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Guidance on Practice for HSSE in Design and Loss Prevention

GP 76-01

BP GROUP
ENGINEERING TECHNICAL PRACTICES

Foreword

This is the first issue of Engineering Technical Practice (ETP) BP GP 76-01.

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1. Scope

- a. This Guidance on Practices (GP) provides guidance on health, safety, security, and environment (HSSE) and compliance in design.
- b. This GP is applicable to all business units and locations.
- c. This GP includes information relevant to business managers, project managers, project engineers, and design engineers.

This GP will provide the business manager, project manager, project engineer, and project design engineer information on what to include and where to go for further guidance when designing a BP plant or facility to meet the of the Integrity Management Functional Standard (IMFS), the Global or USA HSSE Compliance Framework, and HSSE in projects.

This GP will focus on which ETP documents contribute to HSSE in Design or to an Inherently Safer Design. Links to useful HSSE information are included in the GP.

- d. The overall goal of “HSSE in Design” is to protect human life (BP employees, BP contractors, and the general public) and the environment against possible accidents (fires, explosions, liquid spills to ground or to water, or emissions to the air) caused by failures of BP plants or facilities in all locations around the world.
- e. The main aim of “HSSE in Design” is to ensure that measures are used to minimize the risk and to mitigate the consequences of accidental hazardous material releases, fires, or explosions. These incidents could occur in BP plants and facilities and BP personnel need to address the identified risks to minimize or eliminate them, to achieve the goal stated above and to protect our company reputation and BP company property.
- f. This document defines what Group ETPs used to building plants and facilities will contribute to the above goal of HSSE in Design and provide inherently safe designs.

2. Normative references

The following normative documents contain requirements that, through reference in this text, constitute requirements of this technical practice. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this technical practice are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies.

BP

GIS 14-011	Noise Control - Procurement.
GIS 22-201	Procurement of Flares to API 537.
GIS 30-801	SIS - Design and Engineering of Logic Solvers.
GIS 30-851	Fire and Gas Detection.
GP 04-10	Drainage Systems and Sewers.
GP 04-20	Civil Engineering
GP 04-30	Design of Buildings Subject to Blast Loading.
GP 12-60	Hazardous Area Electrical Installations
GP 14-01	Noise Control.
GP 22-20	Design of Flares to API 537.
GP 24-03	Concept Selection for Inherently Safer Design.



GP 24-20	Offshore Fire & Explosion Hazard Management.
GP 24-10	Fire Protection - Onshore.
GP 30-25	Field Instruments - General.
GP 30-75	SIS - Management of the SIS Lifecycle.
GP 30-76	SIS - Process Requirements Specification.
GP 30-80	SIS - Implementation of Process Requirements.
GP 30-81	SIS - Operations and Maintenance.
GP 30-85	Fire and Gas Detection.
GP 35-10	Engineering Design for Maintainability.
GP 44-10	Plant Layout.
GP 44-25	Depressurisation.
GP 44-60	Area Classification IP-15
GP 44-65	Area Classification API-500
GP 44-70	Over Pressure Protection Systems.
GP 44-80	Design of Relief Disposal Systems.
GP 46-01	New Pressure Vessels.
GP 48-01	Project HSSE Review (PHSSER).
GP 48-50	Major Accident Risk Process.
GP 62-01	Valve Selection.
IMFS	Integrity Management Functional Standard (BP Group Technology).
VIPs	Constructability VIP (Excellence in Project Management).
	Process Simplification VIP (Excellence in Project Management).
	Waste Minimization and Management VIP (Excellence in Project Management)
	HSSE for Projects.
	Getting HSSE Right for Projects (or “in” Projects).
Value improving practice (VIP) documents:	
	Process simplification.
	Waste minimisation and management.
	Design to capacity.
	Facilities system performance.
	Technology selection.
	Value engineering.
	Setting business priorities.
	Constructability.

American Petroleum Institute (API)

STD 2218	Fireproofing Practices in Petroleum and Petrochemical Processing Plants.
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3. Terms and definitions

For the purposes of this GP, the following terms and definitions apply:

Active fire protection

- a. Equipment, systems, and methods required for detection, alarming, control, and extinguishing of fires using water, steam, dry powder, or gaseous extinguishants.



- b. Example would be detection equipment that activates fixed extinguishing or control systems for fire, smoke, gas, or heat.

Fire exposed envelope

- a. Space into which fire potential equipment can release combustible fluids that can cause substantial fire damage.
- b. Unless specified otherwise, fire exposed envelope shall extend from source of liquid fuel horizontally 6 m to 9 m (20 ft to 30 ft) and vertically 9 m to 12 m (30 ft to 40 ft).

Fire scenario envelopes

Fire scenario envelopes are three dimensional spaces into which fire potential equipment can release flammable or combustible fluids that, if ignited, will burn for sufficient time and intensity to inflict escalation.

Fire potential

Applicable to plant and equipment (but excluding pipe work) that contain combustible fluids (see API 2218).

Passive fire protection (PFP)

- a. Non combustible materials that, for defined period during fire, protect equipment, prevent collapse of structural supports, or limit spread of fire.
- b. Passive fire protection incorporates basic requirements for area separation and classification.

4. Symbols and abbreviations

For the purpose of this GP, the following symbols and abbreviations apply:

BLEVE	Boiling liquid expanding vapour explosion.
Capex	Capital expenditures.
CPSSR	Capital project security support review.
CVP	BP's proprietary Capital Value Process comprised of 5 stages: Appraise, Select, Define, Execute, and Operate. More Information on CVP
DSP	Decision Support Package
ESD	Emergency shutdown.
ETPs	Engineering Technical Practices. More Information on ETPs
FEHMP	Fire and explosion hazard management plan.
FEL	Front end loading.
HAZID	Hazard identification.
HAZOP	Hazard and operability review.
HSSE	Health, safety, security, and environment.



IMFS	Integrity management functional standard.
ISD	Inherently safer design.
JV	Joint venture (BP and partner company owning and/or operating plant or facility).
LFL	Lower flammability limit.
LNG	Liquefied natural gas.
LPG	Liquefied petroleum gas.
MAP	Major accident potential.
MAR	Major accident risk (process).
MOC	Management of change (process or system).
NGO	Non governmental organisation.
Opex	Operational expenditures.
P&ID	Piping and instrument diagram.
PEL	Permissible exposure limit.
PFD	Process flow diagram.
PFP	Passive fire protection.
PHA	Process hazard analysis.
PHSSER	Project health safety security and environmental review.
QRM	Qualitative risk matrix.
SIS	Safety instrumented systems.
STP	Site technical practice.
TLV	Threshold limit value.
TWA	Time weighted average.
VIP	Value improving practice.

5. General

- a. All business segments at all locations shall systematically identify hazards arising from normal and abnormal operations and shall eliminate, control, or mitigate hazards such that residual risks and all legal HSSE compliance requirements are managed.

This is a requirement of the IMFS.

- b. Each location shall have formal procedures that shall ensure hazards are identified, risk assessments are made, and systems developed to manage risks and meet all legal HSSE compliance requirements.



- c. These activities shall be appropriate to and consistent with complexity of location and risks present.
- d. For all projects and turnarounds, formal review of health, safety, security, and environmental impacts shall be performed at key stages of project or activity. Each location shall comply with Control of Work Standard.
- e. All BP locations shall apply “inherently safer design” principles during design process and use approved Site Technical Practices (STPs). Project teams shall address full life cycle risks.

This is a requirement of the IMFS.

- f. Assessment of Major Accident Potential (MAP) using Group Major Accident Risk Process shall be performed for each location. (Each Segment shall confirm that it does not and will not operate above the Group Priority Line and is focused on continuous risk reduction.)
- g. STPs
 - 1. All locations shall use a set of STPs that are consistent with BP Engineering Technical Practices (ETPs).
 - 2. Differences shall be justified and approved by appropriate engineering authority based on any specific local requirement.
 - 3. Once in operation, operating, maintenance, and inspection practices shall be implemented and regularly reviewed against approved STPs.
 - 4. All engineered systems, including mechanical, electrical, control, lifting, and structural, shall be designed, procured, constructed operated, inspected, tested, and maintained in accordance with STP to ensure that equipment is fit for service, avoids loss of containment, and maintains structural integrity for expected lifecycle of facility.
 - 5. New plant designs shall minimise risk at source and consider best available technology to improve integrity.
- h. Responsibility to ensure compliance with legislation and any other statutory requirements lies with the user.
- i. A legal HSSE applicability register shall be maintained that identifies all applicable HSSE regulatory, contractual and other requirements that pertain to the location. Risk prioritization shall be performed as part of the HSSE management system to determine those compliance activities which carry the most risk and therefore require attention to mitigate and/or manage in priority order.
- j. This GP should be adapted or supplemented to ensure compliance for specific applications.

6. HSSE in design

6.1. Purpose

HSSE in design is most important aspect of risk management.

Risk is defined as measure of:

- *Human injury.*
- *Environmental damage.*
- *Economic loss.*

Risk is defined in terms of:

- *Incident likelihood.*



- *Magnitude of loss, injury, or damage.*

Effort to reduce risk arising from operation of plants and facilities can be directed towards:

- *Reducing likelihood of incidents (incident frequency).*
- *Reducing magnitude of loss, injury, or damage should an incident occur (incident consequences).*

6.2. Risk management in plants and facilities

6.2.1. Risk identification

- a. Business segments shall:
 1. Systematically identify hazards arising from normal and abnormal operations.
 2. Eliminate, control, or mitigate hazards such that residual risks are managed
 3. Manage legal HSSE compliance requirements in the country in which they operate.
- b. Each location shall have formal procedures and processes in place to ensure:
 1. Hazards are identified.
 2. Risk assessments are made.
 3. Systems are developed to manage risks.
 4. Legal HSSE compliance requirements are met.
- c. Procedures shall be appropriate to and consistent with complexity of location and risks present.
- d. Assessment of major accident potential using the MAR process shall be performed for each project and location and shall comply with GP 48-50.
- e. Each segment shall confirm that it:
 1. Does not and will not operate above the group priority line.
 2. Is focused on continuous risk reduction.

Greatest benefit of major accident risk (MAR) process will be gained if implemented at beginning of capital value process (CVP) define, execute, and operate stages.

- f. Hazard identification and risk assessments shall:
 1. Cover design, procurement, construction, and commissioning.
 2. Employ process hazard analyses.
 3. Be performed by teams that are competent and have comprehensive experience and knowledge of process being evaluated and technique in use.
- g. Findings shall be communicated to workforce that may be affected by recommendations and actions.
- h. Project teams shall address full lifecycle risks.
- i. Hazard Register shall be prepared for each.
- j. Hazard Register shall describe hazards and provide clear links from identified hazards to measures, systems, processes, and procedures implemented to manage risks.
- k. A legal HSSE applicability register shall be maintained that identifies all applicable HSSE regulatory, contractual and other requirements that pertain to the location. Risk prioritization shall be performed as part of the HSSE management system to determine



those compliance activities which carry the most risk and therefore require attention to mitigate and/or manage in priority order.

- l. Risk assessments and process hazard analyses shall include identification of specific hazards.
- m. Accepted recommendations from studies shall be implemented in a timely manner to eliminate hazard or minimise risk from hazard.

6.2.2. Risk reduction

6.2.2.1. General

Strategy for reducing risk, whether directed towards reducing frequency or mitigating consequence of potential accidents, can be classified into four categories, in decreasing order of reliability and preference:

- a. Inherent.
- b. Passive.
- c. Active.
- d. Procedural.

6.2.2.2. Inherent

Inherent strategies eliminate hazard by use of materials or process conditions that are less hazardous (e.g., substituting water for flammable solvent).

6.2.2.3. Passive

- a. Passive strategies minimising hazard by process and equipment design features that reduce either frequency or consequence of hazard without employing active functioning safety devices.
- b. Examples of passive methods include equipment rated for higher pressure, proper selection of materials, safety distance, adherence to good design practices and industry standards, and consideration of human factors.
- c. For fires, passive fire protection (PFP) is normally used if equipment or structures are located in fire exposed envelope or fire scenario envelope.

6.2.2.4. Active

- a. Active means using equipment, such as controls, safety interlocks, and emergency shutdown (ESD) systems, to detect and correct process deviations.
- b. Active systems are commonly referred to as engineering controls.

Examples of active systems include overpressure protection and vent systems, depressurisation systems, proper selection of redundancies in critical and other selected control functions, process isolation and shutdown systems, and corrosion control and monitoring program.

- c. Active fire protection systems shall be used on fire potential process equipment for potential of fire from leak or explosion.

6.2.2.5. Procedural

- a. Procedural strategies use operation procedures, training, administrative checks, emergency response, and other management approaches to prevent incidents or to minimise effects of incidents.

Example of procedural method is hot work procedures and permit.

