The Precautionary Principle and the Risk Analysis in International Environmental Law [1)]

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Introduction

Nowadays, as a result of high and rapid development of science and technology, and economy and industry, human beings are facing with threats of serious or irreversible harm or damage of a global and intergenerational consequence, such as ozone depletion, global warming, marine pollution, food security, living modified organisms and chemicals. At the same time, decision-makers are requested to make a decision to prevent such harm or damage to human health and the environment even if there is lack of scientific certainty about a phenomenon, product or process and a causal link between human activities and their effects.

Several new principles have emerged to govern conducts of States, such as

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the precautionary principle, the principle of common but differentiated responsibility, the principle of sustainable development, the principle of intergenerational equity, etc. They are introduced into international instruments, both multilateral environmental agreements (MEAs) and non-legally binding international instruments.[2)]

Documents in attached Annex I and II introduce the precautionary principle (PP), precautionary approach (PA) or precautionary measures (PM), which is hereinafter referred to as "the Principle" unless otherwise mentioned.[3)] The Principle, different from the traditional principle of prevention of pollution which is based on the scientific evidence of a causal link between causes and effects, is often cited to mean that where there are threats of serious or irreversible damage, States should take measures to prevent environmental degradation, even if there is lack of scientific certainty. For example, the Principle 15 of the Rio Declaration, being acknowledged or reaffirmed by preambles of such MEAs as the Aahus Heavy Metals Protocol, the Aahus POP Protocol, the Rotterdam Convention, the Gothenburgh Protocol and the Cartagena Protocol[4)] contains the Principle by saying that:

> "In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are

2) A full compilation of MEAs and non-legally binding international instruments related to the precautionary principle is found in Arie Trouwborst, *Evolution and Status of the Precautionary Principle in International Law* (2002).

3) According to Annex IIA, document nos. 2, 4-6, 9, 11, 13, 14, 16, 17, 19, 23, 24 and 26, introduce PP, document nos. 3, 15, 16, 18, 20, 22-25 and 27-32 introduce PA and document nos. 1-3, 8, 12, 21 and 25 introduce PM. According to Annex IIB, document nos. 4, 5, 7, 9, 10, and 12-14 introduce PP, document nos. 2, 3, 8, 11, 12 and 15 introduce PA and document no. 6 introduces PM.

4) Article 1 of the Cartagena Protocol provides further that the Parties accord with the precautionary approach contained in the Principle 15 of the Rio Declaration, so does Article 1 of the Stockholm Convention.

> threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."

Article 3.3 of UNFCCC cites the Principle as one of the principles of the Convention, providing that:

> "The Parties should take precautionary measures to anticipate, prevent or minimize the causes of climate change and mitigate its adverse effects. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing such measures, taking into account that policies and measures to deal with climate change should be cost-effective so as to ensure global benefits at the lowest possible cost."

There is a possibility, however, of an abusive use of the Principle for justification of arbitrary decisions and actions by States. This paper aims to find out ways to avoid such an abusive use and to achieve the original objective of the Principle. Risk analysis in terms of risk assessment, risk management and risk communication can be used as one of the useful tools for that purpose.

1. Origin of the Principle and its Development in Europe

1.1 The 1986 German Guideline and the Basic Law amended in 1994

Some domestic legal systems in West Germany and Sweden, for example, have considered the Principle as a legal principle since 1970s.[5] The Principle could be found to be originated as a legal concept in the German law Vorsorgeprinzip, i.e. the principle of prior consideration.[6]

Vorsorgeprinzip was a political principle of conduct as well as a legal principle which needs legislation to be implemented. The 1994 amended Basic Law (Grundgesetz) is said to include Vorsorgeprinzip as a legal duty of the State.[7] Vorsorgeprinzip is composed of three principles: the principle of prevention of danger, the principle of prior consideration of risk, and the principle of future consideration. According to the principle of prior consideration of risk, even if risk cannot be scientifically identified at present time, it needs to be avoided or eliminated. In this sense, the principle of prior consideration of risk, one component of Vorsorgeprinzip, is equivalent to the Principle.

1.2 Development of the Principle in Europe

The 1987 London Ministerial Declaration (Annex IB: 2) introduced the precautionary approach for the first time in history on the international level, which says that:

> "a precautionary approach is necessary which may require action to control inputs of such (the most dangerous) substances even before a causal link has been established by absolutely clear scientific evidence." (Preamble)

The 1990 Hague Ministerial Declaration (Annex IB: 4) adopted the precaution-

5) Scott Lafranchi, "Surveying the Precautionary Principle's Ongoing Global Development: The Evolution of an Emergent Environmental Management Tool," 32 *B.C. Envtl. Aff. L.Rev. 678*(2005); Simon Marr, *The Precautionary Principle in the Law of the Sea: Modern Decision Making in International Law* 5(2003).

6) R. Churchill and D. Freestone eds., *International Law and Global Climate Change* 21 (1991); D. Freestone and E. Hey eds., *The Precautionary Principle and International Law: The Challenge of Implementation* 4, 31 (1996).

7) Kazuhiko Matsumoto, "Development of the Precautionary Principle in Environmental Law," 54 *Osaka Law Review (Osaka University)* 1189 (2005) (in Japanese).

ary principle instead of the precautionary approach, which says that:

> "The participants…will continue to apply the precautionary principle that is to take action to avoid potentially damaging impacts of substances that are persistent, toxic and liable to bioaccumulate even when there is no scientific evidence to prove a causal link between emissions and effects." (Preamble)

Based on these precedents in Europe, the precautionary principle (PP), precautionary approach (PA) or precautionary measures (PM) has been thereafter introduced into MEAs and other non-legally binding international instruments. (See documents in Annex I and II.)

2. The Principle in International Instruments (MEAs) and its Meaning

2.1 Two Constituent Elements of the Principle

Human activities, including a phenomenon, product or process, may cause adverse effects or impacts on human health or the environment. Such effects or impacts are identified by scientific evaluation based on the available data. If they are inconsistent with the chosen level of protection, decision-makers have to take precautionary measures to prevent environmental degradation, even if such scientific information is insufficient, inconclusive or uncertain.

When the Principle is invoked, two constituent elements trigger recourse to it, i.e. adverse effects or impacts, and lack of scientific certainty.

Following is the result of the survey of provisions about each constituent element in MEAs (see Annex IIIA and IV).

2.2 Adverse Effects or Impacts

With regard to the first constituent element, i.e. adverse effects or impacts, MEAs of Annex IA introduce the following different categories of concept: "probability of harm" in doc. nos. 3 and 18, "probability of hazards" in doc. nos. 6 and 9, "probability of adverse effects" in doc. no. 2, "probability of significant adverse human health or environmental effects" in doc. nos. 23, 24, 27 and 32, "risk of long-term or irreversible effects" in doc. no. 15, "potential transboundary impact" in doc. no. 5, "potential harmful impact" in doc. no. 25, "potential adverse effects" in doc. no. 28, "possibility of a significant transboundary impact" in doc. no. 11, "threats of significant reduction or loss of biological diversity" in doc. no. 7, "threats of serious or irreversible damage" in doc. nos. 8, 12,16, 17 and 21, and "threats of serious or irreversible adverse impacts or damage" in doc. no. 30.

It can be concluded that components of the concept of adverse effects or impacts are categorized into three: (1) the kind of adverse effects or impacts, (2) the level of adverse effects or impacts, and (3) the probability or possibility of occurrence of such effects or impacts.

With regard to the first component of the kind of adverse effects or impacts, different concepts such as "harm",[8] "hazards",[9] "adverse effects",[10] "damage",[11] "risk",[12] "harmful impact",[13] or "transboundary impact"[14] are used in MEAs. With regard to the second component, the threshold or level of adverse effects or impacts is varied, i.e. those with the adjective "significant",[15] or "seri-

8) See Annex IA: 3, 18.
9) See Annex IA: 6, 9.
10) See Annex IA: 2, 23, 24, 27, 28, 30, 32.
11) See Annex IA: 8, 12, 16, 17, 21, 30.
12) See Annex IA: 15.
13) See Annex IA: 25.
14) See Annex IA: 5, 11, 26.
15) See Annex IA: 7, 11, 23, 24, 27, 32.

ous or irreversible" [16] and those without the adjective "significant" or "serious or irreversible".[17] And regarding the third component of the probability or possibility of occurrence of adverse effects or impacts, while some MEAs indicate the probability [18] in terms of "may", "likely" or "likelihood", others indicate the possibility[19] in terms of "can", "could", "possible", "potential", "risk" or "threat".

Conclusions can be derived from the above analysis of the first constituent element of the Principle, i.e. adverse effects or impacts.

[1] The first component of the first constituent element, i.e. the kind of adverse effects or impacts, is diverse.
[2] The second component of the first constituent element, i.e. the threshold or level of adverse effects or impacts, is also diverse.
[3] The third component of the first constituent element, i.e. the probability or possibility of occurrence of adverse effects or impacts, is diverse, too.
[4] Therefore, the general definition of the Principle which includes as its components "threats of serious or irreversible damage" is not common to all related MEAs but only to doc. nos. 8, 12, 16, 17 and 21 of Annex IA.
[5] The definition of the Principle in all atmosphere-related MEAs, i.e. doc. nos. 8, 12 and 21 of Annex IA, includes as its component "threats of serious or irreversible damage".

2.3 Lack of Scientific Certainty

With regard to the second constituent element, i.e. lack of scientific certainty, MEAs of Annex IA introduce the following different categories of concept:

16) See Annex IA: 8, 12, 15, 16, 17, 21, 30.
17) See Annex IA: 2, 3, 5, 6, 9, 10, 18, 25, 26, 28.
18) See Annex IA: 2, 3, 6, 9, 18, 23, 24, 27, 32.
19) See Annex IA: 5, 7, 8, 10, 11, 12, 15, 16, 17, 21, 25, 28, 30.

"without waiting for scientific proof" in doc. no. 3, "scientific research has not fully proved a causal link" in doc. nos. 5 and 26, "scientific research has not fully proved the existence of a causal link" in doc. no. 11, "no conclusive evidence of a causal relationship" in doc. nos. 6 and 9, "no conclusive evidence to prove a causal relationship" in doc. no. 18, "insufficient relevant scientific evidence" in doc. no. 10, "absence of adequate scientific information" in doc. no. 15, "lack of scientific certainty" in doc. nos. 28 and 30, and "lack of full scientific certainty" in doc. nos. 7, 8, 12, 16, 17, 21, 23, 24, 27 and 32.

Two components of the concept of the second constituent element are identified: (1) the kind of lack of scientific certainty, and (2) the level of scientific certainty.

With regard to the first component, i.e. the kind of lack of scientific certainty, MEAs provide different concepts such as "no scientific proof",[20] "no scientific proof of a causal link",[21] "no conclusive evidence of a causal relationship",[22] "no adequate scientific information",[23] "insufficient relevant scientific evidence",[24] "lack of scientific certainty",[25] and "lack of full scientific certainty".[26]

With regard to the second component, i.e. the level of scientific certainty, while some MEAs provide the adjective of "conclusive",[27] "sufficient",[28] "adequate",[29] or "full",[30] others do not.[31]

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20) See Annex IA: 3.
21) See Annex IA: 5, 11, 26.
22) See Annex IA: 6, 9, 18.
23) See Annex IA: 15.
24) See Annex IA: 10.
25) See Annex IA: 28, 30, 32.
26) See Annex IA: 7, 8, 12, 16, 17, 21, 23, 24, 27.
27) See Annex IA: 6, 9, 18.
28) See Annex IA: 10.
29) See Annex IA: 15.
30) See Annex IA: 5, 7, 8, 11, 12, 16, 17, 21, 23, 24, 26, 27.
31) See Annex IA: 3, 28, 30, 32.

Conclusions can be derived from the above analysis of the second constituent element of the Principle, i.e. lack of scientific certainty.

[1] The first component of the second constituent element, i.e. the kind of scientific certainty, is diverse.
[2] The second component of the second constituent element, i.e. the level of scientific certainty, is also diverse.
[3] Therefore, the general definition of the Principle which includes as its components "lack of full scientific certainty" is not common to all related MEAs but only to doc. nos. 7, 8, 12, 16, 17, 21, 23, 24, 27 and 32 of Annex IA.
[4] The definition of the Principle in all atmosphere-related MEAs, i.e. doc. nos. 8, 12 and 21 of Annex IA, includes as its component " lack of full scientific certainty".

2.4 Required Measures Resulting from the Application of the Principle

According to the Principle in MEAs, the Contracting Parties are obliged to take either general measures or specific measures.

According to the Principle in Annex IIIA, the Contracting Parties are obliged to take general measures but they have discretion to decide what measures to take, in other words, they are under the obligation of result.

On the other hand, according to the Principle in Annex IV, the Contracting Parties are obliged to take specific measures which each MEA imposes on the Contracting Parties, such as the one to reduce production and consumption of ozone layer depleting substances (Annex IA: 2), sanitary or phytosanitary measures (Annex IA: 10), reduction of sulphur emissions (Annex IA:12), conservation, management and exploitation of straddling fish stocks and highly migratory fish stocks (Annex IA: 15), regulation of ocean dumping of wastes or other matter (Annex IA: 18), control and reduction of emissions of green house gases (Annex

IA: 21), reduction of emissions of heavy metals (Annex IA: 23), elimination of production and use of persistent organic pollutants listed in Annex I (Annex IA: 24), regulation of trade of chemicals listed in Annex III (Annex IA: 25), reduction of emissions of sulphur, nitrogen oxides, ammonia and volatile organic compounds (Annex IA: 27), risk assessment and management of living modified organism, notification by export countries, and decision-making procedure (Annex IA: 28), and regulation of production, use, export and import of persistent organic pollutants set out in Annex (Annex IA: 32).

In most cases the Contracting Parties of MEAs or the member states of international organizations established by MEAs are obliged to take measures, either general or specific, in accordance with the Principle. Stockholm Convention (Annex IA: 32) is the only MEA which provides that treaty organs, such as the COP and the Persistent Organic Pollutants Review Committee are to decide to take specific measures according to the Principle. (See below 3.3)

2.5 Permitted Measures Resulting from the Application of the Principle

Some MEAs permit the Contracting Parties to take certain measures according to the Principle. A Member may provisionally adopt sanitary or phytosanitary measures on the basis of available pertinent information in cases where relevant scientific evidence is insufficient (article 5.7 of the SPS Agreement, see Annex IA: 10). The Contracting Party may ban the import of chemicals listed in Annex III as a precautionary measure based on risk assessment (articles 10, 14.3 (d), Annex II of the Rotterdam Convention, see Annex IA: 25). The Contracting Party may ban the import of the living modified organism in question as a precautionary measure based on risk assessment (article 10 of the Cartagena Protocol, see Annex IA: 28). The Contracting Party may, based on risk assessment, list chemicals in Annex A which prohibits or eliminates in principle its production, use, import and export, Annex B which restricts in principle its production and use,

and/or Annex C which reduces its total releases derived from anthropogenic sources (article 8.7 of the Stockholm Convention , see Annex IA: 32).

2.6 Cost-Effectiveness

Some MEAs oblige the Contracting Parties, when taking the precautionary measures, to ensure that such measures should be cost-effective. When taking the precautionary measures, the Contracting Parties should take into account that policies and measures to deal with climate change be cost-effective so as to ensure global benefits at the lowest possible cost (article 3 of UNFCCC, see Annex IA: 8). When taking the precautionary measures, the Contracting Parties should take into account that such measures to deal with emissions of air pollutants be cost-effective (preamble, para.4 of Oslo Protocol, see Annex IA: 12). The Contracting Parties should take cost-effective measures to prevent environmental degradation (article 1 of Waigani Convention, see Annex IA: 16). The Contracting Parties should take cost-effective measures to prevent environmental degradation (article 4.3(a) of Barcelona Convention amended in 1995, see Annex IA: 17).

What does the cost-effectiveness mean in respective cases? It is not clear whether it includes not only economic considerations but also non-economic considerations such as the efficacy of possible options and their acceptability to the public. It is not clear either what criteria is used for evaluating the cost-effectiveness. These are serious unresolved questions left for the implementation of respective MEAs.

2.7 Reversion of Burden of Proof

As a general rule of law, the burden of proof of adverse effects or impacts is assigned to those parties which claim that they are potential victims of such

effects or impacts. But some MEAs reverse the burden of proof and place it on those parties which plan to develop activities in question or export substances or products in question and oblige them to prove that they are consistent with the chosen level of protection and therefore acceptable.[32)]

Dumping States are obliged to prove by scientific research the safety of low and medium level of radioactive wastes (article 3.3(c) of Annex II of the OSPAR Convention, see Annex IA: 9). The Contracting Party of import shall ensure risk assessments of living modified organisms before import but may require the exporter to carry out the risk assessment (article 15 of the Cartagena Protocol, see Annex IA: 28).

3. Risk, Risk Assessment, Risk Management and Risk Communication

There lies a fear of the abusive use of the Principle in order to justify arbitrary decisions and actions, since most related MEAs, except doc. nos.10, 28 and 32 of Annex IA, neither specify constituent elements, particularly the threshold or level of adverse effects or impacts and the level of scientific certainty, nor make clear who decides them when, and by what procedure. Those parties which are to apply the Principle might take arbitrary actions to their own interests.

Risk analysis in terms of risk assessment, risk management and risk communication is one of the useful tools in this context.

Following three MEAs and one non-legally binding international instrument adopt such risk analysis.

3.1 The SPS Agreement (Annex IA: 10)

3.1.1 The right to take sanitary and phytosanitary measures

32) See Freestone and Hey eds., *supra note* 5, at 84-86; Sumudu A. Atapattu, *Emerging Principles of International Environmental Law* 231-233 (2006).

According to article 2 of the Agreement, Members have the right to take sanitary and phytosanitary measures necessary for the protection of human, animal or plant life or health. And at the same time when applying such measures, they shall ensure that (1) such measures are applied only to the extent necessary for the protection of human, animal or plant life or health, (2) such measures are based on scientific principles, and (3) such measures are not maintained without sufficient scientific evidence except as provided for in para.7 of article 5.

3.1.2 Risk assessment

The Agreement obliges Members to ensure that their sanitary or phytosanitary measures are based on an assessment of the risks to human, animal or plant life or health (article 5.1). In other words, Members are to carry out the risk assessment before they take sanitary or phytosanitary measures.

The risk assessment means (1) the evaluation of the likelihood of entry, establishment or spread of a pest or disease within the territory of an importing Member according to the sanitary or phytosanitary measures which might be applied, and of the associated potential biological and economic consequences, or (2) the evaluation of the potential adverse effects on human or animal health arising from the presence of additives, contaminants, toxins or disease-causing organisms in food, beverages or feedstuffs (Annex A.4).

Therefore, although the Agreement does not define the term of "risk", it can be inferred that the "risk" means the likelihood of entry, establishment or spread of a pest or disease and of the potential biological and economic consequences, or the potential adverse effects on human or animal health.

When assessing risks, Members shall take into account available scientific evidence: such as relevant processes and production methods; relevant inspection, sampling and testing methods; prevalence of specific diseases or pests; existence of pest- or disease-free areas; relevant ecological and environmental condi-

tions; and quarantine or other treatment (article 5.2).

The risk assessment is not confined to purely quantitative scientific data but may include non-quantifiable data of a factual or qualitative nature.[33)]

3.1.3 Determination of measures for achieving the appropriate level of the sanitary or phytosanitary protection from the risk

Based on the result of risk assessment, Members determine the measure to achieve the appropriate level of the sanitary or phytosanitary protection from the risk (article 5.3). Each Member has the independent right to determine the level of protection they consider appropriate.

3.1.4 The Principle

Thus, the Agreement obliges Members to carry out the risk assessment based on the available scientific evidence before they take sanitary or phytosanitary measures. Even in cases where relevant scientific evidence is insufficient, however, it allows Members to adopt such measures provisionally on the following conditions: (1) such measures are based on available pertinent information, including that from the relevant international organizations as well as from sanitary or phytosanitary measures applied by other Members, (2) Members seek to obtain the additional information necessary for a more objective assessment of risk, and (3) Members review the sanitary or phytosanitary measures accordingly within a reasonable period of time (article 5.7).

Thus the Principle is clearly enshrined in article 5.7, although the term itself is not explicitly referred to.[34)]

33) See Report of WTO Appellate Body in the Hormones case. Report of the Appellate Body, WTO Doc. WT/DS26/AB/R and WT/DS48/R (January 16, 1998), paragraph 124.

34) *Ibid.*

3.1.5 Risk management

Since risk assessment is carried out on the basis of available scientific evidence, there seems to be no room for the Principle to be applied at this stage. The Principle is relevant to the management of risk. Faced with the identified risk, although relevant scientific information is insufficient, Members are allowed to take provisionally sanitary or phytosanitary measures to protect their human, animal or plant life or health from such risk. In this sense Members apply the Principle in the stage of the risk management.[35)]

3.1.6 Risk communication

The Agreement does not explicitly refer to the term of risk communication, but seems to include it in the relevant provisions. For instance, Members shall provide information on their sanitary or phytosanitary measures in accordance with Annex B (article 7). Such measures include provisional ones taken on the Principle. Provision of information helps related Members, the Member of export in particular, to take appropriate advance response measures.

3.2 The Cartagena Protocol (Annex IA: 28)

3.2.1 Prior notification and consent

Prior to the export of seeds, for instance, of living modified organisms, the Party of export shall notify, or require the exporter to ensure notification to, in writing, the Party of import and obtain its informed agreement (articles 7, 8). The notification contains the information specified in Annex I (article 8.2). Notified Party

35) See Report of WTO Appellate Body in the Hormones case which admits that the Principle does not override articles 5.1 and 5.2. *Ibid*. paragraph 125.

of import decides whether or not to approve the import (article 10). The Party of import makes this decision based on the risk assessment provided by article 15.

3.2.2 Risk assessment

The Party of import shall ensure that risk assessments be carried out for decisions, which means that either the Party of import itself carries out the risk assessment or the exporter carries it out (see article 5.2).

The risk assessment means the identification and evaluation of the possible adverse effects of living modified organisms on the conservation and sustainable use of biological diversity, taking also into account risks to human health (article 15.1, Annex III.1). The risk assessment is carried out in a scientifically sound manner, in accordance with Annex III and taking into account recognized risk assessment techniques (article 15). Annex III lists objective, use of risk assessment, general principles, methodology and points to consider of the risk assessment.

Hence, although the Protocol does not define the term "risk", it can be inferred that the "risk" means the possible adverse effects of living modified organisms on the conservation and sustainable use of biological diversity, taking also into account risks to human health.

3.2.3 The Principle

According to articles 10.6 and 11.8, the Party of import is allowed to decide whether or not to approve the import in question in order to avoid or minimize the potential adverse effects of a living modified organism on the conservation and sustainable use of biological diversity in the Party of import, taking also into account risks to human health, even in cases of lack of scientific certainty due to insufficient relevant scientific information and knowledge regarding the extent

of such adverse effects. Thus the Principle is herein clearly enshrined.

3.2.4 Risk management

The Principle applies to the stage of risk management when the Party of import decides whether or not to approve the import in question in order to avoid or minimize the potential adverse effects. Appropriate mechanisms, measures and strategies to regulate, manage and control risks identified in the risk assessment are to be established and maintained by the Parties (article 16.1).

3.2.5 Risk communication

The Protocol does not explicitly refer to the term of risk communication, but seems to include it in the relevant provisions of the process of prior notification of the export of living modified organisms, the assessment of their risks, the information provision of the result of risk assessment, and the final decision and its notification to the Party of export or import.

3.3 The Stockholm Convention (Annex IA: 32)

3.3.1 Risk assessment

This Convention aims to protect human health and the environment from persistent organic pollutants, mindful of the precautionary approach set forth in the Principle of the Rio Declaration on Environment and Development (article 1).

According to article 8.1, a Party may submit a proposal to the Secretariat for listing a chemical in Annex A which prohibits or eliminates in principle its production, use, import and export, Annex B which restricts in principle its production and use and/or Annex C which reduces its total releases derived from anthro-

pogenic sources. This proposal should include the information specified in Annex D regarding chemical identity, persistence, bio-accumulation, potential for long-range environmental transport and adverse effects of the chemical in question.

The Persistent Organic Pollutants Review Committee examines the proposal forwarded by the Secretariat by applying the screening criteria set out in Annex D (article 8.2). If the Committee decides that the said criteria have been fulfilled, or the Conference of the Parties has decided that the proposal should proceed, the Committee then reviews the proposal and prepares a draft risk profile in accordance with Annex E (article 8.6). It makes that draft available to all Parties and observers, collects technical comments from them and, taking those comments into account, completes the risk profile (ibid). If the Committee decides, on the basis of the risk profile, that the chemical in question is likely, as a result of its long-range environmental transport, to lead to significant adverse human health and/or environmental effects such that global action is warranted, the Committee further proceed the proposal (article 8.7). The Committee invites, through the Secretariat, information from all Parties and observers relating to the considerations specified in Annex F and then prepares a risk management evaluation that includes an analysis of possible control measures for the chemical in question in accordance with that Annex (ibid).

A Register is established for the purpose of identifying the Parties that have specific exemptions listed in Annex A or B. The Register is maintained by the Secretariat and is available to the public (article 4).

The purpose of the review of the proposal made by the Committee is to evaluate whether the chemical in question is likely, as a result of its long-range environmental transport, to lead to significant adverse human health and/or environmental effects (Annex E). Hence, the said review is equivalent to the risk assessment.

Therefore, it can be inferred that the "risk" means the likelihood of signifi-

cant adverse human health and/or environmental effects as a result of the long-range environmental transport of the chemical in question.

3.3.2 The Principle

As stated above, if the Committee decides, on the basis of the risk profile, that the chemical in question is likely to lead to significant adverse human health and/or environmental effects, the Committee proceeds the proposal. Lack of full scientific certainty shall not prevent the proposal from proceeding (article 8.7(a)).

Thus the Principle is herein clearly enshrined. It is to be noted that the Committee, but not the Parties of the Convention, applies the Principle.

3.3.3 Risk management

The Committee carries out the risk assessment on the basis of scientific information. It then decides, based on the result of the risk assessment and information gained from all Parties and observers, whether or not the chemical in question is to be listed in Annex. Lack of full scientific certainty does not prevent the proposal from proceeding. In this sense, the Principle applies to the stage of risk management.

3.3.4 Risk communication

The Convention does not explicitly refer to the term of risk communication, but seems to include it in the relevant provisions of the proposal for listing a chemical in Annex, the preparation of a draft risk profile, the collection of technical comments from all Parties and observers, the completion of the risk profile by taking those comments into account, the establishment and maintenance of a Register and the preparation of the risk management evaluation.

In addition to these means and channels of communication, the Convention provides for the information exchange regarding the reduction or elimination of the production, use and release of persistent organic pollutants and alternatives to persistent organic pollutants, including information relating to their risks as well as their economic and social costs, directly between or among Parties themselves or through the Secretariat which serves as a clearing-house (article 9). It also provides that each Party shall promote and facilitate awareness about persistent organic pollutants among policy and decision makers and provision to the public of all available information on persistent organic pollutants (article 10).

3.4 EC Communication (Annex 1B: 13)

According to article 130R2 of the Maastricht Treaty (article 174.2 of the Amsterdam Treaty), the Community's environmental policy shall be governed by the following principles: the precautionary principle, the principle that preventive action be taken, the principle that environmental damage be as a priority rectified at source and the polluter-pays principle.

In 1996, EC banned the import of beef treated with growth hormones from the United States based on the precautionary principle as a full-fledged and general principle of international law.[36)]

In 1998, faced with the necessity to formulate the Principle and avoid its abusive use, EC issued the Guideline on the Application of the Precautionary Principle.[37)] And in 2000, EC Communication was formulated with some addi-

36) EC Measures concerning Meat and Meat Products (Hormones) (United States v European Community; Canada v European Community), Report of the Panel, WTO Doc. WT/DS26/R/USA and WT/DS48/R/CAN (August 18, 1997).

37) Guideline on the Application of the Precautionary Principle, HB/hb D(98), October 17, 1998.

tions to the said Guideline, taking into account specific measures based on the Principle which are provided by the Cartagena Protocol.[38)]

This Communication was formulated and issued in order to inform all interested parties, in particular the European Parliament, the Council and Members States of the manner in which the Commission applies or intends to apply the Principle when faced with taking decisions relating to the containment of risk. The Communication established guidelines for the application of the Principle to serve as a general guidance.

According to the Communication, the Principle is considered within a structured approach to the risk analysis which comprises risk assessment, risk management and risk communication.

3.4.1 Risk assessment

Risk assessment is carried out by scientific experts on the basis of scientific information and data. Risk assessment is composed of four components: hazard identification, hazard characterization, appraisal of exposure and risk characterization.

Hazard identification means identifying the biological, chemical or physical agents that may have adverse effects.

Hazard characterization consists of determining, in quantitative and/or qualitative terms, the nature and severity of the adverse effects associated with the causal agents or activity. It is at this stage that the causal relationship has to be established.

Appraisal of exposure consists of quantitatively or qualitatively evaluating the probability of exposure to the agent under study. There is a need for data on the probability of contamination or exposure of the population or environment to

38) Communication from the Commission on the Precautionary Principle, COM(2000).

the hazard.

Risk characterization corresponds to the quantitative and/or qualitative estimation of the probability, of the frequency and severity of the known or potential adverse environmental or health effects liable to occur. When the available data are inadequate or non-conclusive, a prudent and cautious approach to environmental protection, health or safety could be to opt for the worst-case hypothesis.

The Communication does not explicitly define the concept of "risk" but seems to mean the potentially negative, adverse or dangerous effects to the environment, human, animal or plant health deriving from a phenomenon, product or process.

3.4.2 The Principle

Recourse to the Principle presupposes, as a result of risk assessment, that potentially adverse or dangerous effects deriving from a phenomenon, product or process have been identified by scientific evaluation, and that scientific evaluation, however, does not allow the risk to be determined with sufficient certainty.

3.4.3 Risk management

Whether or not to invoke the Principle is a political decision by decision-makers exercised where scientific information is insufficient, inconclusive or uncertain and where there are indications that the possible effects on the environment, human, animal or plant health may be potentially dangerous and inconsistent with the chosen level of protection. Decision-makers faced with such an unacceptable risk, scientific uncertainty and public concerns decide to apply the Principle.

The Principle is essentially used by decision-makers in the management of

risk. The Communication clearly relates the Principle to the risk management.

The Communication lists following general principles to be applied in the risk management: proportionality to the chosen level of protection; non-discrimination in application of measures based on the Principle; consistency with similar measures already taken; examination of the potential benefits and costs of action or lack of action, including, where appropriate and feasible, an economic cost/benefit analysis; review in the light of new scientific data; assigning responsibility for producing scientific evidence, i.e. reversion of burden of proof.[39]

3.4.4 Risk communication

The Communication refers to the term of risk communication as one component of risk analysis but gives no explicit clarification to it. However, it can be inferred that the risk communication is based on the preceding three components.

Conclusion

The above analysis of the Principle embodied in MEAs lead to the following conclusions.

[1] Of the two constituent elements of the Principle, i.e. adverse effects or impacts, and lack of scientific certainty, regarding the first constituent element, each MEA employs different components of the kind of adverse effects or impacts, their threshold, and the probability or possibility of their occurrence. The most common constituent element is, however, "threats of serious or irreversible damage" found in doc. nos. 8, 12, 16, 17 and 21 of Annex IA. All atmosphere-related MEAs, i.e. doc. nos. 8, 12 and 21 of Annex IA, includes as its com-

39) *Ibid*. at 18-21.

ponent "threats of serious or irreversible damage".

Regarding the second constituent element, each MEA employs different components of the kind of scientific certainty and the level of scientific certainty. The most common constituent element is, however, "lack of full scientific certainty" found in doc. nos. 7, 8, 12, 16, 17, 21, 23, 24, 27 and 32 of Annex IA. All atmosphere-related MEAs, i.e. doc. nos. 8, 12 and 21 of Annex IA, includes as its component "lack of full scientific certainty".

MEAs in doc. nos. 8, 12, 16, 17 and 21 of Annex 1A include both "threats of serious or irreversible damage" and "lack of full scientific certainty".

[2] The Principle is different from the traditional principle of prevention of pollution. While the former is applied where there is a scientific uncertainty, the latter is applied where a causal relationship between causes and effects is clearly established. Hence, the constituent requirements of the Principle should be more exact and stringent. In this sense the most common two constituent elements of "threats of serious or irreversible damage" and "lack of full scientific certainty" are pertinent and appropriate.

[3] In order to fulfill the exact and stringent constituent requirements of the Principle, the third constituent element should be added, i.e. the urgency to take precautionary measures as soon as possible. Precautionary measures cannot be postponed until scientific certainty is established.

[4] There lies a fear of abusive use of the Principle for justification of arbitrary decisions and actions, since most related MEAs, except doc. nos.10, 28 and 32 of Annex IA, neither specify constituent elements, particularly the threshold of adverse effects or impacts and the level of scientific certainty, nor make clear who decides them when and by what procedure. Those parties which are to apply the Principle might take arbitrary actions to justify their own interests.

Risk analysis in terms of risk assessment, risk management and risk communication can serve for the purpose of non-abusive use of the Principle.

The SPS Agreement (Annex IA: 10), the Cartagena Protocol (Annex IA: 28) and the Stockholm Convention (Annex IA: 32) provide an institutionalized mechanism for such risk analysis. And EC Communication (Annex 1B: 13) provides the guidelines for the application of the Principle to serve as a general guidance.

[5] Regarding the term of risk, no MEAs cited above in doc. nos. 10, 28 and 32 of Annex IA and the EC Communication (Annex 1B: 13) make clear definition of the term. Although the definition of the term can be inferred from the related term used in the instruments, it is necessary to do so in order to make risk analysis operational enough. In defining the term, it should be kept in mind that the term implies how likely (probability) or possible (possibility) it is that something which human beings want to avoid will happen, exist or be true, or how likely or possible endpoints for evaluation will happen, exist or be true.

[6] With regard to the application of the Principle in the risk management, it is necessary to distinguish clearly between scientific risk assessment and risk management as a policy measure.

[7] Except the EC Communication, no MEAs refer explicitly to the term of risk communication, but three MEAs include risk communication in their relevant provisions. Risk communication plays an important role in risk analysis. It needs to be elaborated more in detail in respective MEAs. Risk communication helps those concerned, including non-state actors, to take appropriate advance response measures.

Annex IA Multilateral Environmental Agreements (MEAs)

(doc. no.) (shortened name : full name) (year of adoption)

1. Vienna Convention: Convention for the Protection of the Ozone Layer (1985)
2. Montreal Protocol: Protocol on Substances that Deplete the Ozone Layer (1987)
3. Bamako Convention: Convention on the Ban of Import into Africa and the Control of Transboundary Movement and Management of Hazardous Wastes within Africa (1991)
4. Maastricht Treaty: Maastricht Treaty on European Union (1992)
5. Helsinki Convention: Convention on the Protection and Use of Transboundary Watercourses and International Lakes (1992)
6. Helsinki Convention on the Baltic Sea: Convention on the Protection of the Marine Environment of the Baltic Sea Area (1992)
7. CBD: Convention on Biological Diversity (1992)
8. UNFCCC: United Nations Framework Convention on Climate Change (1992)
9. OSPAR Convention: Convention for the Protection of the Marine Environment of the North-East Atlantic (1992)
10. SPS Agreement: Agreement on the Application of Sanitary and Phytosanitary Measures (1994)
11. Convention on the Protection of the Meuse: Convention on the Protection of the Meuse (1994)
12. Oslo Protocol: Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution on Further Reduction of Sulphur Emissions (1994)
13. Danube River Convention: Convention on Cooperation for the Protection and Sustainable Use of the Danube River (1994)
14. Hague Migratory Water Birds Agreement: Agreement on the Conservation of African-Eurosian Migratory Water Birds (1995)
15. UN Straddling Fish Stocks Agreement: Agreement for the Implementation of the Provisions of the 1982 UNCLOS Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (1995)
16. Waigani Convention: Convention to Ban the Importation into Forum Island Countries of Hazardous Wastes and Radioactive Wastes and to Control the Transboundary Movement and Management of Hazardous Wastes within the South Pacific (1995)
17. Barcelona Convention amended in 1995: the 1976 Convention for the Protection of the Mediterranean Sea against Pollution amended in 1995
18. Protocol to London Dumping Convention: Protocol to the 1972 Convention for the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (1996)
19. Monaco Agreement: Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area (1996)
20. Rome Agreement amended in 1997: the 1949 Agreement for the Establishment of a General Fisheries Council for the Mediterranean amended in 1997

21. Kyoto Protocol: Protocol to the 1992 United Nations Framework Convention on Climate Change (1997)
22. Washington Agreement: Agreement on the International Dolphin Conservation Program (1998)
23. Aahus Heavy Metals Protocol: Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution on Heavy Metals (1998)
24. Aahus POP Protocol: Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution on Persistent Organic Pollutants (1998)
25. Rotterdam Convention: Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (1998)
26. London Protocol: Protocol on Water and Health to the 1992 Convention on the Protection and Use of Transboundary Watercourses and International Lakes (1999)
27. Gothenburgh Protocol: Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution to Abate Acidification, Eutrophication and Ground-Level Ozone (1999)
28. Cartagena Protocol: Protocol to the 1992 Convention on Biological Diversity on Biosafety (2000)
29. Honolulu Convention: Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific (2000)
30. Cape Town Agreement: Agreement on the Conservation of Albatrosses and Petrels (2001)
31. Windhoek Convention: Convention on the Conservation and Management of Fishery Resources in the South-East Atlantic Ocean (2001)
32. Stockholm Convention: Convention on Persistent Organic Pollutants (2001)

Annex IAA Classification by Issues

1 Atmosphere: 1, 2, 8, 12, 21, 23, 24, 27
2 Hazardous wastes: 3, 16
3 International rivers and lakes: 5, 11, 13, 26
4 Marine environment: 6, 9, 17, 18
5 Marine living resources: 15, 19, 20, 22, 29, 31
6 Biological diversity: 7, 28
7 Nature: 14, 30
8 Food security, etc.: 10
9 Chemicals: 25, 32
10 Others and general: 4

Annex IB Non-Legally Binding International Instruments

(doc. no.) (shortened name : full name) (year of adoption)

1. World Charter for Nature: World Charter for Nature (1982)
2. London Ministerial Declaration: Declaration of the 2nd International Conference on the Protection of the North Sea (1987)
3. Nordic Council's Declaration: Declaration of the Nordic Council's International Conference on Pollution of the Sea (1989)
4. Hague Ministerial Declaration: Declaration of the 3rd International Conference on the Protection of the North Sea (1990)
5. Bergen Ministerial Declaration: Ministerial Declaration on Sustainable Development in the ECE Region (1990)
6. 2nd World Climate Conference Declaration: Ministerial Declaration of the 2nd World Climate Conference (1990)
7. Wadden Sea Ministerial Declaration: Ministerial Declaration of the 6th Trilateral Government Conference on the Protection of the Wadden Sea (1991)
8. Rio Declaration: Declaration of the United Nations Conference on Environment and Development (1992)
9. Esbjerg Ministerial Declaration: Declaration of the 4th Ministerial Conference on the Protection of the North Sea (1995)
10. Sofia Pan-European Strategy: Pan-European Biological and Landscape Diversity Strategy (1995)
11. FAO Code of Conduct: FAO Code of Conduct for Responsible Fisheries (1995)
12. Washington Action Programme: Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities (1995)
13. EC Communication: Communication from the European Commission on the Precautionary Principle (2000)
14. European Council Resolution: European Council Resolution on the Precautionary Principle (2000)
15. WSSD Plan of Implementation: Plan of Implementation adopted at the World Summit on Sustainable Development (2002)

Annex IBB Classification by Issues

1 Atmosphere: 6
2 Marine environment: 2, 3, 4, 7, 9, 12
3 Marine living resources: 11
4 Biological diversity: 10
5 Nature: 1
6 Others and general: 5, 8, 13, 14, 15

Annex IIA Precautionary Principe (PP), Precautionary Approach (PA) and Precautionary Measures (PM) in MEAs

Doc. No. of MEAs	PP, PA, PM	Place of Reference
Annex IA: 1	PM	Preamble ＜reference only＞
Annex IA: 2	PM	Preamble ＜reference only＞
Annex IA: 3	PM,PA,PP	Art. 4 . 3 (f)＜explanation＞
Annex IA: 4	PP	Art.130R2 ＜reference only＞
Annex IA: 5	PP	Art.2.5 (a)＜explanation＞
Annex IA: 6	PP	Art.3.2＜explanation＞
Annex IA: 7	＜no explicit reference＞	Preamble＜explanation＞
Annex IA: 8	PM	Art.3.3＜explanation＞
Annex IA: 9	PP	Preamble ＜reference only＞ Art.2.2 (a) ＜explanation＞
Annex IA: 10	＜no explicit reference＞	Art.5.7＜explanation＞ Art.5.1~3 (risk assessment) Art.5.4~6 (risk management)
Annex IA: 11	PP	Art.3.2(a)＜explanation＞
Annex IA: 12	PM	Preamble＜explanation＞
Annex IA: 13	PP	Art. 2.4＜reference only＞ Annex Ⅰ, 2. 2
Annex IA: 14	PP	Art.II.2＜reference only＞
Annex IA: 15	PA	Art. 5, 6 ＜explanation＞ Annex II
Annex IA: 16	PP, PA	Art. 1 ＜definition＞
Annex IA: 17	PP	Art.4.3 (a)＜explanation＞
Annex IA: 18	PA	Art.3.1＜explanation＞
Annex IA: 19	PP	Art.II. 4 ＜reference only＞
Annex IA: 20	PA	Art.III.2 ＜reference only＞
Annex IA: 21	PM	Preamble (to be guided by art. 3 of UNFCCC)
Annex IA: 22	PA	Art.4.1＜referring to Annex IA:16 and Annex IB:11＞
Annex IA: 23	PA PP	Preamble＜referring to Annex IB:8＞ Annex III (taking into account cost effectiveness and PP)
Annex IA: 24	PA PP	Preamble＜referring to Annex IB:8＞ Annex V (taking into account cost effectiveness and PP)

Annex IA: 25	PA PM	Preamble＜referring to Annex IB:8, Agenda 21: Chapter19＞ Art.14. 3 (d)＜reference only＞＞ Annex V(1 (e))＜reference only＞＞
Annex IA: 26	PP	Art. 5(a) ＜explanation＞
Annex IA: 27	PA	Preamble＜referring to Annex IB:8＞
Annex IA: 28	PA	Preamble＜referring to Annex IB:8＞ Art. 1 ＜referring to Annex IB:8＞ Art. 10. 6 、 11. 8 ＜explanation＞ Art. 15、Annex III(risk assessment) Art. 16 (risk management)
Annex IA: 29	PA	Preamble,Art.5,6＜application of Annex IA:15＞
Annex IA: 30	PA	Preamble, Art.II＜explanation＞
Annex IA: 31	PA	Preamble, Art. 3, 6.3,7＜explanation＞
Annex IA: 32	PA	Art. 1 ＜referring to Annex IB:8＞ Art.8.7,9＜explanation＞

Annex IIB Precautionary Principle (PP), Precautionary Approach (PA) and Precautionary Measures (PM) in Non-Legally Binding International Instruments

Doc. No. of Instruments	PP, PA, PM	Place of Reference
Annex IB: 1	＜no explicit reference＞	Principle 11＜explanation＞
Annex IB: 2	PA	Preamble, paras. XV, XVI＜explanation＞
Annex IB: 3	PA	Preamble＜explanation＞
Annex IB :4	PP	Preamble＜explanation＞ Operative part＜reference only＞
Annex IB: 5	PP	Operative part＜explanation＞
Annex IB: 6	PM	Principle 7 ＜explanation＞
Annex IB: 7	PP	Para.3＜explanation＞
Annex IB :8	PA	Principle 15＜explanation＞
Annex IB: 9	PP	Preamble ＜reference only＞ Paras.16, 17, 42, 54, 58＜explanation＞
Annex IB: 10	PP	Section 2.4、para.3＜explanation＞
Annex IB: 11	PA	Principle 6.5（general principle）、principle 7.5（PA）＜explanation＞
Annex IB: 12	PA PP	Paras.9 (a), 23 (i), 24, 111(a)＜explanation＞ Paras.104 (b) (i), 118 (b) (i), 124 (b) (i)＜explanation＞
Annex IB: 13	PP	＜explanation＞
Annex IB: 14	PP	B、F 1-7, 24, 25
Annex IB: 15	PA	Operative part（III）＜referring to Annex IB:8＞

Annex IIIA General Measures Resulting from Application of the Principle of MEAs

Doc. No. of MEAs	PP PA PM	Kind and Level of Effects	Kind of Lack of Scientific Certainty	Measures Resulting from Application of the Principle
Annex IA: 3	PP PA PM	Probability of harm	Without waiting for scientific proof regarding harm to humans or the environment	Preventing the release into the environment of substances which may cause harm to humans or the environment (art.4 (f))
Annex IA: 5	PP	Potential transboundary impact	Scientific research has not fully proved a causal link between those [hazardous] substances and the potential transboundary impact	Action to avoid the potential transboundary impact of the release of hazardous substances (art. 2(5)(a))
Annex IA: 6	PP	Probability of hazards to human health, harm to living resources and marine ecosystems, damage to amenities, interference with other legitimate use of the high sea	No conclusive evidence of a causal relationship between inputs and their alleged effects	Preventive measures (art.3 (2))
Annex IA: 7		Threats of significant reduction or loss of biological diversity	Lack of full scientific certainty	Measures to avoid or minimize such a threat (preamble, para.9)
Annex IA: 8	PM	Threats of serious or irreversible damage	Lack of full scientific certainty	Precautionary measures to anticipate, prevent or minimize the causes of climate change and mitigate its adverse effects (art.3)

Annex IA: 9	PP	Probability of hazards to human health, harm to living resources and marine ecosystems, damage to amenities, interference with other legitimate use of the sea	No conclusive evidence of a causal relationship between inputs and the effects	Preventive measures (art.2 (2)(a))
Annex IA:11	PP	Possibility of a significant transboundary impact	Scientific research has not fully proved the existence of a causal link between the discharge of those [dangerous] substances and a possible significant transboundary impact	Action to avoid the release of dangerous substances (art.3(2)(a))
Annex IA:16	PP PA	Threats of serious or irreversible damage	Lack of full scientific certainty	Cost-effective measures to prevent environmental degradation (art. 1)
Annex IA:17	PP	Threats of serious or irreversible damage	Lack of full scientific certainty	Cost-effective measures to prevent environmental degradation (art. 4(3)(a))
Annex IA:30	PA	Threats of serious or irreversible adverse impacts or damage	Lack of scientific certainty	Measures to enhance the conservation status of albatrosses and petrels (art. II.3)

Annex IIIB General Measures Resulting form Application of the Principle of Non-Legally Binding International Instruments

Doc. No. of Instruments	PP PA PM	Kind and Level of Effects	Kind of Lack of Scientific Certainty	Measures Resulting from Application of the Principle
Annex IB: 1		Likely to pose a significant risk to nature	Potential adverse effects are not fully understood	Activities which might have an impact on nature shall be controlled; the best available technology that minimize significant risks to nature or other effects shall be used (principle 11)
Annex IB: 2	PA	Certain damage or harmful effects on the living resources of the sea are likely to be caused	No scientific evidence to prove a causal link between emissions and effects	Safeguarding the marine ecosystem of the North Sea by reducing polluting emissions of substances that are persistent, toxic and liable to bioaccumulate at source (para. XVI)
Annex IB : 3	PA	Damage or harmful effects are likely to be caused	Inadequate or inconclusive scientific evidence to prove a causal link between emissions and effects	Safeguarding the marine ecosystem by eliminating and preventing pollution emissions
Annex IB : 4	PP	Potentially damaging impacts	No scientific evidence to prove a causal link between emissions and effects	Action t o avoid potentially damaging impacts of substances that are persistent, toxic and liable to bioaccumulate (preamble)
Annex IB : 5	PP	Threats of serious or irreversible damage	Lack of full scientific certainty	Prevention of environmental degradation
Annex IB : 6	PM	Threats of serious or irreversible damage	Lack of full scientific certainty	Cost-effective measures to prevent environmental degradation
Annex IB : 7	PP	Significant damaging impact on the environment	No scientific evidence to prove a causal link between activities and their impact	Action to avoid activities which are assumed to have significant damaging impact on the environment
Annex IB : 8	PA	Threats of serious or irreversible damage	Lack of full scientific certainty	Cost-effective measures to prevent environmental degradation

Annex IB:10	PP	Potentially adverse impact of activities on biological and landscape diversity	Causal link between activities and the impact has not yet been fully confirmed	Action to introduce appropriate procedures to avoid or minimize potentially adverse impact of activities on biological and landscape diversity
Annex IB:12	PA PP	Threats of serious or irreversible damage(para.24), unreasonable and otherwise unmanageable risk to human health and the environment (para.104 (b) (i))	Lack of full scientific certainty (para.24)	Cost-effective measures to prevent the degradation of the marine environment (para.24); Phasing out or banning chemicals that pose unreasonable and otherwise unmanageable risk to human health and the environment (para.104 (b) (i))
Annex IB:13	PP	Possible effects on the environment, or human, animal or plant health may be potentially dangerous and inconsistent with the chosen level of protection	Scientific information is insufficient, inconclusive, or uncertain	Measures based on the precautionary principle
Annex IB:15	PA	Threats of serious or irreversible damage	Lack of full scientific certainty	Cost-effective measures to prevent environmental degradation

Annex IV Specific Measures Resulting from Application of the Principle of MEAs

Doc. No. of MEAs	PP PA PM	Kind and Level of Effects	Kind of Lack of Scientific Certainty	Measures Resulting from Application of the Principle
Annex IA : 2	PM	Likely to result in adverse effects on human health and the environment	<no explicit reference>	Control measures (art. 2)、calculation of control levels (art. 3), control of trade with non-parties (art. 4, 4A), special situation of developing countries (art. 5), non-compliance (art. 8), etc.
Annex IA : 10		Risks to human, animal or plant life or health	Insufficient relevant scientific evidence	May provisionally adopt sanitary or phytosanitary measures (art.5.7) based on risk assessment (art.5.1−3), and risk management (art.5.4−6)
Annex IA : 12	PM	Threats of serious or irreversible damage	Lack of full scientific certainty	Reduce and maintain their annual sulphur emissions in accordance with the timing and levels specified in Annex II (art. 2), national strategies, policies, programmes, measures and information (art. 4), reporting (art. 5), research, development and monitoring (art. 6), compliance (art. 7), reviews by the Parties at sessions of the executive body (art. 8), etc、
Annex IA : 15	PA	Risk of long-term or irreversible effects of fishing operations	Absence of adequate scientific information	Conservation, management and exploitation of straddling fish stocks and highly migratory fish stocks (art.6.1)、application of the guidelines set out in Annex II (art. 6.3), etc.
Annex IA : 18	PA	Likely to cause harm	No conclusive evidence to prove a causal relationship between inputs and their effects	Protect and preserve the marine environment from all sources of pollution and take effective measures (art. 2), prohibit the dumping of wastes or other matter (art. 4), requirement of permits (art. 4, Annex 1, 2), issuance of permits and reporting (art. 9), compliance procedures (art. 11), etc.

Annex IA : 21	PM	Threats of serious or irreversible damage	Lack of full scientific certainty	Policies and measures (art. 2), reduction commitments (art. 3), reporting of information (art. 7), review of information by expert review teams (art. 8), periodical review of the protocol by COP (art. 9), national implementation of commitments (art. 10), compliance enforcement (art. 17), etc.
Annex IA : 23	PA PP	Likely to cause significant adverse human health or environmental effects	Lack of full scientific certainty	Reduction of emissions of heavy meals listed in Annex I (art. 3), application of the best available techniques (art. 3, Annex III), production control measures (art. 3, Annex VI,VII), strategies, policies, programmes and measures (art. 5), research, development and monitoring (art. 6) , reporting (art. 7), compliance (art. 9), reviews by the Parties at sessions of the executive body (art. 10), etc.
Annex IA : 24	PA PP	Likely to cause significant adverse human health or environmental effects	Lack of full scientific certainty	Elimination of the production and use of Annex I substances; destruction or disposal and transboundary movement of such substances in an environmentally sound manner; restriction of the use of Annex II substances; reduction of the emissions of Annex III substances, application of the best available techniques (art. 3, Annex V), strategies, policies, programmes, measures and information (art .7), research, development and monitoring (art. 8), reporting (art. 9), reviews by the Parties at sessions of the executive body (art .10), compliance (art .11), etc.
Annex IA : 25	PA PM	Potential harmful impact on human health and the environment	<no reference>	Notification to the Secretariat final regulatory action and review by the Chemical Review Committee (art.5, Annex I, II, III); trade regulations of chemicals listed in Annex III (art. 10, 11, 12, 13), such chemicals being subject to evaluation of risk and hazards (Annex I, II, III);

				information on precautionary measures to be exchanged (art. 14.3(d), Annex V)
Annex IA : 26	PP	Prevalence of water-related disease and/or transboundary impacts	Scientific research has not fully proved a causal link between the factor at which such action is aimed and the potential contribution of that factor to the prevalence of water-related disease and/or transboundary impacts	Prevention, control and reduction of water-related disease, adequate supplies of wholesome drinking water, adequate sanitation, effective protection of water resources, sufficient safeguards for human health,(art. 4), national and/or local targets (art. 6), review and assessment of progress (art. 7), review of compliance (art. 15), etc.
Annex IA : 27	PA	Likely to cause significant adverse human health or environmental effects	Lack of full scientific certainty	Reduction of emissions of sulphur, nitrogen oxides, ammonia and volatile organic compounds in accordance with the ceiling and timescales (art. 3, Annex II), application of the limit values (art. 3, Annex IV-VIII), application of the best available techniques (art. 3, decision 1999/1), strategies, policies, programmes, measures and information (art. 6), research, development and monitoring (art.8), compliance (art. 9), reviews by the Parties at sessions of the executive body (art. 10), etc.
Annex IA : 28	PA	Potential adverse effects of a living modified organism on the conservation and sustainable use of biological diversity in the Party of import, taking also into account risks to human health	Lack of scientific certainty	Notification of export(art.8), acknowledgement of receipt of notification (art. 9), decision procedure (including ban of import, art. 10) , risk assessment (art. 15, Annex III), risk management (art.16)

Annex IA : 32	PA	Likely to lead significant adverse human health and/or environmental effects such that global action is warranted	Lack of full scientific certainty	Regulation of production, use, export and import of persistent organic pollutants set out in Annex (art.3-6), conducting risk file by the Committee in listing the chemical in Annex (art.8.6、Annex E), risk management evaluation (art.8.7, 8.8), decision by COP on listing the chemical in Annex (art.8.9)