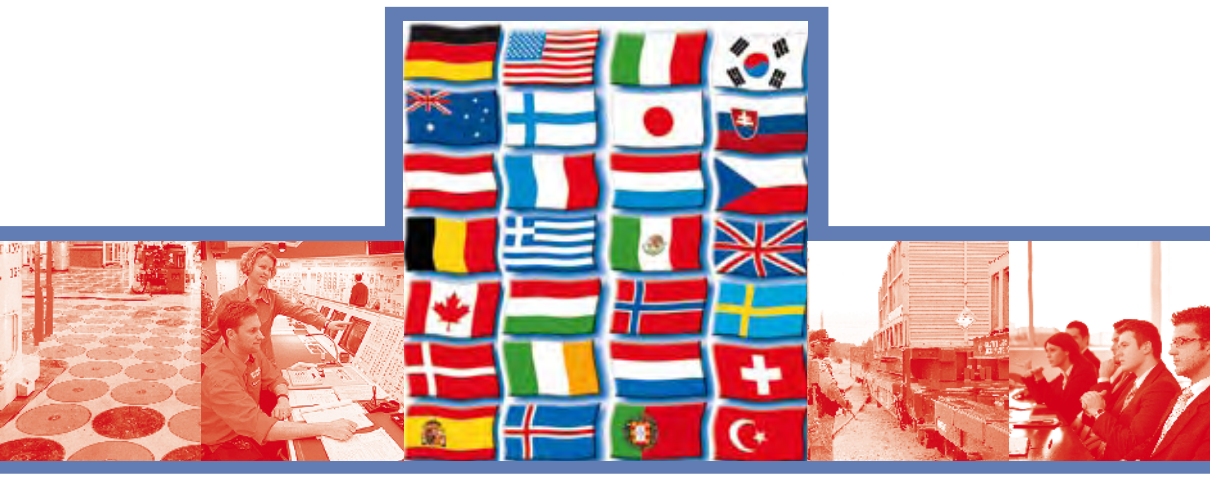

Chapter 10

Legal Frameworks

Key points

- Certain fundamental concepts or principles distinguish nuclear law from other aspects of national law and they are reflected in both national and international legal frameworks governing nuclear activities.
- Whether at national or international level, legal frameworks must be sufficiently flexible to adapt to future developments, including a significant increase in global nuclear energy production and use.
- The current international legal framework consists of a variety of legally binding treaties, conventions, agreements and resolutions supplemented by numerous non-legally binding codes, guidelines and standards. The framework has undergone significant evolution over the last 50 years as a result of scientific and technological progress, national energy policies, economic forces, commercial considerations, environmental concerns, security risks and nuclear accidents.
- One of the most important challenges for the future will be to persuade countries with new nuclear power programmes to adhere to that international legal framework and to abide by the terms of its various instruments. The same challenge will apply to those countries which have already established nuclear programmes but which have chosen not to "harmonise" their regimes with the existing international framework.
- Intergovernmental organisations must continue to provide extensive assistance to their members in the development of national legal frameworks for carrying out nuclear activities, and must continue to constitute important fora for the exchange of information and experience, and for the provision of guidance.
- National regulatory bodies, their responsibilities and attributes, are essential components of national legal frameworks.

10.1 Introduction

Legal frameworks in the nuclear field are sets of special, legally binding rules created to regulate the conduct of entities engaged in nuclear activities. Nuclear activities are those which relate to fissionable materials, ionising radiation and exposure to natural sources of radiation. The rules aim to ensure the protection of persons, property and the environment from the hazards associated with nuclear activities. Today, virtually all activities involved in the nuclear fuel cycle are subject to national and international legal frameworks to some degree. At the national level, a legal framework is normally founded on legislation (including regulations), while at the international level it is comprised of one or more legally binding international instruments such as treaties, conventions and agreements.

Over the last 50 years, both national and international legal frameworks governing nuclear activities have undergone a major transformation as a result of many factors: scientific and technological progress, changing national energy policies, new economic forces, competitive commercial considerations, increased concern for the environment, national and international security risks, and the Chernobyl accident. These legal frameworks must be flexible enough to adapt to future developments, including a significant increase in the global production and use of nuclear energy and the implementation by certain countries of a nuclear power programme for the first time.

Several fundamental concepts or principles are particularly characteristic of nuclear law and are reflected in legal frameworks governing nuclear activities: concepts such as safety, security, responsibility, permission, continuous control, compensation, sustainable development, compliance, independence, transparency and international co-operation. The expectation that nuclear energy production and use will increase in the future is not likely to lead to the creation of new concepts, but it will almost certainly result in greater importance being placed upon the existing ones.

10.2 The international legal framework

10.2.1 Origins

For the most part, international nuclear law has developed reactively to technological developments, major events and increasing public concerns with nuclear hazards. Although the international nuclear community was well aware of the transboundary impact that a nuclear accident could have on human health, property and the environment,[1] it was the Chernobyl accident which triggered the subsequent adoption of international treaties and conventions to specifically address the safety of nuclear power plants, the safe management of spent nuclear fuel and radioactive waste, nuclear emergency notification and assistance, improved compensation for nuclear damage and the international transport of radioactive materials. Similarly, terrorist or other criminal activities at the international level have motivated the international community to adopt new or strengthened legal instruments designed to improve nuclear security, the safety of nuclear trade and the non-proliferation of nuclear weapons.

Multilateral instruments such as the Paris Convention (1960), the Nuclear Non-Proliferation Treaty (1968) and the London Convention (1972) constituted the first international legal frameworks in the nuclear field. It was only after the Chernobyl accident in 1986, however, that a *comprehensive* international framework governing all aspects of nuclear energy production and use began to take shape. That framework now consists of a variety of legally

1. As evidenced, for example, by the adoption in the early 1960s of the Paris Convention (1960), the Brussels Supplementary Convention (1963) and the Vienna Convention (1963) on liability and compensation for nuclear damage and the Convention on the Physical Protection of Nuclear Material (CPPNM) in 1980.

binding treaties, conventions, agreements and resolutions, supplemented by numerous non-legally binding codes, guidelines and standards. Its objective is to ensure that nuclear activities will be carried out whenever, wherever and by whomever on a safe and secure basis.

10.2.2 International legal instruments

An international legal framework often aims to achieve harmonisation. This does not mean uniformity; it does mean consistency. Where the peaceful use of nuclear energy has the potential to cause serious harm to a neighbouring country, consistent management of the risks and the response to incidents lead to better understanding, appreciation and confidence between nations in the use of this technology. Tables 10.1, 10.2 and 10.3 illustrate the more important instruments which currently make up the international legal framework.

In addition, many *non-legally binding* instruments have been issued to assist those involved in peaceful nuclear energy use: policy makers, regulators, nuclear facility operators and suppliers of goods, services and technology. The best-known and most frequently used are the IAEA's *Safety Standards*, the *Code of Conduct on the Safety and Security of Radioactive Sources* and the *Code of Conduct on the Safety of Nuclear Research Reactors*.

Table 10.1: International legal instruments governing safety, radiological protection and emergency response

Instrument	Purpose	Year of adoption
Convention on Early Notification of a Nuclear Accident (Early Notification Convention)	Creates a system for notifying the IAEA/neighbouring countries of a nuclear accident with potential transboundary consequences.	1986
Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (Assistance Convention)	Sets up a framework for prompt assistance and support for nuclear accidents or radiological emergencies.	1986
Council Directive 89/618/EURATOM	Requires the general public to be informed of health protection measures and other steps to be taken in the event of a radiological emergency.	1989
Convention on Nuclear Safety (Nuclear Safety Convention)	An incentive convention* that aims to maintain a high level of safety at operating nuclear power plants (NPPs) by setting international benchmarks for nuclear safety practices and regulations.	1994
Council Directive 96/29/EURATOM	Sets out basic safety standards for protecting the health of workers and of the general public from the dangers of ionising radiation.	1996
Council Directive 2003/122/ EURATOM	Governs the control of high-activity, sealed radioactive sources and orphan sources.	2003

* An "incentive convention" is one which is not intended to ensure that its parties comply with their obligations thereunder by means of controls and sanctions, but rather on the basis of their common interest in achieving the stated goals of the convention. Will is developed and promoted through regular meetings of the parties. In the case of the Convention on Nuclear Safety, parties are required to submit reports on the implementation of their obligations for "peer review" at such meetings.

Table 10.2: International legal instruments governing spent nuclear fuel and radioactive waste management		
Instrument	**Purpose**	**Year of adoption**
Council Regulation (EURATOM) No. 1493/93	Governs shipments of radioactive substances between European Union member states.	1993
Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (Joint Convention)	An incentive convention that aims to achieve and maintain a high level of safety through the enhancement of national measures and international co-operation.	1997
Council Directive 2006/117/EURATOM	Addresses the supervision and control of shipments of radioactive waste and spent fuel.	2006

Table 10.3: International legal instruments governing liability and compensation for nuclear damage		
Instrument	**Purpose**	**Year of adoption**
Paris Convention on Third Party Liability in the Field of Nuclear Energy	Establishes a nuclear liability and compensation regime to compensate victims of a nuclear accident (open to OECD member countries as of right and non-member countries with the consent of all Convention States).	1960
Brussels Convention Supplementary to the Paris Convention	Establishes a scheme to provide compensation supplementary to that required by the Paris Convention (open only to Paris Convention States).	1963
Vienna Convention on Civil Liability for Nuclear Damage	Establishes a nuclear liability and compensation regime similar to that provided for under the Paris Convention (open to any state).	1963
Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention	Acts as a bridge between the Paris and Vienna Conventions, effectively extending the benefits provided by one convention to victims in countries which have joined the other convention.	1988
Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage	Improves the original regime by requiring that more money be made available to compensate more victims for a broader range of damages.	1997
Protocol to Amend the Paris Convention on Nuclear Third Party Liability	Improves the existing regime by requiring that more money be made available to compensate more victims for a broader range of damages.	2004*
Protocol to Amend the Brussels Convention Supplementary to the Paris Convention	Improves the existing regime by requiring that significantly more compensation be made available to supplement that which is to be provided under the Paris Convention.	2004*
Convention on Supplementary Compensation for Nuclear Damage	Provides for a global liability and compensation scheme which may supplement that called for under the Paris Convention, the Vienna Convention or Annex State legislation as defined by this Convention on Supplementary Compensation.	1997*

* Not yet in force.

Liability and compensation for nuclear damage

Governments have generally recognised the need to balance the benefits to society of a developed nuclear industry with protecting the public from the exceptional risks arising from nuclear energy production. For most nuclear power generating countries, attaining this balance has meant setting aside the basic rules of tort law in favour of new principles governing liability for damage suffered by third parties[2] as a result of an accident occurring at a nuclear installation or during the transport of nuclear substances. These principles form the basis of most legislation at national level and the nuclear liability and compensation conventions at international level.[3]

Strict liability: the operator of the nuclear installation is liable for damage, without proof of fault or negligence; only proof of a causal link between the damage and the nuclear accident is needed.[4]

Exclusive liability: with few exceptions, the operator of a nuclear installation is the only entity which may be held liable for damages, regardless of the actual cause of the accident.[5]

Financial security: an operator must financially secure its liability to ensure the availability of compensation funds; private insurance is most commonly used.

Liability limited in amount: an operator's liability is limited in amount, a *quid pro quo* for the benefits of strict and exclusive liability and the result of limited insurance market capacity which largely determines the liability amount. [6]

Liability limited in time: an operator's liability is limited in time, usually to ten years following the accident;[7] again a *quid pro quo* for strict and exclusive liability and because financial security providers will not provide coverage for longer periods.

Long before the Chernobyl accident, countries recognised that the consequences of a nuclear accident would not stop at political or geographical borders. They agreed that an international convention would be desirable to ensure that claimants in countries party to it would have their actions judged by similar laws, regardless of where the accident took place or where

2. A "third party" is anyone other than a nuclear operator or a supplier of goods, services or technology.

3. Some countries have adopted many, but not all of these principles.

4. Under tort law rules, a claimant must prove the fault or negligence of the entity from which it is seeking compensation. As victims would have great difficulty establishing such proof after an accident's occurrence, strict liability provides a large measure of equity to claimants.

5. A claimant normally must pursue those parties potentially liable for the damage. As this would pose a major challenge to victims following a nuclear accident, exclusive liability constitutes a significant benefit. In addition, goods, services and technology suppliers need not defend claims nor incur liability insurance costs.

6. Most governments recognise that for a major accident, the operator's liability will not be sufficient and state intervention, based on state responsibility for the protection and welfare of its citizens, will be necessary.

7. Some countries have extended the period for instituting personal injury or death claims to 30 years.

the damage was suffered. An international convention could also lay down rules for cross-border legal actions, establish liability for damage arising from the transport of nuclear substances from one country to another, and determine which country's courts should have jurisdiction to hear claims and which country's laws should apply. As shown in Table 10.3, there are several such conventions in existence; the first to be adopted, under the auspices of the OECD, was the Paris Convention. Operator liability amounts and supplementary state funding limits under these instruments are shown in Table 10.4 below:[8]

Table 10.4: Operator liability and compensation amounts and supplementary state funding

Instrument	Operator's liability (provided by private funds unless otherwise noted)	Supplementary funding by state(s)
Paris Convention	Maximum: EUR 15M/USD 24M with NEA Steering Committee recommendation: EUR 154M/USD 244M Minimum: EUR 5M/USD 8M	N/A
Brussels Supplementary Convention	As per Paris Convention (see above)	Between EUR 5M/USD 8M and EUR 308M/USD 489M
Vienna Convention	Maximum: none Minimum: USD 95M (approximate)	N/A
Vienna Convention Protocol	Maximum: none Minimum: EUR 308M/USD 489M Reduced liability: EUR 5M/USD 8M Operator/State may share liability;	N/A
Paris Convention Protocol	Maximum: none Minimum: EUR 700M/USD 1.1Bn Reduced liability: EUR 70M for small risk facilities EUR 80M for transport	N/A
Brussels Supplementary Convention Protocol	Maximum: EUR 700M	Between EUR 700M/USD 1.1B and EUR 1.1B/USD 1.7B
Convention on Supplementary Compensation	Maximum: none Minimum: EUR 308M/USD 489M Reduced liability: EUR 5M/USD 8M Operator/State may share liability	EUR 308M/USD 489M (approximate, if all major nuclear power generating states join)

10.2.3 Intergovernmental organisations

Today's international framework was adopted under the auspices of several intergovernmental organisations which address nuclear issues, including the United Nations General Assembly and Security Council, the International Atomic Energy Agency, the OECD Nuclear Energy Agency, EURATOM and the International Maritime Organisation. The UN Environment Programme, the

8. Where the unit of account under the instrument in question is other than the EURO or the US dollar, the liability amount has been converted to the EUR/$US equivalent as of 22 July 2008.

Food and Agriculture Organization, the International Labour Organisation and the World Health Organization have also contributed through sponsorship of supporting instruments. These organisations provide extensive assistance to their members in developing national legal frameworks for carrying out nuclear activities and constitute important fora for the exchange of information and experience.

United Nations

A large number of treaties, conventions and resolutions have been adopted under the auspices of the United Nations. Those which are particularly relevant are set out in this chapter or are referred to in Chapter 9.

OECD Nuclear Energy Agency

The NEA has played an important role in helping its member countries create sound national and international legal regimes required for the peaceful uses of nuclear energy. This is particularly true in the field of liability and compensation for nuclear damage. It was under the auspices of the NEA that the 1960 Paris Convention and the 1963 Brussels Supplementary Convention were adopted, these instruments constituting the first international nuclear third party liability and compensation regime to be established. The NEA has also supported the recent amendment of these conventions as well as the adoption of the 1988 Joint Protocol which links the Paris-Brussels regime to an international nuclear liability regime later established by the IAEA.

International Atomic Energy Agency

As part of the UN family, the IAEA is to be credited with having promoted the adoption of the largest share of the international legal framework. Its instruments, both legally binding and otherwise, address every aspect of nuclear activity and, as with other intergovernmental organisations, national experts from IAEA member states work continuously to improve that framework. Much has been achieved, but much still needs to be done.

Safeguards systems

The most pivotal challenges will be to strengthen the IAEA's safeguards system (see also Chapter 9), to adopt effective enforcement measures, to strive for near-universal application and to ensure its full implementation. This will be particularly important for countries introducing a nuclear power programme for the first time or located in politically less stable regions.

Non-proliferation initiatives

The IAEA is now serving as a forum for discussion of multilateral approaches to the nuclear fuel cycle. Such approaches seek to internationalise or multinationalise sensitive nuclear fuel cycle facilities and to strengthen non-proliferation (see also Chapter 9). These approaches anticipate that countries with existing uranium enrichment and spent nuclear fuel reprocessing

capabilities will provide services to countries without such capabilities. In return, the latter countries would agree to forego having their own domestic facilities in the future.

Global nuclear safety regime

Increased nuclear energy production is an excellent reason to strengthen legal frameworks ensuring nuclear safety. The IAEA, the NEA and other international organisations must continue to promote adherence to international safety conventions as well as to codes of conduct, safety standards and safety practices in this field.

EURATOM

European Union activities in the nuclear field are based on the 1957 EURATOM Treaty, under which competences have been introduced in the fields of R&D, radiological protection, nuclear fuel supply, non-proliferation and international relations. Following debates on the security of future energy supplies, competitiveness, a single energy market and the EU undertakings under the 1997 Kyoto Protocol,[9] the European Commission has increased its initiatives in the nuclear field significantly. Among those that will play a major role in the future are the EC proposals presented in 2003 and amended in 2004 for Council Directives (EURATOM) on nuclear installation safety and the safe management of spent nuclear fuel and radioactive waste.

10.2.4 Outlook for the future

Adaptation, adherence and compliance

With a predicted increase in the number of nuclear power plants worldwide in the coming decades and a corresponding growth in related activity to enable that increase, the international community must be prepared to adapt the existing international legal framework to those new realities. Perhaps the most important challenge will be to ensure that countries with new nuclear power programmes adhere to the treaties, conventions, agreements and resolutions that comprise that framework and abide by their terms. The same challenge will apply in respect of countries with established nuclear programmes which have chosen not to harmonise their regimes with the international framework.

The international nuclear community will thus be obliged to continually focus its attention on *all* instruments forming part of the framework. While specific issues may result from current events,[10] compliance with the entire

9. The EU15 undertook to reduce greenhouse gas emissions between now and 2008-2012 by 8% below 1990 levels. There is no collective target for EU27 emissions.

10. In the years following the 11 September 2001 terrorist attacks against the United States, for example, the international community turned its attention largely to nuclear security, strengthening non-proliferation mechanisms and protection against terrorism and acts of a criminal nature.

framework will go far towards ensuring the future safety and security of the world's population and its environment. Table 10.5 illustrates the challenge that lies ahead by indicating the number of countries which have adhered to the most important elements of that framework.

Table 10.5: Number of contracting parties/states to the major international instruments in the nuclear field

International instrument	Contracting parties/states*
Nuclear Non-Proliferation Treaty	191
Comprehensive Nuclear Test Ban Treaty	144
Convention for the Suppression of Acts of Nuclear Terrorism	29
Convention on the Physical Protection of Nuclear Material	136
Amendment to the Convention on the Physical Protection of Nuclear Material	16
Convention on Nuclear Safety	61
Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management	46
Convention on Early Notification of a Nuclear Accident	102
Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency	100
Vienna Convention on Civil Liability for Nuclear Damage	35
Protocol to Amend the 1963 Vienna Convention on Civil Liability for Nuclear Damage	5
Convention on Supplementary Compensation for Nuclear Damage	3
Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention	25
Paris Convention on Third Party Liability in the Field of Nuclear Energy	15
Brussels Convention Supplementary to the Paris Convention	12

* Data available from the IAEA on 22 June 2008 at: www.iaea.org/Publications/Documents/Conventions/index.html.

In addition, the full potential of existing instruments must be tapped before attempting to establish new ones. In the field of liability and compensation for nuclear damage, for example, there are eight international instruments. Each has benefits and drawbacks and countries must determine which, if any, best suits their political, economic, geographic and social needs. Given the renewed interest in nuclear energy production, it is remarkable that only 234 of the 439 nuclear power plants in operation are covered by an international liability and compensation regime. This is not a matter of negotiating new instruments but of attracting adherence to existing ones.

A similar situation exists with regard to the Joint Convention, the only legally binding instrument in the radioactive waste management field and an important mechanism to achieve worldwide understanding of the issues underlying the back-end of the nuclear fuel cycle. Yet only 46 states have joined this instrument. There is an urgent need for much broader participation

in this convention, now and in the future, when increasing volumes of spent nuclear fuel and radioactive waste will need to be safely managed.

Trends in international law making

The international community will also be obliged to examine the effectiveness of "incentive conventions" and non-legally binding instruments which provide for little or no recourse in the event of non-compliance. Immediately following the Chernobyl accident, considerable efforts were made in international law making. By the end of the 1990s, however, this activity slowed and formal treaty making became rare.

This slowdown could be troublesome in the future. Countries are often reluctant to assume legal commitments, including enforcement measures, preferring the "soft law" of non-binding codes and standards over the "hard law" of treaty obligations, particularly since "soft law" can be adopted, revised and revoked without lengthy implementation procedures. Yet soft law might not be enough. Nuclear materials and technology will continue to spread globally and it is unlikely that political "peer pressure" will prove to be a reliable enforcement measure for responsible use in all cases. While it may be attractive to some, to others it will exacerbate concerns about the safe exploitation of nuclear technology in politically less stable regions.

Other pressing issues, such as management of the nuclear fuel cycle to address proliferation and security concerns, might lead to bilateral or multilateral co-operation projects for which appropriate international agreements would be needed, given that the Joint Convention is not designed to address these initiatives (see also Chapter 9). In addition, the international emergency and response systems established by the early notification and assistance conventions have not been updated and the call to initiate a code of conduct on emergency preparedness and response[11] is a clear sign that these instruments need to be revised.

Countries introducing a new nuclear power programme may adopt whatever legal framework they wish, but the international nuclear community will have a legitimate interest in ensuring that they at least meet minimum requirements. Legislative assistance programmes should be fully utilised for this purpose to ensure the adoption of frameworks that merit the endorsement of that community. Countries with existing programmes will need to demonstrate continued respect for the fundamental concepts referred to above in the face of pressing energy demands, economic interests and political pressures.

Special waste management challenges

Laws governing the siting, construction, operation and closure of waste management facilities have already been adopted by most countries with civil nuclear power programmes – but the solution to waste management

11. IAEA Resolution (2006), GC(50)/RES/1.

challenges does not stop there (see also Chapter 8). Public acceptance will pose far greater obstacles than legal drafting.

10.3 National legal frameworks

The responsible operation of a nuclear power programme requires a comprehensive legal framework at national level governing all activities forming part of the nuclear fuel cycle. Drafting or revising national legislation that establishes such a legal framework is not very different from law making in any other field of national interest, and like any other legislation, nuclear legislation must comply with a State's constitutional requirements. While there is no such thing as a model nuclear energy law, several of the fundamental concepts or principles noted earlier in this chapter are reflected in the national legislation of many countries. They are briefly described in Table 10.6.

Most countries with established nuclear power programmes have adopted legislation that regulates the use of nuclear energy through a mandatory licensing system permitting nuclear activities to be carried out only in accordance with a licence issued by the responsible public authority for that purpose. Licensing systems normally include strong compliance and enforcement mechanisms to ensure that all licence conditions and other applicable requirements are respected. Conditions and requirements normally address nuclear safety, radiological protection, waste management, non-proliferation, security, radioactive materials transport, radioactive sources, environmental assessment/protection and liability for nuclear damage. Compliance is verified through systematic inspections by the licensing authority and obligatory reporting by the licensee, and non-compliance can result in licence suspension or revocation, fines or even imprisonment. Countries introducing a nuclear power programme for the first time will be expected by the international community to follow this same path.

10.3.1 National regulatory regimes

A regulatory regime is one element of a legal framework and is considered by many to be the most important. Several international instruments provide criteria or guidance on its establishment and operation (see also Chapter 7). The IAEA *Fundamental Safety Principles*, for example, stipulate that an "effective governmental framework for safety, including an independent regulatory body, must be established and sustained". The regulatory body must have "adequate legal authority, technical and managerial competence, and human and financial resources to fulfil its responsibilities". It must be "effectively independent of the licensee and of any other body, so that it is free from any undue pressure from interested parties".

Article 8 of the Convention on Nuclear Safety and Article 20 of the Joint Convention are also relevant, but unlike the *Fundamental Safety Principles*, they are legally binding on their contracting parties. Each requires the establishment of a regulatory body, entrusted with implementing the framework referred

Table 10.6: Fundamental concepts of nuclear law	
Safety	Safety is the primary requisite for the use of nuclear energy and the applications of ionising radiation.[i] Priority is to be given to nuclear safety when engaging in activities related to nuclear installations.[ii] Legal controls should reflect the hierarchy of risk associated with various nuclear activities and facilities
Security	Special legal measures are required to prevent the theft, misuse or sabotage of nuclear materials and facilities.
Responsibility	The prime responsibility lies with the operator or licensee who has been granted the authority to conduct specific activities related to nuclear energy or ionising radiation.[iii]
Permission	As a consequence of the special risks associated with nuclear technology, nuclear law generally requires that prior authorisation be obtained for activities involving fissionable material and radioisotopes.[iv]
Continuous control	The regulatory body must retain a continuing ability to monitor activities which have been authorised so as to assure that they are being conducted safely and securely and in accordance with the terms of the authorisation.[v]
Compensation	The operator of a nuclear installation is generally held both strictly and exclusively liable for nuclear damage suffered by third parties as a result of a nuclear accident occurring at its installation or in the course of transporting nuclear substances to or from its installation.[vi]
Sustainable development	Environmental law instruments have identified the duty for each generation not to impose undue burdens on future generations which has implications in the nuclear field because of the very long-lived character of some fissile materials and sources of ionising radiation.[vii]
Compliance	To the extent a state adheres to regional and global, bilateral and multilateral instruments, its national nuclear law must reflect the obligations that they contain.
Independence	Nuclear legislation must ensure the establishment of a regulatory authority which is not subject to interference from entities concerned with the promotion or utilisation of nuclear energy.[viii]
Transparency	Public understanding of and confidence in nuclear technology require that the public and interested bodies be provided with the fullest possible information concerning the risks and benefits of nuclear energy.
International co-operation	Users of nuclear technology and nuclear regulators need to maintain close relationships with counterparts in other states and in relevant international organisations, since the potential for transboundary impacts requires harmonised policies and co-operative programmes, and lessons learnt in one country may benefit others.

i. Article 1, Convention on Nuclear Safety; Article 1, Joint Convention.
ii. Article 10, Convention on Nuclear Safety.
iii. Article 9, Convention on Nuclear Safety; Article 21 (1), Joint Convention.
iv. Article 7 (2)(ii), Convention on Nuclear Safety; Article 19 (2)(ii) and (iii), Joint Convention.
v. Article 7 (2)(iii), Convention on Nuclear Safety, Article 19 (2)(iv), Joint Convention.
vi. These principles are fundamental to all international nuclear liability conventions.
vii. Article 1 (ii), Article 4 (vi) and (vii), Joint Convention.
viii. Article 8 (2), Convention on Nuclear Safety; Article 20 (2), Joint Convention.

Source: Stoiber *et al.* (2003), pp 5-11.

to in the convention and provided with adequate authority and resources to carry out its responsibilities. Both also require an effective separation between the regulatory body's functions and those of other bodies concerned with promoting or utilising nuclear energy, or at least effective independence of regulatory functions from management functions.

A model regulatory body does not exist any more than a model nuclear energy law. Nevertheless, certain of the existing international conventions as well as non-legally binding documents produced under the auspices of various international organisations refer to the following important attributes and functions.

The essential attributes of the regulatory body include:

- adequate authority, competence and financial and human resources to fulfil its responsibilities;
- effective separation from any other body or organisation concerned with the promotion or utilisation of nuclear energy or the effective independence of regulatory functions from other functions where one organisation is involved in both.

The responsibilities of the regulatory body include:

- implementation of the appropriate legislative and regulatory framework governing nuclear activities, including the establishment of a comprehensive licensing system for undertaking nuclear activities;
- establishment of applicable national safety requirements and regulations;
- granting, amending, suspending, revoking and enforcing licences for nuclear-related facilities and activities, including carrying out inspections and assessments of licence compliance;
- monitoring radiation releases, co-ordinating emergency preparedness and response plans and activities;
- communicating information to stakeholders and the public about the safety of nuclear installations and activities and regulatory processes;
- engaging in bilateral, multilateral or international co-operation.

10.3.2 Outlook for the future

Independence and separation of regulatory functions

The effective separation between regulatory functions on the one hand and promotional functions on the other will continue to play a crucial role, and the legal implications of this concept will not change fundamentally. On a more practical level, a regulatory body might require additional or strengthened mechanisms in place to maintain its neutrality *vis-à-vis* influential suppliers, operators, politicians, pro- and anti-nuclear groups as well as other stakeholders and the general public.

Countries establishing a regulatory authority for the first time will expose themselves to the critical eye of the international community which is likely to strongly discourage the same public or state-owned entities from involvement in both the regulatory and promotional aspects of nuclear energy production and use. Such cases can be cause for concern; a *de jure* and *de facto* separation of interests must be guaranteed through institutional and organisational measures as well as through the strict allocation of responsibilities to both the regulator and the regulated entity.

At the international level, there is good communication between national regulatory bodies. The NEA Committee on Nuclear Regulatory Activities (CNRA), for example, has been addressing nuclear regulatory issues on an in-depth basis for almost 20 years. Made up of senior representatives from regulatory bodies of NEA member countries, the CNRA promotes co-operation amongst members to enhance the efficiency and effectiveness of the regulatory process and to ensure that an adequate level of capability and competence is maintained. It reviews current practices and operating experience as well as developments which could affect regulatory requirements in the future. In addition, the International Nuclear Regulators Association has issued a statement strongly encouraging countries that are expanding their programmes for peaceful uses of nuclear energy and those developing new nuclear programmes to adopt strategies of continuous improvement in nuclear safety, noting that further enhancement of international co-operation and commitment of all nuclear power countries, both existing and future, is key to achieving high levels of nuclear safety worldwide.

Transparency versus confidentiality

There is an unavoidable tension between the need to communicate sufficient information to enable policy makers and the public to understand fundamental issues regarding nuclear technology, while protecting information that either contains commercially valuable proprietary information or that, if used in a malevolent manner, could pose additional risks to public health, safety and security. Legislators and regulatory bodies will face this dichotomy more and more frequently in the future and will need to find appropriate solutions. Transparency and public participation (see Chapter 12) are the "modern" tools for instilling confidence and trust in the proper conduct of administrative tasks, and yet there is a clear need to protect sensitive information which, if placed in the "wrong" hands, could pose serious security risks. A coherent approach to balance these trends will be required.

One approach, closely resembling the "need to know" concept, envisages two levels of disclosure: the first involving information needed for the public to hold its government accountable and to participate meaningfully in government processes; and the second involving more detailed information from the regulated entities on their activities. This approach allows for disclosure of "generic" information on security policies and practices to provide a measure of transparency while limiting public release of specific information on facilities, transportation routes, and other technical and operational details to avoid compromising security.

Financial and human resources

With an expected increase in the number of applications to construct and operate nuclear power plants, many of which will eventually encompass new technologies, regulatory bodies are likely to face both legal and practical challenges in the future. The US Nuclear Regulatory Commission, for example, expects 27 combined construction and operation licence applications to

be submitted for 31 new units totalling 41 GWe over the next two years. Responding to that many applications requires an expansion of the NRC's qualified workforce that is not simply a practical convenience but a legal necessity. Adequate financial and human resources are legal requirements under both the Convention on Nuclear Safety and the Joint Convention.[12] Safety and security concerns have to be addressed throughout the lifetime of a nuclear power plant, including its final shutdown and dismantling.

In some countries, sufficient scientific and technical knowledge can be found within the regulatory body itself; in others, that expertise is obtained from other government entities. In still other countries, that expertise may be commissioned from the private sector, but in that case it has to be ensured that the decisions are made by the regulators themselves.

Numerous workshops, conferences and legislative assistance projects organised by the NEA and the IAEA contribute to addressing the "resource" issue. The international nuclear community, and especially those involved with nuclear law, need to encourage and support initiatives to broaden human, financial and technical resources in this field. Regulators will be expected to make timely and scientifically-sound decisions. Yet the licensing process concerning a nuclear power plant is highly complex, requiring close co-operation between engineering, scientific, project management, financial and legal staff.

National perspective on multinational projects

One important initiative reflecting the desire for greater international co-operation in the regulatory field is the Multinational Design Evaluation Programme, set up to enable the sharing of resources and knowledge accumulated by national nuclear regulatory authorities during their assessment of new reactor designs, with the aim of improving both the efficiency and effectiveness of the regulatory process. Although its multinational dimension is one of its strengths, a key element of the MDEP is that it is intended that national regulators retain sovereign authority over all licensing and regulatory decisions.[13]

A farther-reaching phenomenon which could have a significant impact on the functions and responsibilities of national regulatory bodies is the development of multinationally owned nuclear power plants. Small countries may not always be in a position to set up their own nuclear power programme, but they, as well as some larger countries, may well be interested in participating in the projects of neighbouring countries. In June 2007, for example, a law was adopted in Lithuania, providing for the legal, financial and organisational conditions for the construction and operation of a new

12. Article 8(1) of the Convention on Nuclear Safety and Article 20(1) of the Joint Convention.

13. Ten countries are participating in the MDEP, of which seven are NEA members(*): Canada*, China, Finland*, France*, Japan*, the Republic of Korea*, the Russian Federation, South Africa, the United Kingdom* and the United States*. Further details are available at: www.nea.fr/mdep/.

nuclear power plant at Ignalina.[14] Although the plant is planned to be built and operated in Lithuania in accordance with national laws and regulations, foreign participation is permitted and a number of neighbouring countries have shown interest in the project.

10.4 Conclusion

The legal framework governing the peaceful uses of nuclear energy is well-developed in most countries making use of nuclear power, and the foundation for its implementation in countries that have yet to establish nuclear power programmes is strong and supported by the international community. Frameworks, however, need to be flexible. They need to be able to adapt to technological developments, to economic changes, to major international events and to new and more innovative ways of doing business. To ensure that legislation evolves appropriately, governments must be committed to the process. The fundamental responsibilities of law makers and regulators to ensure the safe and secure use of nuclear energy for peaceful purposes will not change in the future, although the ways in which they accomplish that most certainly will.

14. Law on the Nuclear Power Plant of 28 June 2007 (No. X-1231); text reproduced in the NEA *Nuclear Law Bulletin* No. 80, Volume 2007/2, p 93.

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Concluding remarks

Energy is essential for our quality of life. Demand for energy continues to climb unabated as populations increase and standards of living improve. Projections by authoritative organisations specialising in the energy field suggest that by 2050, based on current government policies, energy demand will have risen to around 2.5 times today's level. The demand for electricity, the most flexible and refined form of energy, is expected to rise at least at the same rate. The great majority of these demands are expected to be met by fossil fuel sources, a path which is now almost universally recognised as unacceptable, for reasons of climate change, security of energy supply and escalating prices in a world competing for energy resources.

Authoritative assessments of what needs to be done to manage the threat of climate change have shown just how challenging it will be to deal with the problem; carbon releases need to be reduced to half or less of today's emissions by 2050, at a time when total energy demand may well have more than doubled. Clearly all available means of reducing carbon emissions will be needed.

There is no doubt that nuclear energy could help with all three of the issues of climate change, security of supply and the cost of energy. It has the merits of being almost carbon free on a total life cycle basis, as good as or better than most renewable sources; it uses a fuel that is available from a diverse range of countries, with major producers located in politically stable areas; the cost of nuclear electricity production is relatively insensitive to the price of uranium, providing a stabilising influence on energy prices. Yet despite these benefits nuclear energy remains contentious and in much of the debate, both for and against, emotion competes with fact.

This book has explored nuclear energy's current and likely near-term contribution and its potential up to 2050, the current and future challenges that nuclear energy faces, how these challenges are being addressed and how the technology could develop in the future. The intent is to provide a factual analysis and to put contentious issues into a balanced perspective, from which policy makers can make their own judgements.

In many circumstances nuclear energy is competitive with other sources of generation and will become more so if mechanisms for penalising carbon releases are established. However, in liberalised markets, investors remain cautious. The high capital cost is a discouragement. Investor risk is seen in uncertainties inherent to many government's policies, uncertainties on future carbon cost mechanisms and price, uncertainties in changing regulatory requirements, uncertainties in the time and cost of construction and uncertainties in the impact of public attitudes.

Changes in the market place, technology and regulation have taken place around the world. Progress towards more certainty in regulations,

international co-operation in design evaluation and more predictable planning processes will help to reduce project implementation timescales and risks, and encourage investment. An optimum path towards an expanded contribution from nuclear energy will require collaboration at industrial, regulatory and policy levels in recognition of the increasingly international nature of nuclear technology. The NEA is well placed and well suited to continue its leading role in this global approach.

What can governments do to make progress? Probably first and foremost is to enact "The Polluter Pays Principle" and to establish realistic means of internalising the costs of carbon dioxide releases in the cost of energy. These mechanisms need to be established and set for the long term, or they will not provide the certainty necessary for investment decisions in electricity generation, or indeed, for other large capital investments related to energy. Reasonable certainty on at least a floor price for the future value of carbon will also be necessary. This will facilitate development of all sources of alleviation of greenhouse gas emissions, energy efficiency, nuclear energy, renewables, as well as technologies such as carbon capture and storage and hydrogen production from non-CO_2 emitting sources. The follow-on to the Kyoto Protocol is clearly a key part of the overall process. The current protocol flexibility mechanisms exclude major base load electricity generation technologies such as carbon capture and storage and nuclear energy. Future flexibility mechanisms should also recognise those technologies that can make the bigger contributions in reducing carbon emissions.

In many developed economies, scientific and technical training in general has fallen well below the desired level. The nuclear industry has not escaped unscathed; with an ageing workforce the skills needed are in short supply. Means to encourage the necessary training are required. International efforts to reinforce the mechanisms that have largely been successful so far in preventing the misuse of technologies and materials from being diverted to military or terrorist purposes need attention. Governments have a clear role to play in these issues. They are also key players in achieving progress in the disposal of high-level waste.

Industry also has a role to play. Continued safe operation of nuclear facilities is essential. The media and public sensitivity is such that any moderately significant event at any location has an impact on the international industry. Safety performance must be impeccable even if, as illustrated in this book, public concern about the relative risks of nuclear energy compared to other sources of electricity generation is misplaced. The industry's transparency has not always been adequate in the past and this has led to a loss of trust; policies of probity and transparency must be reinforced and maintained. Regulators have a role to play here; as the public's independent experts, they have a duty to explain the true significance of any events in a fair and balanced way. Public attitudes are also influenced by the failure thus far to implement high-level waste disposal facilities; progress must be made.

The issue of public perception is more complex. The public does not have an especially high appreciation of the merits of nuclear energy and, as long

as the merits are not understood, the public is unlikely to be tolerant of the drawbacks, perceived or real. This is particularly challenging since evidence shows that, in many countries, neither industry nor government is trusted to provide reliable information. If nuclear energy is to expand in response to the serious energy issues facing the world, an ongoing relationship between policy makers, the industry and society that develops knowledge building and public involvement will become increasingly important.

Those bodies which claim that the solution to the world's energy problems is easy (be it a vast increase in energy efficiency, a massive expansion of renewable energy production, massive reliance on nuclear energy or any other means), must be challenged to provide transparent facts supporting their arguments. It is not sufficient to have hope that any of these on their own will resolve the issues; if we wait until it is proved otherwise it will be too late. The public must demand authoritative demonstration that the claims of political and lobby groups are sound and will deliver real solutions. The reliable and environmentally responsible supply of energy at affordable cost is too important to our societies to rely on chance or prejudice.

Nuclear energy could have a large part to play in the resolution of these energy issues. It is a mature technology, providing 16% of the world's electricity and 23% in the more developed economies of the OECD countries; it is not waiting for a technological breakthrough. Today's reactors are more than adequate and those of tomorrow promise to be better still. It could also do much more, expanding to satisfy more energy needs than the provision of electricity. The uranium and technology are available to provide very large quantities of energy, largely CO_2-free and for very long periods of time, which can be used to provide heat, supply potable water and produce hydrogen for transport. It is a technology that cannot be ignored in present circumstances. It will not be for every society, in every situation but, when the contribution it could make is not adopted, this should be on demonstrably rational grounds. How the alternatives will fill the need and are better are valid questions that deserve valid answers. This book is intended to provide a lasting, quality resource to inform that debate; a fitting celebration of the 50th anniversary of the NEA.

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