Safety Guidelines and Good Industry Practices for Oil Terminals

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List of abbreviations

ADNR	European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways
API	American Petroleum Institute
ANSI/ASA	American National Standards Institute /Association
ASME	American Society of Mechanical Engineers
ATEX	European Union Directive Control of Explosive Atmospheres
BAT	Best Available Techniques/Technology
DIN	Deutsches Institut für Normung
EIA	Environmental Impact Assessment
GIP	Good Industry Practices.
HIRA	Hazard Identification & Risk Assesment
IEC	International Electrotechnical Commission
ITPM	Inspection, Testing and Preventive Maintenance
PHA	Process Hazard Analysis
OTMS	Oil Terminal Management System
UNECE	United Nations Economic Commission for Europe

Introduction

The 1992 United Nations Economic Commission for Europe (UNECE) Convention on the Transboundary Effects of Industrial Accidents (Industrial Accidents Convention) aims to protect people and the environment against industrial accidents. It is designed to help prevent accidents from occurring, reduce the frequency and severity of such accidents and to mitigate their effects if they should occur. To date there are 41 Parties to the Industrial Accidents Convention, which include, besides the European Union (EU) and 26 of the EU member countries (without Ireland and Malta), Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Kazakhstan, Monaco, Montenegro, Norway, the Republic of Moldova, the Russian Federation, Serbia, Switzerland and the former Yugoslav Republic of Macedonia. In 2004, the Convention's Conference of the Parties adopted an Assistance Programme to support the above-mentioned countries from Eastern Europe, the Caucasus and Central Asia and South-Eastern Europe in implementing the Convention.

Under the Assistance Programme of the UNECE Industrial Accidents Convention, a project involving the Republic of Moldova, Romania and Ukraine was set up in 2010, aimed at preventing and mitigating the consequences of industrial accidents through improving hazard and crisis management in the Danube Delta. When analysing the risk potential of hazardous installations from the above-mentioned project countries, it became evident that three oil terminals – Giurgiulesti (Republic of Moldova), Galati (Romania) und Reni/Izmail (Ukraine) – had an increased hazard potential for the ecosystem and natural heritage of the Danube Delta. In order to improve risk management within and between the three countries in the Danube Delta, particularly through strengthening hazard and crisis management, the project management group decided to elaborate safety guidelines and good industry practices for oil terminals as a part of the project.

As safety problems and risks at oil terminals exist not only in the above-mentioned countries but may also be present at oil terminals in the entire UNECE region, it was deemed useful to establish an international expert group which would elaborate safety guidelines and good industry practices for oil terminals that could serve as a basis for the harmonization of safety standards across the UNECE region. To this end, the secretariat to the UNECE Industrial Accidents Convention established in March 2012 an international expert group to elaborate safety guidelines for oil terminals in order to assist authorities and operators in the UNECE region to ensure an adequate safety level at oil terminal facilities.

The expert group at its first meeting analysed the reasoning and need for the development of the current guidelines. Being aware that failures and incidents at oil terminal facilities may have far-reaching consequences for the environment and human health, the expert group stressed that since the 1970s, 40 per cent of small- and medium-sized oil spills and 29 per cent of the large oil spills occurred during loading or discharging, typical operations at ports and oil terminals[1], and that such spills have caused harm to human health and severe environmental damage to fisheries, social and economic activities as well as to the aquatic environment.

[1] Source: The International Tanker Owners Pollution Federation (2010), http://www.itopf.com/information-services/data-and-statistics/statistics/index.html#no.

Also in many cases, an incident at oil terminal facilities leads to much higher costs for a company (in terms of repairs, loss of share value, cost of closure, remediation and claims) than the company could have invested to ensure a proper level of safety and to have prevented the incident from happening. Proper design, construction, operation and closure of an oil terminal should therefore be of high priority for both the operator and the authorities.

Although a number of guiding materials in this area are already available internationally, they are often too complex for effective use by many operators and authorities or too focused on particular technical elements. The UNECE safety guidelines and good industry practices for oil terminals aim to address these and other challenges by providing a practical overview of the safety precautions needed for those running such a facility. This is also ensured through the structure of the document which was created in accordance with a facility's life cycle.

Against this background, the international expert group, drawing upon its substantial expertise in oil terminal safety, prepared the present safety guidelines. It took into account input provided by national authorities, operators of oil terminal facilities, financing institutions and non–governmental organizations. The draft safety guidelines were also discussed with representatives and experts from UNECE member countries during a workshop on the safety of oil terminals, held in September 2013 in Odessa, Ukraine. The final version of the safety guidelines and good industry practices will also include comments from international organizations and UNECE member countries. These safety guidelines and good industry practices will be presented to the eighth Conference of the Parties to the Industrial Accidents Convention (Geneva, 3–5 December 2014). .

Objective and Scope

The safety guidelines and good industry practices as described further in this document are designed to prevent incidents at oil terminal facilities from happening and to limit the accidental consequences for human health and the environment. They are based extensively on accepted and published good practice procedures to ensure conformity with international standards.

These safety guidelines and good industry practices apply to oil terminals in which one or more hazardous substances are present or may be present in quantities at or in excess of the threshold quantities listed in annex I to the United Nations Economic Commission for Europe (UNECE) Convention on the Transboundary Effects of Industrial Accidents (Industrial Accidents Convention). They can also be used for oil terminals with lower quantities of hazardous substances.

These safety guidelines and good industry practices are intended for application at land-based oil terminals. While off-shore terminals are not under the scope of the Industrial Accidents Convention, the approach to safety and environmental protection should not differ.

Oil terminals within the meaning of the principles and recommendations, set forth in these safety guidelines and good industry practices, are facilities for storing oil and their derivatives, including loading, unloading and transfer activities, either stand-alone or within bigger industrial activities, e.g. oil refineries. The oil derivatives include but are not limited to gasoline, diesel fuel, jet fuels, heating and fuel oils, naphtha, flammable liquids etc.

The safety guidelines and good industry practices described hereafter are derived from operational industry experience. This includes learning from history and the detail of past major accidents and the remedial and prevention measures, designed to prevent recurrence.

These guidelines recognize that different safety standards may already exist worldwide and that different approaches to safety exist with regard to cargo, the modes of transport and transport interfaces. However, a comparable level of major accident prevention should be achieved for both eisting and new oil terminals. These guidelines are intended to support existing requirements and recommend enhancement of practices wherever appropriate.

Since this document focuses primarily on safety guidelines for oil terminals, security concerns are not within the scope of these guidelines, but they should be taken into account at all stages of the life-cycle of the oil terminal, since security failures can initiate a major accident event.

Definitions

Definition	Explanation
Competent authority	An organisation legally delegated with the power and capability to perform the function of oversight of the operation of an oil terminal. The competent authority is empowered to enforce legal requirements in area within its jurisdiction.
Domino effects	Are increased adverse effects of an accident or triggering of further accidents as a consequence of the proximity of other parts of an installation or nearby installations and their inventories of hazardous substances
Effects	Any direct or indirect, immediate or delayed adverse consequences caused by an industrial accident on, inter alia: (i) Human beings, flora and fauna; (ii) Soil, water, air and landscape; (iii) The interaction between the factors in (i) and (ii); (iv) Material assets and cultural heritage, including historical monuments.
Good industry practices	In relation to any activity and any circumstances, the exercise of that degree of skill, diligence, prudence and foresight which would reasonably and ordinarily be expected from a skilled and experienced operator engaged in the same type of activity under the same or similar circumstances.
Incident	An undesired event which could ("near-miss") or does result in unintended harm or damage ("accident")
Near-miss	Any unplanned event which could have caused harm to health, the environment or property, or could have involved a loss of containment possibly giving rise to adverse effects involving hazardous substances.
Oil terminal	Oil terminals within the meaning of the present Guidelines are facilities for storing oil and their derivatives (i.e. and not limited to: naphta, flammable liquids etc.), including loading, unloading and transfer activities.
Oil terminal operator	Any natural or legal person, including public authorities, responsible for operating an oil terminal.
Public	One or more natural or legal persons.
Safety report/ **Safety Declaration/** **Major Accident**	The written presentation of technical, management and operational information concerning the hazards of a hazardous installation and their control in support of a justification for the

Prevention Report	safety of the installation.
Stakeholder(s)	Any individual, group or organisation that is involved, interested in, or potentially affected by the oil terminal activities.
Transboundary effects	Serious effects within the jurisdiction of a Party as a result of an industrial accident occurring within the jurisdiction of another Party;

PART 1– PRINCIPLES AND GENERAL RECOMMENDATIONS

1. Principles

1. Governments should provide leadership and create suitable administrative frameworks to facilitate the safety of oil terminals at all of its life-cycle stages.
2. The operators of oil terminals have the primary responsibility for ensuring operational and process safety of oil terminals and the personal health of the operating staff.
3. Competent authorities should introduce and enforce adequate measures to ensure that the operators are committed to safety.
4. Appropriate measures should be taken in case of accidents. Emergency plans should be established by oil terminal operators (internal emergency plans) and by authorities (external emergency plans) and should be compatible and regularly tested and updated. These plans should include descriptions of the measures necessary to control accidents and limit their consequences for human health and the environment.
5. For oil terminals which pose a potential risk to neighbouring countries, the concerned UNECE member countries should inform each other of their emergency plans and endeavour to make such plans compatible and where appropriate should draw up joint off-site emergency plans. This is in accordance with the provisions of the Industrial Accidents Convention which requires Parties to: (i) Notify potentially affected Parties of hazardous activities (art. 4); (ii) Inform each other of their contingency plans (art. 8); and to draw up, where appropriate, joint contingency plans to facilitate joint response (art. 8).
6. For oil terminals which pose a potential risk to neighbouring communities and land-users due to their size or presence of hazardous substances, information to and involvement of these communities and land-users should be ensured for the purpose of providing information to the public and drawing up an off-site emergency plan.
7. For the siting and intended post-operational land use of new major oil terminals and proposed significant developments around existing oil terminals, the provisions of art. 7 of the Industrial Accidents Convention have to be applied. It is important to ensure that the public is given early and effective opportunity to participate in the decision-making relating to such developments that can potentially have significant adverse effects. The provisions of the UNECE Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (Aarhus, 1998) and the UNECE Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention, 1992) should be also taken into account.
8. Regular exchange of information between oil terminal operators, authorities and relevant stakeholders (e.g. land use planners, industry associations, branch chambers, etc.) regarding good practices, improvement of oil terminal safety, and past accidents and near-misses should be ensured.

1.1. General recommendations

9. These safety guidelines and good industry practices for oil terminals contain recommendations and key elements for taking actions by UNECE member countries' competent authorities and oil terminal operators to ensure a basic level of safety at oil terminals.

10. For the Parties to the UNECE Industrial Accidents Convention, including the European Union, the need to take actions can be derived from their obligations under the Convention as well as from the General Duty Clause[2]. Non-Parties are also encouraged to take the necessary actions.

11. When using these guidelines, competent authorities and operators should ensure that national requirements are met , taking into account, in order to avoid unnecessary duplication, efforts already made at international level.

12. These guidelines should also be read in the context of existing international guidance, recommendations and standards concerning oil terminals. These guidelines constitute a minimum set of good industry practices to ensure a basic level of safety for oil terminals. Alternative approaches by applying different policies, measures and methodologies are possible, provided they achieve a comparable level of safety.

13. Below are recommendations to the UNECE member countries, competent authorities and oil terminal operators.

1.1.1. Recommendations for UNECE member countries

14. UNECE member countries should develop and implement policies and strategies for reducing the risks of accidents and improving preventive, preparedness and response measures in oil terminals.

15. UNECE member countries should encourage oil terminal operators to demonstrate the oil terminal safety as part of the application for an oil terminal operating permit or similar arrangements. UNECE member countries should encourage operators to complement the oil terminal operating permit with a financial security or any other equivalent, on the basis of arrangements to be decided by the member countries, in order to ensure that all obligations arising under any permit issued, including closure and post-closure requirements, as well as any other obligations, can be met. This should include e.g. insurance to allow proper settlement of any costs associated with an accident.

[2] The General Duty Clause aims to establish the principle, as a matter of law in most countries, that operators of hazardous installations have the responsibility for the safe operation of their installations. Further information about the General Duty Clause could be found in the UNEP Flexible Framework Guidance available at: http://www.unep.org/resourceefficiency/Portals/24147/Safer%20Production%20%28Web%20uploads%29/UN_Flexible_Framework_WEB_FINAL.pdf.

16. UNECE member countries should adopt policies for the Safety of oil terminals, including safe transport, transhipment and storage of hazardous substances, aimed at limiting accidental consequences for human health and the environment. They should raise awareness and share experience and good practices through educational programmes and other means.

17. National legislation should be clear, enforceable and consistent with the requirements of the Industrial Accidents Convention in order to facilitate international cooperation in, for example, the development and implementation of external emergency plans.

18. UNECE member countries should encourage setting up policies on insurance, civil liability and compensation for damage caused by the local and/or transboundary effects of industrial accidents. The UNECE Protocol on Civil Liability and Compensation for Damage Caused by the Transboundary Effects of Industrial Accidents on Transboundary Waters[3] could be used as a reference.

19. UNECE member countries should establish a system of controls and land-use planning procedures with involvement of the public.

20. National laws, regulations, policies and practices should take into account all the relevant stakeholders involved and should be consistent with international agreements and recommendations.

21. In accordance with art. 17 of the UNECE Industrial Accidents Convention, competent authorities should be designated at the national, regional or local level that, alone or together with other authorities, have the necessary competences to ensure adequate monitoring and control of oil terminals. The independence and objectivity of the competent authorities should be ensured.

22. UNECE member countries should ensure that the competent authorities are legally empowered and adequately resourced to be capable of taking effective, proportionate and transparent enforcement action, including where appropriate cessation of operations, in cases of unsatisfactory safety performance and environmental protection by operators and owners.

23. UNECE member countries should establish a system to ensure that information about incidents is evaluated on the national level to follow-up on lessons learnt.

24. UNECE member countries should encourage and expect operators and owners, in following good practices, to establish effective cooperative relationships with the competent authority, supporting best regulatory practice by the competent authority and to proactively ensure the highest levels of safety, including, where necessary, suspending operations without a competent authority needing to intervene.

[3] The Protocol on Civil Liability and Compensation for Damage Caused by the Transboundary Effects of Industrial Accidents on Transboundary Waters is a joint Protocol from the UNECE Industrial Accidents and Water Conventions. It was adopted and signed by 22 countries at the Ministerial Conference "Environment for Europe" in Kyiv, Ukraine, on 21 May 2003 (2 more countries signed the Protocol later in 2003).

1.1.2. Recommendations for competent authorities

25. Competent authorities should maintain within their organisations expertise relating to:
    (a) Accident prevention, emergency preparedness and response;
    (b) Inspection and audit;
    (c) Permitting requirements for operation of the oil terminal
26. Competent authorities should ensure that the objectives of preventing and limiting the effects of accidents are taken into account in their land-use policies, with particular regard to ensure safety distances between oil terminals and residential areas, buildings, areas of public use, recreational areas, major transport routes and areas of particular natural sensitivity or interest. For this purpose competent authorities should use discharge flow modelling and/or other relevant state of the art methodologies.
27. Competent authorities should set up appropriate consultation procedures to facilitate implementation of the policies established. The procedures should be designed to ensure that technical information about human health & safety and protection of the environment is available, on a case-by-case or generic basis, when decisions are taken. Competent authorities should also ensure that the public and other stakeholders are given the opportunity to give their opinion.
28. Competent authorities should consider the technical risks when issuing a permit or similar arrangements for operating an oil terminal. There is the need to ensure that when examining the technical aspects of the license, the licensing authority thoroughly examines the capability of the operator for ensuring continued safe and effective operations under all foreseeable conditions.
29. Competent authorities are responsible for establishing permit conditions based on national legal requirements and safety standards.
30. Competent authorities should implement the permitting process, by enforcing the future oil terminal operator to prepare environmental impact assessment, in a transboundary context when applicable.
31. Competent authorities should require the oil terminal operator to draw up a report on major hazards which should be thoroughly assessed and accepted by the competent authority. Acceptance by the competent authority of the report on major hazards should not imply any transfer of responsibility for control of major hazards from the operator or the owner to the competent authority.
32. Competent authorities should set up a system of inspections or other control measures in order to ensure that oil terminal operators meet the legal requirements.
33. Competent authorities should be empowered to conduct formal inspections. They may establish provisions that set up a system for certified, independent experts to undertake the inspections of facilities.

34. When competent authorities use independent experts for inspections, they remain responsible for assessing the competence and accountability of experts and for the effectiveness of the inspection process.

35. The inspection regime of oil terminals as defined by the competent authorities should reflect the:

    (a) Hazard Potential of the oil terminal;

    (b) Proximity to sensitive environments or communities;

    (c) Age of the installation;

    (d) "Ageing" of the equipment.

    (e) Historical accident and incident record of the terminal,

    (f) Inspection records.

36. Competent authorities should establish internal guidelines for key areas that need to be verified at oil terminals, and should train their own inspectors on an on-going basis.

37. Competent authorities should ensure that oil terminal operators:

    (a) Draw up internal emergency plans and put them into effect without delay when an accident occurs; and

    (b) Supply the authorities designated for that purpose with the necessary information to enable them to draw up external emergency plans.

38. Competent authorities may require the oil terminal operator to provide any additional information necessary to enable them to fully assess potential accidents.

39. Competent authorities should ensure that external emergency plans with measures to be taken in the vicinity of the oil terminal where the effects of accidents might be of concern outside of the site of the oil terminal are drawn up and implemented.

40. Competent authorities should ensure that internal emergency plans are drawn up in consultation with the personnel working inside the establishment, including long-term relevant subcontracted personnel, and that the public is consulted on external emergency plans when they are established or updated.

41. Competent authorities should ensure that external and internal emergency plans are reviewed, tested and, where necessary, revised and updated at suitable intervals.

42. Competent authorities should ensure that proper consideration is given to the prevention of third-party interference. They should provide the appropriate regulatory framework needed to control activities carried out by third parties, including clear awareness of responsibilities.

43. Competent authorities should consult with other authorities (e.g., health and safety at work, chemicals management, explosion protection, fire protection, emergency preparedness and planning), as well as other stakeholders (local communities, Non-Governmental Organizations, other operators), in the surrounding area of oil terminals in order to establish safety objectives and a control framework in the whole area.

44. Competent authorities should encourage the existing educational institutions to develop education and training programmes that could ensure the necessary capacities for both industry and government staff.

45. Competent authorities should operate a programme for dissemination of information to ensure that incidents and accidents at an oil terminal are communicated within the sector nationally and internationally to ensure lessons are learned and recurrence prevented.

46. The competent authorities should approve post-closure plans for oil terminals.

1.1.3. Recommendations for oil terminal operators

47. Oil terminals should be designed, constructed, operated, and maintained to ensure a high level of protection for human health and the environment. Adequate consideration should therefore be given to various aspects which could affect the safety of an oil terminal, such as inherently safer design and stress factors, operability, quality of material, ageing phenomena, external impact protection, corrosion, and monitoring. For new oil terminals the principle of design for decommissioning should be taken into account already during the design and planning stage.

48. Oil terminals should be designed, constructed and operated in accordance with recognized national and international codes, standards and guidelines and, where appropriate, internationally accepted industry standards or specifications.

49. When considering hazard controls, or changes to existing controls, consideration shall be given to reducing the associated risks according to the following hierarchy of controls:

    (a) Elimination of the hazard;

    (b) Substitution of the hazard;

    (c) Engineering controls;

    (d) Administrative controls (e.g. procedures/work instructions) and/or signage/warnings;

    (e) Personal Protective Equipment.

50. The oil terminal investor/operator should ensure at an early stage of the oil terminal lifecycle (design and planning stage) that all equipment is purchased to ensure a high level of protection of man and the environment. During construction, the oil terminal investor/operator is responsible for purchasing all equipment and materials as specified and is also accountable for ensuring the ´as-built´ situation in accordance with design specifications. To this purpose, the oil terminal investor/operator should implement controls on purchased goods and organizes the follow-up of inspections and contractor works.

51. The oil terminal investor/operator should ensure that an appropriate level of competence is available throughout the lifecycle stages of an oil terminal and only competent personnel should be allowed to perform high-risk tasks.

52. The oil terminal operator should establish and maintain a robust and sustainable Oil Terminal Management System (OTMS) that is adequate to manage the oil terminal risks and to comply with the applicable legal and regulatory requirements. The OTMS should also take into account any other voluntary commitments to which the oil terminal operator subscribes. To this purpose, it is recommended that the oil terminal operator adopts a Major-Accident Prevention Policy (MAPP), which would be the foundation of the OTMS.

53. Hazard identification and risk assessments should be undertaken during all stages of the lifecycle, as appropriate, in order to choose among different options and to assess

unusual circumstances. The oil terminal operator should adopt a methodology for the on-going hazards identification, risk assessment and determination of necessary control measures for routine and non-routine activities, and for management of change.

54. A document (see chapter 1.4.1) should be set up in order to make suitable arrangements for major accident prevention. Operators and owners of oil terminals should comprehensively and systematically identify all major accident scenarios relating to all hazardous activities that may be carried out, including impacts on the environment arising from a major accident. The hazard identification, risk assessments and arrangements for major accident prevention should be clearly described and compiled in the report on major hazards. The workers should be consulted at the relevant stages of the preparation of the report on major hazards.

55. The oil terminal operator should inform the competent authority:

    (a) On planned arrangements to prevent major accidents (including the associated performance indicators and safety measures) by conducting risk assessments and adopting appropriate risk controls for identified, and

    (b) On planned arrangements to limit the consequences when an incident occurs, as defined in the Emergency Planning and Response.

56. To enable a safe operation, the oil terminal operator should establish and communicate clear management performance standards for all management levels and define roles, responsibilities and accountabilities for all employees. Lines of control and responsibility should be clearly defined and communicated to all parties.

57. The oil terminal operator should establish a list of key stakeholders (all parties involved in the safe operation of an oil terminal) and identify their requirements.

58. The oil terminal operator should ensure that any person under its control (including contractors and third parties) performing high-risk tasks is competent on the basis of appropriate education, training and experience.

59. The oil terminal operator should establish competence requirements and identify training needs associated with the oil terminal risks and risk controls as described in the OTMS. Consequently, oil terminal operators should train their personnel and reinforce and revise personnel's knowledge on safety as appropriate.

60. The oil terminal operator should determine those operations and activities that are associated with the identified hazards where the implementation of controls is necessary to manage the oil terminal risks. For those operations and activities, the oil terminal operator will need to implement and maintain operational procedures and other controls.

61. Oil terminal should have an operating manual that is available to all personnel and to government inspectors. All documents relating to planning, design and construction should be maintained in an accessible way, with records kept permanently for reference at the future time.

62. Oil terminal operators should implement safety audits for their facilities and promote the use of management systems audits based on international standards.

63. Oil terminal operators are responsible for managing their contractors regarding the implementation of the major accident prevention, preparedness and response policy; this involves at least the following controls:

    (a) Defining competence requirements for contractors/subcontractors to ensure that specific high-risk activities/tasks are executed by competent people.

    (b) Monitoring contractors' performance while working at the oil terminal, including informing them on oil terminal risks and their potential impact on the oil terminal safety performance, communication and consultation where relevant when changes occur etc.).

    (c) Evaluating their overall performance.

64. The integrity and functionality of tanks and all mechanical equipment, instrumentation and safeguards of the oil terminal should be maintained to Good Industry Practices (GIP).

65. Oil terminals should be decommissioned in accordance with national and applicable international legislation, and where appropriate in line with GIP.

66. Oil terminal operators should communicate lessons learned from incidents and accidents to help their national industry to avoid recurrence

PART 2 – TECHNICAL AND ORGANIZATIONAL SAFETY ASPECTS

Technical and organizational aspects of safety should be taken into account throughout the whole lifecycle of oil terminals. This document covers the safety elements and activities to be addressed during the whole lifecycle of an oil terminal.

Experiences from past industrial accidents are integrated in all elements through an efficient feedback mechanism.

The obligations for competent authorities are more general and are reflected already in the previous recommendations of part 1. The primary responsibility for safe operation of an oil terminal is with the operator. The following safety guidelines concentrate on the operator's duties.

1. DESIGN AND PLANNING

Industrial facilities safety fundamentals and best operation practices are being formed during the design and planning stage. The most significant is to consider the whole scope of safety aspects for the purpose of facilities engaged in hazardous substances manufacturing, storage, transportation and other processes. In most cases, oil terminals are classified as such facilities.

During the design and planning stage, there is an opportunity to foresee all the site components location, considering essential safety regulations, similar facilities operational experience (positive and negative), propose the best and the most secure technologies and equipment.

The design process should be carried out in recognition of identified hazards and risks assessment. Accepted design solutions should focus on risks reduction as low as reasonably practicable (ALARP).

Design should comply with national standards requirements, if available. In any case, oil terminals designing should be conducted within the good industrial sector methods and practices.

Design and planning stage results should be documented and go through required monitoring procedures controlled by oil terminal operator and inspection authorities, in accordance with national standards requirements.

During the design and planning stage, all negative environmental impacts, safety factors and possible risk estimation should be considered according to each lifecycle stage particularities, including decommissioning.
Oil terminal operators and inspection authorities should maintain constant control for design and planning solutions implementation during all other lifecycle stages, in accordance with national standards requirements.

Alterations introduced in design solutions during the other lifecycle stages require justification and should be confirmed by oil terminal operators and inspection authorities, in accordance with national standard requirements.

Subsequent parts of this chapter contain proposals on safety provisions to be considered for oil terminals design and planning stage.

1.1. Environmental baseline and impact assessment

Environmental Baseline

For new oil terminals, an Environmental Baseline condition should be established by the oil terminal operator and submitted to the competent authority, as part of the operating permit application. The Baseline Report should contain the information necessary to determine the state of soil and groundwater contamination so as to make a quantified comparison with the expected state upon definitive cessation of activities (decommissioning).

The Baseline Report should contain at least the following information:

(a) Information on the present use and, where available, on past uses of the site;
(b) Where available, existing information on soil and groundwater condition measurements that reflect the state at the time the report is drawn up
(c) Where relevant, existing information on nearby rivers or water courses that may be adversely impacted by the oil terminal operations.

This recommendation applies to oil terminals involving the use, production, storage or transfer of relevant hazardous substances with regard to the possibility of soil and groundwater contamination, or having a potential adverse impact on other vulnerable parts such as water-courses of the receiving environment at the site of the industrial facility.

Environmental Impact Assessment (EIA)

An EIA should be a precondition for construction and operation of an oil terminal, or to major changes to the facilities at or operation of an existing oil terminal, if applicable according to the existing international and national legislation.[4] The EIA should address the potential adverse impact of the oil terminal on the physical and social environment, in particular aquatic environment. The EIA should be available for the general public and interested or affected persons to comment and provide input to the assessment and to comment on or object to the construction and operation of the terminal.

The UNECE Convention on Environmental Impact Assessment in a Transboundary Context Convention (Espoo Convention) sets out the obligations of Parties to assess the environmental impact of certain proposed activities at an early stage of an investment proposal. It also lays down the general obligation of member countries to notify and consult each other on all major projects under consideration that are likely to have a significant adverse environmental impact across boundaries. Among the proposed activities with a mandatory EIA are crude oil refineries and major storage facilities for petroleum, petrochemical and chemical products above certain quantity threshold.

Under the Espoo Convention, there is also a Protocol on Strategic Environmental Assessment (SEA Protocol, Kyiv, 2003) which entered into force on 11 July 2010. The SEA Protocol augments the Espoo Convention by ensuring that individual Parties integrate environmental assessment into their plans and programmes at the earliest stages – so helping to lay the groundwork for sustainable development. It also provides for extensive public participation in the governmental decision-making process.

The oil terminal operator is responsible to prepare the EIA in a manner to conform to applicable legal and regulatory requirements. The information to be included in the environmental impact assessment documentation should, as a recommended minimum contain:

(a) A description of the proposed activity and its purpose;
(b) A description, where appropriate, of reasonable alternatives (e.g. spatial or technological) to the proposed activity and also the no-action alternative;
(c) A description of the environment likely to be significantly affected by the proposed activity and its alternatives;
(d) A description of the potential environmental impact of the proposed activity and its alternatives and an estimation of its significance (for normal operations and when accidental releases are considered);
(e) A description of preventive and mitigation measures to keep adverse environmental impact to a minimum;
(f) An explicit indication of predictive methods and underlying assumptions as well as the relevant environmental data used;

[4] In line with art. 4 of the UNECE Industrial Accidents Convention.

(g) An identification of gaps in knowledge and uncertainties encountered in compiling the required information;
(h) Where appropriate, an outline for monitoring and management programmes and any plans for post-project analysis; and
(i) A non-technical summary including a visual presentation as appropriate (maps, graphs, etc.).

1.2.Facility siting, layout and land use planning

Facility Siting and Land Use Planning can have significant effects on the hazards of the oil terminals. A thorough understanding of the risks posed by an oil terminal will allow these to be minimized without adversely affecting commercial viability. New facilities offer an opportunity for adoption of appropriate safety distances (to vulnerable areas and the community), new technology, inherently safer designs and GIP.

When compared with new facilities, existing facilities may pose different problems demanding innovative approaches, more stringent operational controls, enhanced asset inspection and emergency procedures. For existing facilities, new developments such as replacements and expansions need to reflect current GIP in facility layout. Layout means the location of various components within the plant (such as tank farms, pumping stations, loading stations, flares, relief devices and blow-down systems, emergency access, fire pumps etc.).

1.2.1. Facility siting and layout

In the oil terminal design and planning stage, site-selection decisions should take into account the risk of exposing human populations and vulnerable habitats to the hazards of toxic and flammable materials. The consequences of "credible worst case scenarios" need to be considered during the conceptual or basic engineering phase, before a large commitment has been made to a specific site location. The following parameters should be taken into account by the investor / future oil terminal operator:

(a) General layout of the facility: Is there an adequate buffer zone (safety distance) between the oil terminal and vulnerable environment/populations / and public facilities;
(b) Domino effects: Are there nearby sources (equipment / installations) that could threaten the entire site by potential "domino effects";
(c) Secondary and tertiary Containment considerations;
(d) Emergency access and response support Access for Emergency Response teams (Fire Brigade, Police, Ambulance Services);
(e) Power supplies: The need for emergency equipment such as lighting, fire pumps, sprinkler system to operate when the main power source is impaired;
(f) 'Safe Refuges': Are there safe refuges considered in case of fire and toxic releases;

(g) Occupied Buildings (e.g. Control Rooms, meeting rooms and offices);
(h) The consideration of location of occupied buildings to minimise risk for the occupants in an emergency situation such as fire or explosion
    i. Location (e.g. remote from the source of hazard, consideration of prevailing wind direction);
    ii. Construction (e.g. resistance to effects of fire (thermal radiation) and or explosion (overpressure));
    iii. In the case of Control rooms – provided with uninterruptible power supplies to control systems in the event of power failure.
(i) Provision of Fire water and Fire Protection systems. These may be provided via specific systems within the oil terminal or local city supply or from harbour. Capacity should be related to the fire water requirements (flow and total available volume) to fight the fire event. Vulnerability to disruption during an emergency needs to be considered e.g. damage from fire or explosion causing the fire protection to fail. It is also necessary to consider the retention (tertiary containment) for potentially contaminated fire water to prevent it from contaminating waterways or groundwater.
(j) Security systems and access controls:
    i. Provision of a secure perimeter fence (land side) and measures to prevent unauthorised access from water side;
    ii. Provision of access controls at land side gates and from ships in harbour;
    iii. Equipment for 24 hour surveillance of hazardous areas and perimeter fence.

1.2.2. Land use planning

For new oil terminals, the competent authorities have to take into account appropriate safety distances from transport routes, locations of public use and residential areas and areas of natural sensitivity or interest (vulnerable areas). These distances should limit the consequences of possible accidents for human health and the environment to an acceptable level.

For existing oil terminals, the competent authorities have to consider relevant technical and/or management measures for those establishments in or close to vulnerable areas or other economic activities that involve hazardous substances.

The competent authorities have to consider the establishment of policies on significant new developments, including transport routes, locations of public use and residential areas, in locations which could be affected by the effects of an accident arising out of a existing oil terminals so as to minimize the risks involved.

1.3.Safe design

National standards for equipment design and operation where they exist should be implemented and be the subject of inspection by the oil terminal operator and the competent authority. Wherever possible, the design of equipment within an oil terminal should be to GIP and incorporate learning from relevant incidents (e.g. Buncefield Oil Terminal Fire and Explosion – see Part 3).

Control room design and ergonomics, as well as effective alarm systems, are vital to allow front line staff, particularly control room operators, to reliably detect, diagnose, and respond to potential incidents.

The following key aspects for the design and operation of equipment related to hazard / detection / control and response have to be taken into account at three levels of protection:

1.3.1. Primary safety considerations

The following primary safety considerations are to be taken into account by the oil terminal investor/operator:

(a) Tank design to meet appropriate local legal codes or industry standards (such as ASME, DIN, etc.);
(b) Piping, valve, pumps and fitting design according to requirements for piping design to meet appropriate local legal codes, or industry standards (such as DIN, ANSI, etc.) ;
(c) Choosing construction material according to the mechanical, thermal, chemical and biological stress of service;
(d) Piping and valve fittings (in particular Isolating Valves) should be "firesafe" according to a typical industry standard (e.g. API/ISO) or requirements set by the Competent authority;
(e) Outdoor over ground plant units should be protected against the force of buoyancy during flood events and from mechanical damages due floating substances or objects;
(f) Underground containers and pipelines should be provided with a suitable corrosion protection and secured against the force of buoyancy;
(g) Level measurements devices should be installed, which include Low and High level alarms;
(h) Overfill prevention devices – Level detection linked through a "logic solver" (hardware or software) to interrupt flow in the event of a hazardous level occurring in a tank;
(i) Explosion protection - provision of equipment designed and managed in accordance with ATEX Directive 99/92/EC, the International Electrotechnical Commission System for Certification to Standards Relating to Equipment for Use in Explosive Atmosphere (IECEx), the UNECE Common Regulatory Framework for Equipment Used in Environments with an Explosive Atmosphere, etc.);:

(j) Consideration of Natural Hazards Triggering Technological Disasters (NATECH) such as flood, earthquake, forrest fires, lightning strike, etc.

1.3.2. Secondary safety considerations

The following secondary safety considerations are to be taken into account by the oil terminal investor/operator:

(a) Storage tanks are normally located inside a retaining wall on a solid foundation (i.e. full tank base coverage, not "ring" foundation)
(b) Leak detection shall be ensured (such as, e.g. double-wall base for flat-bottom tanks with monitored space in between walls to detect leaks in the primary containment);
(c) Transhipment sites should have retention facilities capable of accommodating the volumes of liquid that can escape until suitable control measures (such as automatic safety systems) take effect (secondary containment);
(d) As a good practice, underground pipelines should be double-walled or any detachable installed connections and valves should be installed in monitored leak proof inspection chambers;
(e) Construction of containment should be impermeable: The integrity of sealed systems must be in accordance with the physical-chemical properties of the substances handled. The integrity of the containment should be demonstrated by generally accepted and recognized testing method;
(f) As a good practice, the containment should have total volume appropriate to 110% of the largest tank or 25% of all the Tank volumes (whichever is the greater), plus an allowance for maximum daily rainfall;
(g) Additional tertiary containment volume for fire water retention, which must be leak proof and resistant to the fire fighting water and foam, needs to be considered. The size of the fire water retention depends on the volume/quantity of fire water and foam that is expected to be used for the control of the credible worse case fire taking into account the following parameters:
    i. Hazard of the stored substances;
    ii. Readiness of the fire brigade and the predicted time to gain control of a fire event;
    iii. Predicted flow of fire water to control the fire event.
    iv. Fire protection infrastructure (fire detection systems, fire extinguishing system)
    v. Total area and characteristiscs of the storage section (such as height of goods stored in warehouses);
    vi. etc.
(h) Loading and Off-Loading of inland waterway vessels:special care should be taken to observe the process (i.e. ADNR 151412) ;
(i) Overflow detection devices: these could be situated inside the secondary containment or in a piped overflow from a tank;

(j) Gas and Flammable Vapour Detection:

Such equipment acts to detect flammable vapour in (e.g.) secondary containment. They are usually located close to tanks, transhipment areas and equipment such as pumps and overflow piping. They do not act to prevent a loss of containment, but mitigate the potential scale of the event in the sense that they alert process operators or in some cases initiate the fire protection system. There are several suitable technologies used for detection including Infra-Red, Optical beam, Catalytic Oxidation etc.

(k) CCTV surveillance;

This is frequently provided for security purposes, but can also be useful in detecting and observing the build-up and presence of flammable vapour.

1.3.3. Tertiary safety considerations

The following tertiary safety considerations are to be taken into account by the oil terminal operator:

(a) Meeting the hazardous area classification and management (e.g. explosive area classification and zoning (for example, as described in the requirements of the EU ATEX Directive 1999/92/EC);
(b) Operators should review and amend if needed, the management system for the maintenance of equipment to ensure their reliability in operation. This includes:
    i. Periodic proof testing of equipment to minimise the likelihood of equipment failure.
    ii. Management of change (hardware, software, mode of operation, service personnel, material stored or transferred, .
(c) All elements of an overfill prevention system should be proof tested in accordance with validated arrangements and procedures sufficiently frequently to ensure the required reliability (e.g. probability of failure on demand) s; GIP is that for safety instrumented systems the safety integrity levels are managed in accordance with the requirements of Part 1 of IEC 61511.

Periodic tests of the safety-systems should be undertaken by competent experts. The inspection activity should be independent from the operation. This test should be documented and retained by the oil terminal operator in equipment files. Overfill prevention systems (i.e. the high-high level shut off devices) should be physically and electrically separate and independent from the systems which are used to manage and adjust the levels in tanks. This provides a warning that the tank rated capacity has been (or is about to be) reached/exceeded and triggers a response:

Overfill protection systems including instrumentation, alarms and automated shutdown systems should be assessed using IEC 61511, to include the following:

(a) Design, installation, operation, maintenance and testing;
(b) Management systems;
(c) Redundancy level, diversity of measuring methods. (Avoiding common cause failures);
(d) Fail safe design principles, proof testing coverage and frequency;
(e) Consideration of common cause failures.
(f) Independence from the level control activity.

1.4.Hazard management

The term Hazard Management refers to the process of Hazard Identification and Risk Assessment (HIRA), risk ranking and further controlling / reducing the risks to acceptable or tolerable levels. Hazard Management should be taken into account in the design and planning stage and all other stages of the life cycle of the oil terminal by the oil terminal investor, operator and all other key stakeholders as appropriate..

In these guidelines the assumption is that the majority of the oil terminals have the potential for causing a major accident and are potential hazardous activities when considering the quantities of hazardous substances as specified in Annex I of the Convention.

1.4.1. Hazard management in the permitting stage

Competent authorities shall require the future operator to demonstrate hazard management in a written document (e.g. Safety Report / Declaration) addressing also design for decommissioning as part of the operating permit application.

1.4.1.1 Demonstrating hazard management in Safety Report / Declaration

After having conducted a high-level Technical & Economic Feasibility study, the permit application process can start as soon as the investment decision is being made. The oil terminal operator may produce a written presentation of technical, management and operational information concerning the hazards of a hazardous installation and their control in support of a justification for the safety of the installation (a Safety Report/Declaration). The Safety Report/Declaration should contain an adequate description of the O.T. to enable the competent authorities to have a clear picture of the purpose, location, future activities and intrinsic hazards, services and technical equipment for safe operation. The extent of the description should be commensurate to the hazards of the oil terminal. The description should also aim at clarifying the interrelations among the different installations and systems within the oil terminal, both as far as the common services and overall management are concerned.

. A typical Safety Report/Declaration consists of 3 components: :

(a) Demonstration of the operator's Major-Accident Prevention Policy (MAPP)
(b) Demonstration of future operator's Safety Management System (SMS) ;

(c) Demonstration that adequate and sufficient measures will be in place to prevent major accidents from occurring and to reduce their harmfull consequences for people and environment, .

The Safety Report/Declaration should address the following essential parts (chapters):

(a) General information on the oil terminal;
(b) Description of the Oil Terminal Management System (OTMS);
(c) Description of the oil terminal location, indicating the existence of possibly nearby vulnerable environmental sensitive areas or populations;
(d) Description of natural hazards in the surrounding, having the potential to cause natural-hazard induced accidents;
(e) Description of the installation and its operations, including the quantity and characteristics of hazardous substances, storage and related transport modes for the hazardous materials (e.g. ship transfers, pipeline transfers, road and rail transfers) ;
(f) Identification and management of the major-accident hazards, including identification of major accident scenarios, preventive action measures to prevent such scenarios from happening, and in addition risk control measures to limit the consequences on man and the environment in case such scenarios) would happen. This part constitutes the core of the Safety Report/Declaration;

Reference is made to the Internal Emergency Plan (see further 1.5). The operator describes the hazards and relevant scenarios with the potential to cause a major accident. This risk assessment leads to an understanding of potential major accidents allowing ranking of the most credible major accident scenarios and methods of controlling them to a tolerable level. Subsequently, the oil terminal operator examines the Safety Critical Elements for each classified major accident scenario (Safety Report/Declaration or Safety Case). The Safety Critical Elements can also be formulated as the “Critical Barriers” or “Layers of Protection” that prevent the Major Accident from happening.

To be effective, “technical performance standards” should be defined for these critical barriers. The following criteria are considered as GIP for the definition of barriers’ “technical performance standards”:

(a) Functionality –What the barriers should achieve;
(b) Availability – The degree to which a system is in a specified operable state;
(c) Reliability –The likelihood of failure to operate on demand or the likelihood of failure over a period of time;
(d) Survivability –The conditions under which it will be required to operate (from the effects of Major Accident Hazards);
(e) Interaction / dependency – How the critical barrier interacts with or is dependent on other barriers.

Oil terminal operators should ensure (e.g. by testing) that they have suitable techniques to demonstrate and assess their barriers for effectiveness.

Many of the items suggested for the Safety Report/Declaration will be valuable in the creation of the oil terminal Operating Manual.

1.4.1.2 Design for decommissioning

The "design for decommissioning" proactive approach is recommended as GIP and specifies the application of general design requirements such as:
- Using materials that are easy to recycle or reuse.
- Using a modular design to make it easier to assemble, disassemble and transport parts of the industrial facilities
- Minimizing the use of hazardous materials.
- Minimizing the amount of contaminated material or hazardous waste that will be generated upon decommissioning.
- Using pollution prevention measures such as concrete areas, interceptors, containment, and liners to prevent or mitigate pollution from on-going operations.
- Avoiding the installation of underground storage tanks containing hazardous substances, if possible.
- Considering the installation of double contained piping systems for extremely hazardous and toxic chemical piping systems.

The protection of soil and groundwater is of particular concern. Remediation of contaminated soil and groundwater is expensive and very difficult.

The following four key activities reflect the "design for decommissioning" proactive approach, recommended as GIP, to be considered during the oil terminal design and planning stage:

(a) Identifying and implementing current and future legislation, regulatory and contractual requirements. This implies by example:
- Identification of specific site conditions and site closure plans aiming at reaching a "satisfactory state" and preventing on-going pollution)
- Applying relevant legislation on end-of-life equipment (e.g. waste electronic equipment).

(b) Establishing the contractual liabilities of the oil terminal operator, i.e. the company should only be responsible for pollution caused by their own operations (for properties that are bought or leased). This triggers the oil terminal operator:
- To consider any insurance requirements.
- To make possible provisions for future costs.
- To establish conditions and method statements for subcontractors.

(c) Establishing the environmental baseline for soil, waters and groundwater, aiming at:

- Identifying any existing pollution, sources and possible pathways offsite;
- Providing a comparison point for future assessment so that it is easier to show the responsibility for existing pollution at the end of the life of the plant
- Considering the influence of neighbours and surrounding land use;
- Considering the possible impacts of natural phenomena, such as flooding, on the possible spread of pollution offsite;

(a) - Considering the impacts of rainwater runoff.Specifying design requirements (see details sub section 1.5.1)

The above information may be used as part of the permit preparation and should be generated at the design and planning stage for new industrial facilities.

1.4.1.3 Domino effects

. The competent authorities shall identify possible domino effects by actively requesting additional information from the oil terminal operators. The competent authorities should ensure communication to other member countries in case of potential transboundary effects. Large scale domino effects should be considered in External Emergency Plans by the competent authority.

1.5.Emergency planning

Potential emergency situations, including accidents with large-scale impact, exist during all lifecycle stages of a complex industrial facility. The best and the most non-hazardous technologies and equipment selection during design and planning stage, a sound safety culture and a systems approach to process safety management altogether reduce the potential for a major accident, but do not exclude it completely.

However, one should strive to be prepared for the maximum credible worst case scenario. An overview of GIP with regard to emergency planning is given in the following sections.

1.5.1. Emergency plans – general

Emergency plans for oil terminal's need to be established prior to accepting construction, operation or closure by authorities. Hence, they shall be drawn up within the periods set by local or international rules.

Emergency plans should be established and tested by the oil terminal operator (internal plans) and by authorities (external plans). Eventually, upon request of the competent authorities, they should be tested together, to verify inter-relationships and interdependencies.

Emergency plans should be reviewed and updated when needed / where relevant but at least at a frequency not exceeding 5 years. Reviewing and updating should be considered at least in the following situations:

(a) After occurrence of accidents or emergency situations at the site or from lessons learned from accidents at other similar sites;
(b) When the emergency service organization has changed;
(c) When new hazards are identified that are associated with the oil terminal;
(d) When new technical knowledge or new technology is being developed that is considered relevant to the operation of the oil terminal;
(e) When design parameters (e.g. temperature, pressure) have approached/exceeded their limits as a result of changes, mismanagement, structural problems, equipment modification or as a result of natural events.

If relevant and appropriate or based on national requirements emergency plans consider natural hazards, such as flooding hazards, storm risks, forest fires and accidents in the immediate vicinity of the oil terminal. Relevant additional information from natural hazards should preferably be provided in an annex (e.g. inundation maps in case of flooding hazards).

Both types of emergency plans should include/address the following generic topics as a minimum::

(a) The scope and objective of the emergency plan;
(b) Description and evaluation of emergency scenarios, hazards (including natural hazards if appropriate), potentially affected areas etc.;
(c) Names and/or positions and contact data of persons authorized to set emergency procedures in motion and of the person in charge of coordinating the onsite mitigation actions;
(d) Responsibilities of each member of the organization being part of Emergency Management (chain of responsibility and authority for actions to be taken);
(e) The organization of internal and external notifications / communications (as defined by legal requirements and / or internal procedures);
(f) Required equipment for effective interventions and the required human resources based on the outcome of needs identificationInvolvement of ship crews (for communication and action);
(g) Procedures for emergency response / remediation for each of the determined emergency scenarios, including the necessary warning of and interaction with local emergency services;
(h) Requirements for emergency drills and practices with external agencies involved (Fire Brigade, Police, Ambulance, Local Hospitals);
(i) Interactions and interface with other intervention plans, either externally (e.g. from neighbouring plants, National Crisis Plan, Disaster Plan) or internally (e.g. the company's Crisis Plan, its Business Continuity Plan or the company's Recovery Plan).

1.5.2. Internal emergency plans

Internal emergency plans should be part of the operating manual. The internal emergency plan, specific for each site and situation, should be developed and continuously revised.

Plans for notification of key personnel and the public should be an integral part of the emergency plan and should be prepared for slow& rapid aggravating developments and for instantaneous failure conditions.

Internal emergency plans should at least include/address, on top of the generic information (as described above sub 1.5.1):

(a) Names and/or positions and contact data of persons in charge of liaising with the competent authorities in charge of the external emergency plan;
(b) Arrangements and devices for outgoing communications (initiating and activating the alert and call-out procedures) and for incoming communications (receiving warnings of incidents occurred);

(c) For foreseeable conditions or events which could trigger an accident, an assessment of critical resources needed should be made, and consequently, the actions to be taken should be defined for controlling those conditions or events and to limit their consequences (e.g. fire protection, fire water retention and safety equipment);
(d) Arrangements for limiting the risks to persons on site, including the way in which warnings are to be given and the actions which persons are expected to take upon receiving a warning;
(e) Arrangements for providing early warning of the accident to the competent authorities responsible for setting in motion the external emergency plan; the type of information which should be contained in an initial warning; and arrangements for the provision of more detailed information as it becomes available;
(f) Arrangements for training of all oil terminal staff involved in Emergency Management, in the duties they will be expected to perform and, where necessary, coordinating this with emergency services.

1.5.3. External emergency plans

External emergency plans are prepared and implemented by the competent authority, however oil terminal operators are obliged to provide the local authorities with all necessary information of the potentially affected area to evaluate the impact on man and the environment.

Public should be given the opportunity to participate in the preparation and revision of the external emergency plans.

It should be also ensured that in border areas the contingency plans of two regions of neighbouring countries are compatible with each other and include contact details to allow proper notification. The public of neighbouring countries should be given the same rights as the public of the concerned country to participate in preparation and revision of external emergency plans.

External emergency plans should detail all relevant information to ensure adequate emergency response. They should include, on top of the generic information (as described above sub 1.5.2):

(a) Names and/or positions and contact data of persons authorized to take charge of and coordinate actions;
(b) Arrangements for coordinating the resources necessary to implement the external emergency plan;
(c) Lists/maps of vulnerable areas and objects with their specifications;
(d) List of the agencies and organizations that will assist with the management of the incident;

(e) Arrangements for providing the public with specific information on the accident and the actions it should take.

Arrangements for notifying the emergency services of neighbouring countries in the event of a major accident with possible transboundary consequences, in accordance with internationally accepted and established warning- and alert-systems;

2. PROCUREMENT,CONSTRUCTION AND ASSET INTEGRITY MANAGEMENT

2.1. Quality assurance during construction and commissioning

A quality assurance/quality control programme ensures that equipment is purchased and built according to the design requirements, while meeting all applicable legal and technical standards and codes.

The oil terminal operator is recommended to have a quality assurance/quality control programme in place to prevent equipment failures that could result from:

(a) Use of faulty parts / materials due to improper delivery controls;
(b) Improper fabrication, installation or repair methods.

The operator's OTMS should provide guidance and mechanisms to assure that appropriately qualified and trained craftsmen (such as certified welders) are used for specified vessel and piping fabrication and for installing safety critical equipment and instrumentation.

A material tracking programme should be in place as control function to ensure that materials and equipment are purchased as specified in the Oil Terminal Requirements Database. The material certificates supplied by tank fabricators should be stored in the oil terminal operator equipment file.

2.2. Asset Integrity and Reliability

Asset Integrity is a key element in maintaining process safety. It means the systematic implementation of activities which ensure that equipment is on the one hand designed, procured, fabricated, installed, tested and inspected in accordance with agreed specifications, and on the other hand that it remains fit for purpose throughout its lifetime until it is decommissioned. Asset integrity activities range from equipment design to plant operators conducting routine rounds detecting leaks, unusual noise or detecting other abnormal conditions.

Reliability engineering is the process of evaluating how long a system and its components can be operated safely before they should be taken out of service for maintenance or replacement. Reliability engineering enables the planning of inspection and maintenance intervals, and is therefore of paramount importance for safety critical equipment and instrumentation.

The safe design standards as specified in section 1.3 shall be integrated in a comprehensive oil terminal Requirements Database for further reference throughout all other stages of the oil terminal lifecycle.

Inspection, Testing and Preventive Maintenance (ITPM) practices should be in place to help ensure that equipment is fit for service at commissioning and remains fit for service throughout its lifetime.

Oil terminal operator should conduct initial inspections and tests during fabrication and installation as part of plant commissioning. Eventually, this can be done partially at the fabricator's shop for special-order items (when judged to be highly critical that equipment is fabricated according to design specifications).

2.3. Hazard management during construction and commissioning

Oil terminal operators should have a procedure in place indicating which type of HIRA will be used during the construction and the commissioning of the terminal.

Typically, risk assessments as described in the above section on Safety Report/Declaration also apply during the Operations Phase.

Pre-Start-up Safety Reviews are often being used during commissioning, while other specific HIRA methods may be used, such as transport risk studies, fire and explosion risk studies for non-routine tasks.

2.4. Managing the lifetime of ageing assets

All assets and infrastructure (facilities) are subject to ageing phenomena as time goes by. The term "ageing" is not about how old an equipment is; it is about its condition, and how that is changing over time. Ageing facilities are therefore facilities which are, or may be, no longer considered fully fit for purpose due to age-related deterioration in its integrity or functional performance.

A well described approach and methodology is applicable for lifetime extension for offshore facilities, power plants and the nuclear industry, whose design lifetime is well defined upfront as well as the predefined decommissioning time. A comprehensive regulatory scheme is in place when an operator considers extending the operating lifetime of equipment. The key activities to be considered are: a thorough assessment of the asset integrity, risk assessment / risk mitigation and gap analysis against legal compliance to justify for life extension (see Part 3 Sources and further reading).

When the oil terminal assets or infrastructure are approaching the intended design or service life, or the oil terminal in its entirety is reaching the end date of the license to operate, decisions in terms of decommissioning, lifetime extension or extending the license to operate become vital. At this point, the oil terminal operator needs a workable approach and GIP to make sound decisions. On the other hand, the competent authorities should provide adequate guidance and apply decision criteria for extending or not the lifetime of oil terminal operations. Considering the different inspection regimes and approaches in regulatory frameworks of controls for assets in the UNECE member countries, the following two situations are further described as GIP to manage ageing assets/infrastructure: (i) Managing assets with predefined operating lifetime and (ii) Managing assets with undefined operating lifetime.

2.4.1 Managing assets with a predefined operating lifetime

Offshore structures are usually designed and built for a pre-defined lifetime of typically 20 to 30 years; the decommissioning is normally planned upfront as a normal practice. Although this approach of building with a specified design lifetime is normally not applied for oil terminals, it is possible applying the same approach and methodology for lifetime assessment and lifetime extension also for oil terminals. The purpose of management of ageing assets is to ensure that all assets are monitored through life and appropriate action is taken to maintain them in a fit for service condition.
The objective of a life extension assessment for an existing facility is to document that the asset or infrastructure is fit for its intended purpose over the extended service life, and that the consequences in terms of risk are acceptable from a safety, environmental and financial point of view (return on investment).

The overall methodology for assessment of the remaining lifetime of assets consists of six subsequent activities: (a) Technical Condition Assessment, (b) Life extension evaluation, (c) Regulatory compliance check, (d) Technical qualifications for life extension, (e) Preparing for obsolescent equipment, and (f) Estimating operating costs for lifetime extension.

a) Technical Condition Assessment
   The technical condition assessment is a high level review to identify equipment of high risk for safe and reliable continuation of production. The condition review may be based on site observations, review of documentation, management systems and interviews of personnel. It should cover the following elements: safety, operations history, engineering, documentation, inspection and maintenance. A risk based condition equipment assessment model is used to rank the equipment, while considering current operational disposition, consequence of failure and probability of failure/unavailability. An asset risk register is compiled as a result of this technical condition assessment.

b) Life Extension Evaluation

The objective is to evaluate the future operating conditions and production scenarios and identify the challenges for the facility to continue operations with equipment considered as critical.

The remaining lifetime of critical assets with a high risk ranking is estimated based upon considerations, such as (not limited to):

- Original design life (specified in years or number of operating cycles).
- Current equipment age and condition.
- How long ago the damage initiated and how fast it is accumulating.
- Rate of degradation (whether constant, variable, or exponential).
- Expected future operating conditions and degradation mechanisms.
- Maintenance plan
    - Vendor support and spare part availability.

c) Regulatory Compliance Check

The objective is to identify current regulatory gaps and assess the risk taken when operating with the gaps. The gap analysis may give input to an ALARP process(As Low As Reasonably Practicable) to minimise the risk of major accidents and provides insights on the efforts needed to comply with future applicable legislation.

d) Technical Qualification for Life Extension

The objective is to ensure that equipment has safe and reliable operations when operating beyond original design life. This qualification will normally be used by the operator to seek consent and technical assurance for extended design life. In case the technical qualifications do not provide the required assurance, the oil terminal operator should consider decommissioning at end of current design life.

e) Preparing for Obsolescent Equipment

Out-of-date or obsolescent assets and equipment, particularly electrical control and instrumentation equipment can cause problems. The objective of this assessment is to create an overview of equipment where spare parts are no longer available or where vendor support does not exist. The review will propose alternative solutions in order to be prepared when obsolete equipment fails.

f) Estimating Operating Costs for Lifetime Extension

To establish operating costs including the need for modifications into the future, a transparent cost estimation model is required. The cost model should include overhauls, replacements experienced from operations of similar facilities and it should be based on estimations of min/mean/max time for the modification as well as min/mean/max cost for the modification.

2.4.2 Managing assets with undefined operating lifetime

As mentioned earlier, the average estimated design life of a typical process plant is about 25 years. Onshore process plants should be continuously maintained and repaired as soon as ageing of assets is observed by means of a targeted inspection programme, designed and implemented immediately following commissioning. Turnarounds (Maintenance shutdowns) are usually the triggering points to assess the integrity status of critical assets and those with the highest deterioration rate; this periodic "rejuvenation" takes place during so-called "large turnarounds", typically every 3-5 years.

To address the shortcomings of legal / regulatory inspection regimes in the UNECE member countries, the following approach should apply as GIP for oil terminals aiming at sound management of ageing assets to prevent and control major accident hazards.

Oil terminal operators using assets, equipment, instrumentation and infrastructure subject to ageing should adopt a two-steps approach to ensure their continued fitness for purpose: (1) Step 1: Establish an ageing plant inspection regime and (2) Step 2: Implement an asset integrity management system to address ageing assets.

Step 1 – Establish an ageing plant inspection regime

It is recommended to adopt as "red thread" a risk-based inspection approach across the entire ageing plant inspection regime.

The ageing plant inspection regime can be subdivided in four asset categories:

(a) Primary Containment Systems
(b) Infrastructure
(c) Process Safeguards
(d) Electrical Controls &Instrumentation (EC&I systems)

Step 2: Implement an asset integrity management system to address ageing assets

It is vital that there is coordination, leadership, ownership and senior management engagement in the ageing plant inspection regime as described above. The effective management of plant ageing is fundamental to the maintenance of process safety on a high hazard site. As such, it is imperative that the oil terminal operator has a clear understanding of the processes in place to manage the issue and that they monitor their effectiveness. Key elements in this will be the presence of suitable Key Performance Indicators (KPIs) and evidence of commitment from the leadership team to the maintenance of the integrity of plant across the oil terminal. Assuring

that sufficient and competent resources are available to manage plant ageing is also one of the outcomes demonstrating senior management commitment.

The key elements of an asset integrity management system are:

(a) Maintenance Management Plan & Performance Standards
(b) Asset Register, with flagged safety critical assets
(c) Asset Risk Assessment procedures tailored for ageing phenomena
(d) Management of Change
(e) Plant inspections and technical audits
(f) Anomaly & incident reporting and investigation routines
(g) Statistical analysis & trending
(h) Corrective actions and action tracking system
(i) Learning from events
(j) Review

The above-mentioned asset integrity management system can be integrated in the overall OTMS, as described earlier.

3. OPERATIONS

Oil terminals refer to industrial facilities with high potential to large-scale accidents occurrence, due to operations performed, installed equipment, handled or processed hazardous substances and other distinctive features. Technology and equipment accepted during the design and planning stage and implemented during procurement/construction/asset integrity management stage cannot generate emergency situation alone. Various emergency scenarios including large-scale accidents, occur only in the process of industrial activity, i.e. during the operational stage.

Workforce (experts of various specializations and qualification, etc.) is one of the key elements of industrial activity. Operated facility safety status depends much on the personnel actions. Successful personnel performance, causing no emergency situations, depends on systematic approach to oil terminal industrial process safety management.

Subsequent parts of the chapter provide elements of oil terminals safety management.

3.1. Process safety in operations

For managing operating systems and processes that handle hazardous substances a disciplined framework called Process Safety Management is being used in both upstream and downstream oil and gas industries, as is in the chemical industry.

Personal or occupational safety hazards may impact human health by short or long-term exposure to hazardous materials or by accidental damage to individual workers as a result of slips, falls or contacts with machinery or moving objects.

Process Safety hazards, on the other hand, can give rise to more severe consequences or major accidents involving the release of potentially hazardous materials, the release of energy (fires and explosions) or both; they can have catastrophic consequences and may result in multiple fatalities, economic loss, substantial loss to property or severe environmental damage.

Therefore, the oil terminal operator should focus on Process Safety and Process Safety Management, which means orienting resources more towards issues such as safe design, adoption of engineering good practices, process hazards assessments, management of

change, inspection, testing and maintenance of safety critical equipment, effective alarms, effective process controls and training his workforce accordingly, to enable them to better understand and manage process safety hazards.

Process Safety Management involves a particular type of hazards management, identifying and controlling the hazards arising from process activities, such as the prevention of leaks, spills, equipment malfunctions, over-pressures, excessive temperatures, corrosion, metal fatigue, and other foreseeable conditions. Reference can made to the principles defined by the Process Safety Leadership Group (PSLG), 2009[5].)

Oil terminal operators should implement an integrated and comprehensive management system that systematically and continuously identifies process safety hazards, reduces and manages process safety risks, including risk of human error/failure, to finally achieve acceptable levels of risks.

The following sections from this Chapter are considered as GIP for implementing an OTMS oriented towards process safety.

3.2. Leadership and Safety Culture

A poor safety culture has been found to be a significant causal factor in major accidents. The leadership of senior managers, and the commitment of the chief executive, is therefore vital to the development of a positive safety culture.

The following seven elements are considered as essential features for establishing and maintaining a sound process safety culture:

(a) Establish process safety as core value:
The oil terminal operator and the workforce are highly committed to process safety and accept full responsibility for their performance. A strong operational discipline is adopted; as such, there is a strong individual and group intolerance for violations of performance norms.

(b) Enforce high standards of performance:
Management performance standards and workforce expectations are fully understood, while adopting a zero tolerance policy for wilful violations of process safety standards, procedures and rules.

(c) Provide strong leadership:
Oil terminal Leaders act as role model and walk the talk by visible and consistent support for selected process safety programs and established targets. Adequate

[5] The Process Safety Leadership Group is a joint industry and regulators group, set up in the United Kingdom in September 2007 to drive forward high standards in process safety leadership and to complete the implementation of the Buncefield Major Incident Investigation Board's recommendations.

resources are provided to support a high performance level, without creating initiative overloads for leaders and the workforce.

(d) Document the cultural values:
The key principles and practices that characterize the foundation of the company values and beliefs are documented in clear statements and periodically challenged.

(e) Empower employees at all levels:
A positive and trusting work environment is aimed for, while avoiding a blame culture and allowing maximum learning from incidents. The oil terminal operator should encourage effective communication lines and a mutual understanding between management and workforce.

(f) Incorporate process safety in senior management decision-making:

(g) Conduct timely risk assessments:
Process safety programs tend to have a long-term focus and may require higher investments in resources, in comparison with personal safety initiatives. This long-term timespan often needed to achieve results in process safety performance should be well considered when allocating accountabilities and expectations to the oil terminal operator, line managers and supervisors.

3.3. Governance system

The Governance system as described hereafter encloses the management system and controls framework with roles and responsibilities for managing the oil terminal hazards.

3.3.1. Roles and responsibilities

Safe operation and maintenance of the oil terminal requires that there is a system of control at the economic entity in order to meet safety requirements, and in particular it requires reliable human performance at all levels, from managers and engineers to operators and craftsmen.

Clear understanding and definition of roles and responsibilities, and assurance of competence in those roles, are essential to achieve a high reliability of task execution for the control of major accident hazards.

Oil terminal operators should ensure that they have:

(a) Clearly identified the roles and responsibilities of all those involved in managing, performing, or verifying work in the management of major hazards, including contractors and ship operators/crews;

(b) In particular, defined the roles and responsibilities of control room operators (including in automated systems) in ensuring safe fuel transfer operations;

(c) Defined the roles and responsibilities of managers and supervisors in monitoring safety-critical aspects of fuel transfer operations.

Oil terminal operators should ensure that they have implemented a competence management system, linked to major accident risk assessment, to ensure that anyone whose work impacts on the control of major accident hazards is competent to do so.

3.3.2. Staffing and work organisation

Staffing, shift work arrangements and working conditions are critical to the prevention, control and mitigation of major accident hazards.

Oil terminal operators should ensure they can demonstrate that staffing arrangements are adequate to detect, diagnose and recover any reasonably credible hazardous scenario.
Oil terminal operators should develop a fatigue management plan, to ensure that shift work is adequately managed to control risks arising from fatigue.

Oil terminal operators should review working conditions, in particular for control room and field staff, and develop a plan.

Oil terminal operators should provide guidance to ensure safe operations by adopting criteria for minimum staffing of the oil terminal at all times.

3.3.3. Process safety knowledge and competence assurance

Poor process safety knowledge & competence has often resulted in major accidents, due to the fact that it often reflects poor understanding of hazards, failure to properly identify and analyse hazards during the Process Hazard Analysis (PHA), inadequate operator training, inadequate guidance in emergency response decisions and ultimately in poor management decision-making.

The oil terminal operator shall ensure that any person under its control performing tasks that can impact the oil terminal's safety performance are competent on the basis of appropriate education, training and experience, and shall retain associated records.

The oil terminal operator shall identify the knowledge & competence requirements of all individuals working at the oil terminal; subsequently, a competence gap analysis shall be made based on the actual competence availabilities. A risk assessment and prioritisation of training needs is the next step to develop a process safety competence assurance programme.

The oil terminal operator shall develop the competence assurance programme based on insights in safety critical functions, safety critical task inventories and minimum

knowledge, skills and abilities for specified functions, such as control room operators, process operators, design engineers etc.

The oil terminal operator shall provide general risk awareness training and specific process safety training as defined in the training plan to ensure an adequate level of risk competence as addressed in the needs analysis.

The oil terminal operator shall define refresher training frequencies and updates of training needs based upon experience feedback and changes in legislation, to be able to bridge the gap between reality and expectations.

3.3.4. Education and training

The life-cycle approach to oil terminal requires that personnel in a variety of different professions and institutions have a common understanding and knowledge of the technical and managerial aspects, and use complementary professional procedures in their work. This requires a certain level of training (and re-training) of various persons associated with oil terminal, including contractors.

The personnel concerned should be identified along the lifecycle chain.

Personnel working at and responsible for safety of oil terminal should be educated and trained in technology, standards and regulations as well as emergency response.

The inherent uncertainties surrounding all potentially hazardous oil terminals require special skills in risk assessment and management but also in risk communication and reporting.

Training of relevant personnel should include apart from the technical aspects of oil terminal also the “context” subjects that concern related disciplines such as environment, social and financial areas, and the risks for the oil terminal operating staff.

3.3.5. Operating manual

The oil terminal shall be operated and managed on the basis of an Operating Manual (in the meaning as further defined/outlined hereafter) which is developed in the design and planning stage and progressively modified. Its aim is to effectively manage the hazards / risks at the oil terminal.

The Operating Manual should contain as a minimum:
(a) Description of the oil terminal and its environment;
(b) Description of normal operations;

(c) The methodology for hazards identification and risk assessment;
(d) Description of all monitoring procedures (sampling locations, sampling frequency, checklists and compliance parameters;
(e) Procedures for reporting on non-compliance and failures;
(f) Procedures describing how corrective actions are to be applied in case of non-compliance situations;
(g) Emergency preparedness and response;
(h) Performance measurement and compliance assessment, including key performance indicators (leading and lagging indicators);
(i) An overview of applicable legal requirements and other requirements to which the oil terminal subscribes (key stakeholder requirements);
(j) Internal auditing and follow-up;
(k) Management review and continuous improvement.

The oil terminal Operating Manual should include or refer to internal inspection programmes.

3.4. Operating procedures and safe work practices

Operating procedures are those that govern planned activities in a normal sequence of converting raw materials to finished products. Unloading a ship is a typical routine task, described in a procedure and is often associated with a checklist describing the steps to follow.

Safe Work Practices typically control normal operations, hot work, stored energy (lockout / tag out), opening process vessels or lines, confined space entry and similar non-routine operations. Non-routine work such as the simple removal of a pressure safety valve increases the risk level significantly and can directly lead to conditions that make a catastrophic accident more likely. Safe Work Practices are therefore critical in managing major accident hazards.

a) Operating Procedures

The oil terminal operator should establish a task list for all routine tasks with the intent to screen those with a high risk potential. Consequently, a task-based risk assessment is recommended for each of the high risk tasks. Controls should be defined to reduce the risk to an acceptable level. The need for an operating procedure as control measure for a specified high risk task is decided by the assessment team.

The oil terminal operator should consider all operating modes in the task list, including normal and abnormal working conditions such as temporary shutdown, shutdown for

annual maintenance, emergency shutdowns, initial start-up, preparing equipment for maintenance, decommissioning of a unit etc.

The oil terminal operator should put emphasis on pre-start-up safety reviews (PSSR) as these reviews provide a high degree of safety when conducted in a comprehensive and professional manner.

The oil terminal operator should ensure an adequate level of detail in the operating procedures, and therefore address concise instructions where relevant: including Safe Operating Limits and consequences of deviation from these safe limits (also referred to as "operating windows") are considered GIP.

The oil terminal operator should consider developing written procedures to control temporary or non-routine operations.

The oil terminal operator should hold their workforce accountable for consistently following the operating procedures and ensure that they are periodically reviewed.

b) Safe Work Practices for non-routine tasks

The oil terminal operator should define when and where safe work procedures apply. Typical applications are these non-routine tasks which involve several parties, usually the owner of the equipment and the crew assigned to do a certain job, either by own maintenance staff or by subcontractors. A short non-limitative list is given hereafter to clarify the type of work that usually requires safe work practices:

(a) Lockout/tag-out for control of energy hazards;
(b) Line breaking/opening of process equipment;
(c) Confined space entry;
(d) Lifting over process equipment;
(e) Excavation in or around process areas;
(f) Temporary bypassing of interlocks.

The oil terminal operator is responsible for providing adequate training to all oil terminal employees and contractors involved, respectively the party responsible for issuing work permits and those who execute the work.

The oil terminal operator ensures that access controls to highly hazardous areas are in place.

c) Shift Handover

Transfer of hazardous materials into storage tanks frequently continues across shift changes, and there is little doubt that unreliable communications about plant or

transfer status at shift change could potentially contribute to a tank overfill. It has been a contributory factor in several previous major accidents.

Oil terminal operators should set and implement arrangements for effective and safe (recorded) communication at shift and crew change handover. Oil terminal sites should include a summary of the arrangements for effective and safe communication at shift and crew change handover in the Safety Report/Declaration.

3.5. Management of change

Effective Management of Change, including organisational change as well as changes to plant and processes (further denoted as technical change), is vital to the control of major accident hazards.

Oil terminal operators should establish a Management of Change system which allows for properly reviewed and authorized change requests, including risk assessments and risk controls appropriate to the proposed change. The following practices are considered as GIP for managing technical and organisational change in an industrial facility:

a) *Management of Technical Change*

Oil terminal operators should adopt and implement management procedures for planning and controlling of all changes in plant, processes and process variables, materials, equipment, procedures, software changes, design or external circumstances which are capable of affecting the control of major accident hazards.

Oil terminal operators should ensure they have suitable guidance for their staff about what constitutes a plant or process change, and that they have suitable arrangements in place for management of the range of permanent, temporary, and urgent operational changes.

b) *Management of Organisational Change*

Oil terminal operators should ensure that there is a suitable policy and procedure for managing organisational changes, including a risk assessment to evaluate the likely consequences of the change.

Oil terminal operators should take appropriate measures for retention of corporate memory.

Oil terminal operators should ensure that they maintain an adequate level of technical competence to manage major accident hazards. The oil terminal operator should remain capable of assessing the impact of work subcontracted or outsourced.

3.6. Good Industry Practices (GIP) for transport and storage of hazardous materials

Due to the specific activities in oil terminals a set of Principles and GIP is compiled together for transport and storage of hazardous materials:

a) Principles for safe transfer management

Oil terminal operators involved in the transfer and storage of hazardous material should adopt good practice principles for a safe transfer management.

Oil terminal operators involved in the transfer and storage of fuel should review 'job factors' to facilitate safe fuel transfer. This would normally be via written (and periodically trained) operating instructions for all oil terminal operations.

b) Operational Planning

Human factors issues are important at various safety-critical stages in transfer operations including operational planning. Oil terminal operators that are receivers or senders of hazardous material should develop procedures for successful planning and review them with their senders/receivers and all appropriate intermediates.

c) Operational Controls

The following operational controls apply for areas where hazardous substances are used / stored:

(a) Oil terminal operators should ensure the ready availability of a list of all hazardous substances in their facilities, with safety-related information. This includes an updated inventory of actual storage amounts in the tanks.

(b) Areas are clearly marked, properly supervised, and regularly inspected

(c) Stakeholders in the vicinity of the oil terminal should share information and experience related to flammable and other hazardous chemical materials safety. Oil terminal operators should coordinate with ship's masters and the individuals responsible for other transport modes (e.g. pipelines) to ensure that all relevant regulations and codes are followed for the proper transfer and storage of hazardous substances.

Oil terminal operators should address the following basic safety requirements:

(a) All functional units of an oil terminal have to be secure, enclosed, stable and sufficiently resistant against mechanical, thermal and chemical influence (primary safety);

(b) Leak proof and a durable secondary containment should be provided for all tanks loading and unloading stations and pipe tracks;

(c) Leakage of substances which are hazardous to the environment must be detected in time with reliable devices, retained and properly treated or disposed of. This practice is also relevant for any resulting waste.

Oil terminal operators should regularly monitor the oil terminal (e.g. capacity, groundwater level, functioning of the drainage system, surface water diversion).

d) Principles for Consignment of Transfer Agreements

The sender is primary responsible for the safe transfer of the agreed consignment quantity to the receiving storage.

The following principles apply to all modes of transfers where separate parties control: the supply of material to a tank or tanks; and the tank or tanks. This includes, for example, transfers between sites belonging to one business. It does not apply to transfers where a single person or team controls both 'ends' of the transfer, although an equivalent standard of control is necessary.

Oil terminal operators involved in inter-business transfer should agree on the nomenclature to be used for their product types.

e) Procedures for the Transfer of Hazardous Materials

Procedural problems are frequently cited as the cause of major accidents. In the major hazard industries, fit-for-purpose procedures are essential to minimize errors and to protect against loss of operating knowledge (e.g. when experienced personnel leave).

Oil terminal operators should ensure that written procedures are in place, and consistent with current good practice, for safety-critical operating activities in the transfer and storage of fuel.

f) Communications during Transfer Activities

When transferring from e.g. a pipeline or ship, the oil terminal operator should have arrangements in place to ensure the receiving installation (e.g. storage tank) has ultimate control of transfer and tank filling.

The receiving installation control should be able to safely terminate or divert a transfer (to prevent loss of containment or other dangerous conditions) without depending on the actions of a remote third party, or on the availability of communications to a remote location. These arrangements will need to consider upstream implications for the pipeline network or ship.

Events such as level alarm activation should be communicated rapidly to the receiving and sending facility control to avoid the loss of containment and potential problems upstream.

3.7. Management of abnormal situations

Management of abnormal situations often depends on the effectiveness of dealing with large number of alarms centralised in a control room environment when equipment failures are observed. A different type of abnormal situation which is relevant to oil terminals is dealing with large numbers of contractors on-site during a large turnaround (large stop of activities for maintenance, repair and inspection work).

a) Alarm Management

Increased automation provides a relatively calm operating scenario when the plant is in a steady state. However, given the importance of alarms in times of upset, the display of alarm information has to be given high priority. Even if there are relatively few alarms on the system and the system is not a distributed control system (DCS) the same principles apply, to ensure a reliable response to alarms.

- Oil terminal operators should proactively monitor control systems, such as the tank gauge system, so that designated level alarms sound only in situations requiring a response from oil terminal staff.

- Oil terminal operators should ensure that their control room information displays, including human-computer interfaces and alarm systems, are reviewed in relation to recognised GIP.

- Where reasonably practicable, oil terminal operators should put plans in place to upgrade control room information displays, including human–computer interfaces and alarm systems, to recognized GIP.

- Oil terminal operators should ensure that modifications or development of new control rooms or human–computer interfaces comply with recognised GIP both in their design, and their development and testing.

b) Contractor / Turnaround Management

Oil terminal operators should implement specific controls when preparing for a large turnaround (e.g. maintenance shutdown) which usually involves large number of contractors working at the facility. Turnaround Management should therefore be done according to standards and GIP as applicable in the refining industry.

In addition to the basic requirements on selection and evaluation of contractor performance (ref. para 54 of Part 1), the following additional requirements are considered as GIP for managing contractors:

(a) Classify the selected contractors as High / Medium / Low Risk Contractors, based on well-defined criteria and define controls appropriately;

(b) Designate oil terminal contractor coordinators for the High & Medium Risk Contractors;

(c) Organise pre-job meetings with High & Medium Risk Contractors;

(d) Ensure that competence requirements are met at all times for the High & Medium Risk Contractors; conduct periodical compliance checks and involve them as much as possible in the oil terminal training programmes.

3.7.1. Incident/Accident investigation and reporting

As technical systems have become more reliable, the focus has turned to human causes of accidents. The reasons for the failure of individuals are usually rooted deeper in the organisation's design, decision-making, and management functions.

Oil terminal operators should ensure they have suitable procedures for:

(a) Notification and reporting of incidents/accidents and near-misses to the competent authorities;
(b) Identifying incident/accident/near miss potential;
(c) Investigating according to the identified potential;
(d) Identifying and addressing both immediate and underlying causes;
(e) Identify lessons learned;
(f) Tracking of remedial actions;
(g) Evaluating the effectiveness of corrective / preventive actions.

Oil terminal operators should make periodically statistical evaluations of trends in root causes and other system errors and take adequate measures to avoid recurring incidents/accidents.

3.7.2. Performance monitoring and compliance assurance

Measuring performance to assess how effectively risks are being controlled is an essential part of the OTMS.

Proactive monitoring provides feedback on performance before an accident or incident (e.g. leading key performance indicators), whereas reactive monitoring involves identifying and reporting on incidents to check the controls in place, identify weaknesses and learn from mistakes (leading and lagging performance indicators).

Oil terminal operators should ensure that a suitable active monitoring programme is in place for key systems and procedures for the control of major accident hazards.

Oil terminal operators should develop an integrated set of leading and lagging performance indicators for effective monitoring of process safety performance (API 754 Process Safety Performance Measurement for the Refining and Petrochemical Industries.).

Oil terminal operators should establish and maintain procedures for testing and calibrating instruments and equipment which is considered safety-critical for a safe operation, and shall maintain records of calibration and maintenance activities thereof.

Oil terminal operators should establish and maintain procedures for periodically evaluating compliance with applicable legal requirements and other commitments to which it adheres.

Oil terminal operators should keep records of the results of the periodic compliance evaluations.

3.8. Records management

The oil terminal operator should define which records are necessary to demonstrate legal compliance and compliance to other commitments to which the oil terminal subscribes, in addition to conform to the requirements of its OTMS.

Oil terminal operators should identify those records needed for the periodic review of the effectiveness of control measures, and for the root cause analysis of those incidents and near misses that could potentially develop into a major incident.

The oil terminal operator should maintain the abovementioned records and establish the duration and location of storage for reasons of traceability and easy retrieval.

Retention of relevant records is also necessary for the periodic review of the effectiveness of control measures, and the root cause analysis of those incidents and near misses that could potentially have developed into a major incident.

3.9. Audits and Management Reviews

Audits and reviews should be performed at all stages of the lifecycle of the Oil terminals, incl. to the routine monitoring of performance (i.e. active monitoring).

3.9.1. Audits

The oil terminal operator should carry out periodic audits of the OTMS, the MAPP and the Safety Report/Declaration as a normal part of its business activities.

An audit is a structured process of collecting independent information on the efficiency, effectiveness, and reliability of the total OTMS. It should lead to a plan for corrective action. Intervals between audits should not exceed 3 years.

Oil terminal operators should adopt and implement audit plans defining:

(a) The areas and activities to be audited, with a particular focus on process; safety/control of major accident hazards;
(b) The frequency of audits for each area covered;
(c) The responsibility for each audit;
(d) The resources and personnel required for each audit;
(e) The audit protocols to be used;
(f) The procedures for reporting audit findings; and
(g) The follow-up procedures, including responsibilities for implementation.

Oil terminal operators should ensure that they have implemented suitable arrangements for a formal review of the suitability of the OTMS and effectiveness of controls of major accident hazards, including:

Feedback of audit findings should be within e.g. 1 month of the audit to all parties including management and staff at the oil terminal. Corrective actions need to be covered in follow-up reviews scheduled within 1 year of the audit.

3.9.2. Management reviews

Reviews are responsibility of the management of the oil terminal. They need to take account of information generated by the measuring (active and reactive monitoring) and auditing activities, and how to initiate remedial actions.

The requirements for audit and review are well established. The main issue is to ensure that process safety is adequately included in audit and review programmes.

(a) The areas and activities to be reviewed, with a particular focus on process safety/control of major accident hazards;
(b) The frequency of review (at various levels of the organisation);
(c) Responsibility for the reviews;
(d) The resources and personnel required for each review;
(e) Procedures for reporting the review findings; and
(f) Arrangements for developing and progressing improvement plans

3.10. Learning from experience

The management review should form the basis for providing an effective feedback mechanism.

The oil terminal operator shall consider the past performance to learn from observed deviations, near-misses and accidents occurred as part of its commitment to continual improvement.

A policy statement should be established by the oil terminal operator which sets a framework to demonstrate its commitment towards management of the major accident hazards to acceptable levels and towards performance improvement and legal compliance.

3.11. Maintaining the integrity and reliability of assets

ITPM practices should be in place to help ensure that equipment is fit for service at commissioning and remains fit for service throughout its lifetime.

3.11.1. Inspection, testing and preventive maintenance (ITPM) during operations

To ensure that the assets of the oil terminal remain fit for purpose during the entire operations stage, the oil terminal operator should establish an ITPM plan and clearly define ITPM tasks. The following ITPM activities are considered as GIP:

(a) Storage tanks and the mechanical equipment attached should be maintained to GIP (e.g. API 653), represent relevant good practice and should form the basis of minimum industry standards for tank integrity management and repair to prevent loss of primary containment

(b) Inspection and Testing:

i. Oil terminal operators should have a process for determining the scope of the asset integrity program and frequency of inspection and testing. This includes the storage and transfer hardware facilities, measurement and control systems, emergency response equipment, communications, security controls.

ii. Inspection and testing should include the operator training programmes, emergency response procedures and liaison with emergency services and the local community during emergencies.

iii. Inspection and testing shall be done regularly: The methods will typically be Non Destructive such as Ultrasonic, X ray, Magnetic Particle, etc. and should be carried out to methods and frequency set out by industry standards organisation or based on the assessed risk.

iv. Oil terminal operators should establish and implement procedures for inspecting and calibrating safety critical equipment and instruments, and keep records thereof. Inspection and testing should apply to all equipment such as piping, valves, pumps, and emergency equipment such as fire pumps and fixed and mobile fire fighting equipment.

v. Control and safety instrumentation (level, pressure, temperature) should be comprehensively tested (whole loop – field sensor, logic solver and final element) in accordance with normal industry practice and standards (such as IEC standard 61511).Where the system is protected by alarms, testing should include the operator response, recognising the need to understand an alarm and the time need to respond and correct the hazardous state.

vi. Condition monitoring is done according to the planned schedule and deviations or overdue ITPM tasks are monitored and followed up.

vii. ITPM tasks are conducted by trained and qualified individuals using approved methods /procedures.

viii. Repair work should be done in conformance with design codes, agreed engineering standards and considering manufacturer's recommendations, as applicable.

ix. A spare parts management plan should be applied to ensure timely availability of critical spare parts.

x. A mechanism should be in place to correct deficiencies and to apply the lessons learned from deviations or near miss incidents to other equipment / systems.

3.12. Hazard management during operations

Typically, risk assessments as described in the section on Safety Report/Declarations also apply during the Operations Stage.

Task-based risk assessments are often used for all routine tasks while Job Safety Analyses and Pre Start-up Safety Reviews are being used for more complex and non-routine tasks such as safe start-ups after shutdown and specific maintenance activities.

Expert safety reviews, Process Hazards Analysis, legal compliance checks and due diligence reviews are being used for life extension considerations, closure and decommissioning activities.

3.13. Emergency preparedness and response

OT operators have to be aware that leakage into receiving waters can cause far-reaching and often trans-boundary damages. Therefore, emergency preparedness has to be in place and suitable response equipment must be installed

For emergency preparedness it is essential to have early warning and alert systems in place. Early Warning Systems imply a double requirement:

3.13.1. Warning and alert systems

- a suitable *organization:* distribution of the measuring devices, involving a network of stations linked one another, etc.), and
- a suitable technical equipment for *event detection* and *assessment of warning and alert relevance*.

Early warning systems should be set up by the operator at the oil terminal and the state bodies for the whole river catchment.
These Early Warning Systems are often integrated in International Warning- and Alarm Plans established by International River Commissions.

At oil terminal, a continuous „online monitoring“ should be set up and adjusted to different alarm levels. These alarm levels have to be agreed with the competent authorities and should be in line with the respective threshold levels of International Alarm plans (i.e. Rhine, Maas, Danube).

For scenario-calculations regarding a discharge, established flow time-modelling should be used (i.e. Rhine-model, ALAMO).

3.13.2. Emergency response equipment / installation

The oil terminal operator should identify the emergency needs based on risk assessments of major accident scenarios; the Safety Report/Declaration should be used as guidance document.

For preparedness to potential accidents, the following emergency response equipment should be in place and operational:

(a) Fire protection:
Fire water sources (Storage tanks, City water supplies, harbour water), Fire pumps, Sprinkler Systems, Fire Fighting Foam systems, Deluge systems, Steerable Deck Monitor nozzles (with or without foam injection). Also portable equipment, like fire trucks/pumpers, Fire Hoses, Portable Monitors, Fire extinguishers
(b) Personal Protective Equipment
(c) Emergency Power supply;
(d) Hazard Detection systems: gas & fire detection equipment;

(e) Emergency & Rescue Equipment for potential Human and/or Environmental Damages.
(f) Fire Water Retention Basins
(g) Fixed/Passive protection system (storm-water basin, firewall, dike, etc.)

3.13.3. Emergency teams

The oil terminal operator should ensure that an Emergency team is established which is capable of responding to the defined major accident scenarios. The Emergency Team should comply as a minimum to the applicable legal requirements.

The oil terminal operator should ensure that training programmes are organised and executed based on a needs assessment, and compliant to legal requirements.
Everybody involved in Emergency Management should be trained and drills be given. Consequently, by definition, everybody at the plant and in particular those with a key role, from the security guard to the top manager.

The oil terminal operator should ensure that an adequate number of emergency drills are executed, which corresponds as a minimum to applicable legal requirements.
The competent authorities may require specific scenarios to be tested jointly with other Emergency Teams located in the same region. A yearly test should be envisaged.

A system should be in place to evaluate the adequacy of the emergency team's capability to deal with the major accident scenarios.

4. CLOSURE AND DECOMMISSIONING

The features dominating the decommissioning activities are the pollution prevention and control requirements). This requires establishing a Decommissioning Plan for both existing and new industrial facilities in order to prevent or minimise pollution to the environment. A distinction is made between temporary closure and final decommissioning.

4.1. Temporary closure ("preservation")

The industrial facility can be considered for temporary closure, partly or completely, when there is insufficient fuel demand / raw material supply, in case of poor market conditions or due to other economic reasons. The following considerations are recommended as GIP during this de-activation phase, also denoted as "mothballing" or "hibernation phase". This hibernation phase is typically about 1 year and should not last longer than 3 years, after which re-activation or decommissioning should take place.

The oil terminal operator shall develop a Temporary Closure Plan, considering at least the following issues:

(a) The closure will not cause adverse environmental impacts or imminent threat to human health at the site;
(b) The closure will not cause significant harm or significant burden on public facilities and other plants or land areas adjacent to this industrial facility;
(c) Existing components and waste are properly disposed of and harmlessly utilized or destroyed without harm.

It should be clear that a temporary closure is not a site abandonment. Before undertaking any work on temporary closure, the oil terminal operator should agree with the competent authority on surveillance of the Temporary Closure Plan, which covers following recommendations:

(a) The parts of the oil terminal containing substances hazardous to water must be drained, decontaminated and if necessary inactivated with a substance not hazardous to water (e.g. water or nitrogen);
(b) All piping must be separated from storage tanks and cisterns and tightly flanged;
(c) All storage tanks and piping left in situ should be cleaned and inerted for mothballing with inert gas or hydrophobic foam, as applicable;
(d) Devices showing leakage must remain under control / supervision;
(e) All parts of the industrial facility that are temporarily closed must be protected against illegal use;

(f) It is considered unacceptable to store drums with substances hazardous to water. If this is impossible/not cost effective due to the temporary closure – it is necessary to comply with the relevant recommendations of international river commissions. These warehouses with drums should not be considered as a closed industrial facility;
(g) Those parts of the oil terminal that are temporarily closed and located at areas prone to floods, should be protected in accordance with international River Commissions' recommendations for flood protection;
(h) Before re-activation of the mothballed facility or parts of the industrial facility, it should be inspected in accordance with the recommendations of River Commissions and other recommendations, as applicable. The conditions for re-activation should be reflected in the Temporary Closure Plan.

4.2. Final Decommissioning

Decommissioning means the permanently taking out of service of the plant or industrial facilities. Decommissioning includes dismantling, demolition & disposal of terminal buildings and infrastructure and last but not least dealing with the potential liabilities associated with the partial closure or complete cessation of the oil terminal activities.

Oil terminals shall be closed:
(a) If the relevant conditions stated in the permit have been met and continued operations through lifetime extension are not justifiable from an economic viewpoint;
(b) At the substantiated request of the operator, after authorization of the competent authority; or
(c) If the competent authority decides for obvious and justified reasons (e.g. observed environmental damage or notified imminent threat of such damage).

When designing new industrial facilities it is important to anticipate on the decommissioning activities and to incorporate them in the design and planning stage; the so-called "design for decommissioning" principles are recommended as GIP for new facilities / plants (see also Chapter 1.5.1.).

4.2.1. Obligations of the oil terminal operator prior to decommissioning

(a) Regulatory Framework:
It is vital to identify all the legal requirements as early as possible in the design and planning stage and to make contact with the appropriate authorities to understand their requirements. Besides the relevant international legislation, the oil terminal operator should identify the applicable regional and national legislation and compile an overall Regulatory Framework related to decommissioning issues.

(b) Notifications:

Appropriate notifications need to be made to different local and national authorities when decommissioning activities are planned. Additional pollution prevention measures or remediation can be required depending on the planned future uses of the land.

(c) Environmental Liability:
Upon definitive cessation of the activities, the oil terminal operator shall assess the state of soil, waters& groundwater contamination by relevant hazardous substances used, produced or released as a result of the terminal operations and compare this with the "baseline conditions".

The oil terminal operator should apply sound risk assessment procedures to establish the actual environmental situation and level of significance of the pollution of soil and groundwater at cessation of its activities.

In case of significant environmental damage resulting from the oil terminal operations or in case of an imminent threat of such damage, the oil terminal operator shall adopt measures and develop practices for remediation of land damage and to minimise the risks of environmental damage, aiming at reaching the baseline condition (return the site to the state described in the baseline report).

It is worth noting that international legislation do not prevent member countries from maintaining or adopting more stringent provisions in relation to the prevention and remedying of environmental damage.

Best Available Technologies ("BAT's"), when applicable, should be incorporated by the competent authority in the operating permit. The permit should also include emission limit values for polluting substances, or equivalent parameters or technical measures, appropriate requirements to protect the soil and groundwater and monitoring requirements.

4.2.2. Obligations of the oil terminal operator during decommissioning

The oil terminal operator is bound to adopt general SHE guidelines for prevention and control of community health and safety impacts that may occur at the end of the oil terminal lifecycle, including decommissioning.

The key topics to address and for which procedures and best practices should be in place relate to mitigation of adverse impacts and prevention of safety incidents:

(a) Noise and vibration (e.g. during earth moving, use of excavation equipment, cranes and transportation of materials and people);

(b) Soil erosion (e.g. by exposure of soil surfaces to rain and wind during earth moving and excavation activities); this may mobilise and transport sediment /soil particles which in turn may impact the quality of natural water systems;
(c) Air quality (decommissioning activities may generate emission of fugitive dust, uncontrolled release of asbestos fibres and other hazardous materials);
(d) Hazardous materials (release of petroleum based products such as lubricants, hydraulic fluids, PCB's, oil etc. during storage, transport or use in equipment, spill clean-up material etc.),
(e) Solid waste (release of non-hazardous materials such as scrap and cement building materials),
(f) Exposure to occupational health and safety hazards (e.g. ergonomic injuries during manual handling, slips and falls, work at height, struck by objects, moving machinery, confined spaces and excavation, traffic).

In addition, the oil terminal operator is responsible for maintaining 3 key activities up and running:

(a) The implementation of the Closure Plan
(b) Depending on outcome of the environmental risk assessment and degree of environmental damage caused, the oil terminal shall take the necessary actions aimed at the removal, control, containment or reduction of relevant hazardous substances, so that the site, taking into account its current or approved future use.
(c) Environmental monitoring and reporting as defined in the permit and the outcome of the environmental risk assessment (e.g. storage tank emissions to air & water, effluent discharges, groundwater monitoring and waste disposal).

4.2.3. Obligations of the oil terminal operator after decommissioning

After an oil terminal site has been closed, the operator remains responsible for monitoring, reporting and corrective measures until the site is returned to the satisfactory state as described in the environmental baseline report.

The oil terminal operator should also be responsible for sealing the oil terminal industrial facility and removing the facilities. The above obligations shall be fulfilled on the basis of a post-closure plan designed by the oil terminal operator based on GIP. A provisional post-closure plan shall be submitted to the competent Authority.

Prior to the final closure of the oil terminal site, the provisional post-closure plan should be:
(a) Updated as necessary, taking account of the risk analysis outcome, GIP and technological improvements;
(b) Submitted to the competent authority for its approval; and
(c) Approved by the competent authority as the definitive post-closure plan (final decommissioning).

The approved definitive post-closure plan is considered as the formal transfer of responsibility from the oil terminal operator to the competent authority. The competent authority should then be responsible for further monitoring and corrective measures, considering the future destination of the oil terminal site.

4.3. Hazard Management during Decommissioning

Expert safety reviews, Process Hazards Analysis, legal compliance checks and due diligence reviews are being used for life extension considerations, closure and decommissioning activities.

PART 3 – SOURCES AND FURTHER READING

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