risks/Hazardous and Harmful Occupational Factors

The priority includes two elements, which establish that the KMG Group identifies and assesses Risks/Hazardous and Harmful Occupational Factors, defines

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the necessary controls, records and maintains PSM knowledge gained as a result of actions to identify and assess Risks/Hazardous and Harmful Occupational Factors:

- 1) Process safety and environment information;
- 2) Process risk and hazard analysis.

#### 5.1.3.3. Risk management

The priority includes seven elements, which establish that the KMG Group introduces, manages controls of Risks/Hazardous and Harmful Occupational Factors identified during Assessment of Risks/Hazardous and Harmful Occupational Factors:

- 1) Manuals, regulations and procedures;
- 2) Mechanical integrity;
- 3) High risk operations;
- 4) Management of change;
- 5) Pre-start safety check;
- 6) Emergency response actions and plans;
- 7) Contractors safety.

#### 5.1.3.4. Review and improvement

The priority includes three elements, which establish that the KMG Group measures, checks compliance with PSM structure expectations, confirms, learns lessons from such measurements and results:

- 1) Incident investigation;
- 2) PSM compliance audits;
- 3) PSM performance improvement.

#### 5.1.4. **Connection between Workplace Safety and Process Safety**

5.1.4.1. Both areas require continuous commitment of KMG Management, Heads of Business Lines, Heads of Business Areas, Chief Executive Officers of the KMG Organisation, Line Managers at all levels of the KMG Group.

5.1.4.2. Workplace H&S is mainly focused on Employee actions, which have resulted in an Incident (such as fall from height, electric shock etc.).


5.1.4.3. PSM Incidents may result in catastrophic consequences, multiple employee injuries, shutdown of equipment and production, loss of property and assets, environmental pollution. The process is fully focused on performance of processes and systems (identification and Assessment of Risks/Hazardous and Harmful Occupational Factors, Mechanical Integrity etc.).

5.1.4.4. Despite that Workplace H&S and PSM Incidents are rooted from human factor or Employee behaviour, even proper observance of Workplace H&S cannot guarantee 100% effectiveness and performance of PSM.

## 5.2. **PROCESS SAFETY MANAGEMENT ORGANISATION**

### 5.2.1. **Health, Safety and Environment Committees of the KMG Group**

The main executive PSM bodies in the KMG Group are Committees:

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1) At the KMG Group level: HSE&SD Committee headed by a member of the KMG Board of Directors;

2) At the KMG Headquarters level: the KMG Committee headed by the Chairman of the KMG Management Board;

3) At the KMG Group Organisation level: the KMG Group Organisation Committee headed by Chief Executive Officer.

#### 5.2.2. **Functions of Process Safety Management Committees**

##### 5.2.2.1. The KMG Board of Directors (HSE&SD Committee):

- 1) Approves internal HSE, PSM regulations/standards;
- 2) Oversees effectiveness of KMG HSE, PSM programme documents;
- 3) Monitors and evaluates HSE, PSM activities;
- 4) Builds and improves HSE culture;
- 5) Reviews HSE performance, reports following work-related fatality investigations and major technological accidents, and develops recommendations for necessary measures;

6) Reviews the results of KMG PSM Compliance Audit;

7) Ensures enhancement and continuous improvement of HSE, PSM, and MS in general.

##### 5.2.2.2. The KMG Headquarters (KMG Committee):

1) Prepares recommendations and suggestions for arrangement and maintenance of MS, provides necessary resources for PSM (finances, materials, manpower);

2) Monitors KMG HSE, PSM performance, reviews and assesses achievement of goals and objectives;

3) Coordinates and effectively interacts with the Committees of the KMG Organisations;

4) Initiates and conducts PSM Compliance Audit in the KMG Group.

##### 5.2.2.3. KMG Group Organisation (KMG Group Organisation Committee):

1) Analyses Incident statistics to identify and report trends for change, and recommends corrective actions;

2) Oversees introduction of internal HSE, PSM regulations/standards, timely updates them;

3) Initiates and implements the first party and second party PSM Compliance Audits;


4) Reviews inspection records and ordinances from state supervision authorities and Compliance Audit reports;

5) Monitors effectiveness of HSE training;

6) Informs employees about HSE risks and hazards;

7) Analyses and evaluates PSM performance.

### 5.3. LEADERSHIP AND COMMITMENT

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### 5.3.1. **Managers commitment demonstration**

5.3.1.1. KMG has Health and Safety Code of Conduct for Employees “Golden Rules”, Health, Safety and Environment Leadership and Commitment Code for the KMG Group Employees, KMG Health and Safety Policy and KMG Environmental Policy approved by the KMG Board of Directors, which are regularly revised to reflect KMG needs.

5.3.1.2. MS, PSM management and support mechanisms are defined and being implemented at all levels – from KMG Board of Directors to Employees through the KMG Group HSE Committees.

5.3.1.3. KMG Management, Heads of Business Lines, Heads of Business Areas, Chief Executive Officers of KMG Organisations, Line Managers:

- 1) Demonstrate personal HSE, PSM commitment and responsibility;
- 2) Promote an open and trusted environment and understand how their behaviour affects other Employees;
- 3) Set clear HSE, PSM goals and objectives, target performance indicators and action plans, regularly evaluate effectiveness and performance of MS, PSM;
- 4) Establish scope, priority and rate at which MS, PSM is implemented considering specifics of the activity, complexity of operations, Risks/Hazardous and Harmful Occupational Factors associated with Processes and Production Processes;
- 5) Allocate MS, PSM roles, duties, authorities and responsibilities;
- 6) Provide sufficient resources (finances, materials and manpower) for certain HSE, PSM roles and duties to reduce the likelihood of Incidents;
- 7) Maintain understanding of what is going on in a Workplace/Facility to identify and address key HSE, PSM issues and areas for improvement;
- 8) Recognise and encourage safe behaviour and HSE, PSM performance, intervention in situations, which pose reasonable hazard to life and health of Employees or other people in Facilities to correct/eliminate deviations from the required performance of the KMG Group.


### 5.3.2. **Employee involvement in Process Safety Management**

5.3.2.1. KMG Management, Heads of Business Lines, Heads of Business Areas, Chief Executive Officers of KMG Organisations, Line Managers:

- 1) Involve Employees in two-way communication about HSE, PSM policies, goals, objectives, target performance, action plans, and share the lessons learnt from Incidents inside and outside of the KMG Group;
- 3) Introduce HSE, PSM promotion and involvement programmes to continuously raise awareness of Employees, Contractors/Subcontractors about HSE, PSM, and promote the culture of openness, transparency, beliefs, motivations, individual responsibility, involvement and commitment.

5.3.2.2. Employees and Contractors/Subcontractors take active part in improvement of HSE, PSM performance and are aware of PSM Risks/Hazardous and Harmful Occupational Factors, how to identify, manage and control them.



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## **5.4. PROCESS SAFETY AND ENVIRONMENT INFORMATION**

### **5.4.1. Identification and compliance with Statutory HSE Requirements and industry standards**

5.4.1.1. KMG Management, Heads of Business Lines, Heads of Business Areas, H&ED, Chief Executive Officers of KMG Organisations, Line Managers, HSE Service:

1) Ensure identification, understanding and observance of the valid Statutory Requirements (codes, laws, bylaws, licenses, permissions, industry standards) and other requirements of Authorised HSE, PSM Bodies, which are defined, documented, updated and communicated to Employees as established by internal documents of the KMG Group;

2) Ensure observance of Statutory HSE, PSM Requirements and industry standards, take measures to identify them, consistently check that they are compliant with activities of the KMG Group.

5.4.1.2. Statutory HSE, PSM Requirements and industry standards are identified and checked for compliance at all levels of the KMG Group.


### **5.4.2. Hazardous chemicals and materials**

5.4.2.1. KMG Organisations shall complete a compilation of documented process safety and environment information (collection) before conducting any Assessment of Risks/Hazardous and Harmful Occupational Factors.

5.4.2.2. The compilation of written process safety and environment information is required to analyse Risks/Hazardous and Harmful Occupational Factors, will help Employees to identify and understand the Risks/Hazardous and Harmful Occupational Factors posed by Processes and Production Processes involving hazardous chemicals and materials.

5.4.2.3. Process safety and environment information shall include information on the hazards of the hazardous/highly hazardous chemicals and materials used or produced by the Process or Production Process, including:

- 1) Toxicity;
- 2) Permissible exposure limits;
- 3) Physical data;
- 4) Reactivity data;
- 5) Corrosivity data;
- 6) Thermal and chemical stability data, and hazardous effects of inadvertent mixing of different substances and materials;
- 7) An evaluation of the consequences of deviations affecting safety and health of employees, environment;
- 8) Safety Data Sheets for chemicals and materials in accordance with Statutory Requirements.

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### 5.4.3. Process, design and engineering of equipment

5.4.3.1. KMG Organisations shall confirm in writing that the operated or commissioned equipment has been certified and complies with Statutory Requirements, was designed, manufactured under state and international standards, is maintained, inspected/tested and operated safely.

5.4.3.2. Assessment of information on process, design and engineering of equipment includes:

- 1) Block diagrams or simplified process flow diagrams, process diagrams;
- 2) Process and instrumentation diagrams;
- 3) Materials of construction;
- 4) Piping and instrumentation diagrams;
- 5) Specifications for piping and equipment;
- 6) Electrical networks and installations diagrams, classification;
- 7) Relief systems design and design basis;
- 8) Design and arrangement of relief and ventilation systems;
- 9) Design codes and standards employed;
- 10) Interlock and shutdown systems (e.g. interlocks, detection or suppression systems);
- 11) Safety Data Sheets for substances and materials in accordance with Statutory Requirements.

5.4.3.2. The process safety and environment information provides the basis for identifying and understanding the Risks/Hazardous and Harmful Occupational Factors and is necessary to develop the Risks/Hazardous and Harmful Occupational Factors analysis and may be necessary for complying with other provisions of PSM such as Management of Change and Incident Investigations.


### 5.4.4. Change recording documentation

5.4.4.1. KMG Management, Heads of Business Lines, Heads of Business Areas, Chief Executive Officers of the KMG Group Organisations, Line Managers, within their authority:

- 1) Initiate and conduct change recording procedures to identify potential HSE, PSM Risks/Hazardous and Harmful Occupational Factors to maintain reliable operation of systems and equipment, maintain facilities;
- 2) Provide access to change recording documentation for Employees, Contractors/Subcontractors, who are required to use it;
- 3) Ensure that change recording documentation is updated, stored and protected.

5.4.4.2. To comply with expectations of the other PSM structure elements, change recording documentation includes:

- 1) Process design and safe operation basics;
- 2) Drawings;
- 3) Equipment data (inspections, tests, maintenance and modifications) and parameters;

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- 4) Workplace inspection reports and logs;
- 5) Employee training and competence records;
- 9) Incident Investigation, Environmental Pollution reports;
- 6) Operating procedures;
- 7) Environmental permits;
- 8) Compliance with Statutory Requirements;
- 9) Assessment of Risks/Hazardous and Harmful Occupational Factors;
- 10) Internal documents and standards;
- 11) Hazardous substances and materials used;
- 12) Material and product data sheets.

## **5.5. PROCESS RISK AND HAZARD ANALYSIS**

### **5.5.1. Requirements for process risk and hazard analysis**

5.5.1.1. KMG Management, Heads of Business Lines, Heads of Business Areas, Chief Executive Officers of the KMG Group Organisations, Line Managers, within their authority:


1) Conduct integrated Assessment of Risks/Hazardous and Harmful Occupational Factors at all life cycle stages of the Facility (design, construction, installation, commissioning, start-up and decommissioning in accordance with design solutions);

2) Consistently identify, assess and manage Risks/Hazardous and Harmful Occupational Factors resulting from activities of a KMG Group Organisation.

5.5.1.2. Corporate Risk Management System Policy of JSC NC “KazMunayGas” and its Subsidiaries and Dependent Entities is implemented using the Methods of Risk Identification and Assessment, Selection of Risk Management Practices of JSC NC “KazMunayGas” and its Subsidiaries and Dependent Entities (KMG-MD-986.3-37), Model Regulations for Production and Non-Production Risk Management in JSC NC “KazMunayGas” and its Subsidiaries and Dependent Entities (KMG-PR-251.3-37).

5.5.1.3. Integrated Assessment of HSE, PSM Risks/Hazardous and Harmful Occupational Factors is conducted due to:

- 1) Operation conditions;
- 2) Start, shutdown, maintenance and abnormal situations;
- 3) Previous Incidents;
- 4) Process hazards;
- 5) Potential accidents and their consequences due to:
  - a) Failures of monitoring and control, management, alarm, interlock systems;
  - b) Human factor;
  - c) External events.

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Integrated Assessment of Risks/Hazardous and Harmful Occupational Factors of Processes and Production Processes is recommended every five years.

5.5.1.4. Controls of Risks/Hazardous and Harmful Occupational Factors are implemented according to the hierarchy of controls (elimination, mitigation, isolation, control, PPE, workplace discipline) to manage and reduce them to a safe and acceptable level.

5.5.1.5. HSE, PSM Risks/Hazardous and Harmful Occupational Factors are assessed for:

- 1) Current operations;
- 2) Hazardous substances and materials;
- 3) New projects;
- 4) Goods, work and services;
- 5) Any change.


5.5.1.6. Risks/Hazardous and Harmful Occupational Factors are assessed in view of:

- 1) Health and safety of Employees, Contractors/Subcontractors and stakeholders;
- 2) Human and organisational factors;
- 3) Lessons learnt from Incidents;
- 4) Process safety;
- 5) Environment;
- 6) Reputation;
- 7) Asset integrity;
- 8) Business discontinuity;
- 9) Third party assets;
- 10) Clients.

5.5.1.7. Risks/Hazardous and Harmful Occupational Factors are assessed by competent Employees under the Corporate Standard for Health, Safety and Environment Competences in JSC NC “KazMunayGas” Group (KMG-ST-3467.1-13).

5.5.1.8. KMG Management, Heads of Business Lines, Heads of Business Areas, Chief Executive Officers of the KMG Group Organisations, Line Managers, within their authority and according to the magnitude of Risks/Hazardous and Harmful Occupational Factors:

- 1) Review, analyse and approve Risks/Hazardous and Harmful Occupational Factors Assessment records, take documented decisions;
- 2) Regularly revise status of controls of Risks/Hazardous and Harmful Occupational Factors for timely completion of recommendations;
- 3) Inform all stakeholders about the process and results of Risks/Hazardous and Harmful Occupational Factors Assessment;

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4) Regularly control and monitor how high HSE, PSM Risks mitigation recommendations are implemented, update them as soon as new changes appear.

### **5.5.2. Risk and hazard assessment techniques**

5.5.2.1. The Group uses HSE and PSM risk and hazard assessment methods and techniques with different degrees of depth and detail using one or more methods with different complexity (ST RK ISO/IEC 31010-2010).

PSM structure elements, based on Risks/Hazardous and Harmful Occupational Factors Assessment, which are recommended to be implemented first, are provided in (KMG-F-2544.3-13/ ST-3679.2-13).

5.5.2.2. Assessment format and outputs shall be compatible with Risks/Hazardous and Harmful Occupational Factors criteria established for the defined scope. Methods to assess a Risk/Hazardous and Harmful Occupational Factor shall be selected so that the method:

1) Is consistent with the situation in question and specifics of KMG Organisation activities;

2) Provides results in a format which promotes awareness of the Risk/Hazardous and Harmful Occupational Factor and processing methods;

3) Ensures traceability, repeatability and verification of the process and results.

5.5.2.3. When selecting Risk/Hazardous and Harmful Occupational Factor assessment methods, provide a substantiation and specify that they are acceptable and suitable, ensure that the applied methods and outputs are appropriate to combine results of different studies.

### **5.5.3. Employee participation in risk and hazard assessment**

5.5.3.1. The KMG Group consults with Employees and their representatives on development and conduct of Risks/Hazardous and Harmful Occupational Factors Assessment, PSM, development of Incident Prevention Plans.

5.5.3.2. The KMG Group provides access to documented (written) HSE, PSM information under this Standard.

## **5.6. MANUALS, REGULATIONS AND PROCEDURES**


### **5.6.1. Operating manuals, regulations and procedures**

KMG Management, Heads of Business Lines, Heads of Business Areas, Chief Executive Officers of the KMG Group Organisations, Line Managers, within their authority:

1) Ensure that systems and equipment operate within the established parameters and in accordance with Statutory Requirements, which is an important HSE, PSM aspect;

2) Approve operational manuals, technical regulations and procedures to support Processes and Production Processes, which are defined, available, accurate, updated, clear, and properly used;



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3) Apply operating manuals, technical regulations and procedures relevant to workplace Risks/Hazardous and Harmful Occupational Factors, including human factor, to maximise the convenient use and minimise the probability of errors and non-compliances.

5.6.2. Operating manuals, technical regulations and procedures ensure:

- 1) Safe operating range;
- 2) Actions to avoid going beyond Safe Operating Limits or operating range;
- 3) Specific and clear instructions about actions to take if Safe Operating Limits or operating range are exceeded.


5.6.3. Operating manuals, technical regulations and procedures are regularly revised, updated with involvement of Line Managers, engineers and technicians and workers who practise them.

#### 5.6.2. **Non-standard procedures**

5.6.2.1. Since the majority of Incidents occur during non-standard procedures, operating instructions cover all possible work phases:

- 1) Start;
- 2) All normal operation stages, including testing, maintenance and inspection;
- 3) Detection of and responding to deviations from normal operation;
- 4) Temporary or special operations;
- 5) Operation during maintenance;
- 6) Normal shutdown;
- 7) Emergencies including shutdown;
- 8) Decommissioning, in particular considering Safe Operating Limits;
- 9) Consequences of deviations;
- 10) Actions to correct or prevent a deviation, in particular considering HSE aspects;
- 11) Properties of hazardous substances and materials used in the process;
- 12) Precautions necessary to prevent exposure to Risks/Hazardous and Harmful Occupational Factors, including engineering and administrative controls, personal protective equipment in accordance with the Corporate Standard for Provision of Protective Clothing, Footwear, Personal Protective Equipment in the JSC NC “KazMunayGas” Group (KMG-ST-3407.1-13);
- 13) Control measures to be taken if physical contact or airborne exposure occurs;
- 14) Quality control for raw materials and control of hazardous chemical inventory;
- 15) Any special or unique Risks/Hazardous and Harmful Occupational Factors;
- 16) Safety systems (e.g., interlocks, detection or suppression systems) and their functions.

5.6.2.2. To ensure safety of Employees against hazardous exposure to any energy during maintenance and operation of systems, process equipment and units,

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and during repairs and prevention, JSC NC “KazMunayGas” Source of Energy Isolation Rules (KMG-PR-2065.1-13) are applied.

## 5.7. TRAINING AND COMPETENCES

### 5.7.1. Initial training and refresher training

5.7.1.1. KMG Management, Heads of Business Lines, Heads of Business Areas, Chief Executive Officers of the KMG Group Organisations, Line Managers, within their authority:

1) Establish the need for Employee training, training calendars and training periods according to individual training schedules, and evaluate training efficiency as per the Rules for Training and Development of Employees of JSC NC “KazMunayGas” (KMG-PR-434.8-6);

2) Provide training/refresher training for Employees in H&S, industrial and fire safety in hazardous production facilities of the KMG Group, with scopes and on dates as provided by Statutory Requirements (except for administrative personnel);

3) Provide initial training (including introduction) for each Employee (new or transferred) involved in PSM, process and operating procedures review;

4) Provide refresher training at least once every three years (as required) for each Employee involved in PSM processes, to understand and comply with the current PSM process operating procedures.

### 5.7.2. Competences

5.7.2.1. KMG Management, Heads of Business Lines, Heads of Business Areas, Chief Executive Officers of the KMG Group Organisations, Line Managers, within their authority:

1) Ensure the required HSE, PSM competences of Employees, and compliance with qualification requirements for the work for all roles and duties within the KMG Group as per the PSM structure expectations;


2) Ensure the compliance with qualification requirements and HSE, PSM competences of Contractor/Subcontractor employees for the provided services or work.

5.7.2.2. Competences of the KMG Group Employees are ensured in accordance with the Corporate Standard for Health, Safety and Environment Competences in the JSC NC “KazMunayGas” Group (KMG-ST-3467.1-13), including:

1) Regular evaluation by Line Managers of competences and suitability of Employees for their roles and duties within the PSM structure;

2) Identification of gaps and need in Employee training and development to improve HSE competences as part of consistent improvement of MS, PSM.

5.7.2.3. As part of introduction and implementation of MS and PSM, Employees receive special training (theory and practice) such as: HSE leadership and commitment, Risks/Hazardous and Harmful Occupational Factors assessment

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techniques, Management of Change, project management, Incident Investigations, Compliance Audits, PSM etc.

## **5.8. CONTRACTORS SAFETY**

5.8.1. KMG Management, Heads of Business Lines, Heads of Business Areas, Chief Executive Officers of the KMG Group Organisations, Line Managers, when interacting with Contractors:

1) Receive and evaluate information concerning Contractors’ HSE indicators and programmes;

2) Inform Contractors/Subcontractors about Incidents, potential Risks/Hazardous and Harmful Occupational Factors associated with Contractor work and Process;

3) Inform and explain to Contractors/Subcontractors the applicable provisions of Emergency Response Plans;

4) Review and approve Contractors’/Subcontractors’ HSE Plans on sites under contractual obligations;

5) Occasionally evaluate how Contractors/Subcontractors perform their HSE obligations; record Incidents associated with Contractor/Subcontractor activities at the Facilities.

5.8.2. Management and control over safe services and work by Contractors/Subcontractors, and evaluation of their HSE activities are provided under the Corporate Standard for Contractor Engagement in Health, Safety and Environment in the JSC NC “KazMunayGas” Group (KMG-ST-3524.1-13).

## **5.9. MECHANICAL INTEGRITY**


### **5.9.1. Compliance with design solutions and quality standards**

5.9.1.1. KMG Management, Heads of Business Lines, Heads of Business Areas, Chief Executive Officers of the KMG Group Organisations, Line Managers, within their authority:

1) Ensure availability of documented (written) information, procedures to maintain continuous integrity of systems, process equipment and units;

2) Ensure that systems, process equipment and units, materials and maintenance spares are of good quality and fabricated and installed according to project specifications;

3) Ensure that systems, process equipment and units meet the established Statutory Requirements, and their results meet the requirements for them.

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5.9.1.2. The KMG Group ensures consistency and actions to control, manage and monitor systems, process equipment and units, and their interconnection, including:

1) For safety systems: piping systems→ relief and ventilation systems→ emergency shutdown of systems→ controls (detection, alarms and interlocks) → pumps;

2) For Mechanical Integrity: identification and classification of equipment → frequency of inspections and tests → maintenance procedures → training of maintenance personnel → acceptance test results criteria → documentation with manufacturer recommendations.

### 5.9.2. Barriers

5.9.2.1. The KMG Group uses the following Integrity Barriers for systems, process equipment and units:

1) Prevention: primary containment, process management, primary and secondary structure;

2) Detection: dispatcher alarms, detection of fire, gas or leakage;

3) Control and mitigation of consequences: equipment orientation and clearances, secondary insulation and drainage, purging systems, fire protection and extinguishing;

4) Emergency response: local alarm, evacuation, emergency communication, emergency power supply.

5.9.2.2. The number of Barriers (equipment or control systems) for systems, process equipment and units can be kept at a logical and manageable level (normally less than 20). Barrier models, functions and evaluations are provided in (KMG-F-2697.4-13/ ST-3679.2-13).

### 5.9.3. Inspection and maintenance

5.9.3.1. KMG Management, Heads of Business Lines, Heads of Business Areas, Chief Executive Officers of the KMG Group Organisations, Line Managers, within their authority:


1) Ensure that integrity of systems, process equipment and units is maintained, that they conform to HSE, PSM Requirements;

2) Provide requirements for inspection and maintenance to reduce the probability of a serious Incident resulting from failure of a system, process equipment or unit;

3) Identify systems, process equipment and units in the register of assets, which provides the updated lists of assets and records on systems, process equipment and units, including location and specifications data;

4) Schedule and manage inspections/audits of systems, process equipment and units based on the register of assets;

5) Approve inspection and maintenance programmes/plans, and re-approve them in case of schedule delays;

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6) Provide sufficient competent Employees for inspection and maintenance;  
7) Review and analyse findings and recommendations following inspections and maintenance of assets, have them completed according to priority of Risks/Hazardous and Harmful Occupational Factors.

5.9.3.2. Asset inspection and maintenance programmes/plans are based on Assessment of Risks/Hazardous and Harmful Occupational Factors, ensuring long-term integrity of assets, HSE, PSM.

5.9.3.3. Asset inspections and maintenance are conducted by competent asset integrity, HSE, PSM Employees.

5.9.3.4. Asset inspection and maintenance programmes/plans are regularly reviewed in accordance with Risks/Hazardous and Harmful Occupational Factors using results of industry practice, Incidents to identify and address PSM issues and areas for improvement.

## **5.10. MANAGEMENT OF CHANGE**

### **5.10.1. Management of change (in general)**

5.10.1.1. KMG Management, Heads of Business Lines, Heads of Business Areas, Chief Executive Officers of the KMG Group Organisations, Line Managers, according to PSM structure (Organisation – People – Processes – Technologies), within their authority:

1) Ensure that Risks/Hazardous and Harmful Occupational Factors resulting from any change (permanent or temporary) are consistently identified, assessed and managed to improve HSE, PSM;

2) Ensure that changes are approved according to Risks/Hazardous and Harmful Occupational Factors associated with the suggested changes, that all changes are properly documented;

3) Inform and provide access to documented (written) information about changes for Employees. Contractors/Subcontractors and other stakeholders who are required to use it;

4) Ensure that changes are recorded by competent HSE, PSM Employees.

### **5.10.2. Management of change in organisation**

5.10.2.1. Management of change in organisation includes:

1) Strategy and policy;

2) Management structure;

3) Environment;

4) Financial stability;


5) Production indicators;

6) Reputation;

7) Third party assets;

8) Business discontinuity.



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### 5.10.3. Management of change in personnel

5.10.3.1. Management of change in personnel includes:

- 1) Transfer or relocation of an Employee;
- 2) A new employee or new hire;
- 3) Readiness for work;
- 4) Organisation management structure and work management;
- 5) State of health and fitness for work;
- 6) Physiological and psychological status of an Employee;
- 7) Competence of an Employee (awareness, knowledge, skills and experience);
- 8) Composition of work groups (shifts, crews);

### 5.10.4. Management of change in processes

5.10.4.1. Management of change in processes includes:

- 1) Statutory Requirements, industry standards and internal documents;
- 2) Permits and licenses;
- 3) Technical documentation including reasons and technical substantiation for a change;
- 4) Reporting change-related Risks/Hazardous and Harmful Occupational Factors;
- 5) Mitigation measures such as: limiting time of work, advanced training;
- 6) Operating procedures;
- 7) Work techniques and organisation of work, location of work;
- 8) Work environment and conditions.

### 5.10.4. Management of change in technologies


5.10.4.1. Management of change in technologies includes:

- 1) Assets or equipment;
- 2) Operations or operating procedures;
- 3) Processes, Production Processes, equipment and tools applied;
- 3) Products, materials or substances;
- 4) Organisation or personnel;
- 5) Software or control systems;
- 6) Structures or specifications;
- 7) Standards or practices;
- 8) Inspection, maintenance and test programmes/plans.

## 5.11. HIGH RISK OPERATIONS

### 5.1.11. Hazardous work

5.11.1.1. The KMG Group uses Permit to Work system for hazardous work as established by Statutory Requirements (Industrial Safety Guidelines for Hazardous Production Facilities, Permit to Work Issue and Application Rules for High Risk Operations, ST RK 12.3.001-2005, SN RK 1.03-05-2011, SP RK 1.03-106-2012):

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1) Permit to Work is issued by a competent Employee authorised by an internal instruction of the KMG Group;

2) Permit to Work is received by a competent Employee and responsible performer (supervisor, foreman, crew leader);

3) Employees have safety toolbox talk, recorded in the Permit to Work before being admitted to work by the responsible performer;

3) The authorised competent Employee signs completion of work for the Permit to Work;

4) Permit to Work is cancelled or renewed by the authorised competent Employee.

5.11.1.2. According to activity specifics, the KMG Group conducts the following high-risk activities (services):

- 1) Repair or maintenance of machinery;
- 2) Work with electrical installations;
- 3) Confined space work;
- 4) Earthwork in areas with underground utilities;
- 5) Hot work;
- 6) Work using or near hoisting machinery;
- 7) Work at height;
- 8) Disabling safety systems (fire alarm equipment before repair);
- 9) Gas hazardous work;
- 10) Assembly and disassembly of reinforced concrete and steel structures (buildings and facilities, scaffolding);
- 11) Climbing work;
- 12) Work in operated process units;
- 13) Work near power transmission lines etc.


5.11.1.3. Risks/Hazardous and Harmful Occupational Factors of hazardous work are assessed under the Health, Safety and Environment Hazard and Risk Identification Guidelines for High Risk Operations in JSC NC “KazMunayGas” (KMG-PR-2629.1-13).

#### 5.11.2. Gas and hot work

5.11.2.1. Gas and hot work with the highest-level Risk/Hazardous and Harmful Occupational Factors in hazardous production facilities of the KMG Group are carried out as established by Statutory Requirements (Industrial Safety for Hazardous Production Facilities, ST RK 1748-2008, ST RK 12.3.001-2005, GOST R 12.3.047-98).

5.11.2.2. Gas and hot work is carried out by competent Employees in accordance with industrial and fire safety requirements, who have been trained in the manner and within the periods established by Statutory Requirements.

## 5.12. PRE-START SAFETY CHECK

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### 5.12.1. **Availability**

5.12.1.1. The KMG Group Organisations initiate consistent review of availability and integrity of systems, process equipment and units before start-up, which includes:

- 1) New and upgraded units and equipment;
- 2) Recovery after maintenance;
- 3) Restart after system shutdown, full shutdown or scheduled outage.

5.12.1.2. The KMG Group Organisations apply regularly reviewed and updated availability criteria, which cover:

- 1) Hardware;
- 2) Control systems and software;
- 3) Human and organisational factors;
- 4) Operating procedures;
- 5) Documentation.

5.12.1.3. KMG Management, Heads of Business Lines, Heads of Business Areas, Chief Executive Officers of the KMG Group Organisations, Line Managers, within their authority:

- 1) Conduct checks, review of availability of systems, units and equipment according to the magnitude of Risks/Hazardous and Harmful Occupational Factors;
- 2) Ensure that checks of systems, units and equipment are conducted and documented by competent Employees;
- 3) Ensure that the identified troubles and open issues are classified and processed by operating elements;
- 4) Ensure that availability of systems, units and equipment is approved and accepted according to the magnitude of Risks/Hazardous and Harmful Occupational Factors; commissioning;


5.12.1.3. The KMG Group Organisations manage industrial and fire safety preparedness in hazardous production facilities of the KMG Group as per Statutory Requirements (Industrial Safety Rules for Hazardous Production Facilities, Industrial Safety Rules for Hazardous Oil and Gas Production Facilities), and Rules for Review and Evaluation of Preparedness of the JSC NC “KazMunayGas” Group Organisations for Prevention and Extinguishing of Fires (KMG-PR-2456.1-13).

### 5.12.2. **Compliance check and start-up**

5.12.2.1. Commissioning and start-up of new, upgraded or existing systems, units and equipment is an operation with high Risks/Hazardous and Harmful Occupational Factors.

5.12.2.2. Before starting up or introducing a major change, the KMG Group checks and reviews:

- 1) Any document which can be affected by the change, with relevant changes being made to procedures and instructions;

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- 2) Informing and training of Employees affected by the change;
- 3) Accessibility of the changed procedures and instructions for Employees affected by the change;
- 4) Issue of the relevant permits and informing the affected Employees if work conditions change;
- 5) Observation of the valid Statutory Requirements and obtaining all necessary permits and licenses;
- 6) Applying the results of completed Risks/Hazardous and Harmful Occupational Factors Assessments (as required);
- 7) Performance of all safety systems.

### 5.12.3. **Operating condition control and monitoring**

5.12.3.1. KMG Management, Heads of Business Lines, Heads of Business Areas, Chief Executive Officers of the KMG Group Organisations, Line Managers, within their authority:


- 1) Ensure all-round control and monitoring over operating status of systems, units and equipment;
- 2) Ensure that roles and authorities are effectively transferred among Employees or Employee groups to ensure continuous integrity of operations in the KMG Group;
- 3) Ensure that requirements for process and operating status and requirements for transfer of roles and authorities are defined, understood and fulfilled.

5.12.3.2. KMG Management, Heads of Business Lines, Heads of Business Areas, Chief Executive Officers of the KMG Group Organisations, Line Managers, within their authority define and ensure for all systems, process equipment and units according to the existing Risks/Hazardous and Harmful Occupational Factors:

- 1) Safe Operating Limits beyond which the process will not be deliberately started, when troubleshooting stops and gets replaced with pre-defined actions to bring the process in a safe state;
- 2) Procedures to guarantee that Safe Operating Limits are regularly checked and updated;
- 3) Consistent monitoring of operating parameters against Safe Operating Limits;
- 4) Control, monitoring and detection of exceeded Safe Operating Limits;
- 5) Procedure for handover of operating state of systems, process equipment and units including: operation and repair shift handover, sequence of shifts and work groups and roles (one to another).

## 5.13. **EMERGENCY ACTIONS AND RESPONSE**

5.13.1. The KMG Group Organisations operating hazardous production facilities develop Emergency Response Plans for all Facilities (Emergency Response Plan, Emergency Oil Spill Response Plan, Accident Response Plan).

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5.13.2. The KMG Group Organisations periodically train their Employees, Contractors/Subcontractors in effective emergency response including:

- 1) Identification of an emergency;
- 2) Measures to prevent adverse consequences of emergencies;
- 3) Identification of an emergency response team;
- 4) Specific tactical procedures, which define actions for different Incidents and emergencies;
- 5) Evacuation procedures;
- 6) Emergency drills;
- 7) Studying emergency action plans.

5.13.3. Organisation and coordination of the KMG Group accident and emergency response systems are defined by Crisis Management Regulations of JSC NC “KazMunayGas” (KMG-RG-3313.1-13), First Aid Regulations of the JSC NC “KazMunayGas” Group (Version 1).

5.13.4. Preparedness and response of the KMG Group to potential emergencies to prevent or minimise consequences for the KMG Group and stakeholders are provided within the business continuity management system in accordance with the Rules for Arranging Business Continuity Management Process in JSC NC “KazMunayGas” and its Subsidiaries and Dependent Entities (KMG-PR-3203.1-37).

## **5.14. INCIDENT INVESTIGATIONS**

5.14.1. Incidents to be reported to Authorised Bodies are communicated and investigated in the KMG Group in accordance with Statutory Requirements.

5.14.2. The KMG Group Organisations operating hazardous production facilities thoroughly investigate each Incident at the Workplace/Facility, which could have or have resulted in serious consequences.


5.14.3. Internal Incident investigation is carried out to identify and analyse root causes for the Incident, to the extent consistent with Statutory Requirements, in accordance with the Rules for Reporting and Investigating Incidents in JSC NC “KazMunayGas” (KMG-PR-2235.1-13).

5.14.4. Internal incident investigations are conducted by competent Employees from among Line Managers, HSE Service and representatives of employees, engineers and technicians, workers involved in operation of the corresponding systems, process equipment and units. Internal incident investigations may involve other concerned Employees as part of participation in Risks/Hazardous and Harmful Occupational Factors management processes.

5.14.5. Internal investigation report includes, but is not limited to:

- 1) Date of the Incident;
- 2) Date when the Incident investigation started;
- 3) Description of the Incident;



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- 4) Factors which contributed to the Incident;
- 5) Corrective actions or recommendations following internal Incident investigation based on conclusions;
- 6) As required, revisions to the valid internal documents of the KMG Group Organisation (job descriptions and work instructions, technical documentation).

5.14.6. In case of an Incident, the KMG Group Organisations operating hazardous production facilities act and take measures in the manner and within the periods established by Statutory Requirements.

## **5.15. PROCESS SAFETY COMPLIANCE AUDITS**

### **5.15.1. Internal compliance audit**

5.15.1.1. To establish effectiveness and performance of the PSM system, the KMG Group Organisations confirm and evaluate compliance herewith by conducting internal (scheduled) compliance audits at least once every three years.

5.15.1.2. Internal compliance audit shall be conducted by at least one Employee from among engineers and technicians, who is aware of and competent in PSM processes. The internal compliance audit is followed by a report, which includes the identified flaws and deviations of the PSM system. Compliance audit reports are deposited in the archive of the KMG Group Organisation.

5.15.1.3. The KMG Group applies first party and second party internal compliance audits. First party audit is conducted by a KMG Group Organisation itself (facility, shop, site, etc.). Second party audit is conducted by another KMG Group Organisation (within the same business line, e.g. exploration and production) horizontally (crosswise).

5.15.1.4. If an Incident occurs in a KMG Group Organisation, which can lead to serious consequences for life and health of Employees, environment, assets and property, the internal compliance audit is repeated (unscheduled audit)


### **5.15.2. External compliance audit**

5.15.2.1. External or third-party compliance audit is conducted in the KMG Group by an independent third-party company with the necessary experience in evaluation of MS, PSM, and a license/accreditation from the relevant authorised body (as required).

## **5.16. PROCESS SAFETY MANAGEMENT PERFORMANCE IMPROVEMENT**

### **5.16.1. Key Performance Indicators (KPIs)**

5.16.1.1. To monitor and analyse key PSM performance indicators (KPIs), the KMG Group uses Lagging Indicators, which enable tracing, recording of the actual integrity, failures of PSM, number of Incidents, and Leading Indicators, consistently

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measuring indicators, which enable performance evaluation of protection and control systems and mechanisms constituting Barriers.

5.16.1.2. Monitoring and analysis of PSM KPIs of the KMG Group are based on the actual data and include:

- 1) PSM KPIs;
- 2) Results of Barrier performance checks;
- 3) Findings of Compliance Audits;
- 4) Incident investigations and lessons learnt;
- 5) KPI benchmarking.

5.16.1.3. Monitoring and analysis of KPIs are aimed at identifying change trends and taking prompt corrective measures in the KMG Group to improve effectiveness and performance of PSM and MS in general.

5.16.1.4. PSM effectiveness is monitored using several correctly selected indicators, which represent different aspects of PSM, work discipline and PSM effectiveness. Description, requirements and sample set of KPIs are provided in (KMG-F-2545.3-13/ ST-3679.2-13).

#### 5.16.2. **Safe standards and best practices**

5.16.2.1. KMG Management, Heads of Business Lines, Heads of Business Areas, Chief Executive Officers of the KMG Group Organisations, Line Managers, within their authority, assist with and ensure:

1) Introduction of effective and reliable design standards, inspection and maintenance standards, safe working practices, which bring together Statutory Requirements, industry standards and best international practices (OSHA, IOGP) in a set of guidelines to be used to develop design, inspection and maintenance plans;

2) Revision, regular updates and approval of this Standard according to changes in Statutory Requirements, industry standards, best international practices and Incident investigation results;


3) Compliance with or excellence of the applicable Statutory Requirements considering other important PSM aspects including human and organisational factors;

4) Providing access to the approved standards and practices for Employees who apply them, including Contractors/Subcontractors and other stakeholders.

5.16.2.2. Deviations from the standards of design, construction, operation, inspection and maintenance of the Facilities is permitted if they do not contradict Statutory Requirements, engineering design, technical and operating manufacturer specifications, only after substantiation of the solution has been evaluated, analysed, documented and approved by competent authorised officers of the KMG Group.

## 6. **PERFORMANCE CRITERIA**

Performance criteria include:

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6.1. Compliance with Statutory HSE Requirements and requirements hereof in the KMG Group;


6.2. Identification and elimination of Risks/Hazardous and Harmful Occupational Factors to maintain integrity of the KMG Group assets.

6.3. Improvement of key PSM, MS performance Indicators.

## 7. DOCUMENT REFERENCES

7.1. This Standard includes references to internal KMG documents:

1.	Resolution of the Board of Directors of JSC NC "KazMunayGas" dated 4 October 2018, Minutes No. 14/2018	JSC NC “KazMunayGas” Development Strategy - 2028
2.	Resolution of the Board of Directors of JSC NC “KazMunayGas” dated 20 February 2020, Minutes No. 2/2020	JSC NC “KazMunayGas” Health and Safety Policy
3.	Resolution of the Board of Directors of JSC NC "KazMunayGas" dated 20 February 2020, Minutes No. 2/2020	JSC NC “KazMunayGas” Environmental Policy
4.	Resolution of the Board of Directors of JSC NC "KazMunayGas" dated 13 December 2016, Minutes No. 17/2016	Corporate Risk Management Policy of JSC NC “KazMunayGas” and its Subsidiaries and Dependent Entities
5.	Resolution of the Management Board of JSC NC “KazMunayGas” dated 30 October 2015, Minutes No. 54	Golden Rules, Health and Safety Code of Conduct for JSC “National Company “KazMunayGas” Employees
6.	Resolution of the Board of Directors of JSC NC “KazMunayGas” dated 3 September 2020, Minutes No. 8/2020	Health, Safety and Environment Leadership and Commitment Code for the JSC “National Company “KazMunayGas” Group Employees

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7.	Version 1	KMG Group Health, Safety and Environment Management System Manual
8.	KMG-MD-986.3-37	Methods of Risk Identification and Assessment, Selection of Risk Management Practices of JSC NC “KazMunayGas” and its Subsidiaries and Dependent Entities
9.	KMG-PR-251.3-37	Model Regulations for Production and Non-Production Risk Management in JSC NC “KazMunayGas” and its Subsidiaries and Dependent Entities
10.	KMG-PR-3203.1-37	Rules for Arranging Business Continuity Management Process in JSC NC “KazMunayGas” and its Subsidiaries and Dependent Entities
11.	KMG-PR-2456.1-13	Rules for Testing and Assessing Preparedness of the JSC NC “KazMunayGas” Group Organisations for Prevention and Extinction of Fires
12.	KMG-PR-2629.1-13	Risk Identification Guidelines for High Risk Operations in JSC NC “KazMunayGas”
13.	KMG-PR-2065.1-13	JSC NC “KazMunayGas” Source of Energy Isolation Rules
14.	KMG-PR-434.8-6	Rules for Training and Development of Employees of JSC NC “KazMunayGas”
15.	KMG-PR-2235.1-13	Rules for Reporting and Investigating Incidents in JSC NC “KazMunayGas”
16.	KMG-RG-3313.1-13	Crisis Management Regulations of JSC NC “KazMunayGas”
17.	Version 1	Regulations on Emergency Medical Care in the JSC NC “KazMunayGas” Group
18.	KMG-ST-3467.1-13	Corporate Standard for Health, Safety and Environment Competences in the JSC NC “KazMunayGas” Group
19.	KMG-ST-3524.1-13	Corporate Standard for Contractor Engagement in Health, Safety and Environment in the JSC NC “KazMunayGas” Group
20.	KMG-ST-3407.1-13	Corporate Standard for Provision of Protective Clothing, Footwear, Personal Protective Equipment in the JSC NC “KazMunayGas” Group

7.2. This Standard contains references to the following laws and regulations, standards of the Republic of Kazakhstan:




1.	No. 188-V ZRK dated 11 April 2014	RoK Civil Protection Law
2.	No. 414-V ZRK dated 23 November 2015	Labour Code of the Republic of Kazakhstan
3.	No. 212-III ZRK dated 9 January 2007	RoK Environmental Code
4.	No. 342 dated 30 December 2014	Order of the Minister of Investments and Development of the Republic of Kazakhstan regarding Approval of Industrial Safety Rules for Hazardous Petrochemical, Oil Refining Production Facilities, Oil Depots and Filling Stations
5.	No. 343 dated 30 December 2014	Order of the Minister of Investments and Development of the Republic of Kazakhstan regarding Approval of Industrial Safety Rules for Hazardous Production Facilities
6.	No. 299 dated 26 December 2014	Order of the Acting Minister of Investments and Development of the Republic of Kazakhstan regarding Approval of Requirements for Legal Entities Qualified for Industrial Safety Work
7.	No. 358 dated 30 December 2014	Order of the Minister of Investments and Development of the Republic of Kazakhstan regarding Approval of Industrial Safety Rules for Operation of Pressure Equipment
8.	No. 359 dated 30 December 2014	Order of the Minister of Investments and Development of the Republic of Kazakhstan regarding Approval of Industrial Safety Rules for Operation of Hoisting Machinery
9.	No. 352 dated 30 December 2014	Order of the Minister of Investments and Development of the Republic of Kazakhstan regarding Approval of Industrial Safety Rules for Hazardous Mining and Exploration Production Facilities
10.	No. 353 dated 30 December 2014	Order of the Minister of Investments and Development of the Republic of Kazakhstan regarding Approval of Hazardous Production Facilities Identification Rules
11.	No. 355 dated 30 December 2014	Order of the Minister of Investments and Development of the Republic of Kazakhstan





		regarding Approval of Industrial Safety Rules for Hazardous Oil and Gas Production Facilities
12.	No. 341 dated 30 December 2014	Order of the Minister of Investments and Development of the Republic of Kazakhstan regarding Approval of Rules Establishing Criteria to Classify Hazardous Production Facilities as Declarable Facilities, and Rules for Hazardous Production Facility Industrial Safety Declaration Development
13.	No. 122 dated 20 February 2015	Order of the Minister of Energy of the Republic of Kazakhstan regarding Approval of Safety Rules for Operation of Thermal Mechanical Equipment of Power Plants and Heating Networks
14.	No. 222 dated 19 March 2015	Order of the Minister of Energy of the Republic of Kazakhstan regarding Approval of Safety Rules for Operation of Consumer Electrical Installations
15.	No. 344 dated 28 August 2020	Order of the Minister of Labour and Social Protection of Population of the Republic of Kazakhstan regarding Approval of Permit to Work Issue and Application Rules for High Risk Operations
16.	No. 1219 dated 19 November 2010	Resolution of the Government of the Republic of Kazakhstan regarding Approval of Technical Regulations “Toxic and Highly Toxic Substances Safety Requirements”
17.	ST RK ISO 45001-2019	Occupational Health and Safety Management Systems - Requirements with Guidance for Use
18.	ST RK 1748-2008	Petroleum and Natural Gas Industries - Management of Safe Gas Hazardous Work on Trunk Gas Pipelines
19.	ST RK 12.3.001-2005	Occupational Safety Standards System. Gas Hazardous Work - Classification. General Requirements
20.	ST RK ISO 20815-2011	Petroleum, Petrochemical and Natural Gas Industries - Production Assurance and Reliability Management
21.	ST RK ISO 12489-1-2016	Petroleum, Petrochemical and Natural Gas

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		Industries - Reliability Modelling and Calculation of Safety Systems
22.	ST RK ISO 31000-2010	Risk Management - Principles and Guidelines
23.	ST RK ISO/IEC 31010-2010	Risk Management - Risk Assessment Methods
24.	GOST 12.0.003-74* (ST SEV 790-77)	Occupational Safety Standards System. Hazardous and Harmful Occupational Factors - Classification
25.	GOST 12.1.010-76* (ST SEV 3517-81)	Occupational Safety Standards System. Explosion Safety - General Requirements
26.	GOST R 12.3.047-98	Occupational Safety Standards System. Fire Safety of Technological Processes - General Requirements. Control Methods
27.	GOST 12.3.002-2014	Intergovernmental Standard. Occupational Safety Standards System. Manufacturing Processes - General Safety Requirements
28.	RD 34.03.305-88	Instructions on Fire Safety Measures during Hot Work at Energy Facilities

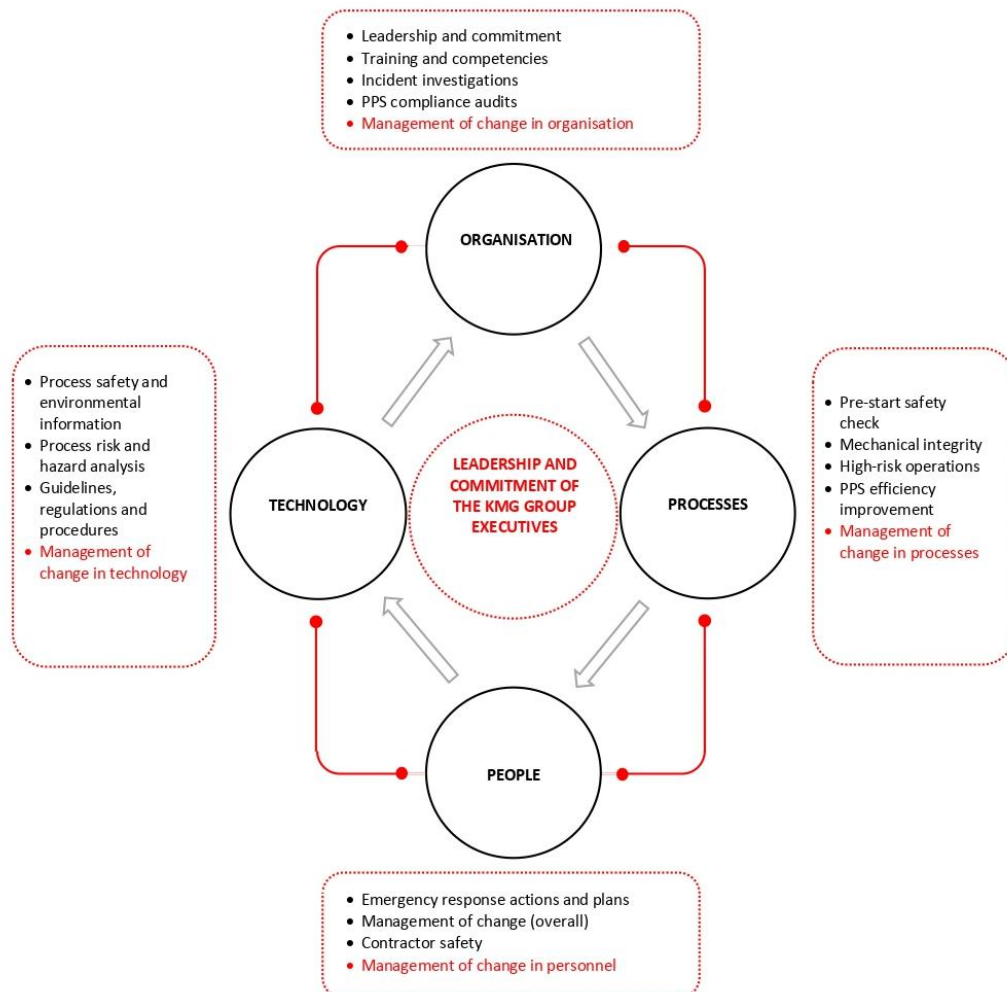
## 8. RECORD FORMS


1.	KMG-F-2543.3-13/ ST-3679.2-13	Process Safety Management Model in the KMG Group
2.	KMG-F-2544.3-13/ ST-3679.2-13	PSM elements for initial introduction (recommended)
3.	KMG-F-2697.4-13/ ST-3679.2-13	Barrier models, performance and evaluation
4.	KMG-F-2545.3-13/ ST-3679.2-13	Description, requirements and sample set of KPIs

### Production Process Safety Management Model of the KMG Group

The production process safety management model (PPSM) of the KMG Group consists of 4 blocks, including 14 main elements that determine the focus areas of PPSM, such as Leadership and Safety Culture Enhancement, Risk and Hazard Identification and Assessment, Risk and Hazard Management, Review and Improvement.

Block of Elements - Organisation		Block of Elements - Processes	
1	Leadership and commitment	8	Pre-start safety check
2	Training and competencies	9	Mechanical integrity
3	Incident investigations	10	High-risk operations
4	Compliance audits of production process safety	11	Improvement of production process safety efficiency
Block of Elements - People		Block of Elements - Technology	
5	Emergency response actions and plans	12	Process safety and environmental information
6	Management of change	13	Process risk and hazard analysis
7	Contractor safety	14	Guidelines, regulations and procedures



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## PPS Elements for Initial Implementation (recommended)

### Introduction

Considering the importance of the Risk / Hazardous and Harmful Occupational Factors management processes and changes in the PPSM for the initial implementation of this Standard in the KMG Group, it is recommended at the initial stage to introduce the following key PPS elements:

- 1) Process safety and environmental information;
- 2) Process risk and hazard analysis;
- 3) Management of change (technology);
- 4) Pre-start safety check.

### 1. Process safety and environmental information (PS and EI)

#### Purpose and definition of the element:

1) Process safety and environmental information is the information necessary to ensure the design, operation and maintenance of hazardous production facilities. It includes information on Risks / Hazardous and Harmful Occupational Factors, technologies and equipment used in Technological Processes, as well as the potential negative environmental impact of the KMG Group organisations.

2) The element creates the basis (framework) for identifying and understanding all the risks and hazards associated specifically with the conduct of the Technological Process.

3) The element is of primary importance for the Employees involved in Production Processes and the Engineering Department Employees for the development and implementation of equipment modifications, development of production procedures for operation and maintenance of equipment and installations, and further training of Employees.

The PS and EI documentation shall be developed and approved in writing with subsequent support and monitoring of PPSM in the KMG Group organisations. This system should review the information on a regular basis and be updated.

Cases where the PS and EI process should be applied:

- 1) a new Facility or unit: before its start;
- 2) an operating Facility or unit;
- 3) when significant changes are made to the existing Technological Process.

#### Recommendations for implementation of the element:


- 1) developing an internal guideline document (procedure) for PS and EI (if unavailable);
- 2) developing regulations on HSE Committee (if unavailable) or PS and EI Sub-Committee within the existing Committee (where necessary);
- 3) conducting training on the PS and EI process for the involved Employees (working groups).

### 2. Process risk and hazard analysis

#### Purpose and definition of the element:

The PPSM best practices provide a large number of procedures for conducting Process Risk and Hazard Analysis (PRHA), the main of which are:

- 1) Check-lists;
- 2) Preliminary Hazard Analysis (PHA);
- 3) Production Safety Information (PSI);
- 4) Operational Readiness Review (ORR);

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- 5) Hazard and Operability Study (HAZOP);
- 6) Hazard Identification (HAZID);
- 7) Structured What If Technique (SWIFT);
- 8) Business Impact Analysis (BIA);
- 9) Root Cause Analysis (RCA);
- 10) Failure Mode and Effect Analysis (FMEA);
- 11) Fault Tree Analysis (FTA);
- 12) Event Tree Analysis (ETA);
- 13) Cause-Consequence Analysis (CCA);
- 14) Layers of Protection Analysis (LOPA);
- 15) Human Reliability Assessment (HRA);
- 16) Bow Tie Analysis (BTA);
- 17) Reliability Centered Maintenance (RCM);
- 18) Consequence/Probability Matrix (C/PM).

The most common techniques include Hazard and Operability Study (HAZOP) and Structured What If Technique (SWIFT), which is a light version of HAZOP.

It is proposed to initially dwell on the Structured What If Technique (SWIFT) since this technique is less constrained and has a wider scope of applications than HAZOP.

The importance and effectiveness of using the PRHA element in the KMG Group:

- 1) ability to identify all potential risks and hazards associated with all operating Technological Processes;
- 2) identification and prioritisation of the most hazardous Production Processes;
- 3) determination of measures to eliminate and/or reduce the Risks associated with the hazards of operating processes;
- 4) identification of potential consequences of the PPSM Incidents;
- 5) involvement of the majority of production business units (operation and construction, maintenance and others) in the operating PPSM processes.

The PRHA documentation should be developed and approved in writing for the adoption of short-term and long-term joint activities.

Cases where the PRHA process should be applied:


- 1) for all new Technological Processes and Facilities, where hazardous chemicals and materials are present, or where there is a risk of fire (explosion) due to Technological Processes or equipment operation;
- 2) when changes are made to the existing Technological Processes, Facilities and work instructions;
- 3) as a result of Incident investigations;
- 4) permanent or temporary inactivation of equipment or installations (for example, due to the need for major repairs);
- 5) when revising the findings of previous PRHA (generally once every 5 years) etc.

Recommendations for implementation of the element:

- 1) developing an internal guideline document for the PRHA principles (if unavailable);
- 2) developing regulations on HSE Committee (if unavailable) or PRHA Sub-Committee within the existing Committee;
- 3) conducting training in the PRHA process using the Structured What If Technique (SWIFT) or other techniques for the Employees (working groups) involved;
- 4) conducting training in the general information of the Hazard and Operability Study (HAZOP).

### **3. Management of change (technology)**



 <b>КазМұнайГаз</b> <small>NATIONAL COMPANY ҚАЗМҰНАЙ ГАЗ КОМПАНИЯСЫ</small>	<b>PPS elements for initial implementation (recommended)</b>	
<b>IMS Form</b>	<b>KMG-F-2544.3-13/ ST-3679.2-13</b>	<b>page 3 of 4</b>

Purpose and definition of the element:

Management of engineering change (MOEC) is an integral part of PPSM and is aimed at ensuring the safe operation of equipment after modification of both the equipment itself and the Production Process.

The MOEC process' purpose is to reduce potential Incidents by systematic monitoring of permanent, temporary and emergency changes introduced at the Facilities, to the Production Processes and the end products (or services).

The MOEC process is applicable when introducing permanent, temporary and emergency changes that affect the established operating mode of the Production Facility, its operation or products, in cases where such a change can affect the health and safety of people, environment, performance or reliability of equipment, but is not an organisational change.

Cases where the MOEC process should be applied, including but not limited to the following changes:

- 1) changes to the design parameters of equipment;
- 2) changes in the operating conditions of equipment, including decommissioned equipment;
- 3) changes to the Technological Process management;
- 4) changes to the fire protection systems;
- 5) changes at auxiliary Facilities (that are not part of the technological process) that affect the safety or health of workers, the population, or negatively impact the environment;
- 6) departures from the standard operating procedure or design solutions, such as SNiP or others.

Recommendations for implementation of the element:

- 1) developing an internal guideline document for MOEC (if unavailable);
- 2) conducting training in the MOEC process and the Structured What If Technique (SWIFT) or other techniques for the Employees (working groups) involved;
- 3) developing functional MOEC checklists for the units involved in the process;
- 4) conducting at pilot Facilities (1-2 facilities at the design stage using the Structured What If Technique (SWIFT) under the supervision of a competent Employee);
- 5) conducting mentoring sessions/workshops for the involved Employees (working groups) on the selected projects.

#### **4. Pre-start safety check**

Purpose and definition of the element:


Pre-start safety check (PSSC) ensures a final check of new and modified equipment to confirm that all necessary PPS elements have been successfully reviewed and the Facility is safe to start.

PSSC also includes the safe start-up of equipment or installations after major repairs. PSSC is carried out at the time when a change has already been introduced, but no start-up permit has been obtained yet.

The PSSC's purpose is to assess the condition of process equipment and utility systems to ensure their safe start-up and operation. This includes checking the readiness of safety systems and other infrastructures operating at the production site.

Primary goals and objectives of this process:


- 1) the Facilities to be started up are constructed as per the approved design;
- 2) these Facilities or equipment can function in a safe and efficient manner;
- 3) the Facilities will be operated, repaired and maintained by trained and competent Employees;
- 4) the Facilities have been designed and will be operated in accordance with the Statutory Requirements, KMG corporate standards, international oil and gas practices;

 <b>ҚазМұнайГаз</b> <small>NATIONAL COMPANY ҰЛТТЫҚ КОМПАНИЯСЫ</small>	<b>PPS elements for initial implementation (recommended)</b>	
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5) all of the above activities are formalised and documented.

Recommendations for implementation of the element:

- 1) developing an internal guideline document for the PSSC process (if unavailable);
- 2) conducting training in the PSSC process and the Structured What If Technique (SWIFT) or other techniques for the Employees (working groups) involved;
- 3) developing functional PSSC checklists for the units involved in the process.

 <b>КазМұнайГаз</b> <small>NATIONAL COMPANY ҚАЗАҚСТАН РЕСПУБЛИКАСЫНЫҢ АТҚАРУУ ОРҒАНЫ</small>	<b>Description, requirements and a sample set of KPIs (indicators)</b>	
<b>IMS Form</b>	<b>KMG-F-2545.3-13/ ST-3679.2-13</b>	<b>page 1 of 3</b>

## Description, Requirements and a Sample Set of KPIs (Indicators)

### 1. Description

The indicators are used to assess the integrity measures of the KMG Group assets in accordance with the stated PPS, MS goals. Given that major violations of asset integrity are relatively rare, it is important to record and track even minor Incidents (near misses).

Lagging Indicators are reactive monitoring techniques that require reporting on and investigation of specific Incidents and events to identify weaknesses in this PPSM system. Incidents must not result in serious damage or injury, or even loss of containment, provided they represent Failure of a significant control system that protects or limits the effects of a major Incident. Lagging Indicators show when the desired safety result has failed or has not been achieved. A Lagging Indicator shows weaknesses or "holes" in this barrier discovered after the Incident. An Incident does not necessarily have to result in injury or environmental damage, but it can be a hazardous event, a precursor event or an unwanted outcome associated with failures in the Risk control system.

Leading Indicators are an active form of monitoring that targets multiple Critical Safety Elements and risk management systems to ensure continued effectiveness. Leading Indicators require regular, systematic verification of whether the key activities or actions are performed as intended. They can be viewed as process measures or inputs required to achieve the desired PPSM outcome. Leading Indicators identify weaknesses or "holes" in vital aspects discovered during regular reviews of the operation of Critical Safety Elements and Risk control systems.

### 2. Indicator requirements

Necessary PPS indicator requirements:

- 1) the applied Lagging and Leading Indicators of PPS should be numerical;
- 2) the indicators should provide means of measuring activity, status or performance in accordance with the PPSM requirements and objectives;
- 3) Lagging Indicators should identify and classify Incidents;
- 4) Leading Indicators should identify and classify conditions that may ultimately lead to more severe consequences;
- 5) Indicators should be regularly monitored and reviewed by the KMG Group to determine corrective actions to improve PPS.

### 3. Examples of Lagging and Leading Indicators

Serious Incidents (Incidents, Accidents and, as a consequence, Fire) occur when a series of Failures realises simultaneously in several Critical Safety and Risk Management Elements. Each Critical Safety and Risk Management Element constitutes an important Barrier or Means of Protection in PPSM. It would not take more than one significant Failure of a critical Barrier to trigger a major Incident. Continuous measurement and monitoring of the actual performance of these Safety Barriers in real time ensures that operational integrity would not be compromised by the deterioration of the Barriers.

Leading and Lagging Indicators are established in a structured and systematic manner for each Critical Safety and Risk Management Element within PPSM. Collectively, they maintain integrity, providing double assurance that the Risk control system is functioning properly or warning that troubles are starting to develop.

<b>No.</b>	<b>Critical Safety and Risk Management Elements</b>	<b>Example of a Lagging Indicator</b>	<b>Example of a Leading Indicator</b>
1.	Inspection and	Percentage or number of	Percentage of safety-

	maintenance of equipment or installations	Loss-of-Containment Incidents	critical equipment or installations that meet specification when tested
2.	Competencies	Number of Incidents involving loss of containment, equipment damage due to lack of understanding, knowledge or experience of correct actions	Percentage of Employees meeting the assessed competency criteria; Average time required to reach full readiness after being appointed to a new position
3.	Operating procedures	Number of operational errors caused by incorrect or unclear procedures	Percentage of checked and updated procedures versus target
4.	Instrumentation and warning systems	Number of Incidents associated with a Failure of instrumentation or warning systems	Percentage of functional tests of warning systems or scheduled outages
5.	Management of change	Number of Incidents associated with a Critical Safety Element Failure	Percentage of organisational changes, related risks are assessed and approved prior to installation or start-up of equipment; The average time required to fully implement a change after its approval
6.	High-risk operations (high-risk operation permit)	Number of Incidents where errors in the process of high-risk operations are identified as contributing to the occurrence of the Incidents	Percentage of high-risk operations performed where all hazards were identified and all necessary controls were indicated; Percentage of high-risk operations performed with all of the listed controls being fully engaged at the Workplace
7.	Engineering and design of equipment or installations	Number of Incidents where errors in the design of equipment or installations are identified as contributing to the occurrence of the Incidents	Number of modifications to equipment or installations after start-up that are relevant to and required by production; No deviations from applicable codes and standards; Percentage of Safety-Critical Equipment and Systems in full compliance with applicable design codes
8.	Emergency response	Number of emergency	Percentage of Employees

		<p>response elements that are not fully functional when activated in a real emergency</p>	<p>involved in emergency drills during the reporting period; Percentage of emergency isolation valves or process shutdowns tested as per the schedule defined by the relevant standard or facility safety case</p>
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## Barrier Models, Linkage to KPIs, Functioning and Measurement

1. The Swiss Cheese model (Fig. 1) states that no Barrier is ever 100% effective, because weak links (weaknesses) or “holes” are always there, even if each of them may be temporary.

The purpose of the model is to identify weak links (weaknesses) or "holes", and then make them as small and as short-term as possible, bearing in mind that they are constantly changing (equipment wear and tear, temporary protective mechanisms, operational changes, service disruptions, competence etc.). Therefore, multiple Barriers are used to manage the Risk of Serious Incidents, thereby reducing the likelihood that all holes will "line up" and the worst-case scenario will occur.

- Hazards are contained by many protective Barriers.
- Barriers can have weaknesses or “holes”.
- When “the holes” match, a hazard gets through Barriers, which can lead to adverse effects.
- Barriers can be physically engineered restraints or behavioural controls that depend on people.
- "Holes" can be latent (emerging) or actively opened by people.

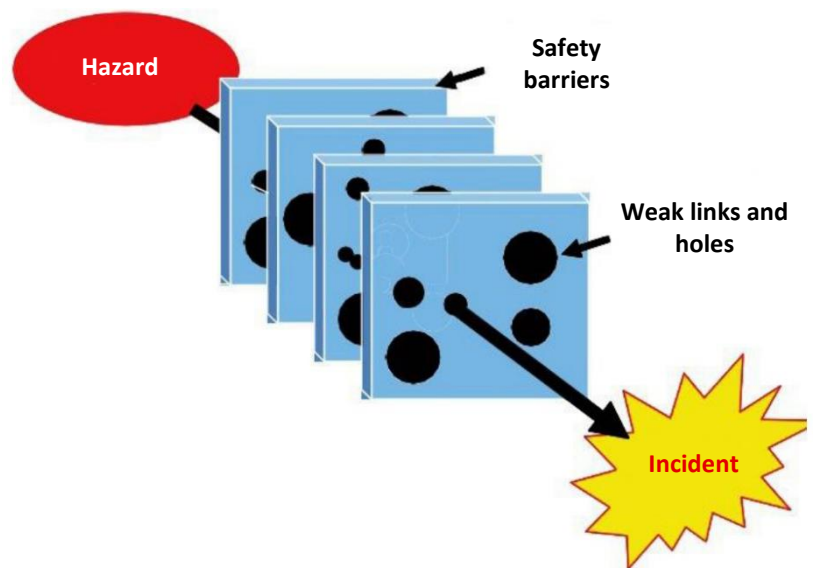


Fig. 1

2. An alternative method to visualise and determine the need for fencing is to use the Bow Tie model (Fig. 2). The model demonstrates how Barriers can both reduce threats of a hazard and limit effects if a hazard occurs.

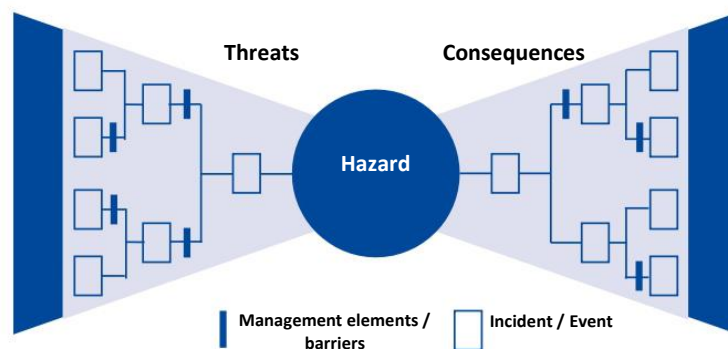


Fig. 2

3. An essential element of any PPS improvement programme is the measurement of present and future results. Therefore, for continuous improvement of PPS indicators, it is important that the KMG Group organisations apply effective Leading and Lagging Indicators.

These recommendations are compiled for a common set of Leading and Lagging Indicators for the KMG Group by reference to the PPSM best practices.

Lagging Indicators are a retrospective set of indicators based on Incidents meeting the severity threshold, which should be reported as a PPS indicator.

Leading Indicators are a perspective set of indicators that demonstrate the efficiency of key work processes, work discipline or layers of protection to prevent Incidents.

Near miss and other internal Lagging Indicators are descriptions of less serious Incidents (i.e. below the threshold value) or unsafe conditions that have triggered one or more protective layers. While these events are actual (i.e. Lagging Indicators), they are generally considered to be a good indicator of conditions that may ultimately lead to a more serious Incident.

These three types of indicators can be viewed as measurements at different layers of the Safety Pyramid (Fig. 3). The Safety Pyramid is divided into four separate layers (Process safety incidents, Other incidents, Near miss and Unsafe behaviours, Insufficient operating discipline).

All the KMG Group organisations are strongly encouraged to include each of these three types of indicators in their internal PPSM system.

Fig. 3. Safety Pyramid

