2006 年核安全评论

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2006 年核安全评论

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前　言

《2006 年核安全评论》报告了世界范围内为加强核安全、辐射安全、运输安全和放射性废物安全以及应急准备所作的努力。

“分析性概述”辅以两个更详尽的附文，它们是：“2006 年世界范围内与安全有关的事件和活动”（附文一）和“国际原子能机构的安全标准：2006 年的活动”（附文二）。

《2006 年核安全评论（草案）》已作为 GOV/2007/2 号文件提交 2007 年 3 月理事会会议。根据理事会的讨论结果编写了《2006 年核安全评论》的最后文本。

正 文 摘 要

随着国际原子能机构服务于和平利用核能的时间进入第 50 年，已有明确的迹象显示各国开始对核电方案再度发生了兴趣。世界各地纷纷制订了核电新发展和复兴以及其他核技术应用的计划。至关重要的是，今后利用核能的计划和相关工作要与同样雄心勃勃的建立和加强可持续安全基础结构的计划相配套。必须制订计划以有效传承将很快从制造单位、监管机构和营运组织退休的有经验工作人员掌握的知识。同样重要的是，要制订对下一代进行知识和专门技能教育和培训的计划，以支持核安全和辐射安全。

2006 年，国际核安全咨询组（核安全咨询组）发表了一份关于全球核安全制度的报告，其中得出的结论是，该制度当前正在一个有效的水平上发挥作用，但还可以通过实行审慎的变革加强其对改进安全的影响。

2006 年，理事会核准了作为原子能机构安全标准依据的“安全基本法则”。“安全基本法则”规定，对引起辐射危险的设施和活动负有责任的法人或组织必须对安全负主要责任。“安全基本法则”还规定，必须制订和保持有效的法律和政府安全架构。目前面临的挑战是确保整个核能界以适当的方式适用原子能机构的安全标准。

既由于预计到会扩大利用核能，也为了符合当前的国际标准，一些成员国正在进行立法和监管改革。

大多数成员国现在都认识到需要让利益相关者参加到涉及核技术的决策中来。面临的挑战仍然是如何让各种利益相关者切实有效地参与其中。与此相关的是，还需要营运者、用户和监管机构以公开透明的方式与公众进行有效的沟通。

安全问题的全球性反映在当前已制订的包括公约和行为准则在内的相关国际文书中。与安全有关的国际公约 2006 年都愉快地接纳了新的缔约国。在这一年中，《乏燃料管理安全和放射性废物管理安全联合公约》召开了缔约方第二次审议会。

新设立的综合监管评审服务正在促进加强成员国的立法和监管基础结构以及统一核安全、辐射安全、放射性废物安全和运输安全监管方案。这种服务还是有关原子能机构标准适用问题的最有效的反馈工具之一，它将被用来进一步完善现有的标准和导则。此外，这种服务方案不仅对政策和战略进行评价，而且也对政策和战略对于防护各种照射有多大效率和效能进行评价。因此，它还是关于良好政策和实践的信息共享和相互学习的工具，因而，可被用来逐步统一各种政策和实践。

总的看，核工业的安全实绩目前处于良好状态。然而，“经常出现的事件”仍然接连不断，因此必须保持警惕。还有必要在核工业各部门广为宣传所吸取的各种经验教训。强有力的安全管理和安全文化对于保持这种良好实绩至关重要。领导者必须确保工作人员受过适当的培训，并确保能够获得足够的资源。

全世界的核电行业依然安全、可靠，没有任何工作人员或公众由于核电厂的运行而接受显著的辐射剂量。2006 年，没有任何核电厂出现过导致对环境造成损害的放射性释放事件。尽管这种持续牢靠的安全实绩令人鼓舞，但也有迹象显示这一点正滋长着一些营运者、监管者和政府组织的自满情绪。

2006 年，研究堆继续安全运行。目前的工作重点是落实原子能机构组织的《研究堆安全行为准则》有效适用问题不限人数会议 2005 年 12 月提出的各项建议。

随着原子能机构准备于 2007 年年初派出其第一个燃料循环设施运行期间安全评价工作组，人们又开始重新重视燃料循环设施的安全。对核技术预期的扩大利用还将给许多核设施带来有待评价的新的安全挑战。

通过持续强调在工作场所“合理可行尽量低”的职业性照射，正在继续努力鼓励形成一种职业性照射下降的趋势。目前正在关注个人剂量评估和报告的统一问题，这与核领域流动散工的数量越来越多尤为相关。

成员国对于涉及电离辐射的常规医疗过程和最前沿医疗技术的需求日益增加。虽然在向医学从业人员提供控制患者受照量的信息方面取得了进展，但仍需做出大量努力，才能使与全世界数以 10 亿计的患者打交道的数百万从业人员了解到这些信息。

正在考虑建立一个提供生态系统辐射防护的一般国际框架，有关辐射剂量评定的一些方法也处在最后制订阶段。关于生物群保护的一般国际框架仍在进行讨论。

许多成员国正致力于实施《放射源安全和保安行为准则》所载的导则和《放射源的进口和出口补充导则》。各国还越来越意识到放射源的制造商在促进源的安全和保安方面的作用。但仍有有待完成的工作，例如在各成员国建立一类源和二类源的国家登记制度。

放射性物质运输一直保持着十分良好的安全记录。2006 年，由八个沿岸国和承运国组成的一个小组在原子能机构的协助下继续进行非正式讨论，以期为在放射性物质海上安全运输方面增进相互理解、建立信任和加强沟通而保持对话和磋商。

由于不断出现拒绝运输的问题（大部分涉及空运），原子能机构成立了一个拒绝运输放射性物质问题国际指导委员会来帮助解决这一问题。

更多的成员国开始关注放射性废物管理和处置方案，并且出现了一种不断增加的从整体角度考虑废物管理和处置问题的趋势，即把所有因素以及核材料与放射性物质的整个寿期都考虑进来。然而，延期建造和运行处置设施依然是核工业面临的挑战。

已经到达寿期终点而需要退役的核装置数量日益增加，成员国愈来愈认识到适当规划、资源和监管控制对退役活动的重要性。但在许多情况下，退役活动还无法获得充足的资金。

已毁坏的切尔诺贝利 4 号机组的退役和切尔诺贝利禁区内放射性废物的安全管理以及该地区的恢复仍然是一个重要挑战。人们越来越意识到有必要解决遗留场址的污染问题，并且日益关注天然存在的放射性残留物质的管理问题。

靠近大多数核装置的地区都已制定了应急准备和响应计划，但要所有成员国对核和放射性紧急情况都达到十分可靠的应急准备程度，则无论在国家还是国际一级都还有很多工作要做。总体而言，这些计划都需要利用现代通讯和信息处理技术，并利用相关的国际合作努力和能力。

原子能机构和各成员国都在继续完善安全与保安之间的接口，并确认需要采取统一和协同的方案，这样才能使安全与保安问题都得到适当处理。

目　录

分析性概述 1

A. 导言 1

B. 全球安全趋势和问题 1

C. 安全基础结构 4
C.1. 趋势和问题 4
C.2. 国际活动 5
C.3. 未来挑战 7

D. 事件和紧急情况的报告、应急准备与响应 8
D.1. 趋势和问题 8
D.2. 国际活动 9
D.3. 未来挑战 10

E. 核电厂安全 11
E.1. 趋势和问题 11
E.2. 国际活动 12
E.3. 未来挑战 13

F. 研究堆安全 13
F.1. 趋势和问题 13
F.2. 国际活动 14
F.3. 未来挑战 15

G. 燃料循环设施的安全 15
G.1. 趋势和问题 15
G.2. 国际活动 16
G.3. 未来挑战 16

H. 辐射防护 16
H.1. 趋势和问题 16
H.2. 国际活动 17
H.3. 未来挑战 17

I. 职业辐射安全 18
I.1. 趋势和问题 18
I.2. 国际活动 18
I.3. 未来挑战 19

J. 患者的放射防护 19

J.1. 趋势和问题 19
J.2. 国际活动 20
J.3. 未来挑战 21

K. 保护公众和环境 21
K.1. 趋势和问题 21
K.2. 国际活动 22
K.3. 未来挑战 23

L. 放射源安全和保安 23
L.1. 趋势和问题 23
L.2. 国际活动 23
L.3. 未来挑战 24

M. 放射性物质运输安全 25
M.1. 趋势和问题 25
M.2. 国际活动 25
M.3. 未来挑战 26

N. 核损害民事责任 26
N.1. 趋势和问题 26
N.2. 国际活动 27
N.3. 未来挑战 27

O. 放射性废物管理和处置安全 27
O.1. 趋势和问题 27
O.2. 国际活动 29
O.3. 未来挑战 30

P. 退役 30
P.1. 趋势和问题 30
P.2. 国际活动 31
P.3. 未来挑战 32

Q. 受污染场址的恢复 33
Q.1. 趋势和问题 33
Q.2. 国际活动 33
Q.3. 未来挑战 34

Appendix 1: Safety related events and activities worldwide during 2006 35

A. Introduction 35

B. International instruments 35

B.1. Conventions 35
B.1.1. Convention on Nuclear Safety 35
B.1.2. Convention on Early Notification of a Nuclear Accident and Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency 35
B.1.3. Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management 36
B.2. Codes of Conduct 37
B.2.1. Code of Conduct on the Safety of Research Reactors 37
B.2.2. Code of Conduct on the Safety and Security of Radioactive Sources 37

C. Cooperation between national regulatory bodies 37
C.1. International Nuclear Regulators Association 38
C.2. G8-Nuclear Safety and Security Group 38
C.3. Western European Nuclear Regulators Association 38
C.4. The Ibero-American Forum of Nuclear Regulators 39
C.5. Cooperation Forum of State Nuclear Safety Authorities of countries which operate WWER reactors 39
C.6. Network of Regulators of Countries with Small Nuclear Programmes 39
C.7. The senior regulators from countries which operate CANDU-type nuclear power plants 40
C.8. The International Nuclear Event Scale 40

D. Activities of international bodies 40
D.1. United Nations Scientific Committee on the Effects of Atomic Radiation 40
D.2. International Commission on Radiological Protection 41
D.3. International Commission on Radiation Units and Measurements 41
D.4. International Nuclear Safety Group 42

E. Activities of other international organizations 43
E.1. Institutions of the European Union 43
E.2. Nuclear Energy Agency of the Organisation for Economic Co-operation and Development (OECD/NEA) 43
E.3. World Association of Nuclear Operators (WANO) 44

F. Safety legislation and regulation 45

G. Safety significant conferences in 2006 46
G.1. Safety of Transport of Radioactive Material: A Seminar on Complex Technical Issues 46
G.2. International Conference on Effective Nuclear Regulatory Systems 46

G.3. International Conference on Improving Nuclear Safety through Operational Experience Feedback 47
G.4. International Conference on Management of Spent Fuel from Nuclear Power Reactors 47
G.5. International Conference on Lessons Learned from Decommissioning of Nuclear Facilities and the Safe Termination of Nuclear Activities 48
H. Safety significant events in 2006 48
I. Safety networks 51
I.1. Asian Nuclear Safety Network 51
I.2. Ibero-American Radiation Safety Network 52

Appendix 2: The Agency's Safety Standards: Activities during 2006 53
A. Introduction 53
B. Commission on Safety Standards (CSS) 54
C. Nuclear Safety Standards Committee (NUSSC) 55
D. Radiation Safety Standards Committee (RASSC) 56
E. Transport Safety Standards Committee (TRANSSC) 56
F. Waste Safety Standards Committee (WASSC) 57
The IAEA Safety Standards as of 31 December 2006 59

分析性概述

A. 导言

《2006 年核安全评论》概述了世界范围内在核安全、辐射安全、运输安全和放射性废物安全以及应急准备方面的发展趋势和存在的问题，并突出强调了 2006 年的发展情况。本评论辅以两个更详尽的附文 [1]。鉴于核保安与核安全之间的关系，本报告也将讨论核保安问题。将以一份单独的报告叙述核保安。

B. 全球安全趋势和问题

随着国际原子能机构服务于和平利用核能的时间进入第 50 年，已有明确的迹象显示各国开始对核电方案再度发生了兴趣。许多成员国已经宣布或正在计划雄心勃勃地扩大核电计划，而一些成员国也正在考虑进行核电投资。这些扩大不仅仅限于利用核能发电。核技术的工业和医学应用在世界各地继续增多，放射性物质的运输量和对安全废物处置的要求也在成比例增加。

至关重要的是，新的核电发展和复兴计划以及其他核技术应用计划要与同样雄心勃勃的建立和加强可持续安全基础结构的计划相配套。就其性质而言，核电项目是一项大型工程。它需要在时间、人力资源和财政上进行大规模的前期投入。但在能源、工业或运输部门，其他一些大型项目的投资也与之不相上下，所需项目管理能力也非常之高。核电项目的独特性在于它与其核特征和放射性特征联系在一起的安全问题。国际法律文书和国际公认安全标准是在国家一级建立可持续安全基础结构的基本要素。核电计划必须建立在核安全的基础之上，从计划伊始就需要考虑核安全。而健全的安全文化是核安全不可或缺的组成部分。

公众的信任和接受与安全错综复杂地联系在一起，而这本身又对设施的无事故运行有着直接影响。所有利益相关者都积极参与核电厂项目的所有适当阶段非常重要。包括场址的选择和评价、环境影响评定的准备和证明应急计划可行性在内的各个领域与“非核”部门都有着非常紧密的接口。它们都是非常明显地需要所有利益相关者特别是受到直接影响的公民进行有力参与的活动。这种参与以透明的方式进行并在最早阶段建立起公众对项目的信任至关重要。

既由于预期将会扩大利用核技术和采用新的核技术，也为了使相关活动与当前的国际预期相一致，许多成员国正在进行立法和监管改革。

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[1] “2006 年世界范围内与安全有关的事件和问题”（附文一）和“国际原子能机构的安全标准：2006 年的活动”（附文二）。

预期新设立的综合监管评审服务将促进加强成员国的立法和监管基础结构以及统一核安全、辐射安全、放射性废物安全和运输安全监管方案。这种服务还有望成为有关原子能机构标准适用问题的最有效的反馈工具之一，将被用来进一步完善现有的标准和导则。此外，所采用的方案不仅对政策和战略进行评价，而且也对它们在防护各种类型的照射有多大效率和效能进行评价。因此，这一服务也是关于良好政策和实践的信息共享和相互学习的工具，因而，可被用来逐步统一各种政策和实践。

2006 年 9 月，理事会核准了作为原子能机构安全标准依据的经修订和合并的“安全基本法则”。“安全基本法则”中载有关于在整个核活动中采取一致的战略性安全方案的 10 项基本安全原则。“安全基本法则”规定，对引起辐射危险的设施和活动负有责任的法人或组织必须对安全负主要责任。“安全基本法则”还规定，必须制订和保持有效的法律和政府安全框架。现在的目标是确保这些法则在包括国际、地区和各国组织、监管机构、设计者、业主、营运者和工作人员在内的整个核行业得到适当和统一适用。

公约是具有法律约束性质的国际文书，它们建立在实现世界范围内高水平安全的共同愿望的基础之上。2006 年，所有与安全相关的国际公约 [2] 都愉快地接纳了新的缔约国。2006 年 5 月 15 日至 24 日，《乏燃料管理安全和放射性废物管理安全联合公约》缔约方在维也纳举行了第二次审议会。它们注意到自第一次审议会以来在乏燃料和放射性废物管理国家战略、与利益相关者和公众协作以及废密封放射源控制等领域取得的改进。附文一中载有关于每项公约的更详细资料。

“行为准则”[3] 是不具有法律约束性质的国际文书，它们仅在安全方面提供重要的指导。对两部已公布的“行为准则”的支持继续增多，许多成员国正在采纳它们的导则条款。《研究堆安全行为准则》得到了原子能机构组织的各次地区会议的广泛支持。与会成员国讨论了基于地区和自愿的适用机制。

八国集团国家 2006 年 7 月在俄罗斯联邦圣彼得堡举行的首脑会议注意到在加强放射源控制和防止擅自使用方面取得的进展。这些国家重申致力于履行原子能机构《放射源安全和保安行为准则》条款，努力尽早落实对放射源进出口的控制，并敦促所有其他国家采纳该行为准则。八国集团表示，它将继续支持加强放射源监管控制的国际努力，特别是原子能机构“改进辐射防护基础结构的地区示范项目”。

原子能机构和各成员国都在继续完善安全与保安之间的接口，并确认需要采取统一和协同的方案，这样才能使安全与保安问题都得到适当处理。还在继续开展工作，以确定和维持所需公开性和透明度之间的平衡，从而既能向公众适当通报情况，又能满足所需的保密要求，同时又不使心存恶意企图者得到敏感资料。

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[2] 《及早通报核事故公约》、《核事故或辐射紧急情况援助公约》、《核安全公约》和《乏燃料管理安全和放射性废物管理安全联合公约》。

[3] 《放射源安全和保安行为准则》、《研究堆安全行为准则》。

成员国对于涉及电离辐射的常规医疗过程和最前沿医疗技术的需求日益增加。虽然这些技术的好处勿庸置疑，但问题仍然是患者受到的电离辐射迄今依然是人类最大的人工照射源，其潜在危害不容忽视。在向医学从业人员提供控制患者受照量的最新准确资料方面取得了显著进展。但很明显，仍需做出大量努力，才能使与全世界数以10 亿计的患者打交道的数以百万从业人员了解到这些信息。

有关核燃料循环新框架的计划将对运输安全产生影响，因为这将需要长途运输大量的核材料。除此之外，将研究堆从使用高浓铀转为使用低浓铀并将不再需要的核材料和放射性物质返还给原产国的趋势正在不断扩大。

2006 年，“革新型核反应堆和燃料循环国际项目”与安全有关的活动主要致力于修订该项目方法学手册中涉及核电厂安全和燃料循环设施安全的章节。

近年来，放射性物质运输继续保持着非常良好的安全记录。

由于拒绝运输特别是拒绝运输短寿命医用放射性同位素的现象继续发生，原子能机构成立了一个拒绝运输放射性物质问题国际指导委员会，以促进协调旨在尽量有效减少拖延和拒绝运输放射性物质情况的国际努力。

尽管靠近大多数核装置的地区都已制定了应急准备和响应计划，但在国家和国际一级仍有许多工作要做。总体而言，这些计划都需要利用现代通讯和信息处理技术以及国际合作努力和能力。

在过去的几年中，原子能机构一直支持成员国建立和运行供专家和运行人员交流安全知识和运行经验的网络的努力。为此，需要建立更多的地区网络，使每个人都有机会向其他人学习。如果所有成员国都属于其中的一个或多个地区网络并在所有各级进行信息分享，则国际一级的运行经验分享将会得到加强。

切尔诺贝利事故对核设施和放射源当今的设计、运行和监管产生了重要影响。在20 年后的今天可以清楚地看到，建立全球核安全制度的努力正在得到回报。但切尔诺贝利事故也在提醒着我们，需要不断保持警惕，绝不能自满，因为“大家都在同一条船上”。

已经多次指出，永远也不能将核安全视为业已解决的问题。近年来出色和稳定的实绩令人欣慰。但令人关切的事件也间或一再发生，这清楚地表明，无论对营运者而言还是对监管者而言，都应当始终将促进强有力的安全文化视为一项持续性的工作。广泛实施多层面的全球核安全制度，使所有参与者都加入其中，并以适当的法律文书为依托建立全球核安全和核保安伙伴关系，是确保核电复兴迹象导致最现代技术在全球得以应用从而造福于全人类的唯一办法。

C. 安全基础结构

C.1. 趋势和问题

核电发展和其他核技术应用计划需要得到同样雄心勃勃的建立和加强可持续安全基础结构的计划相配套。这种基础结构切不可仅仅虑及实际考虑中的核活动，它还必须解决支持主要活动所需的辅助活动的核安全、辐射安全、运输安全和废物安全问题。

全球核安全制度仍然是促进世界范围内实现核技术高水平安全的框架，其核心内容是每个成员国为确保在其管辖内的核技术安全和保安而开展的活动。促进核安全的各种国际组织的活动加强了这些国家努力，这些国际组织涉及政府间组织、多国营运者和监管者网络、国际核工业界、多国科学家网络、制订国际标准的组织以及诸如公众、媒体和非政府组织等参与核安全的利益相关者。所有这些努力都应当加以利用，以提高安全实绩。2006 年，国际核安全咨询组（核安全咨询组）印发了一份报告 [4]4，其中得出的结论是，“现有的‘全球核安全制度’当前正在一个有效的水平上发挥作用。但还可以通过实行审慎的变革加强其对改进安全的影响。”该报告除其他外，特别建议在以下领域采取行动：

- 加强利用公约审议会作为一种公开和评论性同行评审的手段以及作为一种学习他人最佳安全实践的园地；
- 加强利用原子能机构的安全标准尽实际可能统一国家安全条例；
- 加强运行经验的交流以改进运行和监管实践；
- 多国合作对新型核电厂设计进行安全审查。

正在考虑增加对核技术的依赖的国家应当认识到这一步骤包含了一些特殊责任。依靠专设安全系统本身不足于确保安全。核技术的设计应采用保守工程和依靠纵深防御作为确保安全的一种手段。在设计中还应谨慎确保通过冗余和多样性安全系统合理可行地排除导致严重事件的途径。但是，人为故障或制度性缺陷能够使这些专设安全系统无法发挥作用、失效或受到妨碍。只有基础结构到位以确保机器与人共同协调工作，才能确保安全运行。这种基础结构的基本要素包括营运者的能力、安全的法律基础、监管能力、财政稳定性、应急准备、技术能力和国际网络。核安全咨询组的报告中提供了更多详细情况。

公众对核电项目的信任和接受与其安全紧密相联。此外，内部和外部所有利益相关者在项目各适当阶段的积极参与能够有助于增强其取得成功的机会。诸如选址和评价、准备环境影响评定和证明应急计划可行性等基本问题与“非核”部门有着非常密

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[4] http://www-pub.iaea.org/MTCD/publications/PDF/Pub1277_web.pdf

切的关系。它们都是非常引人注目的活动，需要所有利益相关者特别是直接受影响民众的强力参与。至关重要的是，这种参与应以透明的方式进行并尽可能在最早阶段建立公众对项目的信任。

普遍认识到知识管理仍是一个关键问题。更多的成员国已经采取了具体步骤，例如在大学重新启动或引入核工程教育大纲以及制订教育和专业发展计划等，以确保持续拥有足够数量受到适当培训和经验丰富的工作人员来监管和运行核设施和核活动。地区安全网络虽然也取得了一些成果，但这些网络仍然既不普及，也缺乏兼容并蓄。

同样重要的是，应当在核设施整个寿期内为营运者和监管机构提供充分的财政资源，包括为设施的安全退役提供财政资源。许多监管机构仍面临着人力和财政资源限制。在很多情况下，监管机构和营运者正在为获得同样的技术技能而竞争。许多成员国认识到增加技术专家数量的必要性，并已为此制订了计划。基础结构的必要性并不限于人力或财政考虑因素。必须有可资利用的设施以运用、研究和获得支持核活动的数据。

在辐射安全领域接受原子能机构技术援助的 100 多个成员国已在完成确保可持续辐射安全所需的基础结构方面取得了进展。今后将继续提供这种技术援助。

许多成员国还面临着需要迎头赶上利用放射源的新技术和正在兴起的技术。在医学领域，这种情况尤其如此。因此，监管基础结构需要有容量和能力适应这类变化。同时也增加了对在国际一级进行协调统一的期望和需求。许多成员国正在采取步骤实施《放射源安全和保安行为准则》规定的导则。一些成员国正在积极致力于建立与当前国际要求和导则协调一致并兼容的国家辐射源登记制度和信息管理系统。

“制定和适用原子能机构安全标准的行动计划”的实施改进了这些标准的质量和成员国对这些标准的适用。一些国家和组织最近发表的报告都确认，原子能机构的安全标准正在被更广泛地用作协调统一的基准，并被作为审查国家条例或是否将其纳入国家条例体系的依据。“安全基本法则”第 SF-1 号《安全基本原则》[5] 的出版首次将核安全各领域的基本原则整合在一起。这是向广泛适用原子能机构安全标准迈出的重要一步。所有草案和已出版的标准及其译本均登载于原子能机构网站[6]。

C.2. 国际活动

目前有一些能够使监管者与其他国家的对口方进行信息和经验交流的论坛，例如国际核监管者协会、八国集团核安全和核保安小组、西欧核监管者协会、伊比利亚-美洲核监管者论坛、运行水冷和水慢化动力堆国家核安全当局合作论坛、拥有小型核计

[5] 第 SF-1 号《安全基本原则》由欧洲原子能联营、粮农组织、劳工组织、海事组织、经合组织/核能机构、泛美卫生组织、环境规划署和世卫组织联合编写。

[6] http://www-ns.iaea.org/standards/

划国家监管人员网络和运行坎杜型核电厂国家高级监管者论坛等。接受原子能机构援助的成员国监管者之间的有效沟通以及经验和专门知识交流正在继续通过辐射安全监管者网进行。在核营运者之间也存在着类似和（或）相同的论坛。

原子能机构多年来一直提供法律和政府基础结构相关同行评审服务[7]，目的是在增强和提高成员国监管基础结构和核监管机构的有效性方面向其提供建议和援助。根据统一的“安全基本法则”方案，原子能机构 2006 年开始提供一项称为“综合监管评审服务”的新的安全评审服务，这项服务涵盖核安全、辐射安全、废物安全和运输安全领域对立法框架和监管机构活动有效性的要求，并以原子能机构安全标准为基础。这项新的综合评审服务是促进原子能机构标准适用的一种有效的反馈工具。此外，所采用的方案不仅评价政策和战略，而且还评价它们在防止所有类型照射方面的效率和有效性。因此，它也是实现在良好政策和实践方面信息共享和相互学习的一种良好的手段，这些良好政策和实践可用来逐步实现协调统一。2006 年，原子能机构向罗马尼亚派遣了综合监管评审服务工作组（监管评审组以及辐射安全基础结构评价[8]后续访问），向英国派遣了有限范围的综合监管评审服务工作组和向法国派遣了全面的综合监管评审服务工作组。

2006 年 2 月 27 日至 3 月 3 日，俄罗斯联邦主办了有效核监管体系国际会议。这次会议首次将来自世界各地的核安全、辐射安全和核保安领域的高级监管人员聚集在一起，讨论如何提高监管有效性问题。这次会议为政府、监管机构和国际组织提出了很多建议，并得出以下结论：“核安全和核保安有效监管的实施对现在和将来的核能和相关技术的安全和可靠利用至关重要，并且是实现全球能源安全和全球可持续发展的一个必不可少的先决条件。”

美国提出了多国进程建议，目的是发展革新型方案以共享将被赋与审查新核电厂设计任务的国家监管当局的资源和知识。这一进程已被重新定名为“多国设计评价计划”。该计划的第一阶段正在实施，涉及芬兰、法国和美国之间的合作，重点是对欧洲压水堆进行设计审查。第二阶段将涉及法规、标准和安全目标的多国融合。第三阶段将包括落实第二阶段的成果，以促进为包括“第四代国际论坛”正在开发的那些核电厂在内的新核电厂颁发许可证。2006 年 9 月，参项国[9]通过了第二阶段的工作范围。第二阶段涉及法规、标准和安全目标的多国融合。第二阶段将由一个政策小组管理，并由一个技术指导委员会执行，以经合组织/核能机构作为技术秘书处。还成立了一个负责部件制造监督的工作组，该工作组目前正在执行其行动计划。原子能机构将参加“多国设计评价计划”第二阶段的工作。

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[7] 国际监管评审组（监管评审组）、放射源辐射安全和保安基础结构评价、运输安全评价服务、国际核保安咨询服务、应急准备评审和研究堆综合安全评定。

[8] 辐射安全基础结构评价。

[9] 加拿大、中国、芬兰、法国、大韩民国、俄罗斯联邦、南非、英国和美国。

随着理事会 2006 年通过“安全基本法则”，原子能机构在完成 2004 年 3 月“制定和适用原子能机构安全标准的行动计划”确定的所有行动方面已达到了一个重要里程碑。目前正在通过制订有关监管职能、燃料循环设施、放射性废物处置、研究堆以及辐射源的医学和工业应用的新标准来消除安全标准涵盖范围方面已确定的空白。向新安全标准结构过渡的工作已在所有领域取得良好进展，安全标准委员会目前在维护一套便于管理的安全标准的同时正在着眼于该行动计划之外的问题，以响应成员国不断提出的新需求。

2006 年 9 月，在原子能机构大会期间同时在维也纳举行了高级监管人员会议。来自 50 多个成员国的高级监管人员讨论了监管有效性和相互学习的问题。突出强调了核监管人员与工业界之间加强对话的必要性。讨论了运行经验反馈的问题，包括如何建立一个国际系统以促进交流对实际利用核技术者有益的运行经验。高级监管人员还讨论了保持透明度与保密之间的平衡问题。公众希望监管人员和营运者在它们如何解决安全问题方面保持公开和透明，然而还有必要保守秘密，以便不向那些有恶意企图者提供信息。

核安全咨询组也在原子能机构大会期间举办了一个论坛，讨论国家安全基础结构的哪些要素对于那些扩大核电计划或初次考虑核电的国家是必需的。

原子能机构继续提供培训班、研讨会和讲习班以及包括技术设备和监管部门信息系统（RAIS 3.0 版）等信息管理工具在内的其他咨询和援助，以支持成员国对放射源实施“从摇篮到坟墓”的管理。截至 2006 年底，有 90 多个国家或正在利用 RAIS 3.0 版开展日常活动，或正在对其进行评定，以改进其现有的国家登记制度。

C.3. 未来挑战

随着有经验的工作人员退休、设施老化和核技术应用的扩大，许多国家当前面临的主要挑战仍然是建立、保持和提高监管机构和技术支助机构的技术能力。虽然核技术的利用不断增长，但许多监管机构仍然面临着财政和人力资源的短缺问题。在很多情况下，这种增长导致监管机构和营运组织为获得同样的技术人才而竞争。所有这些都发生在政府和公众希望监管机构保持公开、透明和一致的时候。需要制订一个包括继承规划、教育和培训计划、在质量管理框架内建立的程序和充分的财政资源在内的综合多方位方案。对安全需求作出承诺不应被视为是一种潜在的负担，而应被看作是将有助于确保核工业的健康和持续发展。

随着“制定和适用原子能机构安全标准的行动计划”接近完成，现在必须将重点转向不断改进过程和对成员国的需求作出适当响应上来。存在的挑战是维持一整套更新的标准，并将需要把从这些标准的适用中得到的反馈系统地纳入新标准的制订和现有标准的修改。另一项挑战是在各个级别上促进工业界、用户和运行人员了解和适用原子能机构的安全标准。

在改进国际一级运行经验反馈方面取得了有限的进展。这方面的例外是瑞典福什马克核电厂非计划停堆事件等引人高度关注的事件，这起事件导致世界各地对发生类似事件的概率和后果进行了广泛讨论。在该领域仍然有很多机会来加强在国际一级进行知识共享。

监管机构的有效独立性对许多国家来说仍将是一项重要挑战。在拥有有限资源（合格工作人员、设备和（或）设施）的成员国，对促进性职能和监管性职能的管理仍将是一项挑战。

虽然在监管机构实施自评定方法学方面已经取得了一些进展，但将这种方法学作为监管机构质量管理计划的一部分加以实施仍是一项挑战。更多的同行评审对于加强国家安全基础结构具有重要意义。

实现成员国的条例和监管方案与包括《放射源安全和保安行为准则》和《放射源的进口和出口导则》在内的原子能机构标准和导则的更大一致性仍将是原子能机构的一个目标。

在许多成员国，建立和维护完整的国家放射源（至少包括一类和二类放射源）登记制度仍是一项挑战。

D. 事件和紧急情况的报告、应急准备与响应

D.1. 趋势和问题

有效的国家和全球响应能力对于尽量减少核和放射性事故与紧急情况的影响以及建立公众对核技术安全和保安的信任至关重要。核技术的增加利用和更加严峻的保安关切要求相应地增加国家、地区和国际应对事故或紧急情况的能力。就此而言，原子能机构已着手加强其事件和应急中心，以便更好地支持成员国处理紧急情况和保安事件。

核事件和放射性事件继续发生。2006 年，向原子能机构报告了 168 起事件。但其中只有一小部分涉及显著照射或危险放射源。原子能机构接到的报告来自每个成员国建立的各种报告系统[10]。

2006 年报告的事件似乎表明了两个关键趋势。第一，涉及严重过度照射的大多数事件系工业射线照相应用所致。第二，造成这些事件的主要原因似乎是没有遵循既定程序及缺乏培训。根据初步分析，工作人员要么未使用所提供的辐射测量仪（剂量

[10] 包括“防止非法贩卖数据库”、“网基核事件系统”以及“及早通报公约”和“紧急援助公约”网站。

仪）、忽视了仪器仪表的读数，要么缺乏必要的设备和（或）经验。总体而言，所报告事件和紧急情况有起因相类似的趋势。这说明仍有必要在世界范围内促进有关事件和紧急情况起因与教训的信息交流，以避免它们再度发生。

此外，2006 年报告的事件显示出了明显的国际性，而往年没有这么突出。例如，有两个重要事件涉及到无屏蔽放射性物质的运输，这些物质使至少两个国家的人员受到了照射，因此，需要进行更高水平的国际合作。

应急准备和响应安排对于工作人员以及在核装置和使用放射性物质的任何附近地方生活的公众的安全是必不可少的。运行核电厂的成员国继续开展应急演习。例如，2006 年，阿根廷核管理局组织并举行了一次涉及 Embalse 核电厂的应急演习，有关当地组织和地区组织及当地居民参加了此次演习。

近年来，扩大了努力范围，以便处理对放射性事件和紧急情况的普遍关切，包括对恶意使用放射性物质和旨在破坏核设施的行为的关切。作为响应，成员国正在更新和调整它们的应急响应计划，而且它们向原子能机构提出的对它们的国家活动（如培训班、演习）给予支助的请求正越来越多。成员国现在开展的演习一般都涉及更复杂的假想情况。例如，2006 年瑞典开展了一次去污和监测演习，其中包括几个搜索放射源的演习、一个放射性散布装置假想情况和一所房屋及其周围环境的污染和去污。

成员国为增加和加强它们的应急响应能力而作出了显著的努力。即便如此，成员国之间的应急管理系统尚未实现足够的统一。一些系统没有能力对核事件或放射性事件作出响应，往往达不到国际准则的要求。业已认识到，成员国之间在通讯系统和援助安排上也往往存在差异。在过去的几年中，成员国与原子能机构合作，加强了统一国际通讯和援助系统的努力。在“加强核或放射紧急情况国际准备和响应系统的国际行动计划”的框架内，来自世界各地的专家们正在就如何统一世界范围内的通讯和援助系统拟订建议。

成员国继续广泛使用《国际核事件分级表》，以之作为对核事件和放射性事件的安全影响进行分级的依据。2006 年，成员国核可扩大《国际核事件分级表》的使用范围，使之涵盖与辐射源和放射性物质运输有关的事件。

D.2. 国际活动

原子能机构正在与成员国合作实施“加强核和放射紧急情况国际准备和响应系统的国际行动计划”。

北欧辐射防护和核安全当局已经签署了一份谅解备忘录，表示愿意核可和执行《北欧各国当局在核或放射性事件和紧急情况方面的合作、信息交流和援助》这一文件（《北欧手册》）。《北欧手册》取代以前关于在该地区执行与《及早通报核事故公约》有关的双边协定的文件及其他相关文件和决定，并阐述实际安排和合作活动，

目的是通过反映进行之中的国际发展和原子能机构相关安全标准和其他导则，使《北欧手册》继续发挥作用。

法国向邻国（比利时、德国、卢森堡和瑞士）主管当局提出了一项关于预警、信息交流和援助的标准双边议定书，以便对核或放射紧急情况作出有效和适当的准备和响应。

2006 年，一个工作组在比利时、法国、德国、卢森堡和瑞士主管当局的参与下，开始审议核紧急情况中碘预防的跨境统一问题。

原子能机构还在一系列放射性散布装置应急响应演习中与北约进行了合作，全球卫生保安行动组 [11] 已开始受益于原子能机构建立的援助安排。

2006 年，欧洲委员会和原子能机构加强了合作，开发了欧洲委员会和原子能机构报告系统之间的自动化联接，从而提高了报告欧洲核事件或放射性事件的效率。

D.3. 未来挑战

2006 年，建立了经修订和增强的“响应援助网”。成员国应当适当和精确地在“响应援助网”登记它们的国家援助能力，只有这样，才能在发生核事件或放射性事件时提供高效率的国际援助。与此相关的一个挑战是确保成员国对应急准备和响应的现有国际安排和能力具有明确和共同的认识。大会鼓励各成员国考虑加入“响应援助网”。

2006 年，根据“及早通报公约”和“紧急援助公约”主管当局的建议，大会对制订新的国际应急管理行为准则的倡议表示了欢迎。2006 年 12 月 11 日至 15 日，来自 45 个成员国和两个国际组织的 72 名代表出席了秘书处在维也纳召开的一次技术会议。会议期间，编写了一份合并草案文本供进一步讨论。当前对根据与保安有关的事件调整国际响应系统正显示出新的兴趣，对此也应作出响应。

重要的是，无论是在成员国还是在地区和国际一级，紧急情况的报告、应急准备和响应计划都应利用现代通讯和信息处理技术。现有和新兴技术为进一步统一和简化报告机制提供了机会。应大会第四十八届常会的要求，原子能机构正在致力于建立一个报告和传播事件和紧急情况信息的门户网站，其目的是简化原子能机构的报告机制。

[11] 该行动组由加拿大、法国、德国、意大利、日本、墨西哥、英国和美国的代表组成。

E. 核电厂安全

E.1. 趋势和问题

2006 年，全世界的核电工业依然安全，没有任何工作人员或公众由于核电厂的运行而接受大量的辐射剂量。尽管这一持续良好的安全实绩令人鼓舞，但也有迹象显示一些营运者、监管者和政府组织正在因此而产生自满情绪。虽然 2006 年期间发生了一些具有重要安全影响的事件，但没有任何核电厂出现过导致对环境造成损害的放射性释放事件。

现有大多数核电厂都制订了加强安全的计划，而且大多数计划都正在得到执行。在过去的几年中，世界各地的绝大多数核电厂都实施了显著的安全改进。但是，实绩最佳者和最差者之间的差距仍然令人关切。在有些情况下，安全升级评定不够全面，也不够严格。

在许多地区，核工业专家和工人的平均年龄继续提高。这带来的好处是知识、经验和成熟判断得到了积累，但也带来了职工队伍不断老化的挑战。全世界正日益认识到知识管理，包括维持、扩大和更新现有知识库的必要性。要创造新知识，就需要同时设置新的大学课程，这也将有助于更新人力资源能力。在许多国家，政府对核教育和培训的支持不够以及大学优先事项的变化，已导致核课程、核师资和核设施受到损失，致使这方面的知识管理更加困难。但是，许多成员国正在建立国家培训中心，以便提供继续教育，而且经过改进的在职培训继续是发展和维持有关能力的活动的基本组成部分。还需要使继承规划和职工队伍更新变得更加广泛。

大多数核电厂营运组织都制定了在营运组织一级分析运行经验的广泛计划，若干成员国则制定了国家一级的计划。在国际一级，任何安全重要事件都会引起国际关注，大多数成员国都会认真研究所有重大事件，以了解它们对其本国核计划的意义。但是，作为重大事件先兆是运行经验重要来源的较低一级事件和险些发生的事故，而这些事件却不会在国际一级受到同等水平的研究。尽管为加强分享信息的承诺而作出了不断的努力，向国际事件报告系统报告的事件的质量和数量却一直保持在最低水平。结果，根源相同的事件仍在发生。

核电厂的长期运行被界定为超出了许可证期限、设计时限、标准和（或）条例最初规定的期限的运行。长期运行包括各种做法，如许可证延期、延寿、继续运行及寿期管理。对长期运行必须进行安全评定，审查限制系统、结构与部件寿期的过程和特征，以证明长期运行的合理性。尽管长期运行主要是业主基于预期经济绩效而作出的决定，但必须全面审查和弄清其安全影响。随着更多的核电厂进入长期运行，基于业已获得的经验的国际指导将非常宝贵。

核安全方面的领导能力在许多成员国是一个关键问题。无论对营运者而言还是对监管者而言，最高层工作人员发挥安全领导作用并要求本组织所有各级的其他人也这

样做至关重要。必须将这方面的努力与组织中的管理系统相结合。经验表明，以安全为基本原则的有效管理系统对于支持领导层和个人维护核安全并不断加强良好安全文化不可或缺。安全文化的评定工具和增强程序正在开发和投入使用之中。作为预防事故的早期行动的基础，应将这种开发工作继续下去。

E.2. 国际活动

《核安全公约》为加强世界各地核安全的国际努力提供了框架。“公约”规定的义务为缔约方提供了高水平的保证，即它们的核电工业的运行充分考虑到了安全。“公约”对编写国家报告的要求以及审查会议期间对国家报告的评审，都为自评定和同行评审提供了有意义的机会，而自评定和同行评审对建设强有力的安全文化至关重要。

原子能机构的同行评审服务，如运行安全评审组和运行安全实绩经验同行评审以及世界核电营运者联合会（核电营运者联合会）的同行评价仍然是保证核电厂设计、运行和维护安全的重要工具。原子能机构还继续通过工程安全评审服务协助成员国适用设计方面的安全标准及进行核电厂场址评价。开展工程安全评审服务的目的是协助评审新装置的安全分析报告以及实施现有装置的安全再评价计划。原子能机构还提供长期运行和老化管理同行评审服务，并且正在制订有关长期运行和老化管理的安全标准并管理着这方面的一个协调研究计划。原子能机构与核电营运者联合会合作开展一系列活动并已制订交流程序，以确保原子能机构和核电营运者联合会的活动具有互补性。人的因素和组织因素在安全和安全文化中的重要性已得到广泛承认。安全的文化因素是无形的，在有着同一安全文化的组织中也往往是不为人们所意识的。因此，对安全文化作出可靠的评定非常重要。原子能机构通过安全文化评定评审组服务促进独立的安全文化评定。

针对新出现的趋势，原子能机构已启动在涵盖了确定性和概率性方案及基于风险的决策的先进安全评定方法领域制订新安全标准的进程。新标准的目的是确保从安全评定中获得的深入认识具有一致性和全面性，并能有效和高效地促进安全的进一步加强。原子能机构还在设立先进安全分析工具中心，以便使成员国能够利用先进安全评定，包括数量有限的高质量概率性和确定性分析计算机程序、模型、数据库、验证和核查资料、分析程序、标准及导则。原子能机构还提供有关安全评定方法的广泛培训和培训材料。

核安全咨询组在 2006 年出版了两份报告：“利益相关者对核问题的参与”（INSAG 20）和“加强全球核安全制度”（INSAG 21）。大会鼓励成员国将这些文件中确定的概念酌情纳入其核计划中。核安全咨询组的所有报告都登载在原子能机构的网站上 [12]。

[12] http://www-ns.iaea.org/committees/insag.asp/

经合组织/核能机构也在开展有关核电厂安全的重要活动。2006 年，经合组织/核能机构实施了一个建立数据库和知识库的新计划。该数据库和知识库涉及的是老化管理最重要的两个要素：应力腐蚀破裂和电缆绝缘老化。最终目的是为值得赞扬的老化管理实践提供依据。经合组织/核能机构目前还在实施 14 个有关安全研究的联合项目，包括 2006 年启动的一个研究如何应对各种条件下室-室火势蔓延的项目。

E.3. 未来挑战

核电工业最迫切的挑战是确保建立起适当的安全基础结构，以支持核电厂的设计、建造、运行、维护和退役以及与所有这些相关的监管活动。D 部分详细讨论了基础结构的问题。需要制订既处理技术问题也处理人力资源问题的综合计划。随着商业核电继续增长，在成员国开展新活动或诸如选址等已多年未从事的活动时，对匮乏资源日益增加的需求和日益激烈的竞争将给大多数成员国的核安全基础结构带来挑战。

在进行新核电厂设计时，有机会确保在设计、建造和运行中纳入适当的保安功能。要成功做到这些，就需要制订以适当的国际导则为准绳的有效的国家战略。

尽管已认识到知识管理的必要性，但也存在着一个相关问题，即需要这种知识的相关方及时获取这些知识的能力的问题。还存在着将此种知识管理系统的公开性和透明度要求与出于保安原因对某些信息实行保密的需要相平衡的持续性挑战。一个关键问题是确保这些知识管理系统的活力和长期可持续性。

有效地传播和利用运行经验是一个持续性的挑战。需要加强对报告各种问题和获得的教训并根据其他核电厂的经验采取行动的承诺，以避免事件的重复发生。交流电力公司和监管部门为响应事件而采取行动以及分享和照搬良好实践，将可能有助于防止重要问题的再次发生。

随着核电厂转向长期运行，许多监管机构面临着制订要求和标准以便评定和准予寿期延长及对老化管理计划进行监管性监督的挑战。在许多情况下，这些机构还必须重新制订向新核电厂各个阶段发放许可证的程序。原子能机构通过制订安全分析报告评审计划正在协助成员国确定重新制订这一程序的可接受方法。

F. 研究堆安全

F.1. 趋势和问题

研究堆不仅是国家核科学技术计划的基石，而且也是国家安全基础结构的重要环节。许多研究堆在 2006 年全年持续安全运行。约有 270 座研究堆目前在 56 个国家运行（其中 85 座在发展中国家运行）。新研究堆（如慕尼黑大学 20 兆瓦（热）的 FRM-II 型和 20 兆瓦（热）的澳大利亚开式水池轻水反应堆）都对安全系统和封隔/封闭建筑物

作了重要改进。原子能机构在澳大利亚开式水池轻水反应堆的设计、建造和调试过程中提供了安全评审服务。2006 年 7 月，澳大利亚辐射防护和核安全机构为澳大利亚开式水池轻水反应堆颁发了运行许可证。该反应堆在 2006 年 8 月首次达到临界，2006 年底进行了热调试。

然而，现有研究堆中约有三分之二已运行超过 30 年。设备老化是向原子能机构研究堆事件报告系统报告的事件中最重要的原因之一。仪器仪表和控制系统的过时陈旧是许多设施都存在的一个重要问题。除系统、结构和部件老化外，还存在着研究堆职工队伍老化以及难以招到新人的问题。这些问题在全世界核企业界普遍存在，但如果研究堆缺乏招聘和培训新员工的财政资源，问题会常常变得更加恶化。

有 27 个国家的 35 座研究堆目前受原子能机构项目和供应协定的约束。其中大多数协定自第一次签署以来尚未更新，许多协定还是数十年前签署的。这些协定没有反映原子能机构的现行安全标准或其他现行国际安全导则，包括《研究堆安全行为准则》。

近来安全评审工作组最常见的结论所涉及的问题包括：安全文件（安全分析报告、运行限值和条件、应急计划等）过时或不完整；缺乏退役计划；缺乏战略计划和与之相配套的利用计划；缺乏资源；以及缺乏有效的独立监管机构。这些问题都需要得到解决，这样才能为解决它们有效地开展适当的技术援助。

对研究堆的监管性监督不充分是一个持续存在的特别重要的问题。在许多成员国，法律和政府基础结构不充分，而且（或者）监管机构达不到独立和有效能的国际标准。给监管机构配备有能力、训练有素的人员也是一个问题，特别是在能够配备给监管机构和营运组织的合格人员资源有限的成员国尤其如此。

F.2. 国际活动

原子能机构目前工作的重点是落实《研究堆安全行为准则》有效适用问题不限人数的会议 2005 年 12 月提出的各项建议。与会者要求定期举行会议，讨论与适用该行为准则有关的专题，交流所汲取的经验教训，确定良好实践，讨论今后的计划以及为实现全面遵守该行为准则所遇到的困难和所需提供的援助。此外，与会者还要求将该行为准则纳入原子能机构的所有安全援助和评审活动之中，并建议原子能机构考虑更新项目和供应协定，以反映该行为准则的各项规定。2006 年期间，原子能机构分别在摩洛哥为非洲成员国以及在罗马尼亚为东欧成员国举行了关于该行为准则的地区会议。这些地区讲习班旨在帮助成员国为有效参与定期的国际会议做好准备，并确定地区合作机会和原子能机构可以提供援助的方式。

2007 年将继续开展完成研究堆安全标准大全的工作。大全将提供执行上述“行为准则”和加强安全所需的主要安全要求和建议。大全还将提供原子能机构开展安全评审服务的依据。

原子能机构的研究堆综合安全评定评审服务以适应提出申请成员国需求的模块化格式提供。目前正在对研究堆综合安全评定评审服务工作组提出的建议和现有事件数据库进行分析，目的是确定安全问题和趋势以及响应该工作组建议的状况。这是对一项持续进行的监测“协定”反应堆安全以及评定和采集安全实绩指标的计划所作的补充。

研究堆事件报告系统是通过就异常事件交流与安全有关的信息来提高研究堆安全的重要工具。截至 2006 年年底，49 个有研究堆的成员国已经加入了研究堆事件报告系统。

2006 年，原子能机构开始实施关于计算研究堆源项的协调研究项目。

F.3. 未来挑战

持续出现的挑战是促使国际和地区援助努力与成员国的需求相适应。原子能机构必须为查明真正的安全问题寻求并维持对设施的经常性接触，并充分评价成员国的需求。在许多情况下，落实安全工作组的建议需要提供实际的援助，包括派遣专家指导工作组。有必要根据对安全的重要性确定各项建议的优先次序和拟定实施时间表。

需要派遣结合安全、保安和定期审查各项内容的联合工作组，以避免重复努力并使各项建议具有互补性和一致性。自评定应成为开展一切评审服务的先决条件，这样评定小组才可以将重点放在已经确定的关注领域，并找出未发现的领域。尽管一些成员国具有开展研究堆安全评审所需的自评定能力，但仍须努力确保拥有研究堆的所有成员国均具备此种能力。

继续有必要确保适当解决与堆芯从使用高浓铀转换为使用低浓铀有关的安全问题。

正如以往的“核安全评论”所叙述的那样，考虑到原子能机构在项目和供应协定下有关研究堆安全的具体职责，这种研究堆构成了一种特殊的挑战。虽然许多这种研究堆都接待过安全工作组，但有必要使按计划定期派遣安全工作组成为规范的做法。

国际标准化组织和欧洲委员会等国际组织都在研究堆安全方面开展了活动，有必要与原子能机构的活动进行协调。亚洲核安全网范围内的各专题组也在开展与参与网络成员国研究堆安全有关的许多活动。

G. 燃料循环设施的安全

G.1. 趋势和问题

燃料循环设施涵盖范围广泛的各种活动，包括采矿和冶炼、转化和浓缩、燃料制造、乏燃料临时贮存、后处理和废物整备。其中许多设施由私营部门运营，由于营运者经常相互竞争而使大量工艺和技术资料成为商业敏感信息。过去，这种敏感性问题经常波及到安全领域。然而，情况正在发生变化，现在正越来越多地开始共享关于特定安全实践的信息。

正在审议中的革新型未来反应堆设计将需要进行新的燃料设计。这种新燃料和商业燃料循环设施的安全问题需要加以解决。

燃料循环设施面临独特的安全挑战，例如临界控制、危险物质封闭、化学危害以及易燃易爆。在一些成员国，许多设施和监管机构缺乏人力和财政资源。正在努力通过编写全套安全标准和提供培训来改变这一状况。安全方案必须分级并以潜在危害为基础制订。这种设施目前可以利用的国际安全导则尚不完整，需要进一步制订。

G.2. 国际活动

原子能机构“燃料循环设施运行期间的安全评价”同行安全评审服务准则已经可以利用。定于 2007 年 3 月派出的第一个“燃料循环设施运行期间的安全评价”工作组是一个赴巴西的试验性工作组，2006 年已经为该次工作访问派出了一个预备工作组。

原子能机构在燃料循环设施安全问题上与经合组织/核能机构密切合作。在 2006 年的一次技术会议上，原子能机构展示了将在原子能机构实施的“燃料事件通报和分析系统”的第一个原型网络系统。目前正在开发涵盖用于核电厂（事件通报系统）、研究堆（研究堆事件通报系统）和燃料循环设施（燃料事件通报和分析系统）的事件通报系统的共同网络平台。

经合组织/核能机构核装置安全委员会燃料循环安全组印发了第三版《核燃料循环安全》，它代表了对核燃料循环安全问题所作的最新分析，并提供了关于运行实践、运行经验和从主要事件中汲取的经验教训的资料。

G.3. 未来挑战

原子能机构继续开展完成燃料循环设施专用安全标准大全包括燃料循环设施安全要求的工作，并与成员国一道制订培训计划。

“燃料循环设施运行期间的安全评价”准则的最终定稿将结合赴巴西试验性工作组的经验并考虑到燃料循环设施安全要求最后文本，同时还将鼓励成员国利用“燃料循环设施运行期间的安全评价”服务加强其燃料循环设施的安全。

H. 辐射防护

H.1. 趋势和问题

原子能机构《国际电离辐射防护和辐射源安全基本安全标准》（基本安全标准）被视为电离辐射防护标准的全球参考基准。这些标准依据联合国原子辐射效应科学委员会（辐射科学委）有关辐射照射健康后果的数据制订，并尽可能依循了国际放射防护委员会提出的建议。

在 2005 年和 2006 年期间，原子能机构与协办国际组织合作完成了对“基本安全标准”的评审。原子能机构各安全标准委员会与安全标准委员会于 2006 年末商定应对“基本安全标准”加以修订，目标出版日期定在 2009 年末。

H.2. 国际活动

2006 年 5 月，辐射科学委举行了其第一届会议的五十周年庆祝活动。辐射科学委核准了一份论述辐射生物效应若干问题的科学报告，该报告于 2006 年 10 月在联合国大会作了介绍。目前正在对该报告及其详细的科学附件的出版进行准备。辐射科学委的总体看法是，所审查的数据并不需要对当前有关辐射致癌和遗传效应的总体风险评估作出改变。关于辐射科学委活动的进一步信息可参见附文一。

国际放射防护委员会当前的建议是 1990 年制订的，该委员会若干年前就已着手对这些建议进行审查。2004 年 6 月，国际放射防护委员会发表了一份经修订的系列建议草案，以征求公众意见。国际放射防护委员会在考虑到所收到的公众意见的基础上拟订了该建议的更新草案，于 2006 年 6 月发表以征求公众意见，并收到了 735 页的意见。建议草案更明确地强调维持三个基本防护原则，而且“基本安全标准”规定的剂量限值仍然保持不变。国际放射防护委员会区分了三种照射情况：计划照射、紧急照射和现有照射。国际放射防护委员会的建议草案指出，剂量约束应保护受照最严重者不受特定源的照射，应适用于所有职业和公众照射情况，并应在优化过程一开始就采用。关于国际放射防护委员会活动的进一步信息可参见附文一。

原子能机构 2006 年期间编写的“基本安全标准”审查报告确定了着手修订该标准的理由。其中包括需要将经修订的“基本安全标准”与新的“安全基本法则”联系起来，并需要考虑到国际放射防护委员会的新建议以及《放射源安全和保安行为准则》及相关的《放射源的进口和出口导则》等最新的国际协定。还需要确保与原子能机构安全标准中的其他“安全要求”出版物以及与提出了可用于排除、豁免和解控的散料放射性浓度数值的 RS-G-1.7 号 [13] 等最新主要“安全导则”保持一致并与其相互参照。对“基本安全标准”文本还可以做很多其他方面的改进，包括改进其措辞的明晰度、对某些地方作进一步详细阐述、在确定阐述不足的地方添加新内容，以及将某些可能更适合于“安全导则”的详细材料删除。

H.3. 未来挑战

完成对“基本安全标准”的修订工作是一项主要的挑战。

经修订的“基本安全标准”应支持包括医疗、一般工业、核工业、放射性废物管理和运输在内的各个领域的辐射安全方案，涵盖职业照射、医疗照射和公众照射，并为其他设施和主题安全标准奠定基础。

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[13] 《排除、豁免和解控概念的适用》。

I. 职业辐射安全

I.1. 趋势和问题

正在继续通过持续强调在工作场所实施“合理可行尽量低概念”来努力减少职业照射。欧洲合理可行尽量低网络、欧洲和中亚地区性合理可行尽量低网络以及职业照射信息系统均为这些努力作出了重要贡献。

在原子能机构提供援助的很多情况下，越来越多的成员国正在实施必要的监管措施以控制职业照射。继续实施得到适当的质量管理系统和比对活动支助的合适的工作场所监测和个人监测系统。

目前正在关注统一个人剂量评估和报告的问题，这与核领域流动散工的数量不断增加尤为相关。

保护怀孕工作人员和胎儿是一个高度关注的问题，正在通过以原子能机构安全报告的形式制订更具体的导则来解决此问题。

通过原子能机构、国际劳工组织（劳工组织）和世界卫生组织（世卫组织）之间的集体努力，有关工作场所辐射诱发健康效应的赔偿问题和相关的因果关系概率问题正在得到重视。

原子能机构正在收集有关在天然产生放射性物质工业领域受照射工作人员所受剂量的大量新资料，此举正在促进制订供监管者和其他利益相关者使用的导则。

I.2. 国际活动

原子能机构正在与劳工组织、世卫组织和其他国际组织合作实施的“职业辐射防护行动计划”产生了重要的成果，这些成果体现为安全相关文件、教育与培训教材和资料，以期提高工作人员的认识。该计划还在帮助促进职业辐射防护标准的统一实施。

原子能机构通过促进在服务性组织实施放射性监测质量管理系统，正在为个人剂量评估和报告的协调统一提供支持。根据即将出台的安全标准，原子能机构在其自己从事监测试验的实验室采用了质量管理系统。2006 年，该系统获得了国际标准化组织 ISO17025 标准的第三方认证，现正在向成员国提供，作为供成员国装置采用的一种模式。

原子能机构与劳工组织、世卫组织、国际放射防护委员会和欧洲委员会等其他国际和政府间机构之间的工作关系正在包括职业辐射防护在内的若干领域得到进一步加强，并导致加强了标准的协调统一和适用。

在国际一级，职业辐射防护领域的教育和培训继续受到原子能机构的优先重视；在地区一级，受到欧洲委员会等机构的优先重视。2006 年，原子能机构为劳工代表编写了工作场所监测培训教材和教育资料。

原子能机构继续积极支持劳工组织为加强实施《保护工作人员免受电离辐射公约》（劳工组织“第 115 号公约”）正在进行的努力。劳工组织还制订了一项工作人员辐射防护（电离辐射）实施法规，并于最近完成了对该实施法规的审查，结论是目前无需考虑任何修改。

I.3. 未来挑战

多年来，一直使用实绩指标来确定职业辐射安全工作的有效性，并取得了不同程度的成功。目前的挑战是制订一整套适当的实绩指标，以及准确和全面地收集有关这些实绩指标资料的方法。

当前的工作往往是与其他工作场所安全问题区别开来而孤立地处理辐射安全。这项挑战是制订一个工作场所安全的整体方案，不仅适当关注和控制个人的放射学和非放射学危害，而且还应解决工作场所潜在危害之间的相互关系。

有必要培植地区杰出中心，为成员国实现立足本国解决职业辐射防护问题的可持续能力的工作提供支助。

虽然电离辐射工作人员和用户是任何职业辐射防护计划的关键利益相关者，但他们在原子能机构安全标准和其他国际导则的制订和适用方面的参与程度一直有限。提高他们对辐射防护计划的认识和参与是一项持续存在的挑战。与此有关的是需要共享在职业辐射防护领域取得的积极和消极正反两方面的经验。

由于工业界利用电离辐射的发展步伐很快，满足保健专业人员的辐射防护需求也继续是一项挑战。

需要制订更明确的导则，以帮助成员国制订务实和分级的职业辐射防护监管方案，特别是就天然存在的放射性物质照射而言尤其如此。这包括确定涉及可能需要控制的天然辐射照射的活动，以及编写和分发针对具体部门的补充资料。

J. 患者的放射防护

J.1. 趋势和问题

原子能机构对医学专业人员进行患者辐射防护培训的活动已导致显著增强了对辐射危险和对患者实施防护必要性的认识，特别是对没有使用过辐射设备的专业而言尤其如此。

与诊断放射学、核医学和放射治疗有关的技术和工艺以前所未有的增长速度不断发展。计算机断层照相法更快的成像能力使得各种新应用成为可能。此外，X 射线导向介入和各类医学专业人员从事介入治疗目前涉及大量辐射，而这些医学专业人员其中有很多没有接受过正式的辐射防护培训。每项新应用都会导致新的患者防护问题。

这项技术并不限于那些拥有广泛辐射防护和监管基础结构的成员国。虽然原子能机构正在继续为建立这种基础结构作出努力，但迫切需要与全体专业人员建立联系，以便他们认识到国际标准的存在和可以获得有关患者防护的资料。专业人员还必须能够接触利用这类资料，甚至必要时为这一知识体系作出贡献。

J.2. 国际活动

1“患者放射防护国际行动计划”汇聚了原子能机构、泛美卫生组织、世卫组织和国际专业机构的努力。

2006 年，原子能机构开设了一个关于患者放射防护的网站 [14]。该网站很快就成为了世界范围内患者防护知识的一个有价值的来源。

与患者放射防护主题领域有关的技术合作活动在组织受援国的专家与其他专家一起扩大该知识库方面正在取得良好进展。

2006 年，原子能机构继续为介入心脏病学专家举行辐射防护培训班。介入心脏病学专家是最频繁使用 X 射线荧光透视的用户之一，但他们很多人对辐射防护了解甚少，或者没有接受过这方面的培训。原子能机构重点关注辐射防护问题，以帮助以往没有接受过辐射防护培训但现在正在扩大辐射技术利用的新专业团体。

在“患者放射防护国际行动计划”下开展了一系列活动，由此促进编写了以光盘为载体并得到劳工组织、泛美卫生组织、世卫组织和相应国际专业学会 [15] 支持的培训班教材（诊断和干预放射学辐射防护、放射治疗辐射防护和核医学辐射防护）。原子能机构 2006 年为所有技术合作地区举办了培训班。

2006 年，国际放射防护委员会在制订有关多道探测器计算机断层照相、利用 X 射线的介入心脏病学程序、新放射治疗工艺和技术以及儿科放射学领域辐射防护的具体建议方面取得了相当大的进展。这些建议将对原子能机构安全标准和原子能机构的其他导则、培训教材、援助项目、与新工艺和新技术有关的辐射防护问题监测以及通过原子能机构专门网站传播的其他资料产生影响。

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[14] http://rpop.iaea.org

[15] 国际放射学会、国际医用物理学组织以及国际射线照相师和放射学技师学会。

J.3. 未来挑战

经验表明，如果利用辐射的新的医学应用对患者具有实质性好处，则这些应用将会很快普遍用于临床。一项技术一旦建立，将可能导致一年内照射数百万患者。及时提供防护最优化导则将在群体照射方面产生实质性影响。有必要建立一些机制如专家小组和传播前人获得的知识等办法来提供这种建议。如何高效和迅速地向全世界数百万医学专业人员传播这种建议是一项挑战。

患者放射防护网站当前所针对的是监管机构和全体医学专业人员。原子能机构正在考虑扩展该网站，以便使患者本人能够利用。

在保持诊断资料的同时实质性减少患者照射和避免辐射损伤仍然是成员国的一种需求。这项挑战有待今后几年取得大规模的成果。

2006 年为心脏病学专家和放射学工作者以外从事荧光检查程序的医生启动了一个新的培训计划。由于越来越多的非放射学工作者（如泌尿科医生、肠胃科医生和整形外科医生）在执业中使用 X 射线荧光透视，以及患者受高剂量照射的可能性，这类培训计划已变得至关重要，而且今后几年还需要扩大。

K. 保护公众和环境

K.1. 趋势和问题

建立一个商定的国际环境保护系统以应对电离辐射效应的工作正在继续进行。建立这种系统的基础是过去 30 年来在考虑人体健康和对非人类生物群可能造成的损害方面所作的工作。这项工作涉及众多国际、地区和国家机构的合作，而且必须考虑辐射只是诸多环境应激因素之一。最终目标是就一套评定工具、基准和所关切的影响取得一致意见，以协助确定为利用辐射和放射性物质所提供的环境保护的有效性。但重要的是，应当通盘了解所建议的任何修改的影响。辐射剂量评定方法学目前正处在最后制订阶段，而有关生物种群辐射防护的通用国际框架仍在讨论之中。包括加拿大、法国、德国、瑞典和英国在内的一些国家以及国际放射防护委员会、国际放射生态学联盟、经合组织/核能机构、辐射科学委和欧洲委员会等机构已在该领域取得了实质性进展。其他成员国也正在朝着同一方向推进。

旨在通过禁止在海洋处置放射性废物（1972 年“伦敦公约”）和逐步减少或消除放射性海洋排放（1992 年“奥斯陆和巴黎公约”）来保护海洋环境免遭放射性废物污染的其他国际或区域性文书侧重于可持续发展和减少或消除污染等重要主题。原子能机构将继续与这些公约的缔约方合作。

天然存在的放射性物质在未受到监管机构通常控制的地区也能够浓集到超过对实践所规定的浓度限值水平。这类活动包括原地浸取和堆浸以及通过各种手段进行的常规采矿和矿石加工。目前，还没有明确制订关于适当管理天然存在的放射性物质残留物的国际导则。新导则正在制订之中。

K.2. 国际活动

原子能机构放射性核素大气和水环境排放数据库网络版[16]已于 2006 年启用，该数据库是一个集中了成员国所提交数据的世界范围的中央储存库。每个设施数据集都包括年排放量和探测限值、监管限值（若有）和有关场址区域的有限资料。2006 年 6 月 26 日至 28 日在维也纳举行的第三次放射性物质环境排放数据库技术会议启动了在线提交国家放射性排放正式记录的工作。

原子能机构还在继续维护有关海洋倾倒活动和事故的存量数据库。

营养法典委员会第二十九届会议通过了经修订的国际贸易中使用的事故性核污染后食品中放射性核素指导水平（反映在 ALINORM 06/29/41 号文件中）。该文件草案是原子能机构与其他一些国际组织合作编写的。

2006 年 12 月 11 日至 15 日在维也纳举行的首次国际贸易食品中放射性核素监测问题技术会议讨论了对食品中的放射性核素进行例行和应急监测的战略以及执行 ALINORM 06/29/41 号文件的方法。这次会议得出的结论是，监测食品中放射性核素范围的合理性和最优化以及解释监测数据的程序都需要进一步进行国际协调和统一，而原子能机构应当在这些活动中发挥积极作用。

国际放射防护委员会第五委员会在一个确认保护人类和其他生物种群所涉及的虽有不同但互为补充的宗旨和目标总体框架内，正在制订保护人类和其他生物种群的综合方案。第五委员会还在制订评定基准植物和动物中辐射剂量的方法，以此作为对生物种群实施保护的一种手段。

原子能机构已启动实施其“环境辐射防护活动计划”，并于 2006 年设立了环境辐射防护协调小组。协调小组将起到促进协调国际和地区组织在该领域开展活动的一种机制的作用。该活动计划的主要目标是促进协作，以便在制订用以评定和管理进入环境或环境中存在的放射性核素的方案过程中，通过明确考虑非人类生物种群来加强当前的辐射防护方案，并为成员国保护环境的工作提供援助。

欧盟研究项目“电离污染物的环境危险：评定和管理”即将于 2007 年初完成，其目的是在欧洲一级提供一个利用实用手段评定和管理电离辐射环境危险的综合方案。

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[16] http://dirata.iaea.org

K.3. 未来挑战

强调有效剂量约束值和新定义的国际放射防护委员会新建议的实施将使得有必要与成员国和国际组织进行广泛磋商。

“安全基本法则”涵盖了对保护人类和环境免遭辐射危险的一般陈述。在安全要求一级尚未包括关于环境辐射防护的明确要求，但在最近开始的修订“基本安全标准”过程中正在考虑这种要求。国际放射防护委员会的建议一旦印发，就要在原子能机构安全标准体系内对环境辐射防护问题作进一步改进并将制订详细的导则。

仍然有必要进一步探讨可能适用于其他生物种群的危险的性质，如何可以量化这类危险以及如何能够在法律范畴内积极证明没有对其他生物种群造成危险。

L. 放射源安全和保安

L.1. 趋势和问题

随着成员国作出很大的努力制订和执行有关回收和保持对易受攻击源和无看管源控制的国家战略，这一问题的严重性变得更加清楚。现已明确，这一问题比过去认为的更为严重。

原子能机构的安全标准在放射源的安全和保安方面正在发挥越来越重要的作用。例如，第 RS-G-1.9 号“安全导则”《放射源分类》中所载导则现已被成员国的监管机构、生产商、供应商和用户广泛采用。

各国越来越认识到放射源的生产商在促进源的安全和保安方面的作用。他们的专业组织——国际放射源供应商和生产商联合会——目前正在积极参与原子能机构的相关活动。理事会也已核准将国际放射源供应商和生产商联合会列入派观察员列席大会的非政府组织之列。

L.2. 国际活动

国际上对不具有法律约束力的《放射源安全和保安行为准则》（行为准则）的支持继续增加（截至 2006 年底为 88 个国家），一些国家已经修订其国家立法或正在加强其国家立法的进程中，以便考虑该行为准则中所载各项建议。同意以统一方式执行“行为准则”的补充导则《放射源的进口和出口导则》（进出口导则）的国家的数量继续增加（2006 年底为 37 个国家）。正如 2005 年在波尔多举行的国际会议所表明的那样 [17]，各国执行“行为准则”的程度差别很大。尽管许多成员国正在致力于执行

[17] http://www-pub.iaea.org/MTCD/Meetings/PDFplus/2005/cn134-findings.pdf

“行为准则”和“进出口导则”，但仍有工作要做，例如建立“行为准则”附件一所列一类放射源和二类放射源的国家登记制度。

2006 年 5 月 31 日至 6 月 2 日，原子能机构组织了一次不限人数的技术和法律专家会议。会议就建立自愿和定期交流信息的正式机制以便全体成员国交流在执行“行为准则”和“进出口导则”方面获得的经验和教训达成了共识。2006 年 9 月，建议的机制得到理事会的核可和大会的注意。该信息交流机制的自愿性质与“行为准则”的非法律约束性相一致，并且主要建立在一个对所有国家开放、根据资金可得情况每三年举行一次的国际会议的基础之上。

按照“进出口导则”进行的放射源的进口和出口依赖于进口国与出口国之间的信息交流。为促进这种双边信息交流，秘书处已在其网站 [18] 上登载官方指定的各国联络点的详细资料。此外，已通过密码保护网站向这些联络点提供了以联合国六种正式语文编制的标准表格。

原子能机构继续向成员国提供援助，以提高它们安全管理放射源的能力，包括与捐助国密切合作，在世界特定地区实施有关项目，如以东欧、中东和北非国家为重点的欧洲联盟倡议。除了原子能机构的努力外，澳大利亚也在东亚和太平洋地区领导着类似的努力。

在整个 2006 年期间，欧洲委员会继续强调执行对欧盟成员国具有法律约束力的欧盟理事会 2003 年 12 月 22 日关于高活度密封放射源和无看管源控制的 2003/122/Euratom 号指令。

原子能机构和国际标准化组织一直在合作制定新的、国际公认的危险源辐射警告标志，以传达“危险-远离-禁止触摸”的讯息。新的警告标志旨在补充而非取代三叶形辐射标志。它现为国际标准化组织第 21482 号标准，国际标准化组织成员的最终表决已于 2006 年底结束。

L.3. 未来挑战

为确保每个成员国都能建立并维持有效处理放射源安全和保安问题的国家专门知识，仍需作出很大的努力。

需要继续作出努力，以确保正在进行之中的加强放射源控制和管理以往活动遗留问题的双边、多国和国际活动得以协调和连贯进行，从而最大程度地有效利用资源。

尽管应当尽可能地对放射源进行回用，但适当处置方案的缺乏形成了放射源管理系统中一个令人担忧的缺口。尽管制造商和供应商在处理废源方面可发挥辅助作用，但这并不能取代对国家或地区放射源处置方案的需要。

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[18] http://www-ns.iaea.org/downloads/rw/meetings/import-export-contact-points.pdf

放射源可为社会带来一些非常重要的益处，而挑战在于确保这是在考虑到对放射源的安全和保安关切的情况下不断得到的利好。

M. 放射性物质运输安全

M.1. 趋势和问题

放射性物质运输在 2006 年继续保持良好的安全记录。《放射性物质安全运输条例》（运输条例）[19] 为世界各地放射性物质的安全运输提供了基础。成员国和国际组织继续参与审查过程，这促进了对“运输条例”的高度信任。

有关国家对核发电重新表现出兴趣，以及灭菌、诊断和治疗用放射源需求的不断增加，将导致需要安全和高效率运输的放射性物质越来越多。

拒绝运输拟用于医疗诊断和治疗的放射性物质的问题仍然是 2006 年的一个主要问题。绝大多数拒绝运输的情况发生在空运方面，而多数情况下，空运是确保这些物质能够及时到达预定目的地的唯一切实办法。

成员国对制订放射性物质运输的辐射防护计划继续表现出兴趣，而且许多成员国已经在这方面寻求原子能机构的援助。

M.2. 国际活动

2006 年，根据原子能机构审查和修订“运输条例”的政策，完成了对 2005 年版“运输条例”的审查工作。运输安全标准委员会确定没有必要对“运输条例”立即进行修订。安全标准委员会在 2006 年 6 月会议上确认了这一评定意见。

原子能机构继续努力完成以“运输条例”为基础的关于放射性物质安全运输遵约保证的安全导则草案。该草案已在 2006 年分发给成员国征求意见，而考虑到成员国意见的修订版将提交运输安全标准委员会 2007 年第一次会议。

就放射性物质运输期间的保安问题拟定建议的工作还在继续进行。有关保安级别和实物保护措施的建议已经提出，并将于 2007 年年初最后完成。

2006 年 5 月，国际空运协会制作了一张数字光盘，说明放射性同位素对于医疗目的的重要性，包括迅速运输的必要性，以及空运对于实现迅速运输的重要意义。国际空运协会向其成员单位和原子能机构分发了该光盘，原子能机构正在与国际空运协会合作，以便更广泛地分发该光盘。

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[19] 第 TS-R-1 号《放射性物质安全运输条例》（2005 年版）。

2006 年 5 月，原子能机构举行了一次专家技术会议，进一步讨论了拒绝运输放射性物质问题的进展情况。专家建议设立一个拒绝运输放射性物质问题指导委员会。该指导委员会的职能和作用将是在一项行动计划的基础上确定、评价和实施旨在减轻拒绝运输放射性物质问题的行动。该指导委员会 2006 年 11 月在维也纳举行的第一次会议已制订了一项行动计划，其中包括：提高国际组织和成员国对事件、事件后果、基本问题及其解决方法的认识；对服务提供商进行培训；对服务提供商进行教育宣传；提高放射性物质利用的积极形象；进行经济评定和采取经济措施以确定和减轻造成可持续性问题的经济负担；以及统一工业界应当（以通用拒绝运输报告形式）向联合国进行通报的国际要求。

2006 年 9 月，由八个沿岸国和承运国组成的一个小组在原子能机构的协助下在维也纳举行了第二轮非正式讨论，以期保持旨在放射性物质海上安全运输方面增进相互理解、建立信任和加强沟通的对话和磋商。

M.3. 未来挑战

确保原子能机构有关放射性物质安全运输的导则与其他国际组织的导则相统一是一项持续性的挑战。

随着核技术的利用继续增加，拒绝运输的潜在可能性也将增加，除非采取具体行动解决这一问题。而解决问题的关键是提高利益相关者对原子能机构运输安全要求的认识。应当使从事放射性物质运输的各方都理解、接受和采用原子能机构有关运输的安全标准。

由于运输方式的不同，可能存在两个或者更多的负责管理放射性物质运输的监管机构，因此，确保这些机构的作用明确、接口清楚是一项持续性的挑战。

N. 核损害民事责任

N.1. 趋势和问题

落实有效的民事责任机制对核损害造成的人体健康和环境损害以及实际经济损失进行保险的重要性已成为各国更加感兴趣的一个主题。与此同时，在现有国际核责任文书的执行方面仍存在着不确定性和争论。此外，虽然一些国家是这些文书的缔约方，但许多国家却不是，而且各种文书条款之间的兼容性以及它们之间的关系被认为非常复杂。

总干事 2003 年设立的国际核责任问题专家组继续审议和处理各国对核责任文书的关切，以期促进更好地理解和遵守整个国际核责任制度。

N.2. 国际活动

2006 年 7 月，国际核责任问题专家组再次举行会议。其间，专家成员除其他外，特别就核损害民事责任领域的新发展交换了意见并审议了进一步发展核责任制度的必要性，尤其是通过讨论和分析为消除各责任文书在界限和范围上可能存在的一些空白而采取具体步骤来实现这种进一步的发展。此外，他们还审议了是否有必要将责任文书与在原子能机构主持下通过的相关国际法律文书相统一的问题，还考虑了理事会在确定将少量核材料排除在相关核责任文书适用范围之外的最高限值方面将来有可能采取的行动。在这方面，将编写一份关于这一问题的文件，供理事会 2007 年审议。

也是在 2006 年，在国际核责任问题专家组外展活动的范畴内，于 12 月 11 日至 13 日在秘鲁利马举办了第二次核损害责任问题地区讲习班。该讲习班遵循了国际核责任问题专家组制订的标准计划，拉丁美洲地区的 20 个成员国参加了讲习班。举办这一讲习班的主要目的是介绍现行核损害国际责任制度的有关情况。讲习班还为促进遵守国际核责任制度提供了一个平台，同时也为公开讨论该地区各国实行该制度可能存在的困难、关切或问题提供了一个论坛。第三次地区讲习班定于 2007 年晚些时候在南非举行。

N.3. 未来挑战

国际核责任问题专家组的工作仍在进行，预期它将继续发挥重要作用，既作为承运国和沿海国之间讨论专门知识的论坛，又就原子能机构主持通过的核责任文书提供权威性意见和建议。该专家组的下一次会议定于 2007 年 7 月举行。

O. 放射性废物管理和处置安全

O.1. 趋势和问题

由于越来越重视核能以及扩大国家核电发展的规划或引入核能生产计划，许多国家还开始更多地关注燃料循环后端和放射性废物管理和处置方案。作为先进燃料循环讨论的一部分，已经提出了在专用反应堆中“燃烧”长寿命锕系元素的前景问题。不过在现阶段，这仍然只是概念性的，在国际一级尚未广泛讨论调查这种前景的切实计划。

2006 年仍在延续从整体的角度即把所有因素和核材料与放射性物质的整个寿期都考虑进来的角度考虑废物管理和处置问题的趋势。

2006 年 3 月，美国国家科学院发表了一份报告，建议对低放废物的监管方式加以改变。报告建议根据低放废物造成的危险而不是产生这种废物的工业对其进行监管；

目前适用的很多条例相互不一致，必须尽量实现标准化。报告确认，低活度废物一直并将继续按照美国现行条例进行安全处置。报告还认为，利用国际协商一致的标准作为美国监管的基础可有助于赢得公众对任何变革的支持。

2006 年 4 月，比利时政府在对地方当局的一个合伙人提交的文件进行审议之后同意将一个低放废物近地表处置设施的选址定在代瑟尔社区。

高放废物地质处置是一个十分棘手的课题，目前一些成员国正在采取不同的安全论证方法。2006 年 3 月，瑞士联邦能源办公室公布了瑞士各类放射性废物深部地质处置库选址实施计划草案。该计划草案成了 2006 年夏天公众协商的主题，预计最终文本将在 2007 年夏天前完成。在法国，通过了新的废物处置法案，该法案支持对高放废物和乏燃料在有待确认、2015 年前颁发许可证并于 2025 年前开始运行的场址进行可逆地质处置。英国政府已经接受其废物管理委员会关于高放废物未来管理问题的所有建议。

近年来出现了一种值得注意的趋势，即一些国家发展到在地下设施处置中低放废物。2006 年 7 月，加拿大原子能有限公司宣布了一项建议，该公司准备在加拿大地盾结晶岩的一个深部处置库处置来自乔克河实验室场址的中低放废物。

非产热废物处置方面的一项重要发展是美国新墨西哥州环境署 10 月作出的一项决定，即准备为该能源署的废物隔离中间工厂颁发经修订的危险废物设施许可证。远距离操作的超铀废物将置放在设施处置室墙壁的水平钻孔中。迄今只对该设施颁发了低放废物许可证。

大多数乏燃料贮存系统均为短期使用而设计。处置设施的缺乏已导致贮存系统运行期延长。一个重要的安全问题是如何确保长期安全，以及如何提供对燃料的持续完整性、燃料容器、废物贮存设施的结构和保持次临界状态的信任。将监测、视察和研究工作结合起来可能是合适的，并需要体现在安全标准之中。

仍然存在的情况是，许多成员国都有较小数量的放射性废物需要进行地质处置，而它们发展各自的地质处置库的代价又太大。已经采取了各种举措，目的是研究建立地区处置库以便放置若干个国家的废物的可行性。对这一问题将需要根据其对进一步实施国家处置项目的潜在影响进行进一步的审议。

将继续考虑发展小直径钻孔类设施来处置小数量放射性废物，特别是废密封源。许多国家都面临着对这种源进行管理的问题，尽管返还供应国已显示为一项不错的选择，但法律和后勤方面的实际可行性却常常妨碍着进行此种选择。国际上正在对钻孔方案的安全性进行审议，包括制订安全标准和发展可以按当地场址作用户化处理的通用安全评定方法学。

O.2. 国际活动

“联合公约”缔约方第二次审议会于 2006 年 5 月 15 日至 24 日在维也纳举行，41 个缔约方参加了会议，其中有 8 个国家是首次与会。虽然各国情况千差万别，但所有缔约方都认为，自第一次审议会议以来已经取得了进展。它们兑现了改进政策和实践的承诺，特别是对乏燃料和放射性废物管理国家战略、与利益相关者和公众协作以及废密封放射源控制等领域的政策和实践作了改进。在包括实施国家乏燃料长期管理、高放废物处置、历史废物管理、无看管源回收、知识管理和人力资源政策在内的一些领域仍存在挑战。还认识到有必要确保缔约方的财政承诺与核损害的责任范围保持一致。很多缔约方认识到通过加强交流信息、经验和技术等国际合作所带来的益处。拥有有限放射性废物管理和研究计划的缔约方还特别强调了共享知识和相互协助的必要性。

2006 年 6 月 19 日至 22 日在维也纳召开了核动力堆乏燃料管理国际会议。这次会议超过了以前会议的范围，包括了政策、安全和保安问题。成员国对乏燃料的看法仍然各不相同，有的成员国将其视为资源，而另外一些成员国则将其视为废物，因此，对其进行管理的战略也各有差异，从进行后处理到直接处置等等，不一而足。与会者普遍一致的看法是，深部地质处置是最适当的最终解决方案。会议还对乏燃料贮存的许多技术问题进行了审查，这些问题包括：燃耗信任制、乏燃料贮存系统运行期延长和干法贮存的燃料行为。

正在继续开展原子能机构工作计划范围内促进发展和比较与放射性废物安全有关的安全评定方法学的项目。关于对近地表废物处置设施适用安全评定方法的计划和关于由安全评定推动的废物管理解决方案的计划将继续引发成员国的广泛兴趣。

成员国正越来越多地要求原子能机构作出安排，以便按国际标准对废物处置设施进行国际同行评审。就大韩民国和立陶宛中低放废物处置设施的选址进行了两次这样的评审。

西欧核监管者协会继完成与确定核电厂安全参考水平有关的工作之后，现已将其工作范围扩大到放射性废物和乏燃料贮存与退役，其目的是制订地区范围内所有核设施和核活动统一的安全论证方案。参考水平以原子能机构的安全标准为基础制定，西欧核监管者协会正与原子能机构一道开展工作，以确保实行和谐一致的标准适用和经验反馈方案。

通过西欧核监管者协会的工作，一些西欧国家开展了实验性研究，以探索性的方式发展类似的地质处置设施参考水平。最近制订的地质处置国际安全标准得到了利用，原子能机构和欧洲委员会正积极合作开展这项研究。

欧洲委员会资助的评价欧洲地区废物处置库可行性的新项目即将开始实施，这表明已认识到建立 25 个国家处置库无论从经济上看还是从安全和保安的理由看都不是最佳方案。继 2005 年欧洲委员会资助的一项实验性研究之后，“欧洲处置库行动”[20] 项目将就一项切实可行的实施战略以及 2008 年起开始执行的具体计划所需的组织结构提出建议。

正在开展一些国际项目，以帮助利用钻孔处置技术消除全球性的密封废辐射源问题。对一些成员国来说，这种处置概念提供了与这种放射性废物潜在的危险相称的处置方案前景。然而，在这一概念的安全论证方面以及在发展钻孔处置设施许可证审批所需的监管能力方面还必须开展更多的工作。

O.3. 未来挑战

将继续考虑在中等深度的设施中处置那些不适合近地表处置的某些类型的废物。正在安全标准计划的范围内进一步考虑这种较深度处置所带来的隔离和包容方面的额外好处。

对放射性废物延期贮存的安全影响仍然需要作进一步阐述和系统评价，对延期贮存情况可能需要制定具体的安全标准。这种评价不仅考虑到了遗留废物，而且还考虑到了今后将产生的废物。需要进一步阐明延期贮存在各种时间框架内的影响，并就这种方案的可持续性和保证安全的能力达成共识。

由审查和修订国际放射防护委员会建议所导致的辐射安全方面国际建议的发展情况表明，有必要完善处理现有照射情况的导则。这种情况通常涉及到含有天然存在的放射性物质的废物，在不涉及核燃料循环的情形下尤其如此。这种废物应作为放射性废物加以管理的情况正越来越多地得到确定。需要制订对这种废物进行管理的合理方案，以便既处理现有废物，也处理未来活动可能产生的废物。

P. 退役

P.1. 趋势和问题

全世界利用放射性物质、已到达寿期终点而接近退役的设施（核电厂、研究堆、燃料制造厂、研究中心、实验室等）数量正日益增多。这已导致成员国扩大退役活动并愈来愈认识到需要有适当的规划、资源和监管控制才能确保安全退役。特别是已经确定了更多已关闭或行将关闭的研究堆，而且目前正在更多地考虑早期退役计划。然

[20] 欧洲地区处置库实验倡议支持行动。

而，对于许多设施来说，退役资金仍然是一个令人关注的问题，许多成员国缺乏足够适当的监管和业务基础结构来支持退役，其中包括缺乏适当的废物处置解决方案。

全球愈来愈意识到早期规划对初期规划、选址和运行期间的安全以及从运行到退役过渡期的安全、退役期间安全和退役活动完成之后的安全的重要性。

现在已经认识到退役活动的安全评价和论证是必不可少的，并且正在开展工作收集在安全评定的发展和审查以及分级方案的适用中所汲取的经验教训和良好实践。

全球退役项目情况表明，大多数退役废物低于解控值，因此，可以解除对其实行的监管控制。然而，要使这项工作做到一致需要有明确界定的标准和监督执行程序。第 RS-G-1.7 号“安全导则”[21] 提供了指导，但还需要有关地表污染（或适当替代）水平的补充导则。也有必要改进这些标准在成员国适用的一致性。此外，还需要在实施监督遵守这些限值的战略方面做出改进和保持一致性，对国家之间通常交易的材料如废金属尤其如此。

适当的费用概算和筹资机制对成功完成退役变得越来越重要。这一点对没有规定退役筹资机制的无论国有的还是已经关闭的小型设施尤为重要。

全球的退役经验表明，在设施关闭后和退役期间保留胜任和合格的工作人员是一项挑战。这关系到设施设计、改造和运行知识的保存及其向后代的传承问题。成员国正在制订保存现有知识的各项措施。

P.2. 国际活动

2006 年 9 月，理事会核准了第 WS-R-5 号“安全要求”《利用放射性物质的设施的退役》，其中规定了在规划和实施退役期间为终止实践和解除对设施的监管控制而必须满足的主题安全要求。

2006 年，原子能机构还出版了第 WS-G-5.1 号“安全导则”《解除终止实践后场址的监管控制》，其中规定了与场址解除监管控制以供非限制使用或限制使用有关的安全导则，包括在已解除控制的场址上开展新实践的安全考虑。

为退役和退役债务管理建立适当的筹资机制的重要性正在获得广泛的认同。2006 年，欧洲委员会通过了一项新的建议，其中载有确保核退役活动拥有充足和得到妥善管理的财政资源和确保安全管理乏燃料和放射性废物的措施。乌克兰已经为水-水动力堆型核电厂的退役设立了退役基金。此外，克罗地亚也计划为 Krsko 核电厂设立一项退役基金。加拿大已决定作出五年财政承诺，着手清理追溯至核技术和核医学在加拿大兴起之时由研究和发展活动引起的“核遗留债务”。

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[21] 《排除、豁免和解控概念的适用》。

2006 年 12 月 11 日至 15 日在希腊雅典举行了从核设施退役和安全终止核活动中汲取经验教训的国际会议。会议为来自营运组织、监管机构和技术支持组织的 300 多名专家和其他专家提供了一个论坛，以交流退役活动的监管、规划和实施、废物管理、退役技术、社会经济问题和小型设施退役方面的知识、经验和良好实践。会议的成果将纳入计划进行的对“国际核设施退役行动计划”的审查和修订活动中。

原子能机构正在探讨通过建立国际退役杰出中心来加强成员国退役信息和经验教训交流的可能性。

正在通过 2006 年启动的原子能机构的一个新项目对伊拉克以前的核场址的退役和清理活动提供国际支持和技术援助。该项目旨在对伊拉克以前的核综合体进行退役以及对污染地区和处置场址进行恢复，从而减少对公众和环境造成的总体放射性危险。已经确定了至少 10 个场址，每个场址至少有 1 到 40 座设施不等，它们目前的情况都需要加以分析，对其实施恢复活动的必要性也将进行评价。

2006 年，原子能机构发起实施了国际研究堆退役示范项目，目的是协助成员国适当规划和实施研究堆安全退役。该项目通过技术合作和亚洲核安全网提供支持，并将向营运者和监管者提供亲自参加规划、实施和监管研究堆退役活动的机会。该项目还将促进信息和经验交流以及教育和培训，并作为其他成员国开展退役项目的一个范例。菲律宾政府已提出将已经关闭并已选择立即拆除战略的位于马尼拉的菲律宾研究堆 PRR-1（铀氢锆堆）用做该项目的一个示范。作为第一阶段的一部分，该项目正在协助监管机构发展评审营运者建议的必要方案和确保适当地适用国际安全标准的能力。2006 年在马尼拉举行了两次技术会议，重点讨论了法律和监管问题以及退役规划。

“联合公约”缔约方第二次审议会注意到很多缔约方特别是那些拥有核电厂的缔约方已经制订了退役筹资计划。还注意到缔约方的战略从“立即”退役（即在最终关闭后的当年至 10 年左右）到长期安全关闭阶段之后“推迟”退役各不相同。缔约方认识到保存装置方面的知识和知识库具有非常重要的意义，特别是在推迟退役的情况下尤其如此。

西欧核监管者协会废物和退役工作组正在以原子能机构相关安全标准和欧洲国家的监管经验为基础制订退役参考水平，其目的旨在促进监管机构之间就“退役安全参考水平报告草案”目前介绍的参考水平达成一致，并确保这些参考水平在 2010 年前纳入各监管系统之中。

P.3. 未来挑战

随着全球范围内更多地考虑和规划新设施，有必要汲取现有设施退役的经验教训并提出改进新设施设计的建议。需要对国际安全标准加以更新，以考虑到世界各地在退役活动方面已经积累的重要经验。

解决退役安全的现有国际机制如“联合公约”需要更有效地加以适用，以提高对退役的早期规划、充足资金来源、政府支持和长期管理战略必要性的认识。

拥有有限资源的成员国的小型设施退役问题将继续成为国际社会面临的挑战。

Q. 受污染场址的恢复

Q.1. 趋势和问题

在整个非洲、亚洲和澳大利亚都存在着许多过去铀矿开采和加工活动遗留的场址。虽然这些场址中有一些正在进行恢复，但在前苏联的中亚各国，这种形势仍然最为迫切。那里有很多被废弃的采矿场、从前的加工设施以及一些含有相关残留物的场所。这些残留物包括尾矿和废石以及废金属垃圾堆和废弃的基础设施。所有这些场所都对居民和环境的安全构成了放射学、化学和物理学方面的潜在危害。

一个不断发展的问题是遗留的场址，目前正在对这些场址进行检查，以了解其重新启用恢复铀生产的潜力。在许多情况下，这种情况正在发生，而很少为恢复现有状况制订明确的计划。与很多这些场所有关的监管基础结构薄弱，使得有可能导致安全相关危险增加到不可接受的水平。

由于近来世界铀市场价格的增加和当前铀供应相对电力生产需求的短缺，各国正在对以前的铀生产场址进行研究，以期重新启用生产。这些活动主要见诸于来自非洲、北美和南美以及亚洲的报道。铀生产部门长期缺乏活动意味着目前在铀矿开采和加工部门的各个领域都存在着技能短缺的问题。目前，这种情况既影响到生产商，也影响到监管部门。将有必要开展一系列培训和教育活动，以帮助成员国解决此问题。至关重要的是，所有这类重新启用的活动都涉及到双重问题，既要努力符合当前商定的国际安全标准，又要对同一场址上以前的遗留物实施恢复措施。

Q.2. 国际活动

在结合切尔诺贝利事故 20 周年举行的各种活动上介绍了“切尔诺贝利论坛”[22] 取得的成果。这些成果目前是最近 20 年来关于可归因于这起事故的环境、健康、社会和经济后果的基准资料。

在原子能机构的一个地区技术合作项目下，在哈萨克斯坦、吉尔吉斯斯坦、塔吉克斯坦和乌兹别克斯坦举办了一系列讲习班，目的是改进监督和监测系统，并规划对

[22] 该论坛的参与方是联合国系统的八个组织（原子能机构、世卫组织、联合国开发计划署（开发计划署）、粮农组织、联合国人道主义事务协调厅（人道主义协调厅）、联合国环境规划署（环境规划署）、辐射科学委和世界银行）以及白俄罗斯、俄罗斯联邦和乌克兰的主管当局。

铀矿开采和加工遗留场址实施恢复的办法。除举办讲习班外，该项目还提供了适当的设备以增强上述各成员国当局的监督和监测能力，并组织和实施了一项对欧洲已恢复场址进行科学访问的计划。该项目还涉及与该地区实施相关项目的其他机构保持联系。在该初始项目展期活动期间将对这项工作开展后续活动，以及在参项成员国制订一些针对不同国家情况的国家项目。

Q.3. 未来挑战

已毁坏的切尔诺贝利 4 号机组的退役和切尔诺贝利禁区内放射性废物的安全管理以及该地区的逐步恢复在可预见的将来仍然是一个重要挑战。加固 20 年前建造的切尔诺贝利掩蔽设施的工作已于 2006 年完成。新掩蔽结构的建造工作应当在 2007 年启动。

中亚地区铀矿开采残留物管理项目将扩大到进一步开展一些有关尾矿和其他受影响残址恢复的具体计划。这将要求加大努力以建立适当的监管研究机构和基础结构，对将需要实施的恢复战略进行监督。必须进一步建立与本着同样目的在该地区实施计划的其他国际、地区和国家组织的联系，以便使用于各项技术援助计划的有限资源达到最优化。

由于在世界范围内越来越认识到天然存在的放射性物质在辐射安全领域的重要性，天然存在的放射性残留物的管理问题日益引起关注。各国正在特别重视这些物质用于其他应用的问题，而不是简单地将这些物质宣布为废物。有必要制订有关可用于最大限度地减少天然存在的放射性废物的方案的国际导则，这些方案包括天然存在的放射性残留物的替代用途和废材料的再利用。这项工作将需要涉及运输和工作人员安全以及环境和公众防护的问题。这些领域的一些导则已经在制订中。

Appendix 1

Safety related events and activities worldwide during 2006

A. Introduction

This report identifies those safety related events or issues during 2006 that were of particular importance, provided lessons that may be more generally applicable, had potential long-term consequences, or indicated emerging or changing trends. It is not intended to provide a comprehensive account of all safety related events or issues during 2006.

B. International instruments

B.1. Conventions

B.1.1. Convention on Nuclear Safety (CNS)

In 2006, Estonia, Kuwait and the Former Yugoslav Republic of Macedonia acceded to the CNS, which now has 59 Contracting Parties, including all Member States operating nuclear power plants.

The fourth Review Meeting of the Contracting Parties will be held in Vienna from 14 to 25 April 2008. The organizational meeting in preparation for this meeting will start in Vienna on 24 September 2007.

B.1.2. Convention on Early Notification of a Nuclear Accident and Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (Early Notification and Assistance Conventions)

In 2006, Cameroon ratified and Euratom acceded to the Early Notification Convention, which had 99 parties at the end of 2006.

In 2006, Cameroon and Iceland ratified and Euratom acceded to the Assistance Convention, which had 97 parties at the end of 2006.

In 2006, no notification messages were submitted under the provisions of the Early Notification Convention. However, in relation to four events, advisory messages were exchanged under the *Emergency Notification and Assistance Technical Operations Manual* (ENATOM) arrangements. The ENATOM arrangements were originally designed to exchange notifications under the Convention, but are now used for a broader range of events.

In seven cases, the Agency was requested to provide assistance pursuant to the Assistance Convention. In one of these cases, the Agency deployed a fact-finding and assistance mission in cooperation with the State Party. In the other cases, the Agency facilitated multi-lateral or bi-lateral discussions.

In eight cases where events with radiological consequences were reported either officially or communicated through open sources, the Agency offered its good offices under the Assistance Convention.

B.1.3. Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (Joint Convention)

The Joint Convention applies to spent fuel and radioactive waste resulting from civilian nuclear activities and to planned and controlled releases into the environment of liquid or gaseous radioactive materials from regulated nuclear facilities. In 2006, Brazil, Estonia, Italy, and the Russian Federation ratified the Joint Convention and China, Iceland, Kyrgyzstan, and South Africa acceded to the Joint Convention (for Kyrgyzstan, the Joint Convention will enter into force on 18 March 2007; for South Africa 13 February 2007). At the end of 2006, the Joint Convention had 42 parties. Considering that the vast majority of Member States have some requirements for radioactive waste management, it is hoped that more States adhere to the Joint Convention. The Agency continued to conduct seminars where Member States receive presentations regarding the benefits of adherence to the Joint Convention.

The Second Review Meeting of the Contracting Parties to the Joint Convention was held at the Agency's Headquarters from 15 to 24 May 2006. The President of the Review Meeting was Mr André-Claude Lacoste, France. All 41 Contracting Parties, including eight new Contracting Parties, with nearly 500 delegates, were in attendance and participated actively in the peer review. In addition, the Contracting Parties agreed to allow China to fully participate in the Review Meeting. China had not yet deposited its instrument of accession, but had requested to be invited as a full participant. The Nuclear Energy Agency of the Organisation for Economic Co-operation and Development (OECD/NEA) was present as an observer.

Areas for which the need for further work was identified at the First Review Meeting were addressed by the Contracting Parties and reflected in their National Reports and oral presentations during the Second Review Meeting.

Contracting Parties also demonstrated their commitment to improving policies and practices particularly in the areas of:

- National strategies for spent fuel and radioactive waste management;
- Engagement with stakeholders and the public;
- The control of disused sealed sources.

Challenges continue in a number of areas including the implementation of national policies for the long-term management of spent fuel, disposal of high level wastes, management of historic wastes, recovery of orphan sources, knowledge management and human resources. The need to ensure that Contracting Parties' financial commitments are consistent with the extent of liabilities was also recognized.

Many Contracting Parties see the benefit of enhancing international cooperation through the exchange of information, experiences and technology. In particular, needs for sharing knowledge and assistance were emphasized by Contracting Parties with limited radioactive waste management and research programmes.

Three topics were discussed by the open-ended working group established at the opening plenary session:

- Ways to increase membership;
- Improvements in the review process;
- Roles of safety standards in the review process.

Concerning the role of the IAEA Safety Standards, the Contracting Parties shared the view that they constituted a useful source of guidance, among others, to which a Contracting Party could refer, on a voluntary basis, in preparing its National Report.

The third review meeting will be held from 11 to 22 May 2009.

B.2. Codes of Conduct

B.2.1. Code of Conduct on the Safety of Research Reactors

In response to a recommendation from the 2005 open-ended meeting to discuss how best to assure effective application of the Code of Conduct on the Safety of Research Reactors, regional meetings were held in Morocco (Africa) and Romania (Eastern Europe) in December 2006 on the application of the Code. These meetings brought together senior experts from Member States having or planning research reactors so they would understand the background, content and legal status of the Code, and to discuss the status of research reactor safety and exchange of information.

B.2.2. Code of Conduct on the Safety and Security of Radioactive Sources

By the end of 2006, 88 States had expressed their political support and intent to work toward following the Code of Conduct on the Safety and Security of Radioactive Sources.

From 31 May to 2 June 2006, the Agency organized an open-ended meeting of technical and legal experts where consensus was reached on a formal mechanism for a voluntary, periodic exchange of information for all States to share experiences and lessons learned in implementing the Code and its supplementary Guidance on import and export. The recommended mechanism was endorsed by the Board of Governors in September 2006. This endorsement was noted by the General Conference taking into consideration concerns expressed by Member States on the legal and financial aspects. The voluntary nature of the information mechanism is consistent with the non-binding nature of the Code. The mechanism is primarily based on a single international meeting open to all States held every three years, subject to the availability of funding.

From 13 to 15 December 2006, a group of senior experts from Latin America met in Mexico City to share experiences in implementing the Code and discuss matters related to the harmonization of procedures for the supplementary Guidance on import and export. The Agency organized the meeting, which was hosted by the Government of Mexico through the National Commission of Nuclear Safety and Safeguards (CNSNS). Participants from Argentina, Brazil, Cuba, Mexico, Panama, Peru, Uruguay and Venezuela attended the meeting.

C. Cooperation between national regulatory bodies

There are a number of forums in which regulators can exchange information and experience with their counterparts in other countries. Some of these are regional, some deal with particular reactor types and

others are based on the size of the nuclear power programme. All of these forums meet regularly to exchange information of common interest and some are developing exchange mechanisms involving the Internet for more rapid means of communication. In 2006, the Agency organized an International Conference on Effective Nuclear Regulatory Systems, which is discussed in greater detail in section G.2. In addition, selected safety issues of wide interest to regulators are discussed at a meeting of senior regulators held in association with the Agency's General Conference each year.

C.1. International Nuclear Regulators Association (INRA)

INRA comprises the most senior officials of a number of well-established national nuclear regulatory organizations in Europe, America and Asia who wish to exchange perspectives on important issues with the purpose of influencing and enhancing nuclear safety and radiological protection from a regulatory perspective. INRA met twice in 2006 under French chairmanship.

In 2006, INRA members informed each other on recent developments regarding nuclear safety regulation and radiological protection in their countries and exchanged views on issues including, inter alia, waste management, follow up to the review meetings of the Convention on Nuclear Safety and the Joint Convention and harmonisation of regulatory requirements. INRA members discussed in depth the issue of safety and radiological protection and decided to improve interaction with the ICRP regarding the revision of the ICRP recommendations.

In 2006, Republic of Korea was welcomed as a member of the Association. INRA intends to continue to act as a leadership organisation in the field of nuclear safety and radiological protection.

C.2. G8-Nuclear Safety and Security Group (G8-NSSG)

Under the presidency of the Russian Federation, the G8-NSSG met three times in 2006. The Agency, European Commission, OECD/NEA and the European Bank for Reconstruction and Development also attend these meetings. The G8-NSSG discussions focussed on: the safety of the NPP in Armenia; the Chernobyl shelter including stabilization of the sarcophagus and construction of a new safe confinement; Chernobyl's dry storage facility for spent fuel and liquid radioactive waste treatment facility; implementation of the Code of Conduct on the Safety and Security of Radioactive Sources and the additional guidance on import/export control; and safety aspects of multinational approaches to the nuclear fuel cycle. The group provided input on safety and security issues to the G8 summit held in July 2006 in St. Petersburg, Russian Federation.

At the last meeting in November 2006, the main themes to be addressed during the 2007 German G8 presidency were introduced. Ratification of safety and security conventions, strengthening non-binding international instruments and the import/export control guidelines and a global network for nuclear safety are some of the themes proposed by Germany.

C.3. Western European Nuclear Regulators Association (WENRA)

WENRA was established in 1999 and currently includes the heads of nuclear regulatory authorities of 17 European countries with at least one nuclear power plant in construction, operation or decommissioning phase. One of its main objectives is to develop a harmonized approach to selected nuclear safety and radiation protection issues and their regulation, in particular within the European Union. In November 2006, the Czech Republic took over the chairmanship of WENRA for the next three years.

At present, WENRA is developing common reference safety levels in the fields of reactor safety, decommissioning safety, radioactive waste and spent fuel management facilities in order to benchmark

national practices by the year 2010. For this purpose, two working groups have been established: the Reactor Harmonization Working Group (RHWG) and the Working Group on Waste and Decommissioning (WGWD). Both groups have developed the safety reference levels and started to work towards their finalization by means of benchmarking (WGWD) and revision based on comments received from relevant stakeholders (RHWG).

C.4. The Ibero-American Forum of Nuclear and Radiological Regulators

The Forum met in June 2006 in Madrid, Spain, with the chief regulators from Argentina, Brazil, Cuba, Mexico, Spain and Uruguay attending. At that meeting, the Forum reviewed ongoing projects, including the implementation of the Ibero-American Radiation Safety Network. At the meeting, the Forum presidency was transferred from Spain to Mexico. The Forum also established an office in Argentina in charge of projects' preparation and evaluation.

The Agency continued to support the activities of the Forum in the frame of an extrabudgetary programme dedicated to nuclear and radiation safety. Ongoing projects include a probabilistic safety assessment applied to radiotherapy treatment with linear accelerators, methodology for self-assessment of the regulatory system for protection of patients against radiation exposure and harmonization of procedures for import/export of radioactive sources.

C.5. Cooperation Forum of State Nuclear Safety Authorities of Countries which operate WWER[23] Reactors

The Forum provides an opportunity for senior staff of regulatory bodies in countries operating WWER reactors to exchange information on various regulatory issues and share recent experiences. The 13th Annual Meeting of the Forum was held in June 2006 in Yerevan, Armenia and was attended by the Chairpersons and key experts of the regulatory authorities of Armenia, Bulgaria, Czech Republic, Finland, Hungary, India, Islamic Republic of Iran, Russian Federation, Slovakia and Ukraine. Observers from the German technical support organization (GRS), the French Institute for Radiological Protection and Nuclear Safety (IRSN) and the Agency also attended. Forum members presented their national reports on recent changes in nuclear legislation, exchanged information related to regulation of nuclear safety and atomic energy utilization, operational events of common interest and measures undertaken based on event investigation results. The forum also considered the activities of its working groups on regulatory use of probabilistic safety assessment, evaluation of operating experience of WWER regulators and digital instrumentation and control systems.

C.6. Network of Regulators of Countries with Small Nuclear Programmes (NERS)[24]

The current membership of NERS includes Argentina, Belgium, Czech Republic, Finland, Hungary, Netherlands, Pakistan, Slovakia, Slovenia, South Africa and Switzerland. The Ninth Annual Meeting of NERS was held in Bled, Slovenia from 7 to 9 June 2006 and the meeting agenda included the following items:

- Ageing and lifetime management;
- Regulatory control of radioactive waste management;
- Regulatory control of transport of radioactive materials;
- Regulatory control of radioactive sources.

The Netherlands will be the next chair of NERS with the next meeting scheduled for June 2007.

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[23] water cooled, water moderated power reactor

[24] www.ners.info

C.7. The senior regulators from countries which operate CANDU-type nuclear power plants

The annual meeting of senior regulators from countries which operate CANDU-Type NPPs (Argentina, Canada, China, India, Republic of Korea, Pakistan and Romania) was hosted by the Pakistan Nuclear Regulatory Authority in Karachi, Pakistan in November 2006. The meeting agenda included: generic safety issues; a standardized approach to probabilistic safety assessment; severe accident management guidelines and symptom based emergency operating procedures; regulatory experience with construction and commissioning; regulatory issues related to new pressurized heavy water reactor design; impact of safety R&D initiated by regulatory bodies; and reporting for the next review meeting of the Contracting Parties for the Convention on Nuclear Safety.

C.8. The International Nuclear Event Scale (INES)

More than 60 Member States are currently members of INES and use the INES to communicate the safety significance of events at the national level. Member States also used the INES to communicate on events that are rated at Level 2 or higher or that are of international media interest — through the Nuclear Event Web-based System (NEWS) — to the media, the public and to the international scientific community.

Since the publication of the INES Manual 2001 edition[25], the use of the INES has expanded. Two documents on clarification of the rating of fuel damage events and the additional guidance for rating events related to radioactive sources and to the transport of radioactive material were endorsed at the 2006 INES National Officers' Meeting. A revision to the INES Manual is in progress. At the request of the Netherlands, in 2006 the Agency conducted a training seminar on the INES methodology.

D. Activities of international bodies

Several international expert bodies issue authoritative findings and recommendations on safety related topics. The advice provided by these bodies is an important input to the development of the Agency's safety standards and other international standards and is frequently incorporated in national safety related laws and regulations. The recent activities of a number of these bodies are reviewed in this section.

D.1. United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR)

UNSCEAR, a United Nations committee that reports to an international body reporting to the United Nations General Assembly, includes the leading specialists in the field. UNSCEAR reviews epidemiological studies and results from fundamental radiobiological research to assess the health risks from radiation exposure. UNSCEAR's extremely detailed reports ― globally acknowledged as being authoritative ― are a synthesis of thousands of peer-reviewed references. These reports provide the scientific basis for radiation protection schemes and basic standards formed by international and national organizations. In 2006, UNSCEAR celebrated the 50th anniversary of its first session.

[25] http://www-ns.iaea.org/downloads/ni/ines/INES-2001-E.pdf

At its 54th session, held in Vienna from 29 May to 2 June 2006, UNSCEAR summarized the main conclusions of five scientific annexes for inclusion in its report for 2006. The annexes are entitled *Epidemiological studies of radiation and cancer*, *Epidemiological evaluation of cardiovascular disease and other noncancer diseases following radiation exposure*, *Non-targeted and delayed effects of exposure to ionizing radiation*, *Effects of ionizing radiation on the immune system*, and *Sources-to-effects assessment for radon in homes and workplaces*. The overall view of UNSCEAR is that the data reviewed for its 2006 report do not necessitate changes in its current risk estimates for the cancer and the hereditary effects of radiation.

UNSCEAR also scrutinized draft documents on exposures of the public and workers to various sources of radiation, exposures from radiation accidents, exposures from medical uses of radiation and effects of ionizing radiation on non-human biota.

UNSCEAR was a participant in the Chernobyl Forum, and in 2006 the Committee expressed its intention to clarify further the assessment of potential harm owing to chronic low-level exposures among large populations and also the attributability of health effects. It also recognized that some outstanding details merited further scrutiny and that its work to provide the scientific basis for a better understanding of the radiation-related health and environmental effects of the Chernobyl accident needed to continue. Owing to its participation in the Chernobyl Forum, UNSCEAR should now extend the work on updating its own assessments of the health and environmental consequences of the Chernobyl accident in order to scrutinize information that had become available more recently. To do so effectively, UNSCEAR would need to increase the participation of scientists from Belarus, the Russian Federation and Ukraine. The work could not be conducted properly without additional resources.

D.2. International Commission on Radiological Protection (ICRP)

The ICRP is an independent group of experts that issues recommendations on the principles of radiation protection. ICRP Recommendations have provided the basis for national and international standards including the Agency's International Basic Safety Standards (BSS). Appointments to the ICRP and its Committees are made for periods of four years, and the current cycle began in July 2005. Five committees deal with radiation effects, doses from radiation exposure, protection in medicine, application of ICRP Recommendations, and protection of the environment.

The current version of the ICRP Recommendations was issued in 1990 and in June 2004, the ICRP issued a draft revision for public consultation. In 2006, the ICRP issued an updated draft and the second round of consultation was completed in September 2006. The ICRP is currently considering the comments received.

In 2006, the ICRP published Publication 99: *Low-dose Extrapolation of Radiation Related Cancer Risk*.

D.3. International Commission on Radiation Units and Measurements (ICRU)

The ICRU, a sister organization of the ICRP, provides internationally acceptable recommendations concerning concepts, quantities, units, and measurement procedures for users of ionizing radiation in medicine, basic science, industry, and radiation protection. The current ICRU programme is focused on four areas:

- Diagnostic radiology and nuclear medicine;
- Radiation therapy;
- Radiation protection;

- Radiation in science.

In 2006, the ICRU published reports on *Sampling of Radionuclides in the Environment* (report 75) and *Measurement Quality Assurance for Ionizing Radiation Dosimetry* (Report 76).

D.4. International Nuclear Safety Group (INSAG)

The INSAG is a group of experts with high professional competence in the field of safety working in regulatory organizations, research and academic institutions and the nuclear industry. It was chartered by the Director General to be an independent body to provide authoritative advice and guidance on nuclear safety approaches, policies and principles. In particular, INSAG will provide recommendations and opinions on current and emerging nuclear safety issues to the Agency, the nuclear community and the public.

INSAG met twice in 2006, including one meeting in the Republic of Korea and continued its discussion on the following areas:

- Global Nuclear Safety Regime: INSAG issued its report on Strengthening the Global Safety Regime (INSAG 21) in 2006.
- Operational Safety: There are opportunities for continuing improvement of operational safety at existing plants. In 2006, INSAG devoted considerable effort to examining operating experience feedback processes and methods.
- Stakeholder Involvement: Various stakeholders have a legitimate expectation that they will be informed of nuclear matters and their active involvement can enhance nuclear safety. In 2006, INSAG published its report on Stakeholder Involvement in Nuclear Issues (INSAG 20).
- Safety/Security Interface: The threat presented by terrorism has reinforced the importance of ensuring that the world's nuclear infrastructure has adequate security to withstand plausible threats. Safety and security are intimately connected with each other and care is needed to ensure that modifications to enhance security are made in a way that enhance, or at least do not degrade, safety margins.
- Infrastructure for Nuclear Safety: In some parts of the world, construction of NPPs has not been undertaken for many years. In addition, countries with no past experience with nuclear power have indicated an interest in adding NPPs to their generation capacity. In both cases, there is a need to ensure that countries have the infrastructure necessary to ensure that NPPs are designed, constructed, operated and maintained safely. The necessary infrastructure to start and maintain a successful nuclear programme includes legal and regulatory capability, educated staff, research skills, access to industrial capacities, and financial strength. There is also a need to ensure the availability of technical support and a reliable supply of equipment and services for the lifetime of the plant. INSAG intends to continue to examine this issue.

E. Activities of other international organizations

E.1. Institutions of the European Union

The final report by the Working Party on Nuclear Safety (WPNS) of the Council of the European Union (the Council) is close to publication. It will be an extensive experts' document on nuclear safety in the EU, which will also point to possible developments in the future. It is the result of two years of continuous efforts by the WPNS. Once issued, it will be available on the Council website[26]. In the European Commission (EC), two important documents were finalized in 2006 that have nuclear and radiation safety as one of their targets: Council Directive 2006/117/EURATOM on the supervision and control of shipments of radioactive waste and spent fuel and the recommendation on the efficient use of nuclear decommissioning funds.

In addition to legislative efforts, the European Commission carried out numerous radiation protection inspections in EU Member States and commissioned studies on regulations governing radioactive waste disposal in EU countries, the situation concerning uranium mine and mill tailings in an enlarged EU, an inventory of best practices in the decommissioning of nuclear installations, preparatory work for the definition, organisation and planning of a system devoted to the development of safety and industrial standards for nuclear installations in the EU, analysis of environmental, economic and social issues linked to the decommissioning of nuclear installations, and comparison among different decommissioning funding systems. All studies are in the final stages of preparation and will be available at the EC website[27].

E.2. Nuclear Energy Agency of the Organisation for Economic Co-operation and Development (OECD/NEA)

The Nuclear Energy Agency is a semi-autonomous body within the OECD maintaining and developing, through international cooperation, the scientific, technological and legal bases required for a safe, environmentally friendly and economical use of nuclear energy. It operates mainly through a number of committees covering specific areas.

In 2006, the Committee on the Safety of Nuclear Installations (CSNI) and the Committee on Nuclear Regulatory Activities (CNRA) completed appraisal activities in accordance with the OECD/NEA Strategic Plan. A group of recognised senior experts on safety, research and regulation assessed the effectiveness of the committees' work and made recommendations to address future challenges. CSNI and CNRA have incorporated the recommendations into their operating plans. The OECD/NEA continues to act as the Technical Secretariat for Stage II of the Multinational Design Evaluation Programme[28] (MDEP). The CNRA also approved a report produced by a senior-level expert group on the *Regulatory Challenges in Using Nuclear Operating Experience*. The primary focus of this report is on how regulatory bodies can assure that operating experience is used effectively by operating organisations to promote the safety of NPPs. The eighth international workshop on regulatory inspection practices took place in May 2006 in Canada and covered the following issues: how

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[26] http://www.consilium.europa.eu/cms3_fo/showPage.asp?id=254&lang=EN&mode=g

[27] http://ec.europa.eu/energy/nuclear/index_en.html

[28] Formerly known as Multinational Design Approval Program (MDAP)

regulatory inspections can promote, or not promote, good safety culture; inspection of interactions between the licensee and its contractors; and future challenges for inspectors.

A peer review — conducted by an international review team of senior level experts established by the OECD/NEA — of the report by the Spanish Nuclear Safety Council on the lessons learnt from the Vandellós II event was published in 2006.

The Radioactive Waste Management Committee (RWMC) Long-term Safety Criteria Group reviewed the definitions used as a basis for setting long-term safety criteria, and in particular addressed the question of consistency, in a topical session at its annual meeting in March 2006. In 2006, the RWMC Regulators' Forum published a synopsis of the regulatory function for radioactive waste management that presents the national situations and covers the management of radioactive waste from all types of nuclear installation. In 2006, the Working Party on Decommissioning and Dismantling issued a status report on decommissioning funding that provides an overview of underlying principles, the implementation of funding schemes and the associated uncertainties. In 2006, the RWMC also prepared a report that examines the roles that storage plays, or might play, in radioactive waste management in OECD member countries, and draws conclusions on the roles of storage, especially for times beyond about 100 years. In the area of decommissioning, in 2006, the OECD/NEA published policy-level reports on releasing the sites of nuclear installations from regulatory control and on selecting the appropriate decommissioning strategies.

Two new studies from the Committee on Radiation Protection and Public Health (CRPPH) are being finalised documenting the Committee's views on the trends and issues that will be the most significant over the next 10 to 15 years. One study examined emerging risk management issues (social, political, regulatory, operational, etc.), while another examined emerging risk assessment issues (challenges to our scientific understanding of radiation-induced detriment). Also in 2006, the CRPPH organised workshops to discuss impact and usability of the proposed ICRP Recommendations in Prague, Tokyo and Washington. The OECD/NEA is also publishing a new study on radiological protection of the environment that provides a baseline survey and analysis of legislation in OECD/NEA member countries and internationally. The CRPPH has also finalised two reports on challenges to radiological protection policy, regulation and application that may emerge in the coming years. As 2006 marked the 20th anniversary of the Chernobyl accident, the OECD/NEA published a report *Stakeholders and Radiological Protection: Lessons from Chernobyl 20 Years After* on the lessons that the radiological protection community has learnt to help improve living conditions in the areas affected by the accident.

In May 2006, the OECD/NEA held an evaluation workshop that focused on the International Nuclear Emergency Exercises (INEX) exercise that was conducted in 2005 and early 2006 by 15 countries. Participants from 20 countries collectively analysed the outcomes of the exercise and identified key issues in consequence management.

E.3. World Association of Nuclear Operators (WANO)

Every organization in the world that operates a nuclear power plant is a member of WANO. This association is set up purely to help its members achieve the highest practicable levels of operational safety by giving them access to the wealth of operating experience from the world-wide nuclear community. WANO is non profit making and has no commercial ties. It is not a regulatory body and has no direct association with governments. WANO has no interests other than nuclear safety.

WANO conducted peer reviews at 38 NPPs during 2006, altogether 316 since the programme began in 1992. WANO's long-term goal is to conduct a WANO peer review of member NPPs such that each unit is reviewed at least once per six years, either as an individual unit or as part of a peer review that

includes other units at an NPP. In addition, each NPP is encouraged to host an outside review at least every three years.[29]

WANO continues to emphasize technical support missions, which focus on providing assistance in selected areas, with more than 125 technical support missions undertaken during 2006.

A central operating experience team with representatives from all four WANO regional centres continues to develop operating experience products and information for members. This team produces Significant Event Reports, Significant Operating Experience Reports, and Hot Topics to keep members informed of important events and trends occurring in the industry. In addition, WANO maintains a 'Just in Time Training' database that gives plant staff access to relevant operating experience immediately prior to undertaking specific operations and maintenance activities.

WANO's workshop/seminar/training course programme has developed both in scope and in numbers. During the 2006, a WANO Plant Managers' Conference was held in London, United Kingdom. More than 120 plant managers attended this successful two-day conference, with the theme of operational decision making. In addition, each region conducted workshops and seminars on a variety of topics related to NPP operations.

F. Safety legislation and regulation

In June 2006, the French government adopted the Law on 'Transparency and Security in the Nuclear Field'. The Law transforms the former Nuclear Safety Authority into an independent administrative authority with a Commission of five commissioners. The Commission had its first meeting on 13 November 2006. The new Law sets up a renewed, comprehensive and solid legislative basis for nuclear safety. The new authority is charged with controlling civilian nuclear activities in France and informing the public in this field. In 2006, the French parliament also adopted the '2006 Programme Act on the sustainable Management of Radioactive Materials and Wastes'. This Act sets the regulatory framework of waste repositories and expands the missions of the French nuclear waste management agency. It also sets legal provisions for the funding of decommissioning and waste management.

The Russian Federation introduced a number of new regulations in 2006 including, inter alia, 'Near-Surface Final Disposal of Radioactive Waste: Safety Requirements', 'Rules for Arrangement and Safety Operation of Equipment and Pipelines for Nuclear Fuel Cycle Facilities' and 'Rules for Evaluation of Compliance for Equipment, Utility, Materials and Semi-Products to be supplied to Nuclear Facilities'. The Russian nuclear regulatory body also convened international seminars to collect experience for the development of its 'General Technical Regulations on Nuclear and Radiation Safety'.

The UK Nuclear Installations Inspectorate (NII) issued revised Safety Assessment Principles in 2006. NII inspectors use these Safety Assessment Principles to guide their regulatory decision making. The 2006 version of the Safety Assessment Principles was, inter alia, benchmarked against the IAEA Safety Standards and expanded to address emergency arrangements, remediation and decommissioning. The Safety Assessment Principles apply to the assessment of safety cases for both existing and new nuclear facilities.

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[29] Outside reviews include WANO peer reviews, WANO follow-up peer reviews, OSART and national organizational reviews such as those conducted by the Institute of Nuclear Power Operators and the Japan Nuclear Technology Institute.

G. Safety significant conferences in 2006

G.1. Safety of Transport of Radioactive Material: A Seminar on Complex Technical Issues

A seminar on communication of the complex technical issues related to the safety of transport was held from 11 to 12 January 2006 in Vienna. The various presenters discussed all aspects of transport of radioactive material with special emphasis on complex technical issues. The participants had an open and constructive dialogue and gained a shared understanding of key transportation technical issues. Seminar participants concluded that both the Secretariat and the Member States had done an outstanding job in the development of the international transportation standard, the Agency's *Regulations for the Safe Transport of Radioactive Material*. The international adoption and implementation of this standard has resulted in an effective and safe programme for the transport of radioactive material worldwide. Participants agreed that the objectives of the seminar were met.

G.2. International Conference on Effective Nuclear Regulatory Systems

The conference was hosted by the Russian Federation in Moscow from 27 February to 3 March 2006, with 216 participants from 57 countries and six organizations, plus seven observers, in attendance. The conference was the first to bring together senior nuclear safety, radiation safety and nuclear security regulators from around the world to discuss how to improve regulatory effectiveness.

The conference made many recommendations[30] for governments, regulatory bodies and international organizations including, inter alia, that the Agency:

- Strengthen the IAEA Safety Standards in relation to leadership in regulatory bodies, regulatory management systems, resource evaluation and stakeholder engagement;
- Improve, in collaboration with the OECD/NEA, the system for fostering international cooperation in regulatory effectiveness and the sharing of good nuclear safety and security regulatory practices;
- Further develop the Integrated Regulatory Review Service (IRRS) process;
- Develop its programmes to assist Member States in human resource development by organizing training courses in radiation protection, waste safety, nuclear safety and security training courses at international, regional, sub-regional and national level;
- Consider how its activities and those of other international organizations can be coordinated to enable the most effective participation by regulators.

Conference participants also drew the following conclusions:

- Effective nuclear safety and security regulation is vital for the safe and secure use of nuclear energy and associated technologies and is an essential prerequisite for the achievement of global energy security and global sustainable development;
- Regulators work for the benefit of society and therefore play a vital role. To be effective, they must be independent and able to make regulatory decisions without pressure from those who are responsible for the promotion of the use of nuclear energy and associated technologies or those who are opposed to its use;

[30] http://www-pub.iaea.org/MTCD/Meetings/PDFplus/cn150/PresidentReport.doc

- Regulators must be competent and have adequate resources to deliver their mission. The safety and security of nuclear facilities and nuclear and radioactive materials requires effective coordination of safety and security regulation;
- Continued and improved international cooperation is important to develop comprehensive international standards for safety and guidance for security. The importance of wider participation and fuller implementation of international instruments such as conventions and codes of conduct was stressed;
- Head regulators should meet again within three years to review progress and identify new emerging regulatory challenges.

G.3. International Conference on Improving Nuclear Safety through Operational Experience Feedback

This conference was held in May 2006 and was organized by the OECD/NEA jointly with the Agency and WANO. The conference — hosted by the German research organisation GRS and the German utilities — was an opportunity to discuss how to improve the support that international organisations provide to member countries, and how incident reporting systems can be used more efficiently to extract the right lessons and to avoid recurring events. A number of specific proposals were agreed at the meeting.

G.4. International Conference on Management of Spent Fuel from Nuclear Power Reactors

This conference was organized by the Agency and held in Vienna from 19 to 22 June 2006. Compared to previous international conferences on spent fuel management, the scope of this conference was broader and included policy, safety and security aspects. Spent fuel is still differently regarded by Member States — as a resource by some and as a waste by others — and the strategies for its management vary, ranging from reprocessing to direct disposal. In all cases, a final disposition solution is needed and it is generally agreed that disposal deep in geological formations is the most appropriate solution.

In all countries, spent fuel or high level waste from reprocessing is currently being stored, usually above ground, awaiting the development of geological repositories. While these arrangements have proved satisfactory, it is generally agreed that they are interim and do not represent a final solution.

Recent fuel cycle initiatives by USA and Russia have similar overall goals of improving control over the increasing amounts of spent fuel, reducing proliferation and security risks, and assisting new countries to develop nuclear power. The initiatives rely on reprocessing and recycling, but with advanced technologies to reduce proliferation risks and minimize radioactive waste generation. The multilateral approaches also promise better assurances of security and proliferation resistance. It was proposed that the international agencies should continue to be involved and to evaluate these approaches further and it was also suggested that the Agency could be a monitoring agency to oversee the safety and other aspects of any multilateral initiatives that may be implemented

The Joint Convention and the IAEA Safety Standards provide a framework for the international safety regime for spent fuel management. The transport of radioactive material, including spent fuel, provides a well-established example of this international safety regime through the near-universal application of the Agency's *Regulations for the Safe Transport of Radioactive Material*. It was noted that other IAEA Safety Standards in the area of spent fuel management are in the process of being updated and elaborated. Conference participants made a number of proposals on topics that warrant the development of new safety standards.

Presentations at the conference indicated that substantial benefits can be obtained from burn-up credit[31]. However, much of the assessment and development work is for pressurized water reactor and boiling water reactor fuels and there is a need to extend this work to other fuels.

Although most spent fuel storage systems were designed for short term application pending reprocessing or disposal, the unavailability of disposal facilities has resulted in extended operating periods for these storage systems in most countries. An important issue is how to establish the safety of these facilities on a longer term.

Conference participants noted a trend towards dry storage. While specialists expressed confidence in the technical development of storage facilities and containers, it was agreed that more research and development on fuel behaviour in dry storage is needed.

Looking to the future, the presentations at the conference show some clear tendencies which can provide a basis for more international cooperation:

- The need for geological repositories for radioactive waste;
- The development of advanced reprocessing;
- The burning of actinides in fast reactors;
- The necessity to increase the duration of interim storage;
- The unavoidable increase of transport of both spent fuel and radioactive waste.

G.5. International Conference on Lessons Learned from Decommissioning of Nuclear Facilities and the Safe Termination of Nuclear Activities

The International Conference on Lessons Learned from the Decommissioning of Nuclear Facilities and the Safe Termination of Nuclear Activities was held in Athens, Greece from 11 to 15 December 2006 and attended by about 300 experts from 50 Member States. More details of this conference are provided in document GOV/INF/2007/1.

H. Safety significant events in 2006

Through the various reporting mechanisms, the Agency was informed of 168 events involving or suspected of involving ionizing radiation. In all cases, the Agency took actions, such as authenticating and verifying information, providing official information or assistance to the requesting party, or offering the Agency's good offices. Most of the events were found to have no safety significance and/or no radiological impact to people or the environment.

Twenty-five events involved 'dangerous' radioactive sources, whereas 23 events occurred at nuclear facilities. An event at an irradiation facility in Belgium (see paragraph 85 below) was rated at level 4 on the INES scale. In eight events associated with radiography activities, workers received — or were suspected of receiving — doses in excess of regulatory limits.

The Nuclear Events Web Based System (NEWS) is a joint project of the Agency, OECD/NEA and WANO that provides fast, flexible and authoritative information on the occurrence of nuclear events that are of interest to the international community. NEWS covers all significant events at NPPs,

[31] Burn-up credit makes use of the change in the isotopic composition of fuel, and hence its reactivity, due to irradiation to allow denser storage of spent fuel

research reactors, nuclear fuel cycle facilities, as well as occurrences involving radiation sources and the transport of radioactive material. The general public can access information submitted during the previous six months through the Agency's website.[32]

The Incident Reporting System (IRS), operated jointly with the OECD/NEA, was set up in 1983 to exchange information on unusual events at NPPs and increase awareness of actual and potential safety problems. In 2006, the Web-based IRS was created to facilitate data input and report availability. As a consequence, the number of reports has increased and the dissemination delays have reduced. Activities within the IRS extend beyond the exchange of IRS reports. The Agency and the OECD/NEA have meetings and working groups of experts who meet regularly and discuss the safety relevance of events.

The exposure to Polonium-210 in the United Kingdom in 2006 and the related public contamination was an unprecedented event. The UK response to the incident brought together specialists from a wide range of fields in an integrated national effort. At the request of the UK authorities, the Agency facilitated the exchange of information between the UK Health Protection Agency and a number of countries where follow-up actions with individuals who might have been exposed to Polonium-210 contamination was recommended.

The 2006 joint Agency-OECD/NEA meeting of the IRS national coordinators discussed lessons learned from 39 recent events. Some of the participants also gave presentations on 'extreme natural phenomena' events which occurred. Although, in general, plants responded safely to these challenges, there are still some questions without reply: are importance and frequency increasing? Is there a need to look at existing safety design features to protect the plant against these phenomena? Is there a need to re-examine the design criteria for such systems? Are specific human factors aspects to be considered?

In addition, meeting participants discussed two events in detail:

- *Forsmark 1, Sweden (Boiling Water Reactor)*: (2006-07-25). This event involved a protection system in the 400kV switch yard which did not work as expected during the opening of a section disconnector. As a result, the magnitude of the electrical transient was higher than expected. If the line breakers had, as anticipated, opened earlier, the short circuit would have been disconnected in approximately 100 milliseconds, and the transient behaviour would have been 'normal'. The conclusion of the analysis led to an improved solution to the protection system which has been designed, tested and approved. The modifications involve changing over-voltage setpoint values in the protection system of the AC-DC rectifiers and the DC-AC inverters and increasing the delay before tripping of the inverters. This setup will ensure that in the event of a very large voltage transient, the rectifier protection system will actuate, while the inverter will remain available to supply power to the 220VAC bus bar from the Uninterrupted Power Supply (UPS) battery. The new design criterion for the UPS is that it should withstand a voltage transient from 20% to 130% of design value assuming the fastest possible voltage increase. A positive conclusion from the analysis is the performance of the control room operators during the incident. Use of instructions and trained routines worked to minimize the consequences of the event.
- *Catawba, USA (Pressurized Water Reactor)*: (2006-05-23) This event had some similarities with the Forsmark event. An electrical fault in the Catawba switch yard caused several electrical circuit breakers to open, resulting in a loss

[32] http://www-news.iaea.org/news/default.asp

of offsite electrical power to both reactors of Catawba NPP. Both units underwent automatic shutdowns from 100 percent power when their reactor protection systems reacted to the loss of offsite power as designed. The internal fault occurred on a current transformer associated with a power circuit breaker and the resulting current/voltage surge caused the failure of the second transformer.

The majority of the presented events can be classified in the following categories:

- Events related to repair and replacement;
- Events related to loss of off-site power;
- Events related to erosion-corrosion issues;
- Events related to blockage of control rods;
- Events related to human factors issues;
- Events related to loss of ultimate heat sink.

Other events of interest that were reported to the Agency include:

- *Texas A&M University, USA (Research Reactor)*: (2006-02-24) In January 2006, an employee received 758 mSv to the extremities and in February a further 375.4 mSV to the extremities. The employee was involved in neutron activation analysis work. A provisional INES rating of level 2 has been assigned to this event.
- *Fleurus, Belgium (Irradiation Sterilization Facility)*: (2006-03-11) The facility uses gamma radiation emitted from a sealed cobalt-60 source. When not in operation, the source is stored in a water pool. Safety locks prevent the system from taking the source out of the pool when the door of the irradiation cell is open. Upon entering the room where the cell is located, the employee observed that the gamma monitor was in high level alarm, with the door of the cell open and the cell empty. The employee reset the monitor and verified that the alarm did not reappear. The employee decided to close the door of the cell, which required entering the cell to verify that the cell was empty. The employee remained in the cell for about 20 seconds. Some time later, the employee experienced nausea and vomiting, but did not attribute this to work. Three weeks later, he experienced massive hair loss. Blood tests confirmed that the employee was exposed to high radiation dose. Following hospitalization in a French facility highly specializing in treatment of radiation exposure, the employee appears to have recovered from the event. Although the investigation is still underway, provisional results show that the source may have been slightly out of the water pool. This event has been assigned an INES level 4 rating.
- *Kozloduy 5, Bulgaria (Pressurized Water Reactor)*: (2006-03-01) Following the trip of one main circulation pump, the reactor automatic power reduction system actuated and the reactor power reduced to 67%. Following the power reduction, control room personnel identified that three control rods did not move as required. Following procedures, reactor power was reduced to hot standby state and all control rod drives were tested, where it was identified that 22 out of 61 control rods did not move. The initial investigation concluded that the direct cause was sticking of the contact surfaces of the fixating electromagnets of the drive moving system. This event has been assigned a rating of INES level 2.
- *Thane, India (Industrial Radiography)*: (2006-05-22) An industrial gamma radiography exposure device containing about 0.5 TBq of iridium-192 was lost during transport by taxi. The device, along with radiography accessories, was being carried by a trainee radiographer to the worksite from the storage

location. En-route, the radiographer changed taxis, but inadvertently forgot to shift the radiography device to the second taxi. Despite extensive search operations, the source was not located. No radiation injuries have been reported and it is presumed that the source continues to be inside the exposure device. The device has adequate shielding and locking mechanisms in place to prevent inadvertent removal of the radioactive source. This event was assigned a rating of INES level 2.

- *Belgium-Romania (International Transport)*: (2006-07-24) A type A package containing radioactive material was lost during its transport between Brussels and the consignee in Romania. The package contained a limited quantity of iodine-131 (a total of 222 GBq). The package has still not been found by the airline. This event has been assigned an INES level 2 rating.
- *France-Germany (International Transport)*: (2006-12-01) An excepted package of three flasks containing a limited quantity of carbon-14 (a total of 1308 MBq) was sent to the Sanofi Aventis research laboratory in Frankfurt, Germany. The consignee discovered that one of the flasks was not properly screwed and leaked in the plastic bag which contained it. Fortunately, the package was not contaminated. The leakage was not the only problem noticed; the transport document mentioned only one flask instead of three. In addition, due to its activity, the package should have been type A instead of excepted. This event has been assigned an INES level 1 rating.

I. Safety Networks

I.1. Asian Nuclear Safety Network (ANSN)

During 2006, the ANSN continued to develop with hubs in China, Japan and Republic of Korea and national centres in Indonesia, Malaysia, Philippines, Thailand and Vietnam. Australia, France, Germany, Japan, Republic of Korea and the USA provide in-kind and/or financial support.

The ANSN Steering Committee, chaired by Australia, met twice in 2006 to coordinate ongoing work and to prepare the strategic plan for 2007-2009.

In December 2006, the strategic plan and the 2007 activities were approved at the review meeting of the Extrabudgetary Programme on the Safety of Nuclear Installations in East Asia, Pacific and Far East Countries (EBP Asia).

There is a shared view among the countries participating in the ANSN that this network should be, in the future, a platform for addressing policy and technical safety issues for maintaining sustainable nuclear safety in the Asian Region.

Two new topical groups started to work in 2006 dealing respectively with emergency preparedness and response and radioactive waste management. A new topical group on safety management of research reactors was agreed and should be activated in 2007. The topical groups are expected to have more important roles, in particular for the management of EBP Asia activities, the selection of new knowledge to be posted in the ANSN, and the consolidation of existing knowledge.

It has also been decided to increase the use of ANSN for more effective and efficient EBP Asia management. A specific web page has been prepared on ANSN to share information related to EBP Asia, such as: requests from the Member States, Agency evaluations, results of the technical meetings

and the 2007 work plan. The Steering Committee has its own web page for communication between its members.

To increase the ANSN outreach, the bi-weekly ANSN Newsletter is widely distributed worldwide. In 2006, promotional meetings (Caravans) were conducted in China and the Philippines to introduce the ANSN to those countries' scientific communities. The ANSN was also promoted at the Pacific Basin Nuclear Conference in Sydney in October 2006.

Efforts will also continue to link the ANSN to other relevant networks.

I.2. Ibero-American Nuclear and Radiation Safety Network

The development of the Ibero-American Nuclear and Radiation Safety Network version 1.0 was completed in 2006. The work was carried out by Colegio de Fisicos of Spain, under the Agency's Extrabudgetary Programme (EBP) of Nuclear and Radiation Safety in Ibero-America. The EBP Steering Committee — composed of representatives of Argentina, Brazil, Cuba, Mexico, Spain and the Agency — defined the users' requirements for the Network and tested the system operability. The Steering Committee met four times in 2006.

The Network contains technical knowledge of regulatory interest in areas such as radiological protection of patients, safety of radioactive sources, national and Agency safety standards, national legislation and education and training. The Network is populated with resources provided by participating countries. Resources are classified and uploaded according to an agreed taxonomy that allows efficient interrogation and retrieval by registered users.

The Network is currently hosted by the Colegio de Fisicos, which also functions as system administrator. At its last meeting in Vienna in September 2006, the Steering Committee discussed future steps to migrate the Network for hosting by one of the participating countries. A decision on this matter is to be taken by the Forum plenary in 2007.

Appendix 2

The Agency's safety standards: activities during 2006

A. Introduction

Article III.A.6 of the IAEA Statute authorizes the Agency "to establish or adopt, in consultation and, where appropriate, in collaboration with the competent organs of the United Nations and with the specialized agencies concerned, standards of safety for protection of health and minimization of danger to life and property (including such standards for labour conditions), and to provide for the application of these standards to its own operation as well as to the operations making use of materials, services, equipment, facilities, and information made available by the Agency or at its request or under its control or supervision; and to provide for the application of these standards, at the request of the parties, to operations under any bilateral or multilateral arrangements, or, at the request of a State, to any of that State's activities in the field of atomic energy."

The categories in the Safety Standards Series are Safety Fundamentals, Safety Requirements and Safety Guides. The most important achievement was the approval by the Board of Governors, at its September 2006 meeting, of the Safety Fundamentals No. SF-1: *Fundamental Safety Principles*. It establishes a unified set of principles representing a common philosophy across all areas of application of the IAEA Safety Standards and supersedes the previously published three Safety Fundamentals No. 110, No. 111-F and No. 120 respectively on the safety of nuclear installations, on the safety of radioactive waste management and on radiation protection and the safety of radiation sources. This important document published in November 2006 was co-sponsored by Euratom, FAO, ILO, IMO, OECD/NEA, PAHO, UNEP and WHO.

In 2006, the Board of Governors also approved the publication of Safety Requirements No. GS-R-3: *The Management System for Facilities and Activities* and WS-R-5: *Decommissioning of Facilities Using Radioactive Material*.

The Agency conducted a review of the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (BSS). The review concluded that, while there was no major issue requiring urgent revision, there was a case to be made for the revision of the BSS in order to take account of the many improvements that have been suggested. The DPP for the revision was endorsed by the Safety Standards Committees and the Commission on Safety Standards (CSS). In 2006, the General Conference noted that the revision of the BSS is to be coordinated by a secretariat established by the Agency with the participation of the co-sponsors, and urged that secretariat to carefully consider and justify potential changes, taking into account their implications in national regulations.

Since the establishment of the CSS and the Committees in 1995, a total of 79 IAEA Safety Standards have been endorsed by the CSS for publication; of those, 76 (one Safety Fundamentals, 13 Safety Requirements and 62 safety guides) have been published; and 54 further standards (five requirements and 49 safety guides) are being drafted or revised. A list of IAEA Safety Standards, indicating their

status as of 31 December 2006, is included at the end of this Appendix, and up-to-date status reports can be found on the Agency's website[33]. The full text of published IAEA Safety Standards is also available on the website[34].

B. Commission on Safety Standards (CSS)

The CSS, chaired by Mr. A.-C. Lacoste, Chairman of the Nuclear Safety Authority in France, met twice during 2006, in June and in November.

Of utmost importance in the year 2006 was the endorsement and the publication of the unified Safety Fundamentals *Fundamental Safety Principles*. As a result, the CSS particularly focussed its activities in 2006 on addressing the implications of the publication of the Safety Fundamentals on the whole Safety Standards series.

At its June meeting, the CSS discussed a report on the implementation of the Action Plan for the Development and Application of IAEA Safety Standards, the feedback of experience in the use of safety standards and new challenges in relation to the safety standards. The CSS acknowledged that the implementation of the action plan has improved the quality of the safety standards and their utilization by Member States. The report also included proposals for meeting these challenges and steps to be taken, including consideration of the overall structure by the Secretariat in consultation with the Safety Standards Committees.

The CSS welcomed the increasing use of the IAEA Safety Standards by Member States. The strategic interest of achieving better international recognition and use of the IAEA Safety Standards as a reference calls for greater stability. The CSS therefore supported the proposals from the Secretariat and, in a statement issued at its June meeting, requested the Secretariat to elaborate on them further and to propose at the November CSS meeting a policy paper together with a revised overall structure for the safety standards, which should: propose a vision on what the entire series would comprise in the future (the concept of a 'closed set' of safety standards); establish a logical relationship between the unified Safety Fundamentals and the various Safety Requirements, as well as logical relationships between the Safety Requirements and the subsequent Safety Guides; and, maintain a manageable number of publications and take into account the need for efficiency and timeliness for the future development of the Series.

At its November 2006 meeting, the CSS discussed a new report from the Secretariat on 'Beyond the Action Plan for the Development and Application of the IAEA Safety Standards: Overall Structure of Safety Standards' and generally agreed that the report provides a good basis for further work. A subgroup of the CSS, with participation of the chairs of the Safety Standards Committees and the Secretariat, was established to: identify the set of necessary Safety Requirements, including consideration of the harmonization and integration of all thematic requirements; propose a unified format for the drafting of Safety Requirements and consider development of a better distinction between what is a requirement and what is considered as guidance; and develop criteria for managing the transition period with a clear plan of action for minimizing the burden on the Member States and the committees for review of draft standards.

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[33] http://www-ns.iaea.org/downloads/standards/status.pdf

[34] http://www-ns.iaea.org/standards/

In addition to the endorsement of the Fundamental Safety Principles, the CSS endorsed in 2006 the submission of the Safety Requirements *Decommissioning of Facilities using Radioactive Material* to the Board of Governors for approval and of the following Safety Guides for publication: *Remediation Process for Past Activities and Accidents*; *Commissioning of Research Reactors*; *Maintenance, Periodic Testing and Inspection of Research Reactors*; and, *Radiation Protection Programmes for Transport of Radioactive Material*.

The CSS also approved document preparation profiles (DPPs) for nine Safety Guides in 2006.

C. Nuclear Safety Standards Committee (NUSSC)

NUSSC, chaired by Mr. Lasse Reiman of the Radiation and Nuclear Safety Authority (STUK) of Finland, met twice during 2006.

In 2006, three Safety Guides were published: NS-G-2.11: A System for the Feedback of Experience from Events in Nuclear Installations, NS-G-4.1: Commissioning of Research Reactors and NS-G-4.2: Maintenance, Periodic Testing and Inspection of Research Reactors.

At its meetings in March and September 2006, NUSSC approved three draft IAEA Safety Standards for submission to the CSS, namely the unified *Safety Fundamentals, the Safety Requirement on Decommissioning of Facilities using Radioactive Material*, and the *Safety Requirement on Safety of Fuel Cycle Facilities.*

In addition NUSSC reviewed and commented on six draft Safety Standards dealing with various nuclear safety issues, such as ageing, decommissioning, safety assessment and management systems.

In 2006, NUSSC approved DPPs for nine new safety standards.

NUSSC also reviewed a report from the Secretariat on 'Beyond the Action Plan for the Development and Application of IAEA Safety Standards: Overall Structure of Safety Standards' at its September meeting. NUSSC discussed the proposal for a new structure and considered it to be a good starting point. However, some concerns were raised and NUSSC intends to consider the topic further and review a detailed transition plan at its next meeting. NUSSC performed a preliminary review and provided comments on all safety standards included in the 'closed set' of standards proposed by the Secretariat.

NUSSC also decided to have joint meetings with RASSC and WASSC in order to enhance synergism and to avoid duplication of work on the growing number of joint safety standards.

D. Radiation Safety Standards Committee (RASSC)

RASSC, chaired by Mr. Sigurdur Magnussson of the Icelandic Radiation Protection Institute, met in April and October in 2006. Both meetings included a joint session with WASSC to discuss issues of common interest.

In 2006, one Safety Guide was published: RS-G-1.10: Safety of Radiation Generators and Sealed Radioactive Sources.

In 2006, RASSC approved the Safety Fundamentals: *Fundamental Safety Principles*, the Safety Requirements on Fuel Cycle Facilities, a Safety Guide on Application of the Management System for Technical Services in Radiation Safety, a Safety Guide on Implementation of the Remediation Process for Past Activities and Practices; and a Safety Guide on Radiation Protection Programmes for the Transport of Radioactive Material.

RASSC also reviewed the report from the Secretariat on 'Beyond the Action Plan for the Development and Application of IAEA Safety Standards: Overall structure of Safety Standards'. RASSC members concluded that further work needs to be carried out to finalise the structure. It recommended that a working group made up of representatives of all Committees be set up to assist the Secretariat in developing further the overall structure of safety standards

RASSC received reports from the Secretariat on the review and revision of the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (the BSS). At its October meeting, RASSC endorsed a proposal from Secretariat to revise the BSS. It is expected that the revision of the BSS will be completed by late 2009.

In 2006, RASSC approved DPPs for five new Safety Guides.

E. Transport Safety Standards Committee (TRANSSC)

TRANSSC, chaired by Mr. Jarlath Duffy of the Radiological Protection Institute of Ireland, met in March and September in 2006.

In 2006, TRANSSC approved three draft IAEA Safety Standards for submission to the CSS, namely the unified *Safety Fundamentals*, the Safety Guide on *Radiation Protection Programmes for Transport of Radioactive Waste*, and the Safety Guide on *Management Systems for the Safe Transport of Radioactive Material*.

TRANSCC also approved DPPs for three new safety standards in 2006.

TRANSSC reviewed the report 'Beyond the Action Plan for the Development and Application of IAEA Safety Standards: Overall Structure of Safety Standards' at its September 2006 meeting.

In 2005, the Board of Governors approved the new policy for reviewing and revising the Agency's *Regulations for the Safe Transport of Radioactive Material* (Transport Regulations). In 2006,

TRANSSC developed and approved criteria to determine if proposals for changes are sufficiently important to recommend the publication of a new edition of Transport Regulations. Six principles were identified to be used in evaluating proposed changes stemming from the review:

- Optimization;
- Efficiency, practicality, regulatory stability;
- Compliance with dose limits;
- Socio-economic considerations;
- Harmonization with regulations from other international organizations;
- Clarification.

Applying these criteria, TRANSSC determined that the proposed amendments were not sufficiently important for safety to warrant immediate publication of a revision of the Transport Regulations. Thus there would be no 2007 edition of the Transport Regulations. The proposals for change which were accepted will be considered for inclusion in the next revision.

F. Waste Safety Standards Committee (WASSC)

WASSC, chaired by Mr. Thiagan Pather, of the National Nuclear Regulator of South Africa, met in April and October in 2006. Both meetings included a joint session with RASSC to discuss issues of common interest.

In 2006, two Safety Requirements and two Safety Guides were published: WS-R-4: *Geological Disposal of Radioactive Waste*; WS-R-5: *Decommissioning of Facilities Using Radioactive Material*; WS-G-5.1: *Release of Sites from Regulatory Control on Termination of Practices*, and WS-G-6.1: *Storage of Radioactive Waste*.

At its meeting in April, WASSC approved the *Fundamental Safety Principles* and the Safety Guide on *Remediation Process for Past Activities and Accidents* for submission to the CSS.

In 2006, WASSC approved two Safety Requirements and three Safety Guides for submission to Member States for comments.

At its meeting in April, WASSC approved proposals for four new Safety Guides.

In 2006, WASSC also discussed extensively SF-1: Safety Fundamentals: *Fundamental Safety Principles*, and the review and revision of the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (the BSS).

WASSC also reviewed a report from the Secretariat on 'Beyond the Action Plan for the Development and Application of IAEA Safety Standards: Overall Structure of Safety Standards' at its October meeting. WASSC considered that one meeting was not enough to approve the new structure. WASSC agreed to discuss the issue again at the meeting in April 2007.

The IAEA Safety Standards as of 31 December 2006

Safety Fundamentals

SF-1	Fundamental Safety Principles (2006) **Co-sponsorship:** Euratom, FAO, ILO, IMO, OECD/NEA, PAHO, UNEP, WHO

Thematic Safety Standards

Legal and Governmental Infrastructure

GS-R-1	Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety (2000)
GS-G-1.1	Organization and Staffing of the Regulatory Body for Nuclear Facilities (2002)
GS-G-1.2	Review and Assessment of Nuclear Facilities by the Regulatory Body (2002)
GS-G-1.3	Regulatory Inspection of Nuclear Facilities and Enforcement by the Regulatory Body (2002)
GS-G-1.4	Documentation for Use in Regulating Nuclear Facilities (2002)
GS-G-1.5	Regulatory Control of Radiation Sources (2004) **Co-sponsorship:** FAO, ILO, PAHO, WHO

Emergency Preparedness and Response

GS-R-2	Preparedness and Response for a Nuclear or Radiological Emergency (2002) **Co-sponsorship:** FAO, OCHA, OECD/NEA, ILO, PAHO, WHO
50-SG-G6	Preparedness of Public Authorities for Emergencies at Nuclear Power Plants (1982) (under revision)
50-SG-O6	Preparedness of the Operating Organization (Licensee) for Emergencies at NPPs (1982) (under revision)
98	On-Site Habitability in the Event of an Accident at a Nuclear Facility (1989) (under revision)
109	Intervention Criteria in a Nuclear or Radiation Emergency (1994) (under revision)

Two Safety Guides on: preparedness for emergencies (combining G6, O6 and 98); and criteria for use in planning response to emergencies (replacing 109) are being developed.

Management System

GS-R-3	The Management System for Facilities and Activities (2006)
GS-G-3.1	Application of the Management System for Facilities and Activities (2006)

Safety Guides (2001)

Q8	Quality Assurance in Research and Development (under revision)
Q9	Quality Assurance in Siting (under revision)

Q10	Quality Assurance in Design (under revision)
Q11	Quality Assurance in Construction (under revision)
Q12	Quality Assurance in Commissioning (under revision)
Q13	Quality Assurance in Operation (under revision)
Q14	Quality Assurance in Decommissioning (under revision)

Six Safety Guides on management system (for regulatory bodies, technical services in radiation safety, radiation safety for users, waste disposal, treatment of waste and nuclear facilities) are being developed.

Assessment and Verification

GS-G-4.1	Format and Content of the Safety Analysis report for NPPs (2004)

A Safety Requirement on safety assessment and verification and a Safety Guide on risk informed decision making are being developed.

Site Evaluation

NS-R-3	Site Evaluation for Nuclear Installations (2003)
NS-G-3.1	External Human Induced Events in Site Evaluation for Nuclear Power Plants (2002)
NS-G-3.2	Dispersion of Radioactive Material in Air and Water and Consideration of Population Distribution in Site Evaluation for Nuclear Power Plants (2002)
NS-G-3.3	Evaluation of Seismic Hazard for Nuclear Power Plants (2003)
NS-G-3.4	Meteorological Events in Site Evaluation for Nuclear Power Plants (2003)
NS-G-3.5	Flood hazard for Nuclear Power Plants on Coastal and River Sites (2004)
NS-G-3.6	Geotechnical Aspects of NPP Site Evaluation and Foundations (2005)

Radiation Protection

115	International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (1996) **Co-sponsorship:** FAO, ILO, OECD/NEA, PAHO, WHO (under revision)
RS-G-1.1	Occupational Radiation Protection (1999) **Co-sponsorship:** ILO
RS-G-1.2	Assessment of Occupational Exposure due to Intakes of Radionuclides (1999) **Co-sponsorship:** ILO
RS-G-1.3	Assessment of Occupational Exposure due to External Sources of Radiation (1999) **Co-sponsorship:** ILO
RS-G-1.4	Building Competence in Radiation Protection and the Safe Use of Radiation Sources (2001) **Co-sponsorship:** ILO, PAHO, WHO
RS-G-1.5	Radiological Protection for Medical Exposure to Ionizing Radiation (2002) **Co-sponsorship:** PAHO, WHO
RS-G-1.7	Application of the Concepts of Exclusion, Exemption and Clearance (2004)
RS-G-1.8	Environmental and Source Monitoring for Purposes of Radiation Protection (2005)
RS-G-1.9	Categorization of Radioactive Sources (2005)
RS-G-1.10	Safety of Radiation Generators and Sealed Radioactive Sources (2006) **Co-sponsorship**: ILO, PAHO, WHO

Two Safety Guides on protection of the public against exposure to ionizing radiation from natural sources and on justification of practices are being developed.

Radioactive Waste Management

WS-R-2	Predisposal Management of Radioactive Waste, including Decommissioning (2000) (under revision)
111-G-1.1	Classification of Radioactive Waste (1994) (under revision)
WS-G-2.3	Regulatory Control of Radioactive Discharges to the Environment (2000)
WS-G-2.5	Predisposal Management of Low and Intermediate Level Radioactive Waste (2003)
WS-G-2.6	Predisposal Management of High Level Radioactive Waste (2003)
WS-G-2.7	Management of Waste from the Use of Radioactive Materials in Medicine, Industry and Research (2005)
WS-G-6.1	Storage of Radioactive Waste (2006)
WS-G-1.2	Management of Radioactive Waste from Mining and Milling of Ores (2002)

One Safety Requirements on management of radioactive waste and three Safety Guides on safety assessment, management of waste containing naturally occurring radioactive material and on classification of radioactive waste are being developed.

Decommissioning

WS-R-5	Decommissioning of Facilities Using Radioactive Material (2006)
WS-G-2.1	Decommissioning of Nuclear Power Plants and Research Reactors (1999)
WS-G-2.2	Decommissioning of Medical, Industrial and Research Facilities (1999)
WS-G-2.4	Decommissioning of Nuclear Fuel Cycle Facilities (2001)
WS-G-5.1	Release of Sites from Regulatory Control on Termination of Practices (2006)

One Safety Guide on safety assessment for decommissioning of nuclear facilities is being developed.

Rehabilitation

WS-R-3	Remediation of Areas Contaminated by Past Activities and Accidents (2003)

One Safety Guide on implementation of remediation process for areas affected by past activities and accidents is being developed.

Transport Safety

TS-R-1	Regulations for the Safe Transport of Radioactive Material 2005 Edition (2005)
TS-G-1.1	Advisory Material for the Regulations for the Safe Transport of Radioactive Material (2002) (under revision)
TS-G-1.2	Planning and Preparing for Emergency Response to Transport Accidents Involving Radioactive Material (2002)

Five Safety Guides on advisory material for the regulations, management systems for the safe transport of radioactive material, compliance assurance, schedule of provisions and management system are being developed.

Facility Specific Safety Standards

Design of Nuclear Power Plants (NPPs)

NS-R-1	Safety of NPPs: Design (2000)
NS-G-1.1	Software for Computer Based Systems Important to Safety in NPPs (2000)
NS-G-1.2	Safety Assessment and Verification for NPPs (2002)
NS-G-1.3	Instrumentation and Control Systems Important to Safety in NPPs (2002)
NS-G-1.4	Design of Fuel Handling and Storage Systems in NPPs (2003)
NS-G-1.5	External Events Excluding Earthquakes in the Design of NPPs (2004)
NS-G-1.6	Seismic Design and Qualification for NPPs (2003)
NS-G-1.7	Protection Against Internal Fires and Explosions in the Design of NPPs (2004)
NS-G-1.8	Design of Emergency Power Systems for NPPs (2004)
NS-G-1.9	Design of the Reactor Coolant System and Associated Systems in NPPs (2004)
NS-G-1.10	Design of the Reactor Containment Systems for NPPs (2004)
NS-G-1.11	Protection Against Internal Hazards Other than Fire and Explosions (2004)
NS-G-1.12	Design of the Reactor Core for NPPs (2005)
NS-G-1.13	Radiation Protection Aspects of Design for Nuclear Power Plants (2005)
79	Design of Radioactive Waste Management Systems at NPPs (1986)

Four Safety Guides on safety classification of structures, systems and components, on development and application of level and level 2 PSA and on verification and validation of computational tools for accident analysis are being developed.

Operation of NPPs

NS-R-2	Safety of NPPs: Operation (2000)
NS-G-2.1	Fire Safety in Operation of NPPs (2000)
NS-G-2.2	Operational limits and conditions and operating procedures for NPPs (2000)
NS-G-2.3	Modifications to NPPs (2001)
NS-G-2.4	The Operating Organization for NPPs (2002)
NS-G-2.5	Core Management and Fuel Handling for NPPs (2002)
NS-G-2.6	Maintenance, Surveillance and In-Service Inspection in NPPs (2002)
NS-G-2.7	Radiation Protection and Radioactive Waste Management in the Operation of NPP (2002)
NS-G-2.8	Recruitment, Qualification and Training of Personnel for NPPs (2003)
NS-G-2.9	Commissioning of NPPs (2003)
NS-G-2.10	Periodic Safety Review of NPPs (2003)
NS-G-2.11	A System for the Feedback of Experience from Events in Nuclear Installations (2006)

Four Safety Guides on conduct of operations, ageing management, seismic evaluation of existing nuclear power plants and on severe accident management are being developed.

Research Reactors

NS-R-4	Safety of Research Reactors (2005)
NS-G-4.1	Commissioning of Research Reactors (2006)
NS-G-4.2	Maintenance, Periodic Testing and Inspection of Research Reactors (2006)
35-G1	Safety Assessment of Research Reactors and Preparation of the Safety Analysis Report (1994) (under revision)

35-G2 Safety in the Utilization and Modification of Research Reactors (1994) (under revision)

Seven Safety Guides on: operational limits and conditions; operating organization, recruitment, training and qualification; radiation protection and waste management; core management and use of graded approach are being developed.

Fuel Cycle Facilities

116 Design of Spent Fuel Storage Facilities (1995) (under revision)
117 Operation of Spent Fuel Storage Facilities (1995) (under revision)

One Safety Requirements on safety of fuel cycle facilities, and six Safety Guides on: safety of uranium fuel fabrication; MOX fuel fabrication; conversion facilities; reprocessing facilities; fuel cycle R&D and storage of spent fuel are being developed.

Radiation Related Facilities

107 Radiation Safety of Gamma and Electron Irradiation Facilities (1992) (under revision)
RS-G-1.6 Occupational Radiation Protection in the Mining and Processing of Raw Materials (2004)

Three Safety Guides on medical uses, on industrial radiography and on gamma, electron and X ray irradiation facilities

Waste Treatment and Disposal Facilities

WS-R-1 Near Surface Disposal of Radioactive Waste (1999) (under revision)
WS-R-4 Geological Disposal of Radioactive Waste (2006)
WS-G-1.1 Safety Assessment for Near Surface Disposal of Radioactive Waste (1999) (under revision)
111-G-3.1 Siting of Near Surface Disposal Facilities (1994) (under revision)
111-G-4.1 Siting of Geological Disposal Facilities (1994) (under revision)

One Safety Requirement on radioactive waste disposal and four Safety Guides on: geological disposal of radioactive waste; borehole disposal of radioactive waste; near surface disposal of radioactive waste; and monitoring and surveillance of disposal facilities are being developed.

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