UNEP International Technical Guidelines for Safety in Biotechnology

UNEP

United Nations Environment Programme

UNEP
International Technical Guidelines for Safety in Biotechnology

UNEP

United Nations Environment Programme

UNEP

United Nations Environment Programme
P.O. Box 30552
Nairobi, Kenya
Tel: (254-2) 623258/59
E-mail: hamdalla.zedan@unep.no

Printed on recycled paper

CONTENTS

FOREWORD V

PREFACE IX

I. INTRODUCTION 1

II. GENERAL PRINCIPLES AND CONSIDERATIONS 5

III. ASSESSMENT AND MANAGEMENT OF RISKS 8

IV. PROVIDING FOR SAFETY: MECHANISMS AT NATIONAL AND REGIONAL LEVEL 10

V. PROVIDING FOR SAFETY: MECHANISMS AT INTERNATIONAL LEVEL USING INFORMATION SUPPLY AND EXCHANGE 12

VI. CAPACITY-BUILDING 16

ANNEXES

SOURCES CONSULTED IN PREPARATION OF THESE GUIDELINES AND OTHER RELEVANT SOURCES 18

GLOSSARY OF TERMS USED IN THESE GUIDELINES 19

RISK ASSESSMENT: EXAMPLES OF POINTS TO CONSIDER AS APPROPRIATE 21

EXAMPLES OF RISK-MANAGEMENT MEASURES FOR CONTAINED APPLICATIONS 26

EXAMPLES OF RISK-MANAGEMENT MEASURES FOR CONTROLLED RELEASES 27

DATABASES 29

POSSIBLE MECHANISMS FOR PROVIDING INFORMATION TO THE PUBLIC 31

FOREWORD

It gives me great pleasure to launch this edition of the UNEP International Technical Guidelines for Safety in Biotechnology, adopted by the Global Consultation of Government-designated Experts, hosted by the Government of Egypt in Cairo from 11 to 14 December 1995.

It is gratifying to note that the consensus-building process which resulted in the success of the Global Consultation involved a wide spectrum of stakeholders, all of whom took the opportunity to translate their vision of safety in biotechnology into the spirit and flesh of the Guidelines.

The public and the private sectors (including the biotechnology industry), the Secretariat of the Convention on Biological Diversity, relevant United Nations bodies, intergovernmental and non-governmental organizations, among others, all participated and played their part in the development of these Guidelines (at national, subregional and/or global levels).

More importantly, the consultations were undertaken in full cognizance of, and in total harmony with, the work of the Conference of the Parties to the Convention on Biological Diversity and its various bodies in their efforts to develop a protocol on biosafety. In this regard, great significance attaches to decision II/5 of the second meeting of the Conference of the Parties, held in Jakarta from 6-17 November 1995, which states that, during the development of a protocol on biosafety, internationally agreed guidelines on biosafety - such as the UNEP Guidelines (still in draft form at that time) - may serve as an interim mechanism in various substantive ways. They could facilitate the development of national capacities to assess and manage biotechnology risks, the establishment of adequate information systems; and the development of human resources and relevant expertise pertinent to issues of biosafety at the national and regional levels. The second meeting of the Conference of the Parties further noted in its decision II/5 that the UNEP Guidelines, without prejudice to the development of a protocol, could be used to complement it after its conclusion.

To UNEP, the linkage between the application of the Guidelines and the capacity-building that is essential for their implementation is both obvious and inevitable. Indeed, it is vital and urgent for countries and regions to acquire the various relevant capacities to implement the Guidelines. Neither these Guidelines nor the biosafety protocol currently under development, nor any future international agreement on biosafety will in or of themselves ensure safety in biotechnology development, research and application. Consequently, the national and regional capacity-building programmes that are necessary for the effective implementation of these Guidelines should be formulated and given

adequate technical and financial support on a priority basis. Founded on sound scientific principles, their implementation needs to be undertaken with technical competence, logical consistency and judicious urgency.

UNEP has formulated such a programme as part of its 1996-1997 programme of work. It incorporates components and proposals for funding by, among others, the Global Environment Facility (GEF), through which developing countries and countries with economies in transition will receive the technical and financial support to develop and/or strengthen their national biosafety frameworks which will permit the effective implementation of these Guidelines and any future international agreement on biosafety within a harmonized regional and global context.

The development of the national biosafety frameworks called for in the Guidelines will entail technical and financial support to Governments and relevant in-country or regional entities. Such support is essential in order to:

- Establish or strengthen national authorities or national institutional biosafety mechanisms;
- Review national legislative, administrative and policy measures on biosafety;
- Assess and identify priorities in human resources development in biosafety and in the related capacity-building (including infrastructural) requirements in the countries (and their subregions/regions);
- Establish or develop appropriate knowledge bases, infrastructure for information exchange and mechanisms for effecting advance informed agreements;
- Elaborate and implement some national capacity-building programmes for biosafety;
- Stage national training workshops/seminars in risk-assessment and risk-management techniques for support staff, technicians and middle-level cadres;
- Enhance public awareness of biotechnology risks and attendant risk-assessment and risk-management techniques through initiatives involving the community at large, policy makers, legislators, administrators, the private sector and the biotechnology industry;
- Implement in practice and further develop and refine the Guidelines, taking into account emerging issues and new developments in the field of biosafety.

There will, additionally, be need for a thorough, in-depth assessment of the status of safety in biotechnology worldwide. It would encompass the identification of emerging issues and new developments in biosafety and biotechnology and the assessment of

existing guidelines, agreements and legislation, as well as related human, institutional and infrastructural capacities. Such a global biosafety assessment exercise would also attempt to provide a realistic scenario of the availability of the financial resources that would need to be mobilized and/or invested to achieve safety in biotechnology research, development and applications, as envisaged within the framework of the Guidelines (or future international agreement on biosafety).

In effecting the foregoing activities to assist in the enormous work at hand or ahead of us in the quest for safe development and application of biotechnology products covered by the Guidelines, strong partnerships are required and envisaged between UNEP, relevant United Nations bodies (such as the United Nations Development Programme (UNDP), the United Nations Industrial Development Organization (UNIDO), the United Nations Educational, Scientific and Cultural Organization (UNESCO), the Food and Agriculture Organization of the United Nations (FAO) and the Commission on Sustainable Development) and the various key players in the biotechnology and biosafety arenas at national, regional and international levels, both individuals as well as organizations and institutions (e.g. the Organisation for Economic Cooperation and Development (OECD), Instituto Interamericano de Cooperacion para la Agricultura (IICA), the African Ministerial Conference on the Environment (AMCEN), the International Centre for Genetic Engineering and Biotechnology and the Stockholm Environment Institute's Biotechnology Advisory Commission (BAC)). The agenda includes the preparation of sector-specific manuals on pertinent biosafety issues and themes; fostering North-South cooperation and collaborative ventures; mobilizing bilateral/ multilateral support and its timely disbursement; and staging national/ regional training workshops, seminars, symposia, etc. to facilitate the practical implementation of the Guidelines by all parties concerned.

I would like to reiterate here that, in executing the above tasks at all levels, we need to adopt a participatory approach, embracing the widest possible spectrum of stakeholders from among the scientific and general community at large, as well as the public and private sectors. Pertinent views and issues (including gender-related issues) should be duly taken into account, building through this process a consensus that incorporates and reflects the involvement, concerns and aspirations of the whole populace.

I hereby wish to present and commend the Guidelines to you all.

E. Dowdeswell

Elizabeth Dowdeswell
Executive Director
United Nations Environment Programme

PREFACE

In Agenda 21, Governments undertook to consider international cooperation on safety in biotechnology. That commitment includes: sharing experience, capacity-building and international agreement on principles for safety.

The Governing Council of UNEP in its decision 18/36 B affirmed the desirability of UNEP contributing to international efforts on biosafety, including the development of international technical guidelines, while avoiding duplication with other international activities currently being undertaken by organizations, in particular the work initiated by the Conference of the Parties to the Convention on Biological Diversity.

The Conference of the Parties to the Convention on Biological Diversity, at its second meeting, taking into account the provisions of Articles 8(g) and 19 (3) of the Convention, decided to develop a protocol on biosafety, specifically focusing on transboundary movement, of any living modified organism resulting from modern biotechnology that may have adverse effect on the conservation and sustainable use of biological diversity, setting out for consideration, in particular, appropriate procedure for advanced informed agreement. It stressed the importance of the urgent finalization of the UNEP International Technical Guidelines on Safety in Biotechnology, which may be used as an interim mechanism during the development and implementation of a protocol without prejudice to the development and conclusion of such a protocol and to complement it after its conclusion.

These technical Guidelines are intended as a contribution to the implementation of Agenda 21 commitments and aim to assist Governments, intergovernmental, private-sector and other organizations in the establishment and maintenance of national capacities to provide for safety in biotechnology, to assist in developing expert human resources and for international exchange of information.

These Guidelines have been developed on the basis of common elements and principles derived from relevant existing regional and international instruments and national regulations and guidelines, and drawing upon experience already gained through their preparation and implementation.

I. INTRODUCTION

1. Agenda 21, adopted at the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro in June 1992, in its chapter 16 makes specific provision for the "Environmentally Sound Management of Biotechnology". In the introduction to that chapter it is recognized that, although biotechnology cannot provide solutions to all the fundamental problems of environment and development, it could nevertheless contribute substantially to sustainable development by improvements in food production and feed supply, health care and environmental protection.

2. Chapter 16 of Agenda 21 also recognizes that the community at large can only benefit maximally from biotechnology if it is developed and applied judiciously. It therefore seeks to ensure safety in biotechnology development, application, exchange and transfer through international agreement on principles to be applied on risk assessment and management.

3. The Convention on Biological Diversity also addresses the issue of safety in biotechnology in Articles 8(g) and 19, paragraphs 3 and 4. In Article 8(g) Parties to the Convention are called upon to establish or maintain means to regulate, manage or control the risks associated with the use and release of living modified organisms resulting from biotechnology which are likely to have adverse impacts on the conservation and sustainable use of biological diversity, while in Article 19(3) the Parties are called upon to consider the need for and modalities of a protocol for the safe transfer, handling and use of living modified organisms resulting from biotechnology that may have adverse effect on the conservation and sustainable use of biological diversity. Article 19 (4) states that each Party is obliged directly, or by requiring any natural or legal person under its jurisdiction providing the organisms referred to in paragraph 19 (3), to provide any available information about the use and safety regulations required by that Party in handling such organisms, as well as any available information on the potential adverse impact of the specific organisms concerned to the Party into which those organisms are to be introduced.

4. In its decision II/5, the second meeting of the Conference of the Parties to the Convention on Biological Diversity, held in Jakarta from 6-17 November 1995, while establishing an open-ended Ad Hoc Working Group to develop a protocol on biosafety, stressed the importance of urgent finalization of the UNEP International Technical Guidelines for Safety in Biotechnology and that these could contribute to the development and implementation of the protocol on

biosafety without prejudice to its development or conclusion. Furthermore, the Conference of the Parties noted that such International Technical Guidelines may be used as an interim mechanism during the development of the protocol and to complement it after its conclusion for the purposes of facilitating the development of national capacities to assess and manage risks, establish adequate information systems and develop expert human resources in biotechnology.

5. The contribution that the adoption of safe procedures in biotechnology can make to the successful global development of the technology depends on the extent to which international information exchange, cooperation, harmonization, and agreement can be achieved.

6. The development of new techniques of genetic modification in the early 1970s prompted a thorough discussion on safety in biotechnology which resulted in a number of national and international recommendations, guidelines and legislation. By the mid-1980s, it was widely considered that recombinant DNA techniques could be considered as an extension of conventional genetic procedures and that organisms produced by this technology presented risks that were similar in kind to those posed by any other organism. But, while it was also recognized that the potential benefits of biotechnology were greater because of the new molecular techniques which allowed a greater diversity of genes to be introduced into organisms, the relative lack of experience with such organisms nevertheless indicated that it would be appropriate to develop the technology in a precautionary and judicious manner.

7. Modern biotechnology has now been developed and applied since the early 1970s under contained conditions, and since the mid-1980s for applications in the environment. As recognized by decision II/5 of the second meeting of the Conference of the Parties to the Convention on Biological Diversity, although considerable knowledge has accumulated, significant gaps in knowledge have been identified, specifically in the field of interaction between living modified organisms (LMOs) resulting from modern biotechnology and the environment, taking into account the relatively short period of experience with releases of such organisms, the relatively small number of species and traits used, and the lack of experience in the range of environments, specifically those in centres of origin and genetic diversity. Given the rapid development in the use of this technology and taking into account the knowledge and considerable experience gained with certain types and uses of modern biotechnology, international agreement on safety in biotechnology is now opportune.

8. The status and modalities of such international agreement have been the subject of international discussion. One of the issues under consideration then was whether such agreement should take the form of a legally binding instrument (such as a follow-up to Agenda 21 or a protocol to the Convention on Biological Diversity) or whether it should be voluntary in nature (such as a code of conduct, etc). The Conference of the Parties to the Convention on Biological Diversity, at its second meeting in Jarkata, decided to establish an open-ended Ad Hoc Working Group to develop, in the field of the safe transfer, handling and use of living modified organisms, a protocol on biosafety, specifically focusing on transboundary movement, of any living modified organism resulting from modern biotechnology that may have adverse effect on the conservation and sustainable use of biological diversity, setting out for consideration, in particular, appropriate procedure for advance informed agreement. The negotiation process may take several years to conclude the protocol. Furthermore, upon a binding agreement being adopted, a number of countries and intergovernmental, private-sector and other organizations will need technical guidance of the kind contained in these Guidelines to fulfil their commitments under such an international agreement. These technical Guidelines are intended to provide a common framework for safety in biotechnology at national, regional and international levels, without prejudice, but as a complement, to the development of a biosafety protocol. The Conference of Parties, therefore, stressed the urgent need for rapid finalization of the UNEP International Technical Guidelines for Safety in Biotechnology which may be used as an interim mechanism during the development and implementation of a protocol and to complement it after its conclusion (see paragraph 4 above).

9. The Guidelines have been developed on the basis of common elements and principles derived from relevant national, regional and international instruments, regulations and guidelines, and drawing upon experience already gained through their preparation and implementation. The sources taken into consideration are listed in Annex 1.

10. The Guidelines are based on the premise that adequate mechanisms for risk assessment and risk management and capacity-building through - among others - the exchange of information and the use of these Guidelines at national, regional and international levels can contribute significantly to safety in biotechnology.

11. The Guidelines address the human health and environmental safety of all types of applications of biotechnology, from research and development to commercialization of biotechnological products containing or consisting of organisms with novel trait(s). They recognize that before such biotechnological

products are placed on the market, they must comply with any specific product requirements, such as food safety, efficacy and quality, but these are not addressed in the Guidelines.

12. The Guidelines can be implemented by using existing structures and measures, or by introducing new ones.

13. To be credible, safety mechanisms need to be based on up-to-date knowledge.

14. Adequate safety mechanisms and international agreement on safety in biotechnology can contribute to the sustainable development of biotechnology and to the international trade in biotechnological products.

15. The adoption of guidelines does not in itself ensure safety. Rather, the guidelines propose mechanisms for evaluating biosafety, identifying measures to manage foreseeable risks and to facilitate processes such as monitoring, research and information exchange, all of which improve the safe application of biotechnology.

16. These technical Guidelines acknowledge the importance of assessing the socio-economic and other impacts of new biotechnologies, but they do not address such issues, which are often considered within the particular national or regional context.

17. Complying with these Guidelines does not override obligations required under existing national, regional or international legal systems.

II. GENERAL PRINCIPLES AND CONSIDERATIONS

18. As with any human activity, the safety of any technological application is achieved by carrying out certain sequential steps, as follows:

(a) Identifying any hazards;

(b) Assessing the risks: if a hazard has been identified, the combined effect of the consequences and the likelihood of the hazard being realized are estimated;

(c) Managing the risks: where indicated by the results of the risk assessment, either by applying adequate management strategies, including designing procedures and methods to minimize risks and their consequences, or by deciding not to proceed. Management strategies should be commensurate with the results of the risk assessment. Therefore, there might be cases where very few, if any, risk management measures will be necessary.

19. In applying this general principle to biotechnology, which involves the use of organisms, risk assessment takes into account the following components and the interactions between these (see also Chapter III):

- The characteristics of the organisms (see Annex 2) involved, including any newly introduced traits;
- The manner in which organisms are to be used, including any management practices applied, such as provision for containment and waste treatment;
- The characteristics of the areas and other organisms that might be affected, i.e. the potential receiving environment, including humans.

20. Risk assessment and risk management can be based in part on knowledge of and experience (i.e. familiarity) with an organism, the intended application and the potential receiving environment. Risk assessment may vary from a very short process to an extensive review, depending on the extent of familiarity. Adequate familiarity does not necessarily imply that an organism is safe, but it means that known management procedures can be applied. A lack of familiarity does not mean that an organism is not safe, but it means that, until sufficient familiarity with such organisms has been acquired, risks associated with such organisms are assessed on a case by case (e.g. variety by variety or strain by strain) basis and in a step-wise manner. As experience and knowledge evolve, risk assessment may serve for a group of organisms for characteristics that are functionally equivalent on a physiological level. Greater knowledge and experience will be required for the exemption of larger groups of organisms. As a consequence, applications with

certain groups of organisms may proceed under defined generic conditions, or might be exempted from oversight. The development of such generic approaches of risk assessment or exemption in one country does not necessarily mean that similar generic approaches will be applied in other countries.

21. There is generally less familiarity with the behaviour of organisms whose genetic make-up is unlikely to develop naturally, such as organisms produced by modern genetic modification techniques, than with the behaviour of organisms developed traditionally. This has been the reason why many countries have focused on such organisms and products containing them. In these Guidelines, such organisms are called organisms with novel traits. These Guidelines should allow the benefits of biotechnology to be realized and, at the same time, ensure that concerns about novelty are addressed. Although these Guidelines are directed to organisms with novel traits and products containing such organisms, the general principles for safety are applicable to all organisms.

22. The Guidelines provide assistance for identifying organisms whose characteristics may differ from those of the parent organisms from which they are derived in ways that would suggest additional scrutiny might be appropriate. This may be because they produce substances which are not found in the species concerned, or because there are new environmental or other risks associated with the new characteristic.

23. Experience with environmental releases to date suggests that the risks associated with organisms with novel traits, much of which has concerned well- known agricultural crop plants in well-known agricultural environments, will in most cases be the same in kind as those associated with the parent organisms, and can be dealt with satisfactorily by comparable mechanisms. It is generally anticipated that, in most cases, there will be low environmental risk from introducing into a similar environment such well-known crop plants after they have been modified by altering or adding only one or a few genes, especially when compared with the risks of introducing entirely new or alien species.

24. Monitoring can contribute significantly to gaining knowledge and experience with the use of organisms with novel traits. Monitoring may vary from a very simple observation to an extensive research programme. Monitoring can be carried out by the user and/or by an independent authority, organization or body and is often used to verify the assumptions made in a risk assessment and should be used to evaluate whether the risk-management measures used are appropriate and effective.

25. Once adequate risk-management strategies have been formulated, the effectiveness of those strategies depends partially on the user. Therefore, the primary responsibility for the safe use or transfer of organisms with novel traits lies with the user. Consequently, users should be well informed, competent and well aware of their responsibility.

26. An organism with novel traits which is considered to be harmless in one region might be potentially harmful in another region which offers different environmental conditions. Therefore, there is a need for the exchange and supply of scientific information in cases where organisms with novel traits are intended to be released into new environments and when transfer of such organisms across national boundaries is being considered, particularly in those cases in which organisms with novel traits are intended to be released in the environment.

27. In cases in which organisms with novel traits are to be transferred to their centres of origin, there is a need to pay particular attention to risk assessment and risk management, because of possible effects on related species that are present, to ensure adequate protection of genetic resources and biological diversity.

III. ASSESSMENT AND MANAGEMENT OF RISKS

28. An assessment of the risks to human health and the environment associated with the use of organisms with novel traits is based on consideration of the following key parameters, when applicable:

(i) The characteristics relating to the organism with novel traits, taking into account:

- the recipient/parental or host organism;
- the relevant information on the donor organism and the vector used;
- the insert and the encoded trait;
- the centre of origin, when known.

(ii) The intended use, i.e. the specific application of the contained use or deliberate release or placing on the market, including the intended scale and any management procedures and waste treatment;

(iii) The potential receiving environment.

Forecasting models could be developed in the future that may aid in these assessments.

29. Examples of the points to consider in risk assessment are given in Annex 3. These points should be used to arrive at a judgement concerning the consequences and likelihood of hazards occurring which could cause harm to human health and/or the environment and the effectiveness of proposed management strategies to minimize the risk. The severity of harm might depend on the extent to which and the period over which other organisms and their ecosystems or their components are affected.

30. If the risk assessment at first shows that the level of risk of the intended use is not acceptable, additional risk-management measures are to be taken and assessed until the risks have been minimized to an acceptable level. If the risk cannot be minimized in this way, it might be concluded that the intended operation should not proceed, or a risk/benefit analysis might be carried out to determine whether a higher level of risk is acceptable and whether the intended operation should proceed.

31. The type of risk management to be applied depends on the organism with novel traits and the particular application. For contained uses, the degree of containment achieved depends primarily on the type of physical barriers and the application of appropriate work procedures. In the case of controlled releases, different types of barriers, such as biological, chemical, physical or temporal barriers can be used to minimize or limit the dissemination and impacts of organisms with novel traits and/or to provide genetic isolation, if required. Different risk-management practices may be applied, depending on the scale of the proposed release and its duration. Examples are given in Annex 5.

32. International databases are important sources of information for risk assessment and risk management, because they provide detailed knowledge of and experience gained with organisms with novel traits and aid in the development of models. They provide a contact from which further information could usually be obtained. Countries should be encouraged to provide information on access to their own databases. Countries, organizations and companies should be encouraged to contribute to and coordinate the development and maintenance of regional and international databases such as those listed in Annex 6. Databases should be regularly updated and, whenever possible, interlinked and made available for users.

IV. PROVIDING FOR SAFETY: MECHANISMS AT NATIONAL AND REGIONAL LEVEL

33. To implement adequate risk assessment and risk management, countries would need to establish or designate or strengthen national and/or regional authorities/ national institutional mechanisms for oversight and/or control of the use of organisms with novel traits. The authority or mechanism should have, or have access to, relevant scientific and technical knowledge and experience.

34. Effective oversight mechanisms require that: a risk assessment has been done; or the organism has been exempted from oversight on the basis of experience and knowledge; relevant users supply to the authority/national institutional mechanism all required relevant information or appropriate references; users record the outcome of relevant activities and inform the authority/national institutional mechanism of the outcome when required. In particular, they should provide relevant information if there is an unexpected or adverse effect on human health or environmental impact during, or as a result of, the notified use.

35. To fulfil their responsibilities efficiently and effectively, authorities/national institutional mechanisms need adequate capacities which should help to avoid any delay in making decisions.

36. For organisms with novel traits requiring evaluation, an authority/national institutional mechanism should determine who is responsible for preparing and reviewing risk assessments and proposed risk management. It might consider local review to be appropriate; it might conduct the review itself; it may establish a multidisciplinary body, consisting of scientific experts; or it may choose to use a combination of particular expertise from inside and outside the country or region.

37. Mechanisms for oversight and/or control can include prior notification to the authority/national institutional mechanism of contained use facilities and certain contained uses and releases of organisms with novel traits, and the marketing of products containing or consisting of organisms with novel traits. If prior notification of activities under oversight is required, such notification may or may not require a positive decision from the authority/national institutional mechanism before the notified use can proceed.

38. As set out in Agenda 21 and relevant provisions of the Convention on Biological Diversity, authorities/national institutional mechanisms are responsible for encouraging public participation by allowing access to information on which decisions are based, whilst respecting confidential commercial information. This should allow for local knowledge and circumstances to be taken into account in risk assessments. Users are encouraged to enter into dialogue with their staff/ personnel as well as with the general public and workers about their activities. Examples of mechanisms for informing the public are provided in Annex 7.

39. The responsibility for establishing and/or implementing appropriate mechanisms providing for safety lies with countries and/or regions.

V. PROVIDING FOR SAFETY: MECHANISMS AT INTERNATIONAL LEVEL USING INFORMATION SUPPLY AND EXCHANGE

40. Countries would need to establish or designate focal points responsible for the international exchange of information. This might be the authorities responsible for oversight. Countries are encouraged to cooperate with existing international agencies, organizations, mechanisms and regional networks (see Annex 6) for the dissemination of biosafety-related information. Countries and organizations should agree to protect confidential commercial information. The content of such information, however, needs to be discussed between the specific country and company or organization in order that the country can make a decision.

Exchange of general information

41. Countries are encouraged to participate in the exchange of general information about national biosafety mechanisms; generic research of value to risk assessments and risk management; and approvals given for the marketing of products containing or consisting of organisms with novel traits. This last category of information will be of particular importance for living products of modern biotechnology placed on the international market. Countries, organizations and companies will wish to be aware of which countries have adopted measures similar to those set down in these Guidelines to facilitate the exchange of mutually acceptable data and assessments. This form of information exchange can be carried out through direct information exchange, as well as through the creation of an international register or database.

Supply of information when the use of organisms with novel traits could affect human health in, or the environment of, another country

42. The use of an organism with novel trait(s) might in some cases affect other countries. For organisms representing a possible impact or threat due to transboundary movements, the following two points should be followed:

- The potentially affected country should be given notice of the intended use and the opportunity to state whether particular measures will be needed to protect its interests, in particular its biodiversity;

- The potentially affected country should be informed immediately in the event of an adverse effect of the use of a organism with novel traits which could affect it.

43. The information supplied would include the identity, the relevant characteristics and numbers/volumes of the organisms with novel traits involved and any available information regarding the handling of the organisms and information related to risk assessment and risk management.

Supply of information related to transboundary transfer of organisms with novel traits

44. Organisms with novel traits have been and will be transferred from one country to another for research and development purposes and for placing on the market. A person or organization intending to transfer organisms with novel traits to a country will need to comply with the safety mechanisms in that country. However, it is recognized that not all countries are at present able to implement safety mechanisms fully. For such countries, the following paragraphs offer a scheme for information exchange involving a range of mechanisms, from the provision of information from one user to another, to "advance informed agreement" for certain cases. They are aimed at those countries in order to enable them to achieve safety in biotechnology and to make informed decisions.

45. The key to this scheme is that, depending on the characteristics of the organism with novel traits and of the intended use, a user intending to transfer such organisms from one country to another must provide relevant information to the user or appropriate focal point(s) in the receiving country. This request for information transfer would still apply even if the organism has been exempted from oversight in the supplying country. Information could, in some cases, be supplied together with the transferred organisms with novel traits and, in other cases, in advance of the transfer (see paragraph 46 below). The provision of information prior to transfer involves a mechanism of "advance informed agreement", i.e. the transfer of organisms with novel traits to another country first requires the agreement of the receiving country.

46. Under this scheme, whether the relevant information would have to be supplied with, or in advance of, the transfer of organisms with novel traits depends on the intended subsequent use of these organisms, as follows:

- The provision of information to the intended user together with the transfer of organisms with novel traits would be appropriate in cases when such organisms are to be used in containment (e.g. research and development or storage in collections). In general, the information provided should be sufficient to enable the receiving country to undertake a risk assessment. In the case of transfer only for subsequent storage in collections, the identity and possible hazards of the organism with the novel traits would suffice, together with relevant information on appropriate storage procedures.
- The provision of information to the focal point in the receiving country before the transfer of the organisms with novel traits and under advance informed agreement would be appropriate in cases where such organisms to be transferred are intended for subsequent release into the environment (such as in field trials) or are intended to be placed on the market, unless the receiving country has indicated, based on the familiarity or the characteristics of the organisms with novel traits, that no advance informed agreement is required.
- Contained use of certain organisms with novel traits on an industrial scale would in some cases use some organisms in such quantities that they may have adverse effect on human health and the environment if they are released by routine or accident. Transfer of such organisms with novel traits could for these reasons be covered by this advance informed agreement procedure.

47. Examples of the information to be supplied, at the request of the receiving country, prior to the intended transfer of organisms with novel traits in these cases would include:

- name and address of exporting user;
- name and address of receiving user;
- origin, name and taxonomic status of recipient organism;
- description of traits introduced or modified and characteristics of the organism;
- summary of the assessment of risks to human health and the environment;
- intended dates of transfer;
- number of organisms to be transferred or volume of culture and physical form;
- any relevant requirements to ensure safe handling, storage, subsequent transport and use;

- methods for safe disposal and suitable procedures in case of accidents;
- intended use of the organism;
- information on relevant previous releases.

48. Recognizing that some organisms with novel traits will be traded internationally as commodities, there is a limitation in the extent to which information can be provided to an importer about the presence of organisms with novel traits in that commodity. Implementation of the guidelines would, however, assist focal points in obtaining knowledge of the types of traits that have been approved in exporting countries.

49. When information is supplied before transfer, the appropriate focal point in the receiving country should advise the person or organization intending to transfer the organisms with novel traits of the specific information required. After making a decision about the transfer, the appropriate focal point in the receiving country should indicate to the person or organization transferring such organisms and the intended recipient any conditions that might be imposed on the transfer and subsequent use.

50. National focal points should indicate to other focal points and to any international register or database created for this purpose their particular information requirements for cases in which advance informed agreement applies.

51. National focal points approached by other national focal points, authorities/national institutional mechanisms or international bodies for information about organisms with novel traits and their uses, or for advice, are encouraged to provide as full a response as possible. Regional groups are encouraged to make arrangements for routine reciprocal exchanges of information about current activities involving the use of organisms with novel traits. Exchanges can be arranged in a variety of ways, such as between different regional groups, on either a regular or an ad hoc basis. National databases may be useful to provide information to other national databases or focal points.

52. In order to maintain safety levels during transport and transit, organisms with novel traits should be packed and labelled adequately. Packaging and labelling requirements should be commensurate with the level of risk involved. In order to maintain safety during transit and transport, existing international recommendations, agreements and conventions on transport should be taken into account.

VI. CAPACITY-BUILDING

53. These Technical Guidelines have been developed under the clear recognition that:

- The implementation of these Guidelines depends on the availability of human resources (in terms of quantity and quality) and financial resources, information, and/or institutional and infrastructural capacities at the national, regional and international levels;
- Such resources and capacities are currently either not available or are not adequate in a number of countries at various levels.

54. Capacity-building is one of the prime elements which will facilitate effective implementation of the Technical Guidelines. Capacity-building is the strengthening and/or development of human resources and institutional capacities. It involves the transfer of know-how, the development of appropriate facilities, training in sciences related to safety in biotechnology and in the use of risk-assessment and risk-management techniques (see Annex 3).

In this regard, countries, organizations, the private sector and biotechnology industry are called upon to contribute actively to capacity-building at the local, national, regional and international levels.

55. Capacity-building should aim to ensure:

- That countries develop and strengthen their endogenous capacities to facilitate the implementation of these Technical Guidelines;
- That nations and countries involved in the development, use, release or production of organisms with novel traits are aware of any risks associated with their work and have the means to assess and manage risks;
- That Governments are able to achieve safety when certain organisms with novel traits (see Chapter V) are to be transferred into and/or to be used in their countries;
- That the safe development, transfer and application of biotechnology be enhanced by the development and/or strengthening of appropriate policies, facilities (including adequate information systems) and training in sciences related to biosafety and biotechnology, including training in risk-assessment and risk-management techniques and procedures for biosafety.

56. In drawing up programmes directed at capacity-building, Governments and international agencies providing technical and financial assistance to other countries should consider the expressed need of those countries to increase awareness of, expertise in and facilities and resources for assessing and managing risks associated with the use of organisms with novel traits.

57. Those conducting studies or developing products involving organisms with novel traits in countries which have not yet been able to implement safety mechanisms should assist in training at the local and national level in the safe handling and use of such organisms in cooperation with the concerned Governments.

58. Regional and international cooperation and coordination are key factors of the implementation of these Guidelines. Countries, organizations and companies are encouraged to contribute actively to the sharing of experience, through appropriate means.

59. National and international organizations are encouraged to draw up and/or provide directories/databases of individuals (such as scientists, administrators, policy makers and legislators) and organizations that can help in reviewing risk-assessments and risk-management strategies and in providing detailed guidance on mechanisms for national and regional controls.

Annex I

SOURCES CONSULTED IN PREPARATION OF THESE GUIDELINES AND OTHER RELEVANT SOURCES

Sources consulted include:

- UNCED, 1992, Agenda 21, Chapter 16: Environmentally Sound Management of Biotechnology.
- UNCED 1992, Research Paper No: 55 In our Land; EARTH SUMMIT '92.
- OECD recombinanant DNA recommendations (1986).
- OECD Safety considerations in Biotechnology (1993): Scale up of crop plants.
- IICA guidelines for the release into the environment of genetically modified organisms;
- Convention on Biological Diversity;
- Report of the Expert Panel IV Established to Follow-up on the Convention on Biological Diversity;
- The UNIDO Voluntary Code of Conduct for the Release of Organisms into the Environment;
- European Community Directives on the Contained Use of Genetically Modified Microorganisms and the Deliberate Release into the Environment of Genetically Modified Organisms;
- UNEP London Guidelines for the Exchange of Information on Chemicals in International Trade;
- The FAO Code of Conduct on the Distribution and Use of Pesticides;
- The FAO draft Code of Conduct for plant biotechnology as it affects the conservation and utilization of plant genetic resources;
- International Plant Protection Convention.

National regulations, UN transportation regulations, and European Community Directives on Workers' Protection, among others, were also consulted.

Annex 2

GLOSSARY OF TERMS USED IN THESE GUIDELINES

1. **Capacity-building:** It is the strengthening and/or development of human resources and institutional capacities.
2. **Contained use:** Any operation involving organisms which are controlled by physical barriers or a combination of physical and/or chemical and/or biological barriers which limit their contact with, or their impacts on, the potentially receiving environment, which includes humans.
3. **Controlled release:** Deliberate release of organisms where risk management measures are applied.
4. **Containment:** Prevention of the spread of organisms outside the facilities which may be achieved by physical containment (the use of good work practices, equipment and installation design) and/or biological containment (the use of organisms which have reduced ability to survive or reproduce in the environment).
5. **Containment level:** The degree of physical containment which depends on the design of the facility, the equipment installed and the procedures used.
6. **Deliberate release:** Any use of organisms that is not a contained use.
7. **Donor:** The organism from which genetic material is derived for insertion into or combination with another organism.
8. **Centre of origin of diversity:** The place or region where the source of diversity is located.
9. **Familiarity:** Knowledge and experience with an organism, the intended application and the potential receiving environment (see paragraph 20).
10. **Genetic modification:** Modern biotechnology used to alter genetic material of living cells or organisms in order to make them capable of producing new substances or performing new functions.
11. **Hazard:** The potential of an organism to cause harm to human health and/or the environment.
12. **Host:** An organism in which the genetic material is altered by modification of a part of its own genetic material and/or insertion of foreign genetic material.
13. **Organism:** Any entity able to replicate its own genetic material including viruses.

14. **Organisms with novel traits:** Organisms produced by genetic modification and whose resultant genetic make-up is unlikely to occur in nature. These do not include organisms obtained by conventional techniques and traditional breeding methods.

15. **Oversight:** A system for addressing questions of potential risk through guidelines, regulations or other structures.

16. **Parents:** Organisms from which an organism with novel trait(s) is derived.

17. **Pathogen:** An organism that can cause disease.

18. **Potential receiving environment:** An ecosystem or habitat, including humans and animals, which is likely to come in contact with a released organism.

19. **Risk:** The combination of the magnitude of the consequences of a hazard, if it occurs, and the likelihood that the consequences will occur.

20. **Risk assessment:** The measures to estimate what harm might be caused, how likely it would be to occur and the scale of the estimated damage.

21. **Risk management:** The measures to ensure that the production and handling of an organism are safe.

22. **Users:** Any persons, institutions or organizations (including companies) responsible for the development, production, testing, marketing and distribution of organisms with novel traits. Any member of the general public who purchases and/or uses an organism is not a user in the meaning of these Guidelines, unless specific conditions are attached to its use.

23. **Vector:** An organism or object used to transfer genetic material from a donor organism to a recipient organism.

Annex 3

RISK ASSESSMENT: EXAMPLES OF POINTS TO CONSIDER, AS APPROPRIATE

Risk assessment is based on the characteristics of the organism, the introduced trait, the characteristics of the intended use, the receiving environment, and the interaction between these. Knowledge of and experience with any and all of these provide familiarity which plays an important role in risk assessment. A relatively low degree of familiarity may be compensated for by appropriate risk-management practices. Familiarity can be increased as a result of a trial or experiment. This increased familiarity can then form a basis for future risk assessment.

Risk assessment is typically a routine and ongoing component of research and development, and testing of organisms with novel traits. It can range from a routine ad hoc judgement by the researcher to adherence to a formalized assessment.

Risk assessment requires a range of expertise which should be reflected in the competence and experience of those carrying out the assessment in a scientifically sound manner.

The different fields of expertise needed for scientifically sound risk assessment may include, as appropriate:

- Nucleic acid technology
- Molecular genetics
- Population genetics
- Marine biology
- Ecology
- Taxonomy
- Microbiology
- Virology
- Zoology
- Entomology
- Plant biology/botany
- Veterinary science
- Agronomy
- Forestry
- Pathology
- Epidemiology
- Process technology
- Biochemistry
- Toxicology

This list is provided as a guide to the major fields of expertise which may be required and is not intended to be comprehensive. Not all of these are likely to be relevant in each case and, as knowledge and technology advance, other fields of expertise will be important in risk assessment.

The objective of risk assessment is to answer questions related to:

- Identifying any hazards: what are the hazards, if any?
- Assessing the risks: if a hazard has been identified, what is the combined effect of the consequences and the likelihood of the hazard being realized? Can these be estimated?
- Managing the risks: To what extent can the risks be managed? Where indicated by the results of the risk assessment, either by applying adequate management strategies, including designing procedures and methods to minimize risks and their consequences, or by deciding not to proceed. Management strategies should be commensurate with the results of the risk assessment
- How do any identified risks compare with the risks that would be posed by the use, instead, of an organism not covered by these guidelines, if this is possible, or with risks that might be posed by doing nothing.

The impacts to be considered include those on human health, agricultural production, other organisms and the quality of the environment.

Full regard should be paid to the experience gained and to the relevant literature and consultation with available experts and public authorities.

The level of risk can be minimized either by applying risk-management strategies or by deciding not to proceed with the intended use of the organism with novel traits.

The information required for a scientifically sound risk assessment could include the following, depending on the organism, the application and the receiving environment, as appropriate; in some instances, providing a scientifically convincing rationale as to why particular data are not relevant may be helpful:

INFORMATION RELATING TO THE ORGANISM WITH NOVEL TRAITS:

Characteristics of the organism from which the organism with novel traits is derived:

The relevant biological, physiological and genetic and environmental characteristics of the recipient/parental/host organism include, as appropriate:

- the name and identity of the organism;
- Pathogenicity, toxicity and allergenicity (in the case of micro-organisms, it should be noted that there are internationally accepted classification lists for

human pathogens. Similar lists exist at national level for plant and animal pathogens);

- the natural habitat and the geographic origin of the organism, its distribution and its role in the environment;
- mechanisms by which the organism survives, multiplies and disseminates in the environment;
- means for transfer of genetic material to other organisms.

Characteristics of the organism(s) from which nucleic acids are obtained (the donor):

The relevant characteristics include, in particular, pathogenicity, toxicity and allergenicity.

Characteristics of the vector:

- identity, origin, natural habitat, and the relevant safety characteristics of the vector;
- the frequency at which the vector is mobilized or can transfer itself to other organisms;
- factors which would influence the ability of the vector to become established in other hosts.

Characteristics of the inserted nucleic acid (the insert):

- functions coded by the inserted nucleic acid, including any residual vector;
- information on the expression of the inserted nucleic acid and the activity of the gene product(s).

Characteristics of the organism with novel traits:

The organism with novel traits should be compared with the organism from which it is derived, examining, where relevant the following points:

- pathogenecity, toxicity and allergenicity to humans and other organisms (in the case of micro-organisms it should be noted that there are internationally accepted classification lists for human pathogens. Similar lists exist at national level for plant and animal pathogens);

- survival, persistence, competitive abilities and dissemination in the environment or other relevant interactions;
- capacity to transfer genetic material and the ways in which this might occur;
- methods for detecting the organism in the environment and for detecting the transfer of the donated nucleic acid;
- functions which might affect its ecological range;
- characterization of the product(s) of the inserted gene(s) and, where appropriate, the stability of the modification.

INFORMATION RELATING TO THE INTENDED USE

The amount of information required will vary with the characteristics of the organism and use, frequency and the scale of the intended use.

For contained uses, this can include:

- number or volume of organisms to be used;
- scale of the operation;
- proposed containment measures, including verification of their functioning;
- training and supervision of personnel carrying out the work;
- plans for waste management;
- plans for safety of the health of personnel;
- plans for handling accidents and unexpected events;
- relevant information from previous uses.

For deliberate releases, this can include:

- purpose and scale of the release;
- geographical description and location of the release;
- proximity to residences and human activities;
- method and frequency of release;
- training and supervision of personnel carrying out the work;

- likelihood of transboundary movement;
- time and duration of the release;
- expected environmental conditions during the release;
- proposed risk-management measures including verification of their functioning;
- subsequent treatment of the site and plans for waste management;
- plans for handling accidents and unexpected events/disasters;
- relevant information from any previous releases.

CHARACTERISTICS OF THE POTENTIAL RECEIVING ENVIRONMENT

The potential for an organism to cause harm is related to the environments into which it may be released and its interaction with other organisms. Relevant information can include:

- the geographical location of the site, the identity and any special features of the receiving environments that expose them to damage;
- the proximity of the site to humans and to significant biota;
- any flora, fauna and ecosystems that could be affected by the release, including keystone, rare, endangered or endemic species, potential competitive species and non-target organisms;
- the potential of any organism in the potential receiving environment to receive genes from the released organism.

Annex 4

EXAMPLES OF RISK-MANAGEMENT MEASURES FOR CONTAINED APPLICATIONS

Details of risk-management procedures are available in guidelines and regulations available from many countries and organizations.

Annex 5

EXAMPLES OF RISK-MANAGEMENT MEASURES FOR CONTROLLED RELEASES

Risk management is employed during the development and evaluation of an organism in a systematic fashion, for example from the laboratory, through stages of field testing, to commercialization. The number and forms of these stages are not fixed, but depend on the outcome of risk assessment at the different stages. Progression through the appropriate developmental stages, in order to gain knowledge, generally entails a reduction in control and possibly in monitoring, while often increasing in scale.

Appropriate risk management measures for releases will vary considerably from case to case. They will be determined by the risk assessment, the organisms involved and the way that they will be released. In addition to general precautions to control releases, risk management measures often focus on the control of the dissemination of the released organisms and control of the gene flow from the released organisms.

The type of risk-management measures to be employed should be commensurate with the risks identified. Therefore, there might be cases where very few, if any, risk-management measures will be necessary. Consequently, not all of the examples given below are likely to be relevant for any given controlled release.

Examples of risk-management measures for controlled releases include:

General precautions

- Appropriate information and training is provided for those involved in handling the organisms;
- Monitoring procedures are applied in such a way that appropriate measures can be taken in case of unexpected effects during or after the release;
- The dissemination of the released organisms and/or gene flow from the released organisms are controlled;
- Controlling access to the release site.

For plants

- Applying reproductive isolation, by:
  - spatial separation;

- temporal separation: use of plants that will flower either earlier or later than plants of nearby reproductively compatible species;
- biological prevention of flowering (e.g. by omitting vernalisation);
- removal of the male or female reproductive structures;
- bagging of flowers;
- making use of sterility.

- Controlling the persistence or dispersal of reproductive structures such as propagules or seeds.
- Destroying volunteer plants after harvest; control of volunteers may be necessary during longer periods, depending on the species.

For animals

- Confining by appropriate means such as fences, filters, islands, ponds;
- Applying reproductive isolation by using sterile animals;
- Isolation from feral animals of the same species.
- Controlling the persistence or dispersal of reproductive structures such as larvae or eggs.

For micro-organisms

- Using organisms with impaired ability to grow or persist in the environment;
- Minimizing gene transfer by:
  - using organisms that do not contain known self-transmissible mobilizable or transposable genetic elements;
  - ensuring that introduced traits are stably located on the chromosome.

These measures will often not be applicable once an organism with novel traits, such as a modified crop plant, is at the stage of being marketed as a product if, as a result of testing during research and development, it has been shown that the risks are acceptably low.

Annex 6

DATABASES

Computerized and other forms of databases are important elements of a systematic approach to safety in biotechnology and to the process of wider international cooperation. Different types of databases have been established or are in the final stages of preparation and others are under consideration or in early stages of development. In order to contribute positively to the safe use and development of biotechnology, it is important that databases be harmonized wherever possible, that they be made as readily accessible to as many users as possible, and that they be kept up to date. Information in databases should be validated appropriately.

There are databases covering regulation, introductions or releases, microbiology, molecular biology, cell lines and hybridomas, sequence data, bibliography and general biotechnology information. Information is less widely available in systematic form on the wide variety and vast number of crop plants modified by plant breeding techniques.

Major databases include:

- The World Data Centre's Directory to Culture Collections of Micro-organisms;
- National and regional microbial strain databases (MiCIS, MINE in Europe);
- Hybridoma Data Base;
- Immunoclone Database;
- Interlab Animal Cell Database;
- Sequences databases (EMBL, Seqnet, Can/Snd, Gen Bank);
- Botanic databases (ILDIS);
- Taxonomic databases (Biosis, ICECC);
- Plasmids/vectors/gene libraries (NIH Repository of Human DNA Probes);
- Bibliographic databases (Datastar, Dialogue);
- General biotechnology databases (Bioindustry Association databases, BIKE, BIOREP);
- Biotechnology Information Knot for Europe of GBF in Germany;
- Biotrack: on the Use and Release of Organisms (OECD);
- IRRO: Information Resource for the Release of Organisms to the Environment.

- *BINAS*: Biosafety Information Network and Advisory Service.

Some of these are linked through the internationally sponsored information and communications network, the Microbial Strain Data Network (MSDN).

Note: This Annex will be further expanded in the future to include databases related to agronomy, ecology, taxonomy, etc.

Annex 7

POSSIBLE MECHANISMS FOR PROVIDING INFORMATION TO THE PUBLIC

Examples of methods for communicating with the public include:

- Establishing a register of information about work with organisms with novel traits, whether in containment or in deliberate releases into the environment. Such a register should provide for appropriate safeguards for commercially sensitive information; a summary of risk assessments; evaluations by the authorities or any relevant advisory committees;
- Giving interested groups the opportunity to comment on proposals to work with organisms with novel traits, possibly on the basis of a register of information as outlined above;
- Publishing a newsletter outlining the kind of work that is being carried out with organisms with novel traits, its purpose, and the controls under which it is taking place;
- Encouraging those intending to release organisms with novel traits into the environment to inform local people, through public meetings, advertisements in local newspapers, or other appropriate means;
- Encouraging dialogue between companies and academic institutions working with organisms with novel traits and public interest groups;
- Electronic billboarding;
- Making use of radio and television;
- Providing information about products;
- Any other means appropriate within the local context.