

IAEA Safety Standards

for protecting people and the environment

The Management System for the Disposal of Radioactive Waste

Safety Guide

No. GS-G-3.4



IAEA
International Atomic Energy Agency

Copyright International Atomic Energy Agency
Provided by IHS Markit under license with IAEA
No reproduction or networking permitted without license from IHS
Full document details: IAEA GS-G-3.4 2008

Licensee=/, User=,
Not for Resale,

AVA Documents
Document Sharing Hub

THE MANAGEMENT SYSTEM FOR THE DISPOSAL OF RADIOACTIVE WASTE

Safety standards survey

The IAEA welcomes your response. Please see:

<http://www-ns.iaea.org/standards/feedback.htm>

The following States are Members of the International Atomic Energy Agency:

AFGHANISTAN	GREECE	NORWAY
ALBANIA	GUATEMALA	PAKISTAN
ALGERIA	HAITI	PALAU
ANGOLA	HOLY SEE	PANAMA
ARGENTINA	HONDURAS	PARAGUAY
ARMENIA	HUNGARY	PERU
AUSTRALIA	ICELAND	PHILIPPINES
AUSTRIA	INDIA	POLAND
AZERBAIJAN	INDONESIA	PORTUGAL
BANGLADESH	IRAN, ISLAMIC REPUBLIC OF	QATAR
BELARUS	IRAQ	REPUBLIC OF MOLDOVA
BELGIUM	IRELAND	ROMANIA
BELIZE	ISRAEL	RUSSIAN FEDERATION
BENIN	ITALY	SAUDI ARABIA
BOLIVIA	JAMAICA	SENEGAL
BOSNIA AND HERZEGOVINA	JAPAN	SERBIA
BOTSWANA	JORDAN	SEYCHELLES
BRAZIL	KAZAKHSTAN	SIERRA LEONE
BULGARIA	KENYA	SINGAPORE
BURKINA FASO	KOREA, REPUBLIC OF	SLOVAKIA
CAMEROON	KUWAIT	SLOVENIA
CANADA	KYRGYZSTAN	SOUTH AFRICA
CENTRAL AFRICAN REPUBLIC	LATVIA	SPAIN
CHAD	LEBANON	SRI LANKA
CHILE	LIBERIA	SUDAN
CHINA	LIBYAN ARAB JAMAHIRIYA	SWEDEN
COLOMBIA	LIECHTENSTEIN	SWITZERLAND
COSTA RICA	LITHUANIA	SYRIAN ARAB REPUBLIC
CÔTE D'IVOIRE	LUXEMBOURG	TAJIKISTAN
CROATIA	MADAGASCAR	THAILAND
CUBA	MALAWI	THE FORMER YUGOSLAV REPUBLIC OF MACEDONIA
CYPRUS	MALAYSIA	TUNISIA
CZECH REPUBLIC	MALI	TURKEY
DEMOCRATIC REPUBLIC OF THE CONGO	MALTA	UGANDA
DENMARK	MARSHALL ISLANDS	UKRAINE
DOMINICAN REPUBLIC	MAURITANIA	UNITED ARAB EMIRATES
ECUADOR	MAURITIUS	UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND
EGYPT	MEXICO	UNITED REPUBLIC OF TANZANIA
EL SALVADOR	MONACO	UNITED STATES OF AMERICA
ERITREA	MONGOLIA	URUGUAY
ESTONIA	MONTENEGRO	UZBEKISTAN
ETHIOPIA	MOROCCO	VENEZUELA
FINLAND	MOZAMBIQUE	VIETNAM
FRANCE	MYANMAR	YEMEN
GABON	NAMIBIA	ZAMBIA
GEORGIA	NETHERLANDS	ZIMBABWE
GERMANY	NEW ZEALAND	
GHANA	NICARAGUA	
	NIGER	
	NIGERIA	

The Agency's Statute was approved on 23 October 1956 by the Conference on the Statute of the IAEA held at United Nations Headquarters, New York; it entered into force on 29 July 1957. The Headquarters of the Agency are situated in Vienna. Its principal objective is "to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world".

IAEA SAFETY STANDARDS SERIES No. GS-G-3.4

THE MANAGEMENT SYSTEM FOR THE DISPOSAL OF RADIOACTIVE WASTE

SAFETY GUIDE

INTERNATIONAL ATOMIC ENERGY AGENCY
VIENNA, 2008

COPYRIGHT NOTICE

All IAEA scientific and technical publications are protected by the terms of the Universal Copyright Convention as adopted in 1952 (Berne) and as revised in 1972 (Paris). The copyright has since been extended by the World Intellectual Property Organization (Geneva) to include electronic and virtual intellectual property. Permission to use whole or parts of texts contained in IAEA publications in printed or electronic form must be obtained and is usually subject to royalty agreements. Proposals for non-commercial reproductions and translations are welcomed and considered on a case-by-case basis. Enquiries should be addressed to the IAEA Publishing Section at:

Sales and Promotion, Publishing Section
International Atomic Energy Agency
Wagramer Strasse 5
P.O. Box 100
1400 Vienna, Austria
fax: +43 1 2600 29302
tel.: +43 1 2600 22417
email: sales.publications@iaea.org
<http://www.iaea.org/books>

© IAEA, 2008

Printed by the IAEA in Austria
June 2008
STI/PUB/1330

IAEA Library Cataloguing in Publication Data

The management system for the disposal of radioactive waste : safety guide. — Vienna : International Atomic Energy Agency, 2008.
p. ; 24 cm. (IAEA safety standards series, ISSN 1020-525X ; no. GS-G-3.4)
STI/PUB/1330
ISBN 978-92-0-102108-3
Includes bibliographical references.

1. Radioactive waste disposal — Safety measures — Management.
2. Radioactive wastes — Management. I. International Atomic Energy Agency. II. Series.

IAEAL

08-00512

FOREWORD

by Mohamed ElBaradei
Director General

The IAEA's Statute authorizes the Agency to establish safety standards to protect health and minimize danger to life and property — standards which the IAEA must use in its own operations, and which a State can apply by means of its regulatory provisions for nuclear and radiation safety. A comprehensive body of safety standards under regular review, together with the IAEA's assistance in their application, has become a key element in a global safety regime.

In the mid-1990s, a major overhaul of the IAEA's safety standards programme was initiated, with a revised oversight committee structure and a systematic approach to updating the entire corpus of standards. The new standards that have resulted are of a high calibre and reflect best practices in Member States. With the assistance of the Commission on Safety Standards, the IAEA is working to promote the global acceptance and use of its safety standards.

Safety standards are only effective, however, if they are properly applied in practice. The IAEA's safety services — which range in scope from engineering safety, operational safety, and radiation, transport and waste safety to regulatory matters and safety culture in organizations — assist Member States in applying the standards and appraise their effectiveness. These safety services enable valuable insights to be shared and I continue to urge all Member States to make use of them.

Regulating nuclear and radiation safety is a national responsibility, and many Member States have decided to adopt the IAEA's safety standards for use in their national regulations. For the Contracting Parties to the various international safety conventions, IAEA standards provide a consistent, reliable means of ensuring the effective fulfilment of obligations under the conventions. The standards are also applied by designers, manufacturers and operators around the world to enhance nuclear and radiation safety in power generation, medicine, industry, agriculture, research and education.

The IAEA takes seriously the enduring challenge for users and regulators everywhere: that of ensuring a high level of safety in the use of nuclear materials and radiation sources around the world. Their continuing utilization for the benefit of humankind must be managed in a safe manner, and the IAEA safety standards are designed to facilitate the achievement of that goal.

CONTENTS

1.	INTRODUCTION	1
	Background (1.1–1.13).....	1
	Objective (1.14)	6
	Scope (1.15–1.17)	6
	Structure (1.18–1.20)	7
2.	THE MANAGEMENT SYSTEM.....	8
	General recommendations (2.1–2.6)	8
	Safety culture (2.7–2.8)	11
	Grading the application of management system requirements (2.9–2.13).....	12
	Documentation of the management system (2.14–2.15)	14
3.	MANAGEMENT RESPONSIBILITY	15
	General (3.1).....	15
	Management commitment (3.2–3.3)	15
	Satisfaction of the expectations of interested parties (3.4–3.5)	16
	Organizational policies (3.6–3.8)	17
	Planning (3.9–3.10).....	18
	Responsibility and authority for the management system (3.11–3.12)	19
4.	RESOURCE MANAGEMENT	20
	General (4.1–4.2)	20
	Provision of resources (4.3).....	21
	Financial resources (4.4–4.5).....	21
	Human resources and individual competence (4.6–4.12)	22
	Infrastructure and working environment (4.13–4.15)	23
5.	PROCESS IMPLEMENTATION.....	24
	General (5.1).....	24
	Developing processes (5.2–5.6)	24
	Process management and control of products (5.7–5.44)	26

Control of documents (5.45–5.46)	39
Control of records (5.47–5.54)	39
Purchasing (5.55–5.56)	43
Communication (5.57–5.60)	43
Managing organizational change (5.61–5.62)	44
 6. MEASUREMENTS, ASSESSMENT AND IMPROVEMENT ...	45
General (6.1)	45
Monitoring and measurement (6.2–6.3)	46
Self-assessment (6.4–6.6)	46
Independent assessment (6.7–6.8)	48
Management system review (6.9–6.12)	49
Non-conformances and corrective and preventive actions (6.13–6.19)	50
Improvement (6.20–6.21)	53
 APPENDIX I: ASPECTS OF MANAGEMENT SYSTEMS SPECIFIC TO THE PHASES OF OPERATION, CLOSURE AND POST-CLOSURE ACTIVE INSTITUTIONAL CONTROL FOR DISPOSAL FACILITIES FOR RADIOACTIVE WASTE	55
 APPENDIX II: GUIDANCE ON CONTROLLING THE COMPUTER MODELLING OF DISPOSAL FACILITIES FOR RADIOACTIVE WASTE	61
 REFERENCES	69
CONTRIBUTORS TO DRAFTING AND REVIEW	71
BODIES FOR THE ENDORSEMENT OF IAEA SAFETY STANDARDS	73

1. INTRODUCTION

BACKGROUND

1.1. Radioactive waste (referred to in this Safety Guide as waste) must be managed in such a way as to avoid imposing an undue burden on future generations; that is, the generations that produce the waste have to seek and apply safe, practicable and environmentally acceptable solutions for its long term management (Ref. [1], para. 3.29). Management systems play an important role in applying such solutions, and should be implemented for all stages of waste management, from waste generation to waste disposal. Management systems for the disposal of radioactive waste are subject to the requirements established in Ref. [2]. Recommendations on meeting these requirements are presented in this Safety Guide and in Ref. [3].

1.2. This Safety Guide uses the term ‘management system’ instead of ‘quality assurance’. The term management system reflects and includes the evolution in the approach from the initial concept of ‘quality control’ (controlling the quality of products) through ‘quality assurance’ (the system to ensure the quality of products) and ‘quality management’ (the system to manage quality). The management system is the set of interrelated or interacting elements that establishes policies and objectives and that enables those objectives to be achieved in a safe, efficient and effective way. The requirements for the management system established in Ref. [2] and the recommendations in the accompanying Safety Guide, Application of the Management System for Facilities and Activities [3], supersede the earlier code on quality assurance¹.

1.3. A management system should be used to ensure that adequate measures are in place to address technical issues relating to safety, protection of health, protection of the environment, security, quality and economics. Solutions to technical problems are provided by means of such processes as design and research and development, which are controlled by the management system. The management, in the management system:

¹ INTERNATIONAL ATOMIC ENERGY AGENCY, Quality Assurance for Safety in Nuclear Power Plants and other Nuclear Installations, Code and Safety Guides Q1–Q14, Safety Series No. 50-C/SG-Q, IAEA, Vienna (1996).

- (a) Should recognize the need to specify when activities in such processes are required to be conducted;
- (b) Should require the scope of the activities to be carefully defined;
- (c) Should require the activities to be carried out carefully;
- (d) Should require the results to be evaluated and taken into account appropriately.

Technical issues may also have to be addressed so that managerial functions such as independent verification and checking may be carried out.

1.4. Disposal of radioactive waste involves a variety of technical and managerial activities, and may extend over a very long time (potentially hundreds of years). These characteristics present a series of challenges to the development and implementation of effective management systems for facilities and activities for waste disposal. The following aspects warrant particular consideration in developing a management system for programmes for waste disposal:

- (a) By definition, waste is material for which no further use is foreseen. The provision of funds and the organizational arrangements to dispose of waste could be given inadequate attention if they were to become decoupled from the benefits drawn from the activity that generates the waste. The organization and funding of the necessary eventual waste disposal could be much more difficult to put into place later.
- (b) Waste can be managed safely on an interim basis, in many cases for extended periods. As a consequence, the implementation of waste disposal may be postponed by a series of short term deferrals for additional assessment of the options.
- (c) Under the 'polluter pays' principle, the organization that generates the waste is responsible for ensuring that the waste is managed properly. In some jurisdictions, ownership (and hence ultimate responsibility) for waste is transferred when the waste changes hands. In other jurisdictions, waste always remains the responsibility of the original generator. Care should be taken to keep the responsibility clear and fulfilled at all times.
- (d) Public and political sensitivities to decisions about the disposal of radioactive waste can impose constraints on the waste disposal arrangements, timings and technical decisions that are feasible.
- (e) Management systems for all waste management activities should encourage the adoption of unified approaches and solutions and international best practices because of the need to ensure continuity

between successive human generations, and the uncertainty in the long term of organizational, national and international structures.

- (f) The organizations involved in waste management may be publicly or privately owned, or a combination of both. The respective interests, driving factors and responsibilities of different types of organization may present challenges in harmonizing them into a coherent overall management system for a waste management programme. Whatever the arrangements are, safety and environmental protection should always be paramount.
- (g) The long term nature of waste disposal means that particular attention should be paid to:
 - (i) Maintaining public confidence that management supervision will be continuous;
 - (ii) Establishing confidence that the long term performance of the waste disposal facility will meet the requirements;
 - (iii) Estimating costs and establishing the funding arrangements that will be necessary to continue to monitor and control the waste disposal system until active institutional control ceases;
 - (iv) Ensuring continuity of understanding, attention and resourcing from one human generation to the next.

1.5. One particular aspect to consider when developing management systems for geological disposal facilities for radioactive waste is that, after the termination of active institutional control in the post-closure phase, safety and environmental protection will depend on a passive system, primarily the geosphere (i.e. intervention and maintenance are neither planned nor required). In addition to providing a protected, stable environment for the engineered barriers in the short term, the geosphere continues to provide isolation of the waste long after the engineered barriers degrade. This reliance on a geological system affects the development and implementation of the management system, in which the benefits of a stable geological system and the limited ability of humans to modify such a system must be recognized.

1.6. One aspect of the long term nature of all types of waste disposal is the unpredictability of the future behaviour of groups that may be affected by, or may have an impact on, the waste disposal facility; for example:

- (a) Changes in lifestyle (e.g. the evolution from rural life to urban life, the extent of economic activity and exchanges of goods, and the resulting degree of self-sufficiency and reliance on local resources);

- (b) The degree of technological development and the demand for resources, and hence the degree of interest in recovering buried or subterranean material and the ability to do so;
- (c) The potential for the presence of subterranean material that should not be disturbed to be forgotten, leading to a potential for inadvertent intrusion into a waste repository.

1.7. In comparison with nuclear power plants and other nuclear facilities, the state of development of, and the amount of experience with, waste disposal facilities is more varied between the States concerned, and not as extensive and mature. For example, while various types of near surface waste disposal facility are in operation at present, no geological disposal facility for spent fuel or high level radioactive waste is yet operating. Thus, management systems for the siting, design, construction, operation, closure and post-closure phases of waste disposal facilities will have to be developed and improved as knowledge of the development of these facilities is accumulated in States. The accumulation of management knowledge in the organization, in industry and in regulatory bodies and in and among States is very important. In this regard, peer review is considered an effective and useful evaluation method for all stages of development of a waste disposal facility, especially for new endeavours such as geological disposal facilities for radioactive waste.

1.8. The long term nature of waste disposal means that a waste disposal facility will be managed by successive generations and may be controlled under a series of different organizations and management systems; this could present challenges to the maintenance of continuous and consistent management oversight.

1.9. This Safety Guide is issued as one of several IAEA safety standards that deal with management systems for the safety of facilities and activities. It provides recommendations on how to meet the requirements in Ref. [2] for waste disposal, and is supplementary to the general recommendations provided in Ref. [3]. This Safety Guide has a companion standard [4] that provides recommendations on the development of management systems for the processing, handling and storage of radioactive waste prior to its disposal. Application of these requirements and recommendations relating to the management system for waste disposal will contribute to a high level of confidence that the waste disposal facility and its contents will be of sufficient quality and will continue to comply with existing limits, controls and conditions important to safety and environmental protection. The management systems will enable the parties involved to judge the level of safety and environmental

protection provided by the waste disposal facility as new information is obtained regarding disposal. In addition to the careful management of the activities that directly determine the level of safety and environmental protection, those activities that are involved in assessing and demonstrating safety and environmental protection should be managed (e.g. on-site evaluation, facility design, environmental impact assessment, authorization processes, establishment of waste acceptance criteria, planned and systematic methods for waste inspection and emplacement, collection of operational data, facility monitoring and the use of surveillance systems). All these activities should be reflected in a comprehensive safety case, which will provide reliable arguments that can be made about the continuing level of safety and environmental protection provided by the facility and reliable evidence to support them. However, it should be recognized that the prime responsibility for properly executing a particular task (e.g. in design, in construction or in the operation of a waste disposal facility) rests with those who are assigned the task.

1.10. The management systems applied to meet requirements for the siting, design, construction, operation, closure and post-closure phases of waste disposal facilities all contribute to applying the fundamental safety principles established in Ref. [1]. Requirements for legal and governmental infrastructure are established in Ref. [5]. Other technical requirements and recommendations relating to facilities and activities for the disposal of radioactive waste are established in other IAEA safety related publications [6–11]. The basic requirements for radiation protection are established in Ref. [12] and the requirements for emergency preparedness and response in Ref. [13].

1.11. The development and maintenance of a safety culture in an organization is central to the management systems described in this Safety Guide. A management system should help rather than impede a waste management organization in achieving its objectives, fostering positive attitudes towards the management system and the safety culture it supports. The importance of a strong safety culture has been recognized by IAEA Member States.

1.12. The precepts of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management [14] should be considered in developing management systems for waste disposal activities, to give due recognition to the international aspects of the waste disposal activities.

1.13. The management systems discussed in this Safety Guide are intended also to apply to the period of active institutional control in the post-closure phase, but this Safety Guide is mainly concerned with management systems to be implemented and used over the next few decades. Although the recommendations are generally applicable to management systems that may be applied in the extended times of the post-closure phase (e.g. thousands of years and further in the future in the case of passive institutional control for geological disposal of radioactive waste), the recommendations are not intended to be unduly prescriptive for these time periods in the future. Understanding and knowledge will continue to grow and should be managed continuously in the organization, the industry and the regulatory body, and in and among States. This Safety Guide will be revised in the light of knowledge and experience gained on new processes, technological developments, and changes in the skills and tasks of personnel, as well as other, unforeseen, changes.

OBJECTIVE

1.14. The objective of this Safety Guide is to provide recommendations on developing and implementing management systems for all phases of facilities for the disposal of radioactive waste and related activities.

SCOPE

1.15. This Safety Guide covers the management systems for managing the different stages of waste disposal facilities, such as:

- (a) Siting, design and construction;
- (b) Operation (i.e. the activities, which can extend over several decades, involving receipt of the waste product in its final packaging (if it is to be disposed of in packaged form), waste emplacement in the waste disposal facility, backfilling and sealing, and any subsequent period prior to closure);
- (c) Closure;
- (d) The period of institutional control (i.e. either active control — monitoring, surveillance and remediation; or passive control — restricted land use).

The management systems apply to various types of disposal facility for different categories of radioactive waste, such as:

- (i) Near surface (for low level waste);
- (ii) Geological (for low, intermediate and/or high level waste);
- (iii) Boreholes (for sealed sources);
- (iv) Surface impoundment (for mining and milling waste);
- (v) Landfill (for very low level waste).

1.16. This Safety Guide also covers management systems for related processes and activities, such as:

- (a) Extended monitoring and surveillance during the period of active institutional control in the post-closure phase;
- (b) Safety and performance assessments and development of the safety case for the waste disposal facility;
- (c) Regulatory authorization (e.g. licensing).

1.17. This Safety Guide is intended to be used by organizations that are directly involved in, or that regulate, the facilities and activities described in paras 1.15 and 1.16, and by the suppliers of nuclear safety related products that are required to meet some or all of the requirements established in Ref. [2]. It will also be useful to legislators and to members of the public and other parties interested in the nuclear industry.

STRUCTURE

1.18. This Safety Guide follows the structure of Ref. [2]. The key points for establishing a management system, including general considerations, safety culture, graded application of requirements and documentation of the management system, are discussed in Section 2. The roles and responsibilities of the management of an organization for the development and implementation of an effective management system are discussed in Section 3. Resource management, including the provision of financial resources, human resources and an infrastructure and working environment, is discussed in Section 4. Planning and control of the processes used for the specific activities of the organization, the control of documents and control of records, and the management of organizational change are discussed in Section 5. Section 6 addresses the measurement, assessment and improvement of the management system itself.

1.19. To aid the user, the corresponding requirements of Ref. [2] are quoted at the beginning of each section.

1.20. Appendix I provides recommendations on issues relating to the management system that are specific to the operation, closure and active institutional control phases of waste disposal facilities. Appendix II provides recommendations on issues relating to the management system that are specific to the design, testing and application of, and change control processes for, computer modelling that will be used in all phases of activities relating to waste disposal.

2. THE MANAGEMENT SYSTEM

GENERAL RECOMMENDATIONS

2.1. Reference [2] requires in paras 2.1–2.4 that:

“2.1. A management system shall be established, implemented, assessed and continually improved. It shall be aligned with the goals of the organization and shall contribute to their achievement. The main aim of the management system shall be to achieve and enhance safety by:

- Bringing together in a coherent manner all the requirements for managing the organization;
- Describing the planned and systematic actions necessary to provide adequate confidence that all these requirements are satisfied;
- Ensuring that health, environmental, security, quality and economic requirements are not considered separately from safety requirements, to help preclude their possible negative impact on safety.

“2.2. Safety shall be paramount within the management system, overriding all other demands.

“2.3. The management system shall identify and integrate with the requirements contained within this publication:

- The statutory and regulatory requirements of the Member State;
- Any requirements formally agreed with interested parties (also known as ‘stakeholders’⁷);
- All other relevant IAEA Safety Requirements publications, such as those on emergency preparedness and response [13] and safety assessment [15];
- Requirements from other relevant codes and standards adopted for use by the organization.

“2.4. The organization shall be able to demonstrate the effective fulfilment of its management system requirements.”

⁷ Stakeholder: interested party; concerned party. ‘Stakeholder’ means an interested party — whether a person or a company, etc. — with an interest or concern in ensuring the success of an organization, business, system, etc. To ‘have a stake in’ something figuratively means to have something to gain or lose by, or to have an interest in, the turn of events. The term stakeholder is used in a broad sense to mean a person or group having an interest in the performance of an organization. Those who can influence events may effectively become interested parties — whether their ‘interest’ is regarded as ‘genuine’ or not — in the sense that their views need to be considered. Interested parties have typically included the following: customers, owners, operators, employees, suppliers, partners, trade unions, the regulated industry or professionals; scientific bodies; governmental agencies or regulators (local, regional and national) whose responsibilities may cover nuclear energy; the media; the public (individuals, community groups and interest groups); and other States, especially neighbouring States that have entered into agreements providing for an exchange of information concerning possible transboundary impacts, or States involved in the export or import of certain technologies or materials.”

2.2. This Safety Guide provides specific recommendations for meeting the requirements of Ref. [2] on establishing management systems suitable for waste disposal facilities and related activities. The development of the management system for an organization will also be influenced by:

- (a) Internationally recognized standards such as ISO 9001:2000 [16] for quality management systems and ISO 14001:2004 [17] for environmental management systems²;
- (b) Guidance associated with the defined regulatory and statutory requirements of States;
- (c) Standard practices of the nuclear industry;
- (d) The organization's own standard practices.

2.3. Whichever codes, standards and requirements are used in developing the management system, the design of the management system should incorporate systems and processes both to comply with all requirements and to demonstrate the compliance. Assessments of the management system (see Section 6) should demonstrate that the management system is under control, and that the procedures for executing the processes that are controlled under the management system are producing the specified results to satisfy the requirements, thus establishing that the processes are executed correctly.

2.4. The management system should be developed to cover all aspects of waste disposal facilities and the associated activities to be carried out, irrespective of whether they are individual or composite activities. This includes the safety assessments conducted to evaluate all aspects of a facility that are relevant to safety and environmental protection, and the structure and presentation of safety arguments and supporting evidence in the safety case for the waste disposal facility.

2.5. The management system should provide assurance that the waste disposal facilities and related activities will comply with all applicable requirements, respecting the principle of carrying out work correctly the first time. The management system should include measures to be taken in the event that requirements are not met, to the end of active institutional control.

² ISO 9001:2000 is relevant for organizations responsible for active and passive institutional control, but ISO 14001:2004 is not applicable for the passive institutional control (e.g. periods when only land use controls are imposed) of a waste disposal facility.

2.6. The management system should include plans and arrangements for the management system itself to continue for as long as is required to maintain continuous active institutional control over the waste disposal facility. The management system should be planned to take into account the extended periods of the waste disposal operations and of the active institutional control in the post-closure phases. These extended periods influence the long term planning that is necessary to maintain continuity of oversight of the waste disposal facility. Emergency response drills, exercises and planned reviews of the adequacy of measures for emergency preparedness and response should be continued during any extended pre-closure period after operations have ceased, when preparedness may decline in the seemingly static situation. The management system should also be designed to accommodate future technological advances and changes in waste acceptance criteria that could have implications for continued operation of the waste disposal facility.

SAFETY CULTURE

2.7. Reference [2] requires in para. 2.5 that:

“The management system shall be used to promote and support a strong safety culture by:

- Ensuring a common understanding of the key aspects of safety culture within the organization;
- Providing the means by which the organization supports individuals and teams in carrying out their tasks safely and successfully, taking into account the interaction between individuals, technology and the organization;
- Reinforcing a learning and questioning attitude at all levels of the organization;
- Providing the means by which the organization continually seeks to develop and improve its safety culture.”

2.8. The management system should support the development, implementation and continued enhancement of a pragmatic and strong safety culture [18–20] and should promote the adoption of best practices, regardless of the type, scale, complexity, duration and evolution of the activities for waste disposal. The management system for activities for waste disposal should support the safety culture and environmental protection culture throughout all levels of the organizations involved, and for all stages in the lifetime of a waste

disposal facility. The management system should establish an environment in which staff can raise safety issues without fear of harassment, intimidation, retaliation or discrimination.

GRADING THE APPLICATION OF MANAGEMENT SYSTEM REQUIREMENTS

2.9. Reference [2] requires in paras 2.6 and 2.7 that:

“2.6. The application of management system requirements shall be graded so as to deploy appropriate resources, on the basis of the consideration of:

- The significance and complexity of each product or activity;
- The hazards and the magnitude of the potential impact (risks) associated with the safety, health, environmental, security, quality and economic elements of each product or activity;
- The possible consequences if a product fails or an activity is carried out incorrectly.

“2.7. Grading of the application of management system requirements shall be applied to the products and activities of each process.”

2.10. Organizations involved in waste disposal should identify the relative importance of the various activities, facilities and equipment in meeting the overall safety, health, environmental, security, quality and economic requirements, with safety and environmental protection being of primary importance. Resources should then be selectively allocated and processes selectively designed to control the activities, facilities and equipment effectively and efficiently. Controls will vary for different facilities and activities for waste disposal.

2.11. Effective and efficient management of waste disposal involves the selective application of controls on the basis of fundamental factors important to meeting the safety, health, environmental, security, quality and economic requirements, such as:

- (a) The quantities and potential hazards (radiological and non-radiological, for example chemical) of the waste, and the necessary degree of isolation;

- (b) The dispersibility and mobility of the waste forms involved and the necessary degree of containment;
- (c) Experience with, and maturity of, the waste disposal technology and the potential for future advances;
- (d) The reliability of equipment and its function in relation to safety and environmental protection;
- (e) The degree of uncertainty about future evolution of the geological environment and engineered barriers;
- (f) Consideration of future human activities, as appropriate;
- (g) The complexity and degree of standardization of the activities;
- (h) The novelty and maturity of the activities;
- (i) The size of the organization, the number and complexity of interfaces and the safety culture;
- (j) Uncertainty about future public perception of radiation hazards and radioactive waste;
- (k) Uncertainty about future government policy on the nuclear industry and radioactive waste management.

2.12. A graded approach may be adopted (e.g. on the basis of the findings of a hazard and operability studies (HAZOPS) assessment) in applying management system requirements to such aspects of waste disposal activities as the:

- (a) Level of detail of work instructions and supporting documentation;
- (b) Level of qualification and training of workers;
- (c) Quantity, detail and retention times of records;
- (d) Need for, and level of detail in, formal logbooks;
- (e) Level of detail and frequency of testing, surveillance and inspection;
- (f) Equipment to be included in status control for the facility;
- (g) Key performance indicators to be measured;
- (h) Equipment calibration requirements;
- (i) Need to monitor the condition of equipment, emplaced waste and facility integrity;
- (j) Traceability of items, including waste packages;
- (k) Availability and conditions of storage of materials and control of the associated records;
- (l) Level of reporting and authority to act on non-conformances and to implement corrective actions;
- (m) Scope, frequency and detail of assessments;
- (n) Scope, frequency and detail of facility audits to monitor operational processes and levels of safety and environmental protection;

- (o) Need for, and detail of, environmental monitoring.

2.13. Grading is intended to guide the degree of control applied to an item in relation to the importance of its required function. Grading should not be used as a justification for not applying all of the necessary management system elements or required quality controls, or for performing less than adequate technical assessments of items that are less evidently important to meeting the safety, health, environmental, security, quality and economic requirements. Grading should not be used to sanction less than adequate practices. Grading does not mean excluding determination of the adequacy of any activity affecting quality or safety. Grading means making the stringency of the controls by which the adequacy of such activities is evaluated commensurate with the importance of the activities.

DOCUMENTATION OF THE MANAGEMENT SYSTEM

2.14. Reference [2] requires in paras 2.8–2.10 that:

“2.8. The documentation of the management system shall include the following:

- The policy statements of the organization;
- A description of the management system;
- A description of the structure of the organization;
- A description of the functional responsibilities, accountabilities, levels of authority and interactions of those managing, performing and assessing work;
- A description of the processes and supporting information that explain how work is to be prepared, reviewed, carried out, recorded, assessed and improved.

“2.9. The documentation of the management system shall be developed to be understandable to those who use it. Documents shall be readable, readily identifiable and available at the point of use.

“2.10. The documentation of the management system shall reflect:

- The characteristics of the organization and its activities;
- The complexities of processes and their interactions.”

2.15. Operation of a waste disposal facility may continue over an extended period of time, possibly several decades. Closure and post-closure activities at the facility may not commence for many decades thereafter. Both management practices and operating processes may evolve significantly. Particular attention should be paid to ensuring that documents used to control work processes remain relevant, current, understandable and available to the diverse organizations and in the situations in which they are and will be used.

3. MANAGEMENT RESPONSIBILITY

GENERAL

3.1. The processes for fulfilling the responsibilities of senior management in relation to the disposal of radioactive waste are subject to the requirements established in Ref. [2], and the recommendations presented in this Safety Guide and provided in Ref. [3] should be considered.

MANAGEMENT COMMITMENT

3.2. Reference [2] requires in paras 3.1–3.5 that:

“3.1. Management at all levels shall demonstrate its commitment to the establishment, implementation, assessment and continual improvement of the management system and shall allocate adequate resources to carry out these activities.

“3.2. Senior management shall develop individual values, institutional values and behavioural expectations for the organization to support the implementation of the management system and shall act as role models in the promulgation of these values and expectations.

“3.3. Management at all levels shall communicate to individuals the need to adopt these individual values, institutional values and behavioural expectations as well as to comply with the requirements of the management system.

“3.4. Management at all levels shall foster the involvement of all individuals in the implementation and continual improvement of the management system.

“3.5. Senior management shall ensure that it is clear when, how and by whom decisions are to be made within the management system.”

3.3. The management responsible should recognize that waste disposal concerns the entire lifetime of a facility built in the natural environment, and that the facility will need to perform as anticipated over a long period. National and international policies and principles for waste disposal and industry norms and industry standards that currently constitute an accepted management system will evolve over an extended period of time and may affect any aspect of waste disposal. Policy decisions (e.g. regarding fuel reprocessing) and technological innovations and advances (e.g. in partitioning and transmutation) may lead to fundamental changes in the overall waste management strategy. However, management will retain its responsibility for all activities at all times, and continuous commitment by management will remain a prerequisite to ensuring safety and the protection of human health and the environment.

SATISFACTION OF THE EXPECTATIONS OF INTERESTED PARTIES

3.4. Reference [2] requires in para. 3.6 that:

“The expectations of interested parties shall be considered by senior management in the activities and interactions in the processes of the management system, with the aim of enhancing the satisfaction of interested parties while at the same time ensuring that safety is not compromised.”

3.5. Several broad considerations relating to satisfying the expectations of the many present and future interested parties involved (e.g. the operator, the regulatory body, suppliers, national and local governments, the public) should be taken into account in developing the management system for facilities and activities for waste disposal. The requirements of some interested parties (e.g. the regulatory body) must be complied with, while the expectations and preferences of other interested parties may never be complied with entirely. Many issues may be sufficiently important to warrant consideration when developing the management system for waste disposal, such as:

- (a) Legal aspects of waste disposal (such as state or provincial laws and regulations, occupational health regulations, hazardous material regulations, mining regulations);
- (b) Physical protection and security provisions that may be required, as appropriate, for nuclear and other radioactive material;
- (c) Operational limitations including those derived from agreements with local authorities or organizations or operating logistics;
- (d) The adequacy of the activities performed by the organizations that carried out the steps in waste management prior to waste disposal;
- (e) Public attitudes, concerns and expectations about safety and environmental protection in relation to waste disposal activities in the long term (for aspects such as the selection process and site evaluation, the adequacy and reliability of organizational and financial arrangements, the degree of confidence in the protection of public health and the environment in relation to waste disposal facilities, the ability to respond to problems that may arise during the period of active institutional control, and safety and environmental protection during the closure and post-closure phases);
- (f) Public concerns about extended restrictions on the use of land and geological resources;
- (g) Other concerns of interested parties (e.g. cultural expectations about working hours and the composition of the workforce, social expectations about distributing risks and benefits, economic constraints if nuclear activities have a broad scope but are on a small scale, political choices about activities for sustainable development).

ORGANIZATIONAL POLICIES

3.6. Reference [2] requires in para. 3.7 that:

“Senior management shall develop the policies of the organization. The policies shall be appropriate to the activities and facilities of the organization.”

3.7. The management system for waste disposal should specify the requirement to create and periodically review the policies of the organizations involved and the associated arrangements to do so. Organizational policies for waste disposal facilities and activities should cover not only the safety, health, environmental, security, quality and economic aspects but also the items listed in para. 3.5.