UNECE

Safety Guidelines and Good Industry Practices For Oil Terminals

UNITED NATIONS

UNITED NATIONS ECONOMIC COMMISSION FOR EUROPE

SAFETY GUIDELINES AND GOOD INDUSTRY PRACTICES FOR OIL TERMINALS

UNITED NATIONS
NEW YORK AND GENEVA, 2015

Note:

Symbols of United Nations documents are composed of capital letters combined with figures. Mention of such a symbol indicates a reference to a United Nations document.

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries.

This volume is issued in English and Russian only.

ECE/CP.TEIA/28

Authors:
Frank Candreva (Det Norske Veritas Germanischer Lloyd, Oil and Gas, Belgium)
Eddy De Rademaeker (European Federation of Chemical Engineering, Belgium)
Richard Gowland (European Process and Safety Centre, United Kingdom of Great Britain and Northern Ireland)
Alexey Isakov (GCE Group, Russian Federation)
Andy Roberts (United Kingdom Petroleum Industry Association)
Gerhard Winkelmann-Oei (German Federal Environment Agency)

Reviewed by:
Secretariat to the United Nations Economic Commission for Europe
Convention on the Transboundary Effects of Industrial Accidents

Cover photo : © Shutterstock
Layout & Design : © Zoï Environment Network

FOREWORD

Oil terminals store large amounts of hazardous substances and so can pose a serious threat to people and the environment, especially in the case of improper design, construction, management, operation or maintenance. An accident at an oil terminal may result in uncontrolled spills, fires and explosions, potentially leading to the loss of human life or to a major environmental catastrophe. The devastating effects on humans and the environment of such incidents, as well as their far-reaching and severe consequences, have been demonstrated by several major accidents in the United Nations Economic Commission for Europe (ECE) region in the past years.

Since the early 1990s ECE has committed itself to the prevention of, preparedness for and response to industrial accidents, especially those with transboundary effects. The 1992 ECE Convention on the Transboundary Effects of Industrial Accidents (Industrial Accidents Convention) helps to protect people and the environment by preventing such accidents, as far as possible, by reducing their frequency and severity and by mitigating their effects.

The effective and safe storage and distribution of oil products present technical and environmental challenges, while remaining essential for economic activity. As each facility is unique, a tailor-made and comprehensive approach is needed to ensure that oil terminals are operated in a safe, environmentally sound and economic manner. This should also be seen in the light of climate change, which may increase the probability of industrial accidents caused by natural disasters. Flooding can pose a major risk to oil terminals, in particular those located in the flood plains of major international rivers.

In response to the need to improve the safety of oil terminals, ECE member countries decided to develop safety guidelines and good practices for oil terminals within the framework of the project on hazard and crisis management in the Danube Delta, under the auspices of the Convention's Assistance Programme. The safety guidelines were developed by an international expert group and have been subject to consultations with international organizations, ECE member countries, operators of oil terminal facilities, financing institutions and non–governmental organizations. The Conference of the Parties to the Industrial Accidents Convention recommended the use of these guidelines by the ECE member countries during its last meeting in Geneva in December 2014.

I hope that these guidelines will be useful in supporting policymakers, oil terminal operators and the public in enhancing awareness and the implementation of good practices, procedures, safety standards and approaches to technical and organizational safety throughout the life cycle of oil terminals.

I look forward to the successful implementation of the guidelines across the ECE region, in particular by the Parties to the Industrial Accidents Convention and other countries in the region, so as to limit the number of incidents at oil terminals and the severity of the possible consequences for human health and the environment.

Christian Friis Bach

Executive Secretary
United Nations Economic Commission for Europe

ACKNOWLEDGEMENTS

These Safety Guidelines and Good Industry Practices for Oil Terminals were developed under the United Nations Economic Commission for Europe Convention on the Transboundary Effects of Industrial Accidents. This publication would not have been possible without the generous contribution by the authors and the experts listed below. The international expert group established to elaborate the safety guidelines was chaired by Mr. Gerhard Winkelmann-Oei, German Federal Environment Agency. The funding provided by the German Federal Environment Agency is greatfully being acknowledged.

Comments and additional input have been provided by the following experts/organizations: Ionel Andreescu (Danube Logistics); Eric Berger (TOTAL, France); Michael Bloom (Provincial Office for Agriculture, Environment and Land-Use Planning, Itzehoe, Germany); Jean des Déserts (French Union of the Petrol Industries, France); Peter Frijns (Ministry of Infrastructure and Environment, Netherlands); Mark Hailwood (State Office for the Environment, Measurements and Nature Conservation of the Federal State of Baden-Württemberg); Gerd Hofmann (Regional Council Darmstadt, Germany); Martin Merkofer (Federal Office for the Environment, Switzerland); Jill Michielssen (European Union); Alexander Moskalenko (GCE Group, Russian Federation); Johanna Suikkanen (United Nations Environment Programme); Emilia Wahlstrom (United Nations Environment Programme/United Nations Office for the Coordination of Humanitarian Affairs Joint Environment Unit).

CONTENTS

LIST OF ACRONYMS

ADN	European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways
ADNR	Regulations for the Carriage of Dangerous Goods in the Rhine
ALARP	As low as reasonably practicable
API	American Petroleum Institute
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ATEX	Explosive Atmospheres
BAT	Best available techniques/technologies
DIN	German Institute for Standardization (Deutsches Institut für Normung)
ECE	United Nations Economic Commission for Europe
EIA	Environmental impact assessment
EU	European Union
GIP	Good industry practices
HIRA	Hazard identification and risk assessment
IEC	International Electrotechnical Commission
ITPM	Inspection, testing and preventive maintenance
MAPP	Major-accident prevention policy
OTMS	Oil terminal management system
RP	Recommended Practice (of the API)

INTRODUCTION

The 1992 United Nations Economic Commission for Europe (ECE) 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, to 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 its member countries (without Ireland and Malta): Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Kazakhstan, Monaco, Montenegro, Norway, Republic of Moldova, 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 Parties in Eastern and South-Eastern Europe, the Caucasus and Central Asia in implementing the Convention.

In 2010 an Assistance Programme project to improve hazard and crisis management in the Danube Delta was set up in the Republic of Moldova, Romania and Ukraine. When analyzing the risk potential of hazardous installations in these 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 Delta. In order to improve risk management within and between the three countries in the Danube Delta, 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 may also be present at oil terminals in the entire ECE region, in March 2012 an international expert group was established under the Convention to elaborate safety guidelines to assist authorities and operators in ensuring an adequate level of safety at such facilities and to harmonize safety standards for oil terminals across the region.

At its first meeting, the expert group analyzed the rationale and need for the development of the current guidelines. Aware that failures and incidents at oil terminal facilities may have far-reaching consequences for the environment and human health, the expert group highlighted 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 See Oil Tanker Spill Statistics, online document available from the International Tanker Owners Pollution Federation (http://www.itopf.com/information-services/data-and-statistics/statistics/index.html#no_).


93
78
РОСНЕФТЬ

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 if the company had invested to ensure a proper level of safety to prevent 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 are too focused on particular technical elements. The ECE 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, structured 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 ECE member countries during a workshop on the safety of oil terminals, held in September 2013 in Odessa, Ukraine. The present version of the safety guidelines benefited from that discussion, and also includes comments from international organizations and ECE member countries. The Conference of the Parties to the Industrial Accidents Convention took note of the safety guidelines at its eighth session (Geneva, 3–5 December 2014) and recommended their use by ECE member countries.

OBJECTIVE AND SCOPE

These Safety Guidelines and Good Industry Practices for Oil Terminals are designed to prevent incidents at oil terminal facilities and to limit the consequences for human health and the environment should they occur. They are based extensively on accepted and published good practice procedures to ensure conformity with international standards.

These guidelines and good 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 ECE Industrial Accidents Convention. They can also be used for oil terminals with lower quantities of hazardous substances.

The guidelines are intended for application at land-based oil terminals. However, while off-shore terminals are not within 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, functioning either 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 and flammable liquids.

The guidelines and good practices described herein are derived from operational industry experience. This includes learning from history and the details of past major accidents, as well as the remedial and prevention measures designed to prevent their recurrence.

These guidelines recognize that various safety standards may already be in place worldwide, as well as different approaches to safety with regard to cargo, modes of transport and transport interfaces. However, a comparable level of major-accident prevention should be achieved for both existing 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 their scope, 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 organization 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 areas within its jurisdiction.
Domino effects 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.
Good industry practices	Any direct or indirect, immediate or delayed adverse consequences caused by an industrial accident on, inter alia: (a) Human beings, flora and fauna; (b) Soil, water, air and landscape; (c) The interaction between the factors in (a) and (b); (d) Material assets and cultural heritage, including historical monuments.
Incident	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.
Near miss	An undesired event which could ("near miss") or does result in unintended harm or damage ("accident").
Oil terminal	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 terminals within the meaning of the present guidelines are facilities for storing oil and their derivatives (e.g., such as naphtha, 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/ declaration	A written document setting out the hazards identified at the oil terminal, as well as the measures taken for their control, as proof of the installation's safe equipment, operation and management.
Stakeholder(s)	Any individual, group or organization that is involved, interested in, or potentially affected by the oil terminal activities.
Transboundary effects	Serious effects within the jurisdiction of a Party to the Industrial Accidents Convention 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 their life-cycle stages.

2. The operators of oil terminals have the primary responsibility for ensuring the 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 these should be compatible and regularly tested and updated. The 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 that pose a potential risk to neighbouring countries, the concerned ECE member countries should inform each other of their emergency plans, 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: (a) notify potentially affected Parties of hazardous activities (art. 4); (b) inform each other of their contingency plans (art. 8); and (c) to draw up, where appropriate, joint contingency plans to facilitate joint response (art. 8).

6. For oil terminals that pose a potential risk to neighbouring communities and land users due to their size or the presence of hazardous substances, the provision of information to and involvement of these communities and land users should be ensured for the purpose of drawing up an off-site emergency plan.

7. For the siting and intended post-operational land use of new major oil terminals, as well as proposed significant developments around existing oil terminals, the provisions of article 7 of the Industrial Accidents Convention have to be applied. It is important to ensure that the public is given an 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 1998 ECE Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters and the 1992 ECE Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention) 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 and chambers of commerce) regarding good practices, the improvement of oil terminal safety, 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 for the competent authorities and oil terminal operators in ECE member countries, as well as and key elements for taking action, in order to ensure a basic level of safety at oil terminals.

10. For the Parties to the ECE Industrial Accidents Convention, including the EU, the need to take actions can be derived from their obligations under the Convention as well as from national legislation, which generally includes a "General Duty Clause", ensuring that owners/operators of hazardous installations have the responsibility for the safe operation of their installations.[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 efforts already made at the international level to avoid unnecessary duplication.

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.

2 For further information about the General Duty Clause see A Flexible Framework for Addressing Chemical Accident Prevention and Preparedness: A Guidance Document (Paris: United Nations Environment Programme, 2010), available from http://www.unep.org/resourceefficiency/Business/CleanerSaferProduction/SaferProduction/FlexibleFrameworkInitiative/Publications/tabid/102619/Default.aspx.

13. Recommendations to the ECE member countries, competent authorities and oil terminal operators are set out in the following paragraphs.

1.1.1. RECOMMENDATIONS FOR ECE MEMBER COUNTRIES

14. ECE member countries should develop and implement policies and strategies to reduce the risks of accidents and improve preventive, preparedness and response measures in oil terminals.

15. ECE 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. They 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.

16. ECE member countries should adopt policies for the safety of oil terminals, including the 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 on industrial safety, for example, in the development and implementation of external emergency plans.

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

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

3 The Protocol on Civil Liability was adopted by 22 countries to the Industrial Accidents Convention and the ECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes in Kyiv on 21 May 2003, with 2 more countries signing later in 2003. The Protocol is not yet in force.

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 article 17 of the 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. ECE 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, the shut-down of operations in cases of unsatisfactory safety performance and environmental protection by operators and owners.

23. ECE member countries should establish a system to ensure that information about incidents is evaluated at the national level to follow up on lessons learned.

24. ECE 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 the competent authority needing to intervene.

1.1.2. RECOMMENDATIONS FOR COMPETENT AUTHORITIES

25. Competent authorities should maintain within their organizations 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 ensuring safe 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 and 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 a need to ensure that, when examining the technical aspects of the licence, the licensing authority thoroughly examines the capability of the operator to ensure 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, among others, by enforcing the preparation by a future oil terminal operator of an environmental impact assessment, also, when applicable, in a transboundary context.

31. Competent authorities should require the oil terminal operator to draw up a report on the major hazards that 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 also establish provisions that set up a system for certified, independent experts to undertake the inspection of facilities.

34. When competent authorities use independent experts for inspections, they remain responsible for assessing the competence and accountability of those 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 ongoing 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;
(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 the potential risks associated with any accidents that may occur.

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 oil terminal site, 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., in the areas of health and safety at work, chemicals management, explosion protection, fire protection and emergency preparedness and planning), as well as other stakeholders (e.g., local communities, non-governmental organizations and 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 that lessons are learned and recurrence is 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 should 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 life cycle (design and planning stage) that all equipment is purchased to ensure a high level of protection for human health 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 organize 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 life-cycle 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 adopt a major-accident prevention policy (MAPP), which should serve as the foundation of the OTMS.

53. Hazard identification and risk assessments should be undertaken during all stages of the life cycle, as appropriate, in order to choose among different options and to assess unusual circumstances. The oil terminal operator should adopt a methodology for ongoing hazards identification, risk assessment and determination of necessary control measures for routine and non-routine activities and for management of change.

54. A document should be elaborated setting out suitable arrangements for major-accident prevention (the safety report/declaration, see section 1.4.1). In it, 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 safety report/declaration. The workers should be consulted at the relevant stages of the preparation of the document.

55. The oil terminal operator should inform the competent authority of any arrangements planned to:

    (a) Prevent major accidents (including the associated performance indicators and safety measures), by conducting risk assessments and adopting appropriate risk controls for identified risks;
    (b) Limit the consequences when an incident occurs, as defined in the emergency planning section (see section 1.5).

56. To enable 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 furthermore 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 their 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 terminals 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 a 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 MAPP; this involves at least the following controls:

    (a) Defining competence requirements for contractors/subcontractors to ensure that specific high-risk activities and tasks are executed by competent people;
    (b) Monitoring contractors' performance while working at the oil terminal, including informing them of oil terminal risks and their potential impact on the oil terminal safety performance, as well as communicating changes when they occur and consulting on them, where relevant;
    (c) Evaluating the overall performance of contractors/subcontractors.

64. The integrity and functionality of tanks and all mechanical equipment, instrumentation and safeguards of the oil terminal should be maintained in keeping with good industry practice (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 recurrences.

PART 2

TECHNICAL AND ORGANIZATIONAL SAFETY ASPECTS

Technical and organizational aspects of safety should be taken into account throughout the whole life cycle of oil terminals. This document covers the safety elements and activities to be addressed during the whole life cycle of an oil terminal: design and planning; procurement, construction and asset integrity management; operations; and closure and decommissioning.

Experiences from past industrial accidents should be integrated in all stages of the life cycle 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 pertaining to technical and organizational aspects of the safety of oil terminals concentrate on the operator's duties.

1. DESIGN AND PLANNING

Industrial facilities' safety fundamentals and best operational practices are established during the design and planning stage. For facilities engaged in the manufacture, storage or transport of hazardous substances the whole scope of safety issues are the most important consideration. In most cases, oil terminals are classified as such facilities.

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

The design process should be carried out taking into account identified hazards and risk assessments. Accepted design solutions should focus on the reduction of risks to as low as reasonably practicable (ALARP).

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

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

During the design and planning stage, all negative environmental impacts, safety factors and possible risk estimates should be considered according to the particularities of each life-cycle stage, including decommissioning.

Oil terminal operators and inspection authorities should maintain constant control of design and planning aspects also during all the other life-cycle stages of the facility, in accordance with national standards.

Design alterations introduced during other life-cycle stages require justification, and should be confirmed by oil terminal operators and inspection authorities, in accordance with national standards.

1.1. ENVIRONMENTAL BASELINE AND IMPACT ASSESSMENT

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

1.1.2. ENVIRONMENTAL IMPACT ASSESSMENT

An environmental impact assessment (EIA) should be a precondition for the construction and operation of an oil terminal, or making 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 the aquatic environment. The general public and interested or affected persons should be able to comment and provide input to the EIA and also to comment on or object to the construction and operation of the terminal.

The ECE 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 national borders. Among the proposed activities with a mandatory EIA are crude oil refineries and major storage facilities for petroleum and petrochemical and chemical products above a certain quantity threshold.

The Protocol on Strategic Environmental Assessment (Protocol on SEA), which entered into force on 11 July 2010, augments the Espoo Convention by ensuring that individual Parties integrate environmental assessment into their plans and programmes at the earliest stages — thereby 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 for preparing the EIA in a manner that conforms to the applicable legal and regulatory requirements. The information to be included in the EIA 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;

4 In line with article 4, paragraph 4 of the Industrial Accidents Convention.

(f) An explicit indication of predictive methods and underlying assumptions, as well as the relevant environmental data used;
(g) The 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;
(i) A non-technical summary including a visual presentation, as appropriate (maps, graphs, etc.).

1.2. FACILITY SITING, LAY-OUT AND LAND-USE PLANNING

Facility siting, lay-out 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 the adoption of appropriate safety distances (with regard 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 lay-out. Lay-out 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 LAY-OUT

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 lay-out of the facility**: Is there an adequate buffer zone (safety distance) between the oil terminal and vulnerable habitats, populations or public facilities?;
(b) **Domino effects**: Are there nearby sources (equipment or installations) that could threaten the entire site by potential "domino effects"?;
(c) **Containment considerations**: secondary and tertiary;
(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 and a sprinkler system to operate when the main power source is impaired;
(f) **Safe refuges**: Are there safe refuges in case of fire and toxic releases?;
(g) **Occupied buildings (e.g., control rooms, meeting rooms and offices)**: to minimize the risk for the occupants in an emergency situation, such as fire or explosion, the following issues need to be considered with regard to occupied buildings:
    - *Location*: e.g., are they remote from the source of hazard? What is the prevailing wind direction?;
    - *Construction*: e.g., are they resistant to the effects of fire (thermal radiation) and/or explosions (overpressure)?;
    - *Control rooms*: are they provided with uninterruptible power supplies to control systems in the event of power failure?;
(h) **Provision of fire water and fire protection systems**: These may be provided via specific systems within the oil terminal, via local city supply or from a 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;
(i) **Security systems and access controls**:
    - Provision of a secure perimeter fence (land side) and measures to prevent unauthorized access from the water side;
    - Provision of access controls at land side gates and from ships in harbour;
    - Equipment for 24-hour surveillance of hazardous areas and the 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, the locations of public-use and residential areas and areas of natural sensitivity or interest (vulnerable areas). If there is an accident, these distances should limit the consequences 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, and the locations of public-use and residential areas in zones that could be affected by the effects of an accident arising out of an existing oil terminal, so as to minimize the risks involved.

1.3. SAFE DESIGN

Where they exist, national standards for equipment design and operation 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., the 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.

Key aspects for the design and operation of equipment related to hazard detection, control and response that have to be taken into account at three levels of protection (primary, secondary and tertiary) are set out in the subsections below.

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 should meet appropriate local legal codes or industry standards (such as the American Society of Mechanical Engineers, the German Institute for Standardization (DIN), etc.);
(b) Piping, valve, pumps and fitting design should meet appropriate local legal codes, or industry standards (such as DIN, the American National Standards Institute, etc.) ;
(c) Construction material should be chosen according to the mechanical, thermal, chemical and biological stress of service;
(d) Piping and valve fittings (in particular isolating valves) should be "fire safe" according to a typical industry standard (e.g., American Petroleum Institute or International Organization for Standardization standards) or requirements set by the competent authority;
(e) Outdoor overground plant units should be protected against the force of buoyancy during flood events and from mechanical damages due to floating substances or objects;

(f) Underground containers and pipelines should be provided with suitable corrosion protection and secured against the force of buoyancy;
(g) Level measurement devices that include low- and high-level alarms should be installed;
(h) Overfill prevention devices should be installed that include 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) To provide explosion protection, equipment should be designed and managed in accordance with the relevant international standards, such as the EU ATEX Workplace Directive,[5] the International Electrotechnical Commission System for Certification to Standards Relating to Equipment for Use in Explosive Atmospheres (IECEx System)[6] and the ECE Common Regulatory Framework for Equipment Used in Environments with an Explosive Atmosphere;
(j) The potential for natural hazard-triggered technological accidents (NA-TECH), such as floods, earthquakes, forest fires and lightning strikes, should be taken into account.

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 should 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 GIP, underground pipelines should be double walled or any detachable installed connections and valves should be installed in monitored, leak-proof inspection chambers;
(e) The containment structure 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 a generally accepted and recognized testing method;

5 Directive 1999/92/EC of the European Parliament and of the Council of 16 December 1999 on minimum requirements for improving the safety and health protection of workers potentially at risk from explosive atmospheres.

6 See http://www.iecex.com/?ref=menu.

(f) As GIP, the containment structure should have a 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 firefighting 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:
- Hazard classification of the stored substances;
- Readiness of the fire brigade, and the estimated amount of time it will take to gain control of a particular fire event;
- The predicted flow of fire water to control the fire event;
- Fire protection infrastructure (e.g., fire detection and extinguishing systems);
- The total area and characteristics of the storage section (such as height of goods stored in warehouses);

(h) In loading and off-loading of inland waterway vessels, special care should be taken to observe the process (i.e., ADN, annex, part 7);[7]

(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. Such detectors 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) Closed-circuit television (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 requirements (e.g., the ATEX Workplace Directive lays down provisions for explosive area classification and zoning);

7 In earlier guidelines and recommendations on this subject reference was made to the relevant part of the Regulations for the Carriage of Dangerous Goods in the Rhine(ADNR) (i.e., ADNR 151412). However, the ADN regulation superseded the ADNR with effect from 1 January 2011.

(b) Operators should review and amend if needed, the management system for the maintenance of equipment to ensure their reliability in operation. This includes:
    - Periodic proof testing of equipment to minimize the likelihood of equipment failure;
    - Management of change (hardware, software, mode of operation, service personnel, material stored or transferred, etc.);
(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); GIP is that safety integrity levels for safety instrumented systems are managed in accordance with the requirements of International Electrotechnical Commission (IEC) Standard 61511 1.

Periodic tests of the safety systems mentioned in considerations (b) and (c) above should be undertaken by competent experts. The inspection activity should be independent from the operation. Such tests should be documented and retained by the oil terminal operator in equipment files. Overfill prevention systems (i.e., the high-level shut-off devices) should be physically and electrically separate and independent from the systems that 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 61511-1, 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 or reducing 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 oil terminals are hazardous activities with the potential to cause a major accident owing to the quantities of hazardous substances (as specified in annex I of the Convention) present on site.

1.4.1. HAZARD MANAGEMENT DURING THE PERMITTING STAGE

The competent authorities should require the future operator to demonstrate hazard management in a written document (e.g., a safety report/declaration), addressing also design for decommissioning as part of the operating permit application.

1.4.1.1. Demonstrating hazard management in the safety report/declaration

After having conducted a high-level technical and economic feasibility study and an investment decision is made, the permit application process can start. The oil terminal operator should produce a written document setting out the hazards identified at the installation, as well as the measures taken for their control, as proof of the oil terminal's safe equipment, operation and management (a safety report/declaration). The safety report/declaration should contain a description of the oil terminal that is adequate to enable the competent authorities to have a clear picture of its purpose, location, future activities and intrinsic hazards, as well as the services and technical equipment needed for its safe operation. The extent of the description should be commensurate with 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 common services and overall management are concerned.

A typical safety report/declaration consists of three components:

(a) The operator's MAPP;
(b) The operator's safety management system (SMS);
(c) A description of the adequate and sufficient measures that will be put in place to prevent major accidents from occurring and to reduce their harmful consequences for people and the environment.

The safety report/declaration should contain the following essential information (generally in separate chapters):

(a) **General information on the oil terminal**;
(b) **A description of the OTMS**;
(c) **A description of the oil terminal location**, indicating the existence of any possibly vulnerable environmentally sensitive areas or populations nearby;

(d) **A description of the natural hazards in the surrounding area** having the potential to cause natural-hazard induced accidents;
(e) **A description of the installation and its operations**, including the quantity and characteristics of the hazardous substances involved, their storage and the related transport modes for them (e.g., ship, pipeline, road and rail transfers);
(f) **Identification of the major-accident hazards and information on their management**, including a description of the possible major-accident scenarios and measures to prevent them from happening, as well as risk-control measures to limit the consequences for human health and the environment in the event such accidents should occur. Reference should be made to the internal emergency plan (see section 1.5 below). The risk assessment should make it possible to rank the most credible major-accident scenarios and the methods of controlling them to a tolerable level. Subsequently, the oil terminal operator examines the safety-critical elements for each classified major-accident scenario. 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 such standards:
    - *Functionality* —What the barriers should achieve;
    - *Availability* — The degree to which a system is in a specified operable state;
    - *Reliability* —The likelihood of failure to operate on demand or the likelihood of failure over a period of time;
    - *Survivability* —The conditions under which it will be required to operate (i.e., owing to the effects of major accident hazards);
    - *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 the effectiveness of their barriers.

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. The design for decommissioning approach specifies the application of general design requirements, such as:

(a) Using materials that are easy to recycle or reuse;
(b) Using a modular design to make it easier to assemble, disassemble and transport parts of the industrial facilities;
(c) Minimizing the use of hazardous materials;

(d) Minimizing the amount of contaminated material or hazardous waste that will be generated upon decommissioning;
(e) Using pollution prevention measures such as concrete areas, interceptors, containment and liners to prevent or mitigate pollution from ongoing operations;
(f) Avoiding the installation of underground storage tanks containing hazardous substances, if possible;
(g) 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.

Four key activities need to be considered during the oil terminal design and planning stage in connection with decommissioning, in line with the design for decommissioning approach:

(a) Identifying and implementing current and future legislation, regulatory and contractual requirements. This implies, for example:
    - Identification of specific site conditions and site closure plans aiming at reaching a "satisfactory state" and preventing ongoing 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 off site;
    - 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 off site;
    - Considering the impacts of rainwater run-off;
(d) Specifying design requirements (see details in section 1.5.1 below).

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 should identify possible domino effects by actively requesting additional information from the oil terminal operators. The competent authorities should ensure the communication to other member countries of any 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 life-cycle stages of a complex industrial facility. The best and the most non-hazardous technologies and equipment selection during the design and planning stage, a sound safety culture and a systems approach to process safety management, together, reduce the potential for a major accident, but do not exclude it completely. Therefore it is necessary to be prepared for the maximum credible worst case scenario.

1.5.1. EMERGENCY PLANS — GENERAL

Emergency plans for oil terminals need to be established before the competent authorities give permission for their construction, operation or closure. Such plans should be drawn up within the time frames set by local or international rules.

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

Emergency plans should be reviewed and updated when needed or where relevant, but at least every five years. At a minimum, reviewing and updating should also be considered in the following situations:

(a) After the occurrence of accidents or emergency situations at the site or following the issuance of lessons learned from accidents at other similar sites;
(b) When the structure of any of the emergency services 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 or 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 should 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 (internal and external) should include or address the following generic topics as a minimum:

(a) The scope and objective of the emergency plan;
(b) A description and evaluation of emergency scenarios, hazards (including natural hazards, if appropriate) and potentially affected areas;
(c) The 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 on-site mitigation actions;
(d) The responsibilities of each staff member, service or organization involved in emergency management under the plans (chain of responsibility and authority for actions to be taken);
(e) The organization of internal and external notifications and/or communications (as defined by legal requirements and/or internal procedures);
(f) The required equipment for effective interventions and the necessary human resources, based on the outcome of needs identification (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, etc.);
(i) Interactions and interface with other intervention plans, either externally (e.g., neighbouring plants and national crisis/disaster plans) or internally (e.g., the company's crisis, business continuity or recovery plans).

1.5.2. INTERNAL EMERGENCY PLANS

Internal emergency plans should be part of the operating manual. The internal emergency plan, specific to 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 both slow and rapid aggravating developments as well as instantaneous failure conditions.

In addition to the generic information set out in section 1.5.1, at a minimum internal emergency plans should include/address:

(a) The 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 that have occurred);
(c) For foreseeable conditions or events which could trigger an accident, an assessment of the critical response resources, 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 the 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. Oil terminal operators are obliged to provide the authorities with all the necessary information concerning the potentially affected area and the potential impact of any accident on human health and the environment for the competent authorities to prepare the external emergency plan.

The 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 the border 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 country concerned to participate in the preparation and revision of external emergency plans.

External emergency plans should detail all the relevant information to ensure an adequate emergency response. They should include, in addition to the generic information described in section 1.5.1:

(a) The 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) A 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.
(f) 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.

It is recommended that the oil terminal operator 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 ensure 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 a control function to ensure that materials and equipment are purchased as specified in the oil terminal requirements database (see section 2.2 below). 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 that 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 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 should be integrated in a comprehensive oil terminal requirements database for further reference throughout all other stages of the oil terminal life cycle.

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.

The 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 approach to HIRA will be used during the construction and the commissioning of the terminal.
Typically, risk assessments as described in the section on the 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 or 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" in this context is not concerned with how old a particular article of equipment is; it refers to 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 of its integrity or functional performance.

There are well-developed approaches and methodologies for extending the lifetime of offshore facilities, power plants and nuclear industry, whose design lifetime is defined upfront, including decommissioning. A comprehensive regulatory scheme should be in place when an operator considers extending the operating lifetime of equipment. The key activities to be considered are: a thorough assessment of asset integrity, risk assessment/risk mitigation and gap analysis against legal compliance to justify the lifetime extension (see part 3, Sources and further reading).

When the oil terminal assets or infrastructure are approaching their intended design or service life, or the oil terminal in its entirety is reaching the end date of its licence to operate, decisions in terms of decommissioning, lifetime extension or extending the licence 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.

Taking into consideration the different inspection regimes and approaches in the regulatory frameworks of the different ECE member countries, GIP for managing ageing assets/infrastructure are described in the following sections for two situations: for assets with a predefined operating lifetime and for those with an undefined operating lifetime.

2.4.1 MANAGING ASSETS WITH A PREDEFINED OPERATING LIFETIME

Offshore structures are usually designed and built for a predefined lifetime — typically 20 to 30 years — with decommissioning normally planned up front. This approach is normally not applied to oil terminals, but it is possible to do so for both lifetime assessment and lifetime extension of oil terminals.

The purpose of managing the ageing of assets is to ensure that all the assets are monitored throughout the life of the terminal and appropriate action is taken to maintain them in a fit-for-service condition.

The objective of a lifetime 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 the assessment of the remaining lifetime of assets consists of six activities: (a) a technical condition assessment; (b) a life-time-extension evaluation; (c) a regulatory compliance check; (d) a technical qualification for lifetime extension; (e) preparing for obsolescent equipment; and (f) estimating the operating costs for a lifetime extension.

2.4.1.1. Technical condition assessment

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

2.4.1.2. Lifetime-extension evaluation

A lifetime-extension evaluation reviews the future operating conditions and production scenarios and identifies challenges in terms of safety-critical equipment if the facility is to continue operating.

The remaining lifetime of critical assets with a high risk ranking is estimated based upon considerations, such as:

(a) The original design life (specified in years or number of operating cycles);
(b) The current equipment age and condition;
(c) How long ago any damage was initiated and how fast it is accumulating;
(d) The rate of degradation (whether constant, variable, or exponential);
(e) The expected future operating conditions and degradation mechanisms;
(f) The maintenance plan;
(g) Vendor support and spare part availability.

2.4.1.3. Regulatory compliance check

Regulatory compliance checks are needed 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 to minimize the risk of major accidents and provide insights on the efforts needed to comply with future applicable legislation.

2.4.1.4. Technical qualification for lifetime extension

A technical qualification verifies that equipment will operate safely and reliably beyond its original design life. This qualification will normally be used by the operator to seek consent and technical assurance for the extended design life of an oil terminal. If the technical qualifications do not provide the required assurance, the oil terminal operator should consider decommissioning at the end of the current design life.

2.4.1.5. Preparing for obsolescent equipment

Out-of-date or obsolescent assets and equipment, particularly electrical control and instrumentation equipment, can cause problems. A review of such equipment is needed therefore to determine where spare parts are no longer available or where vendor support no longer exists. The review will propose alternative solutions in order to be prepared when obsolete equipment fails.

2.4.1.6. Estimating operating costs for lifetime extension

To establish operating costs for a lifetime extension, including the need for modifications in the future, a transparent cost estimation model is required. The cost model should include overhauls and replacements, based on the experience of similar facilities, and should be based on estimations of the minimum, mean and maximum time it would take to make any modifications as well as the minimum, mean and maximum costs.

2.4.2 MANAGING ASSETS WITH AN UNDEFINED OPERATING LIFETIME

Like offshore structures, 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 of critical assets and those with the highest deterioration rate. This periodic "rejuvenation" takes place during so-called "large turnarounds", typically every three to five years.

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

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

2.4.2.1. Step 1: Establish an ageing plant inspection regime

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

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

(a) Primary containment systems;
(b) Infrastructure;
(c) Process safeguards;
(d) Electrical controls and instrumentation.

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

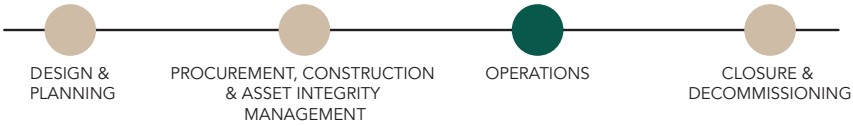
It is vital that there is coordination, leadership, ownership and senior management engagement in the ageing plant inspection regime as described above. The effective management of plant ageing is fundamental to the maintenance of process safety at a high-hazard site. As such, it is imperative that the oil terminal operator has a clear understanding of the processes in place to manage the issue and that the operator monitors their effectiveness. Key elements in this will be the presence of suitable key performance indicators and evidence of commitment from the leadership team to maintaining the integrity of the plant across the oil terminal site. Ensuring 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) A maintenance management plan and performance standards;
(b) An 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 and incident reporting and investigation routines;
(g) Statistical and trend analysis;
(h) Corrective actions and an action-tracking system;
(i) Learning from events;
(j) Review.

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

3. OPERATIONS



Oil terminals are industrial facilities where there is a high potential for large-scale accidents to occur due to the operations performed, the equipment installed and the hazardous substances handled or processed there. This potential is not present during the design and planning stage or even during the procurement, construction and asset integrity management stages. Various emergency scenarios, including large-scale accidents, occur only in the process of industrial activity, i.e., during the operational stage.

The workforce (experts of various specializations and qualifications) is one of the key components of any industrial activity. The safety of a facility depends greatly on its personnel. For staff to perform their tasks successfully, and avoid emergency situations, a systematic approach to industrial process safety management is necessary.

3.1. PROCESS SAFETY IN OPERATIONS

To manage 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 in the chemical industry.

Personal or occupational safety hazards may impact human health through short- or long-term exposure to hazardous materials or by accidental injury to individual workers as a result of slips, falls or contact 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 good engineering practices, process hazards assessments, management of change, inspection, testing and maintenance of safety-critical equipment and effective alarms and process controls, as well as training for personnel 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, overpressures, excessive temperatures, corrosion, metal fatigue and other foreseeable conditions. Reference can made to the principles defined by the Process Safety Leadership Group (PSLG), in its 2009 final report, Safety and environmental standards for fuel storage sites.[8]

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

The following sections in this part 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:

8 United Kingdom of Great Britain and Northern Ireland, Health and Safety Executive (Sudbury, United Kingdom, 2009), available from http://www.hse.gov.uk/comah/buncefield/response.htm. PSLG 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.

(a) **Establish process safety as a 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 managers act as a role model and "walk the talk" through visible and consistent support for selected process safety programmes and established targets. Adequate 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 reviewed;
(e) **Empower employees at all levels**: A positive and trusting work environment is aimed at, while avoiding a culture of blame and allowing maximum learning from incidents. The oil terminal operator should encourage effective communication lines and a mutual understanding between management and the workforce;
(f) **Incorporate process safety in senior management decision-making**: Senior management should develop and apply a sound set of key performance indicators for process safety to enable following up the terminal performance; preferably these would consist of leading and lagging indicators;
(g) **Conduct timely risk assessments**: Process safety programmes tend to have a long-term focus and may require a higher investment of resources in comparison with personal safety initiatives. The long-term timespan often needed to achieve results in process safety performance should be well considered when allocating accountabilities to and setting expectations for the oil terminal operator, line managers and supervisors.

3.3. GOVERNANCE SYSTEM

The governance system as described hereafter comprises the management system and the framework of controls, which, together, assign the roles and responsibilities for managing the oil terminal hazards.

3.3.1. ROLES AND RESPONSIBILITIES

For safe operation and maintenance of the oil terminal, the operator has to put in place a control system in order to meet safety requirements and in par-

ticular to ensure reliable human performance at all levels, from managers and engineers to operators and craftsmen.

A clear understanding and definition of roles and responsibilities, and assurance of staff 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;
(d) 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 ORGANIZATION

Proper 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 from 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 and competence has often resulted in major accidents, as it often reflects a poor understanding of hazards, failure to proper-

ly identify and analyse hazards during the process hazard analysis, inadequate operator training, inadequate guidance in emergency response decisions and, ultimately, poor management decision-making.

The oil terminal operator should 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 should retain associated records.

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

The oil terminal operator should 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 should 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 identified in the needs analysis.

The oil terminal operator should further define refresher training frequencies and updates of training needs based upon experience and feedback, as well as 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 management 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 retraining) of various persons associated with the oil terminal, including contractors.

The personnel concerned should be identified along the life-cycle chain.
Personnel working towards and responsible for the safety of the oil terminal should be educated and trained in the appropriate 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 the oil terminal, also the "context" subjects that concern related disciplines such as environmental, social and financial areas, and the risks for the oil terminal operating staff.

3.3.5. OPERATING MANUAL

The oil terminal should be operated and managed on the basis of an operating manual (as further defined and outlined below), which is developed in the design and planning stage and progressively modified. The manual's aim is to effectively manage the hazards and risks at the oil terminal.

The operating manual should contain as a minimum:

(a) A description of the oil terminal and its environment;
(b) A description of normal operations;
(c) The methodology for HIRA;
(d) A 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 procedures;
(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) Procedures for internal auditing and follow-up;
(k) Procedures for 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 an operating procedure, and is often associated with a checklist describing the steps to follow.

Safe work practices typically control normal operations, as well as hot work, stored energy ("lock-out/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 critical in managing major-accident hazards.

3.4.1. 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 a 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 as they 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 should develop detailed and clear instructions where relevant. Inclusion of safe operating limits and consequences of deviation from them (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 the workforce accountable for consistently following the operating procedures, and should ensure that they are periodically reviewed.

3.4.2. SAFE WORK PRACTICES FOR NON-ROUTINE TASKS

The oil terminal operator should define when and where safe work procedures apply. Typical applications are non-routine tasks that involve several parties, usually the owner of the equipment and the crew assigned to do a certain job,

either by their own maintenance staff or by subcontractors. Some examples of tasks that usually require safe work practices include:

(a) Lock-out/tag-out for control of energy hazards;
(b) Line breaking/opening of process equipment;
(c) Confined space entry;
(d) Lifting operations that involve process equipment;
(e) Excavation in or around process areas;
(f) Temporary by-passing of interlocks.

The oil terminal operator is responsible for providing adequate training to all oil terminal employees and contractors involved, including the personnel 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.

3.4.3. 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 establish 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 organizational change, as well as changes to the 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 that 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 organizational change in an industrial facility:

3.5.1. MANAGEMENT OF TECHNICAL CHANGE

Oil terminal operators should adopt and implement management procedures for planning and controlling all changes in the plant, involving processes and process variables, materials, equipment, procedures, software and design, or in 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 the management of permanent, temporary and urgent operational changes.

3.5.2. MANAGEMENT OF ORGANIZATIONAL CHANGE

Oil terminal operators should ensure that there is a suitable policy and procedure for managing organizational 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 also 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 that is subcontracted or outsourced.

3.6. GOOD INDUSTRY PRACTICES FOR TRANSPORT AND STORAGE OF HAZARDOUS MATERIALS

This section sets out to principles and GIP for transport and storage of hazardous materials at oil terminals.

3.6.1. PRINCIPLES FOR SAFE TRANSFER MANAGEMENT

Oil terminal operators involved in the transfer and storage of hazardous material should adopt good practice principles for 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 operating instructions for all oil terminal operations, as well as periodic training on their implementation.

3.6.2. OPERATIONAL PLANNING

The human factor is 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 appropriate shipment procedures and review them with their senders/receivers and all appropriate intermediaries.

3.6.3. OPERATIONAL CONTROLS

The following operational controls apply for areas where hazardous substances are used or 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) The 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 that 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 and surface water diversion).

3.6.4. PRINCIPLES FOR CONSIGNMENT OR TRANSFER AGREEMENTS

The sender has the primary responsibility for the safe transfer of the agreed consignment quantity to the receiving storage.

The following principles apply to all modes of transfers where different parties control the supply of material to a tank or tanks and the tank or tanks themselves. 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.

3.6.5. 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 are consistent with current good practice, for safety-critical operating activities in the transfer and storage of fuel.

3.6.6. Communications during transfer activities

When transferring hazardous materials 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 how effectively many alarms can be dealt with from a centralized control room when equipment failures are observed. A different type of abnormal situation that is relevant to oil terminals is dealing with large numbers of contractors on site during a large turnaround (e.g., a lengthy shutdown of activities for maintenance, repair and inspection work).

3.7.1. 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 in the system and the system is not a distributed control system, the same principles apply to ensure a reliable response to alarms:.

(a) 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;
(b) Oil terminal operators should ensure that their control room information displays, including human-computer interfaces and alarm systems, are reviewed in relation to recognized GIP;
(c) 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;
(d) Oil terminal operators should ensure that modifications to or the development of new control rooms or human–computer interfaces comply with recognized GIP in their design, development and testing.

3.7.2. CONTRACTOR/TURNAROUND MANAGEMENT

Oil terminal operators should implement specific controls when preparing for a large turnaround (e.g., maintenance shutdown) that usually involves a 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 for selection and evaluation of contractor performance (see part 1, para. 58), the following additional requirements are considered as GIP for managing contractors:

(a) Classify the selected contractors as high-, medium- or low-risk contractors based on well-defined criteria and define appropriate controls accordingly;
(b) Designate oil terminal contractor coordinators for the high- and medium-risk contractors;
(c) Organize pre-job meetings with high- and medium-risk contractors;
(d) Ensure that competence requirements are met at all times for high- and medium-risk contractors, including by conducting periodical compliance checks and involving them as much as possible in the oil terminal training programmes.

3.7.3 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 organization'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 or near-miss potential;
(c) Investigating according to the identified potential;
(d) Identifying and addressing both the immediate and underlying causes;
(e) Identifying lessons learned;
(f) Tracking remedial actions;
(g) Evaluating the effectiveness of corrective or preventive actions.

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

3.7.4 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 Recommended Practice (RP) 754, Process Safety Performance Measurement for the Refining and Petrochemical Industries sets out GIP in this area.

Oil terminal operators should establish and maintain procedures for testing and calibrating instruments and equipment that is considered safety-critical, and should maintain records of related calibration and maintenance activities.

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 with other commitments to which the oil terminal subscribes, in addition to conforming to the requirements of its OTMS.

Oil terminal operators should also 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 operator should maintain the above-mentioned 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 life cycle of the oil terminals, in addition 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 three 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 and the 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;
(g) The follow-up procedures, including responsibilities for their implementation.

Oil terminal operators should ensure that they have implemented suitable arrangements for a formal review of the suitability of the OTMS and the effectiveness of major-accident-hazard controls. Feedback on audit findings should be given within one 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 one year of the audit.

3.9.2. MANAGEMENT REVIEWS

Reviews of the management system are the 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 to specify how to initiate remedial actions.

The requirements for audit and review are well established. The main issue is to ensure that process safety is regarded as a priority in the audit and review plan or programme.

A management review should take into account/include the following elements:

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

3.10. LEARNING FROM EXPERIENCE

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

The oil terminal operator should consider past performance in order to learn from observed deviations, near misses and accidents as part of its commitment to continual improvement.

A safety policy statement should be issued by the oil terminal operator to demonstrate its commitment towards the 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 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 RP 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:
- Oil terminal operators should have a process for determining the scope of the asset integrity management programme and the frequency of inspection and testing. This includes the storage and transfer of hardware facilities, measurement and control systems, emergency response equipment, communications and security controls;
- Inspection and testing should include the operator training programmes, emergency response procedures and liaison with emergency services and the local community during emergencies;
- Inspection and testing should be done regularly. The methods will typically be non-destructive such as ultrasonic, x-ray, magnetic particle, etc., and should be carried out in accordance with the methods and frequency set out in relevant industry standards or based on the assessed risk;
- 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 and pumps, and emergency equipment, such as fire pumps and fixed and mobile firefighting equipment;

- Control and safety instrumentation (level, pressure and 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, recognizing the need to understand an alarm and the time needed to respond and correct the hazardous state;
- Condition monitoring should be done according to the planned schedule and deviations or overdue ITPM tasks should be monitored and followed up;
- ITPM tasks should be conducted by trained and qualified individuals using approved methods/procedures;
- Repair work should be done in conformance with design codes, agreed engineering standards and considering manufacturer's recommendations, as applicable;
- A spare parts management plan should be applied to ensure timely availability of critical spare parts;
- A mechanism should be in place to correct deficiencies and to apply the lessons learned from deviations or near-miss incidents to other equipment or systems.

3.12. HAZARD MANAGEMENT DURING OPERATIONS

Typically, risk assessments as described in the section on the safety report/declaration 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 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 used for lifetime extension considerations, closure and decommissioning activities.

3.13. EMERGENCY PREPAREDNESS AND RESPONSE

Oil terminal operators have to be aware that leakage into receiving waters can cause far-reaching and often transboundary damage. 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.

3.13.1. WARNING AND ALERT SYSTEMS

Early warning systems imply a double requirement:

(a) **A suitable organization**, i.e., distribution of the measuring devices, involving a network of stations linked one to another, etc.;
(b) **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 by 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 the 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 (e.g., those for the Rhine, Meuse/Maas and Danube Rivers).

For scenario calculations regarding a discharge, established flow-time modelling should be used (e.g., the Rhine model, or the ALAMO alarm model for the Elbe River).

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 a guidance document.To prepare for 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, firefighting foam systems, deluge systems and steerable deck monitor nozzles (with or without foam injection). Also, portable equipment, like fire trucks/pumpers, fire hoses, portable monitors and fire extinguishers;
(b) Personal protective equipment;
(c) Emergency power supply;
(d) Hazard detection systems: gas and fire detection equipment;
(e) Emergency and rescue equipment for potential human and/or environmental damage;
(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 that is capable of responding to the defined major-accident scenarios. The emergency team should comply as a minimum with the applicable legal requirements.

The oil terminal operator should ensure that training programmes are organized and executed based on a needs assessment and are compliant with legal requirements.

Everybody involved in emergency management should be trained and drills should be carried out for the staff. These drills should involve everybody at the plant, and in particular key personnel at all levels, from security guards to the executive management.

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 necessitates establishing a decommissioning plan for both existing and new industrial facilities in order to prevent or minimize 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 or raw material supply, in case

of poor market conditions or due to other economic reasons. The following considerations are recommended as GIP during this deactivation phase, also denoted as "mothballing" or a "hibernation phase". A hibernation phase typically lasts about one year and should not last longer than three years, after which reactivation or decommissioning should take place.

The oil terminal operator should develop a temporary closure plan, considering at least the following issues:

(a) The closure should not cause adverse environmental impacts or an imminent threat to human health at the site;
(b) The closure should not cause significant harm to or place a significant burden on public facilities and other plants or land areas adjacent to it;
(c) Existing components and waste should be properly and safely disposed of or treated.

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 monitoring of the temporary closure plan. Such monitoring should cover the following recommended actions:

(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 unacceptable to store drums with substances hazardous to water. If this is impossible or not cost effective due to the temporary closure, it is necessary to comply with the relevant recommendations of the applicable international river commissions. Warehouses with drums storing such substances 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 the applicable international river commission recommendations for flood protection;
(h) Before reactivation of the mothballed facility or parts of the industrial facility, it should be inspected in accordance with the recommendations of the relevant river commission and other recommendations, as applicable. The conditions for reactivation 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 and 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 should 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;
(c) If the competent authority decides for obvious and justified reasons that it should close (e.g., observed environmental damage or notified imminent threat of such damage).

When designing new industrial facilities it is important to anticipate the decommissioning activities and to incorporate them in the design and planning stage; "design for decommissioning" principles are recommended as GIP for new facilities/plants (see also section 1.4.1.2).

4.2.1. OBLIGATIONS OF THE OIL TERMINAL OPERATOR PRIOR TO DECOMMISSIONING

4.2.1.1. 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.

4.2.1.2. 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.

4.2.1.3. Environmental liability

Upon definitive cessation of activities, the oil terminal operator should assess the state of soil, water and groundwater contamination by the 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 the level of significance of the pollution of soil and groundwater following the 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 should adopt measures and develop practices for remediation of land damage and to minimize 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 does not prevent member countries from maintaining or adopting more stringent provisions in relation to the prevention and remedying of environmental damage.

4.2.2. OBLIGATIONS OF THE OIL TERMINAL OPERATOR DURING DECOMMISSIONING

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

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

(a) Noise and vibration (e.g., during earth moving, the use of excavation equipment or cranes and the 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), which may mobilize and transport sediment/soil particles and in turn 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, polychlorinated biphenyls (PCBs), oil, etc., during storage, transport or use of such materials in equipment, spill clean-up, 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, falls, work at height, work in confined spaces and excavation).

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

(a) The implementation of the closure plan;
(b) Depending on the outcome of the environmental risk assessment and the degree of environmental damage caused, the oil terminal operator should take the necessary actions to remove, control, contain or reduce relevant hazardous substances, taking into account the current or approved future use of the site;
(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 and 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 equipment. The above obligations should be fulfilled in accordance with a post-closure plan designed by the oil terminal operator based on GIP. A provisional post-closure plan should 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;
(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 land-use plans for the site.

4.3. HAZARD MANAGEMENT DURING DECOMMISSIONING

Expert safety reviews, process hazards analysis, legal compliance checks and due diligence reviews are being used for lifetime-extension considerations, closure and decommissioning activities.

PART 3
SOURCES AND FURTHER READING

American Petroleum Institute, *ANSI/API Recommended Practice 754, Process Safety Performance Indicators for the Refining and Petrochemical Industries.* Washington, D.C., 2010. Available from http://www.cpcsustainability.com/files/pdf/Process-Safety-Performance.pdf.

American Petroleum Institute, *API Standard 653, Tank Inspection, Repair, Alteration, and Reconstruction*, 4th ed. Washington, D.C., 2009.

Basle Chemical Industry, *TRCI Tank Farm Guidelines for the Chemical Industry.* Basel, Switzerland: 2009. Available from http://www.bafu.admin.ch/tankanlagen/04758/index.html?lang=de.

Central Commission for the Navigation of the Rhine (CCNR) and Oil Companies International Marine Forum, *International Safety Guide for Inland Navigation Tank-barges and Terminals (ISGINTT).* Strasbourg, France: CCNR, 2010. Available from http://www.isgintt.org/300-en.html.

Det Norske Veritas Germanischer Lloyd (DNVGL), Lifetime Extension Assessment — Method Statement (December 2010). Publication available from http://www.dnvgl.com,

Emerson Process Management-Rosemont Tank Gauging (February 2013), *The Complete Guide to API 2350 (4th edition).* Online publication available from http://www2.emersonprocess.com/en-us/documentation/pages/docsearch.aspx?lcid=1033.

Engineering Equipment and Materials Users' Association (EEMUA), *Prevention of Tank Bottom Leakage — A Guide for the Design and Repair of Foundations and Bottoms of Vertical, Cylindrical, Steel Storage Tanks*, EEMUA publication No. 183, 2nd ed. London, 2011.

European Commission, "ATEX Guidelines", Guidelines on the application of 94/9/EC of 23 March 1994 on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially Explosive Atmospheres, 4th ed. September 2012, update December

2013. Online document available from http://ec.europa.eu/enterprise/sectors/mechanical/documents/guidance/atex/application/.

European Union, Council Directive 96/82/EC of 9 December 1996 on the control of major-accident hazards involving dangerous substances, 1997 O.J. (L 10), pp. 13–33. Available from http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:31996L0082.

European Union, Directive 2008/68/EC of the European Parliament and of the Council of 24 September 2008 on the inland transport of dangerous goods, 2008 O.J. (L 260), pp. 13–59. Available from http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32008L0068

European Union, Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control), 2010 O.J. (L 334), pp. 17–119. Available from http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32010L0075.

European Union, Directive 2012/18/EU of the European Parliament and of the Council of 4 July 2012 on the control of major-accident hazards involving dangerous substances, amending and subsequently repealing Council Directive 96/82/EC, 2012 O.J. (L 197),
pp. 1–37. Available from http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1422454263948&uri=CELEX:32012L0018.

International Chamber of Shipping, International Marine Forum and International Association of Ports and Harbours, *International Safety Guide for Oil Tankers and Terminals (ISGOTT)*, 5th ed. London: 2006.

International Electrotechnical Commission System for Certification to Standards relating to Equipment for Use in Explosive Atmospheres (IECex System) website (http://www.iecex.com/).

Instrumentation, Systems, and Automation Society (ISA), *Functional safety — Safety instrumented systems for the process industry sector — Part 1: Framework, definitions, system, hardware and software requirements.* Research Triangle Park, North Carolina, United States of America: 2004. Available from: http://www.isa.org/Content/Microsites267/SP79,_Cryogenic_Valves/Home265/S_840001_Pt1.pdf.

France, Ministry of Ecology, Sustainable Development and Energy, *Plan de modernisation des installations industrielles — Prévenir les risques liés au vieillissement.* Paris: January 2010. Available from http://www.developpement-du-

rable.gouv.fr/IMG/pdf/PlanModernisation_vdef.pdf.

Organization for Economic Cooperation and Development, *Corporate Governance for Process Safety: Guidance for Senior Leaders in High Hazard Industries*, Paris: OECD Environment, Health and Safety Publications, June 2012. Available from http://www.oecd.org/chemicalsafety/corporategovernanceforprocesssafety.htm.

Organization for Economic Cooperation and Development (OECD), *Guidance Concerning Chemical Safety in Port Areas — Guidance for the Establishment of Programmes and Policies Related to Prevention of Preparedness for, and Response to Accidents Involving Hazardous Substances*, OECD Environment Monograph No. 118 (OCDE/GD(96)39). Paris: 1996. Available from http://search.oecd.org/officialdocuments/displaydocumentpdf/?cote=ocde/gd(96)39&doclanguage=en.

Organization for Economic Cooperation and Development, *OECD Guidance on Safety Performance Indicators — Guidance for Industry, Public Authorities and Communities for developing SPI Programmes related to Chemical Accident Prevention, Preparedness and Response, Series on Chemical Accidents,* No. 11. Paris: OECD Environment, Health and Safety Publications, 2003. Available from http://www.oecd.org/env/ehs/chemical-accidents/48356891.pdf.

Organization for Economic Cooperation and Development, *OECD Guiding Principles for Chemical Accident Prevention, Preparedness and Response: Guidance for Industry (including Management and Labour), Public Authorities, Communities, and other Stakeholders*, Series on Chemical Accidents, No. 10. Paris: OECD Environment, Health and Safety Publications, 2003. Available from http://www.oecd.org/env/ehs/chemical-accidents/Guiding-principles-chemical-accident.pdf.

United Kingdom, Health and Safety Executive, *Control of Major Accident Hazards (COMAH) Competent Authority Ageing Plant Delivery Guide*, Version 1. Online publication, June 2010. Available from http://www.hse.gov.uk/comah/ca-guides.htm.

United Nations, Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters, *Treaty Series*, vol. 2161, p. 447. Available from http://www.unece.org/env/pp/treatytext.html.

United Nations, Convention on Environmental Impact Assessment in a Transboundary Context, *Treaty Series*, vol. 1989, p. 309; C.N.443, 2014; and C.N.737, 2014. Available from http://www.unece.org/env/eia/about/eia_text.html.

United Nations, Convention on the Protection and Use of Transboundary Watercourses and International Lakes, *Treaty Series*, vol. 1936, p. 269. Available from http://www.unece.org/env/water/text/text.html.

United Nations, Convention on the Transboundary Effects of Industrial Accidents, *Treaty Series*, vol. 2105, p. 457; and document ECE/CP.TEIA/15/Add.1 (Amendments to annex I to the Convention). Available from http://www.unece.org/environmental-policy/conventions/industrial-accidents/about-us/envteiaabout.html.

United Nations, *European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways* — ADN 2015, vols. 1 and 2. Sales No. E.14.VIII.3. Online version available from http://www.unece.org/trans/danger/publi/adn/adn2015/15files_e.html.

United Nations, Protocol on Civil Liability and Compensation for Damage Caused by the Transboundary Effects of Industrial Accidents on Transboundary Waters to the 1992 Convention on the Protection and Use of Transboundary Watercourses and International Lakes and to the 1992 Convention on the Transboundary Effects of Industrial Accidents (not yet in force), ECE/MP.WAT/11–ECE/CP.TEIA/9. Available from http://www.unece.org/env/civil-liability/welcome.html.

United Nations, Protocol on Strategic Environmental Assessment to the Convention on Environmental Impact Assessment in a Transboundary Context, ECE/MP.EIA/2003/2. Available from http://www.unece.org/env/eia/sea_protocol.html.

United Nations Economic Commission for Europe, *A Common Regulatory Framework for Equipment Used in Environments with an Explosive Atmosphere*, ECE/TRADE/391. Geneva: 2011. Available from http://www.unece.org/index.php?id=29469.

United Nations Economic Commission for Europe, *Safety Guidelines and Good Practices for Pipelines*, ECE/CP.TEIA/16–ECE/MP.WAT/27. Geneva: 2008. Available from http://www.unece.org/env/teia/pubs/pipelines.html.

United Nations Economic Commission for Europe, *Safety Guidelines and Good Practices for Tailing Management Facilities*. Geneva: 2014. Available from http://www.unece.org/index.php?id=36132.

United Nations Environment Programme, Division of Technology, Industry and Economics, *A Flexible Framework for Addressing Chemical Accident Preven-*

tion and Preparedness: A Guidance Document. Paris: 2010. Available from http://capp.eecentre.org/Flexible-Framework-Guidance.aspx.

United States of America, 29 C.F.R. 1910.119, Process safety management of highly hazardous chemicals standard (February 1992). Available from https://www.osha.gov/SLTC/processsafetymanagement/.

World Bank Group, *Environmental, Health, and Safety Guidelines for Crude Oil and Petroleum Product Terminals*. Online document, 30 April 2007. Available from http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/our+approach/risk+management/ehsguidelines.

Safety Guidelines and Good Industry Practices For Oil Terminals

The Safety guidelines and good industry practices for oil terminals were developed within the framework of the project on hazard and crisis management in the Danube Delta involving the Republic of Moldova, Romania and Ukraine under the auspices of the Assistance Programme of the Convention on the Transboundary Effects of Industrial Accidents (Industrial Accidents Convention).

The Conference of the Parties to the Industrial Accidents Convention at its eighth session (Geneva, 3–5 December 2014) took note of the safety guidelines and good industry practices for oil terminals and recommended their use by member countries of the UNECE. Authorities, oil terminal operators and the public are invited to apply these safety guidelines and good practices, which are intended to contribute to limiting the number of oil terminal accidents and the severity of their consequences for human health and the environment.

Information Service
United Nations Economic Commission for Europe

Palais des Nations
CH - 1211 Geneva 10, Switzerland
Telephone: +41(0)22 917 44 44
Fax: +41(0)22 917 05 05
E-mail: info.ece@unece.org
Website: http://www.unece.org

Designed and Printed at United Nations, Geneva – 15 19196**(E)** – September 2015 – 723 – **ECE/CP.TEIA/28**