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(GC(XXXV)/952)

MEASURES TO STRENGTHEN INTERNATIONAL CO-OPERATION IN MATTERS RELATING TO NUCLEAR SAFETY AND RADIOLOGICAL PROTECTION

(a) IMPLEMENTATION OF RESOLUTIONS GC(XXXIV)/RES/529 AND GC(XXXIII)/RES/508

Member States' use of the Agency's services for advancing operational safety

The attached report by the Board of Governors and the Director General is being submitted to the General Conference pursuant to a request made by the Conference last year in resolution GC(XXXIV)/RES/529.

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MEMBER STATES' USE OF THE AGENCY'S SERVICES FOR ADVANCING OPERATIONAL SAFETY

Introduction

1. In operative paragraph 5 of resolution GC(XXXIV)/RES/529, the General Conference last year recommended to Member States that they "avail themselves fully of the Agency's services for advancing operational safety". This paper gives a brief account of - inter alia - the use being made of those services by Member States. The services, which respond to a perceived need for greater and more visible international nuclear safety efforts organized through the Agency, complement national efforts and are not intended to compete with or replace the exercise of national responsibility.

Operational/Pre-Operational Safety Review Teams (OSARTs/Pre-OSARTs)

2. The Operational Safety Review Team (OSART) programme (later to become in effect an OSART/Pre-OSART programme) was initiated in 1982. Under it, a Member State may request an international team to conduct an in-depth review - usually lasting three weeks - of operational safety practices at any of its nuclear power plants. To date (June 1991) 48 missions involving more than 440 external experts and observers in addition to Agency staff members have taken place - 35 OSART missions to plants in operation and 13 Pre-OSART missions to plants under construction. In all, 42 plants in 24 countries have been visited. It is expected that by the end of 1991 the number of missions will have risen to 53, including OSART missions in the context of the extrabudgetary project on the safety of WWER-440/230 plants (this project will be described in a General Conference document to be issued in September). A list of the OSART missions carried out by the end of 1990 and one of those carried out in or planned for 1991 are given in Tables 1A and 1B respectively.

3. The OSART programme provides for on-site international peer reviews of operational safety at nuclear power plants, covering key areas such as: management, organization and administration; training and qualification; operations; maintenance; radiation protection; chemistry; and emergency planning and preparedness. Pre-OSART missions to nuclear power plant construction sites focus on construction quality as a prerequisite for safe operation and normally cover the following areas: project management; quality assurance; civil construction; mechanical, electrical and instrumentation and control (I&C) equipment; preparations for start-up and operation; training and qualification; and radiation protection and emergency response planning. The detailed objectives of and guidelines for OSART missions were published in IAEA-TECDOC-449.

4. Typically, during a three-week period, a team of ten to fifteen experienced specialists assesses plant practices and construction site practices with reference to international standards. Although national authorities are not obliged to act on OSART/Pre-OSART recommendations, follow-up missions to review corrective measures stemming from such recommendations have become an integral feature of the programme.[1])

5. Currently, OSART/Pre-OSART missions are being carried out at a rate of about one a month. Regular use of the service by all Member States with nuclear power plants - in keeping with the size, structure and developmental status of their programmes - is envisaged.

6. The results of each OSART/Pre-OSART mission are summarized in a report submitted to the responsible organizations in the Member State hosting the mission. In addition, OSART/Pre-OSART mission highlights are published from time to time in a manner that preserves the anonymity of the nuclear power plants covered (see IAEA-TECDOCs-458, 497 and 570). Moreover, the Secretariat is

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1 An assessment of OSART follow-up visits is contained in the Appendix to this report.

planning to issue another type of publication soon - on "OSART Good Practices" which may serve as models for plant operators in striving for excellence.

Assessment of Safety Significant Events Teams (ASSETs)

7. The ASSET service was established in 1986. A list of the ASSET missions carried out and planned is given in Table 2. Using a systematic methodology, ASSET missions analyze root causes of incidents/accidents and assess the effectiveness of improvements in the area of operational safety. The detailed objectives of and guidelines for ASSET missions were published in IAEA-TECDOC-573. Three types of assistance are offered: ASSET missions as such; "implementation missions", to assist in making changes in operational safety management (including hardware changes); and training workshops. It is expected that in the future Member States will make increased use of ASSET training workshops. On the basis of the experience gained, it is planned to expand and refine the ASSET methodology and to aim for international acceptance of the ASSET approach. The lessons learned from the activities of the ASSET service are to be disseminated through annual summary reports.

Incident Reporting System (IRS)

8. The Agency has been operating the IRS in co-operation with the Nuclear Energy Agency of the Organisation for Economic Co-operation and Development (NEA/OECD) since 1983. The criteria for reporting are laid down in Safety Series No. 93. By the end of June 1991 the IRS database contained 1533 records. During 1990 the Agency received 170 reports, 116 from OECD and 54 from non-OECD countries. Reports from OECD countries are received mainly through NEA/OECD, which last year agreed with the Agency that it would provide all reports from NEA/OECD countries for inclusion in the IRS database. Table 3 lists the countries participating in the IRS and gives the number of reports received from each. Discussions are continuing between the Agency and NEA/OECD on ways of achieving closer co-ordination. In future more emphasis will be placed on selecting types of incidents for in-depth analysis. A first report on incidents

involving precursors of interfacing loss-of-coolant accidents was prepared in 1990 (see IAEA-J4-CS75). The lessons learned from IRS activities are to be disseminated through annual summary reports.

International Nuclear Event Scale (INES)

9. During 1990 INES was finalized and adopted for a one-year trial period (attached to this document). A list of Member States which have nominated INES national officers is given in Table 4. The rating of the safety significance of nuclear events, based on seven levels and three attributes (on-site effects, off-site effects and degradation of defence in-depth), is described in detail in a users' manual (see IAEA-INES-90/1). Although the scale was developed primarily for rapid communication with the public, it is being used increasingly for technical purposes: many recent IRS reports have used INES, and ASSETs use it to rate the safety significance of events being studied. The Secretariat hopes that in due course all significant events and all other events of public interest will be reported to the Agency within 24 hours using the INES system. It is planned to supplement IRS reporting criteria by criteria based on INES. INES is at present limited to nuclear power plants, but it could be extended to cover all nuclear installations and the transport of radioactive materials. Ultimately, through co-operation between the Agency and other United Nations organizations, INES could be adapted for use in connection with industrial incidents/accidents in general.

International Peer Review Services for Probabilistic Safety Assessment (PSA) Studies (IPERS)

10. Member States are making increasing use of PSA methodology. Since PSAs cover design and operational information, they are being used increasingly in operational safety management ("living" PSAs) and in determining accident management procedures. The Agency has helped many developing Member States to perform PSAs, and an increasing number of them are requesting the Agency to arrange for international peer reviews of the PSAs performed. A list of the

IPERS missions carried out and requested is given in Table 5. All essential aspects of PSAs, including operational safety aspects, are reviewed on the basis of IPERS guidelines (see IAEA-TECDOC-543) and the Agency's PSA guidelines. Although the objective of IPERS is to examine how PSAs have been performed, identified design or operational safety weaknesses are also commented on.

Other safety services

11. In addition to what may now be regarded as routine services for advancing operational safety referred to above, the Agency offers the well-known Radiation Protection Advisory Team (RAPAT) service and various services which cover special aspects of nuclear power plant operational safety or address research reactor safety: Integrated Safety Assessments of Research Reactors (INSARR); Design Review Services; and - in co-operation with UNEP, UNIDO and WHO - services relating to health and environmental hazards of incidents/accidents at industrial facilities in general. A footnote-a/ TC project also exists to assist developing Member States facing specific practical problems related to nuclear safety by organizing specialized safety assessment missions comprising small numbers of international experts (INT/9/123).

Finances

12. Developed Member States bear the costs of missions requested by them. In the case of developing Member States, the costs are covered through interregional, regional or national technical co-operation projects, but the host countries provide free board and lodging in the case of OSART missions. The costs of organizing missions and preparing reports are covered from the Regular Budget resources of the Division of Nuclear Safety.

13. The steady increase in requests for nuclear safety services under zero-real-growth budget conditions is necessarily affecting other parts of the nuclear safety programme. Professional and General Service staff have beenrecruited

under special service agreements and temporary assistance contracts to accommodate the growing demand, and it has been necessary to reduce the manpower and financial resources allocated to other parts of the nuclear safety programme and to delay or cancel some planned activities. The implementation of missions to developing countries is made difficult by the fact that no separate technical co-operation budget exists for the Agency's safety services.

14. In resolution GC(XXXIV)/RES/529, the General Conference urged the Secretariat and the Board to pursue the strategy outlined in the report contained in document GC(XXXIV)/919. A major point made in that report was that "Resources should be substantially increased so as to enable the Agency's safety services ...... to respond to the growing demand from Member States". Clearly, this cannot be done under zero-real-growth budget conditions without cutting back other approved activities.

OSART/PRE-OSART MISSIONS - 1983-1990

COUNTRY	REACTOR* UNITS IN OPERATION (MISSIONS)	REACTOR TYPE	YEAR
BRAZIL	1 (2)	PWR	1985, 89
BULGARIA	5 (2)	PWR	1990
CANADA	18 (1)	PTR	1987
CHINA	- (2)	PWR	1989, 90
CSFR	8 (2)	PWR	1989, 90
FINLAND	4 (2)	BWR, PWR	1986, 90
FRANCE	55 (2)	PWR	1985, 88
GERMANY	30 (3)	BWR, PWR	1986, 87
HUNGARY	4 (1)	PWR	1988
ITALY	2 (2)	BWR	1987, 88
JAPAN	39 (1)	PWR	1988
KOREA	9 (3)	PWR	1983, 87, 89
MEXICO	1 (3)	BWR	1986, 87
NETHERLANDS	2 (2)	BWR, PWR	1986, 87
PAKISTAN	1 (2)	PTR	1985, 89
PHILIPPINES	- (2)	PWR	1984, 85
POLAND	- (1)	PWR	1989
ROMANIA	- (1)	PTR	1990
SPAIN	10 (2)	BWR, PWR	1987, 90
SWEDEN	12 (3)	BWR	1986, 88, 89
U.K.	39 (1)	GCR	1989
U.S.A.	110 (2)	PWR	1987, 89
U.S.S.R.	46 (2)	PWR	1988, 89
YUGOSLAVIA	1 (1)	PWR	1984

BWR = BOILING WATER REACTOR
PWR = PRESSURIZED WATER REACTOR
PTR = PRESSURE TUBE REACTOR
GCR = GAS COOLED REACTOR

* as of 31 December 1990

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OPERATIONAL SAFETY REVIEW MISSIONS IN 1991

COUNTRY	PLANT	OSART DATE
SWEDEN	RINGHALS 3-4	14 JAN. - 1 FEB.
*CSFR	BOHUNICE 1-2	8 - 26 APRIL
*BULGARIA	KOZLODUY 1-4	3 - 21 JUNE
BULGARIA	KOZLODUY 5	15 JULY - 2 AUG.
*USSR	NOVOVORONEZH 3-4	12 - 30 AUGUST
ROMANIA	CERNAVODA	2 - 20 SEPTEMBER
*USSR	KOLA 1-2	9 - 27 SEPTEMBER
SOUTH AFRICA	KOEBERG	4 - 22 NOVEMBER
GERMANY	GRAFENRHEINFELD	25 NOV. - 13 DEC.

TABLE 1 B

July 1991

*Part of safety review missions to older VVER plants

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TABLE 2

ACTIVITIES OF THE ASSET SERVICE
1986 - 1992
REQUESTED BY MEMBER STATES
(as of 21 June 1991)

ASSET MISSIONS (M), WORKSHOPS(W), IMPLEMENTATION MISSIONS (I), FOLLOW-UP MISSIONS (F)				TRAINING SESSION ON THE ASSET INVESTIGATION METHODOLOGY	
TYPE	NPP	COUNTRY	YEAR	COUNTRY	YEAR
M	KRSKO	YUGOSLAVIA	1986		
M	ANGRA	BRAZIL	1988		
M	KARACHI	PAKISTAN	MAY 1989		
M	KARACHI	PAKISTAN	SEPT. 1989		
M	IGNALINA	USSR	NOV. 1989		
M	GREIFSWALD	GDR	JAN. 1990		
I	GREIFSWALD	GDR	JUNE 1990	GDR	JULY 1990
W	GRAVELINES	FRANCE	JULY 1990	HUNGARY	SEPT. 1990
M	BOHUNICE	CZECHOSLOVAKIA	OCT. 1990		
M	KOZLODUY	BULGARIA	NOV. 1990		
W	VANDELLOS	SPAIN	DEC. 1990		
I	KARACHI	PAKISTAN (Rec.No.3)	6-10 JAN. 1991	BELGIUM	28 JAN.-1 FEB. 1991
I	KARACHI	PAKISTAN (Rec.No.6)	13-17 FEB. 1991	SPAIN	11-15 FEB. 1991
I	KARACHI	PAKISTAN (Rec.No.5)	17-28 FEB. 1991	KOREA, REP.OF	18-22 MAR. 1991
M	LAGUNA VERDE	MEXICO	24 FEB.-8 MAR.1991	NETHERLANDS	8-12 APR. 1991
M	KOLA	USSR	15-26 APR. 1991	ARGENTINA	22-26 JULY 1991
M	NOVOVORONEZH	USSR	13-24 MAY 1991	USSR	7-11 OCT. 1991
M	KOZLODUY	BULGARIA	4-15 NOV. 1991	SWEDEN	21-25 OCT. 1991
M	FESSENHEIM	FRANCE	4-16 MAY 1992	BULGARIA	13-17 JAN. 1992
F	ANGRA	BRAZIL	4th quarter of 1992	CZECHOSLOVAKIA	3- 7 FEB. 1992
				CHINA	9-13 MAR. 1992

* In 1991 -
- Developed countries will be invoiced for travel and per diem of the ASSET experts. No salary is paid to the ASSET experts.
- For developing countries, TCAC will bear travel and per diem of the ASSET experts. No salary is paid to the ASSET experts.

TABLE 3

COUNTRIES WITH NUCLEAR POWER PLANTS
PARTICIPATING IN IAEA-IRS
(July 1991)

		Status of participation in IAEA-IRS	Start of participat-ion	No. of units in operation (31.12.90)	No. of IRS country reports
1.	ARGENTINA	PARTICIPANT	05.83	2	8
2.	BELGIUM	THROUGH NEA	02.83	7	28
3.	BRAZIL	PARTICIPANT	11.83	1	6
4.	BULGARIA	PARTICIPANT	02.85	5	11
5.	CANADA	PARTICIPANT	05.87	20	56
6.	CHINA	OBSERVER	06.91	-	-
7.	CSFR	PARTICIPANT	01.85	8	19
8.	FINLAND	PARTICIPANT	05.83	4	31
9.	FRANCE	THROUGH NEA	06.83	56	103
10.	GERMANY	THROUGH NEA	07.83	26	69
11.	HUNGARY	PARTICIPANT	10.84	4	9
12.	INDIA	PARTICIPANT	06.84	7	27
13.	ITALY	THROUGH NEA	03.85	-	13
14.	JAPAN	THROUGH NEA	02.91	41	80
15.	KOREA (Rep.of)	PARTICIPANT	02.83	9	20
16.	MEXICO	PARTICIPANT	09.90	1	-
17.	NETHERLANDS	PARTICIPANT	06.83	2	14
18.	PAKISTAN	PARTICIPANT	08.84	1	6
19.	SOUTH AFRICA	PARTICIPANT	04.90	2	4
20.	SPAIN	PARTICIPANT	01.83	9	24
21.	SWEDEN	THROUGH NEA	10.83	12	21
22.	SWITZERLAND	THROUGH NEA	02.87	5	22
23.	UNITED KINGDOM	PARTICIPANT	03.86	37	56
24.	USA	THROUGH NEA	08.85	112	269
25.	USSR	PARTICIPANT	09.84	45	97
26.	YUGOSLAVIA	PARTICIPANT	05.86	1	12
	TOTAL			417	1005

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(9229d) As of 25 January 1991

TRIAL IMPLEMENTATION OF THE INTERNATIONAL NUCLEAR EVENT SCALE (INES)

Country	Participation	Starting Date	INES National Officer	Fax number/Telex
Argentina	Yes	1 January 1991	Touzet, R.	5449252
Belgium	Yes	22 June 1990	Deckers, B.	02 537 46 19
Brazil	Yes	1 January 1991	Gasparian, A.	55-21-5462379
Bulgaria	Yes	1 January 1991	Ganchev, T.	003592702143/23383 KAE BG
Canada	Yes	1 October 1990	Andersen, W.	416 592 2893
China	Yes	1 February 1991	——	
Czech and Slovak Rep.	Yes	1 October 1990	Brandejs, P.	215-2467
Denmark	Yes	1 October 1990	Kampmann, D.	4531381102/27410 CFS DK
Egypt	Yes	October 1990	Raschad, S.	00202 354 0982
Finland	Yes	1 June 1990	Tossavainen, K. (Mrs)	358 0 708 2392
France	Yes	28 May 1990	Breuil, J.	45564869/204336 F SURATOM
Germany	Yes	1 January 1991	Kotthoff, K.	02212068442/2214123 grs d
Hungary	Yes	1 January 1991	Czoch, I. (Mrs)	0036 114 27598
India	Yes	1 January 1991	Sarma, M.S.R.	0091225550990
Italy	Yes	1 January 1991	Mussapi, R.	500 72916
Japan	Yes	——	——	
Korea, Rep. of	Yes	1 January 1991	Hong, S.	503 76 73
Mexico	Yes	1 January 1991	——	
The Netherlands	Yes	16 August 1990	Van Iddekinge, F.W.	31 70 3334018
Pakistan	Yes	1 October 1990	Maqbool, N.	0092-51-824575
South Africa	Yes	——	——	
Spain	Yes	1 October 1990	Gil, J.	346 0471
Sweden	Yes	1 October 1990	Sjöberg, M.	46 8-661 90 86
Switzerland	Yes	1 October 1990	Deutschmann, H.	056 99 39 07
UK	Yes	1 November 1990	Ludlow, J. J.	0272 64 8000
USA	No	——	——	
USSR	Yes	1 September 1990	Andreev, V. I.	2002273
Yugoslavia	Yes	October 1990	Levstek, M.	38 61 343 667
			INES LIAISON OFFICER	
WANO	Yes		Eckered, T.	071 351 9678
CEC	Yes		Courades, J-M.	4301 4646 (Lux)
OECD	Yes		Ilari, O.	33 1 45 24 94 24
INES COORDINATOR (IAEA)			Thomas, B. Ruatti, D.	+ 43 1 234564
Chairman INES			Taylor, R.H.	0272 64 84 95

TABLE 4

TABLE 5

ACTIVITIES OF THE IPERS SERVICE
1989-1990

REQUESTED* BY MEMBER STATES
(as of 1 July 1991)

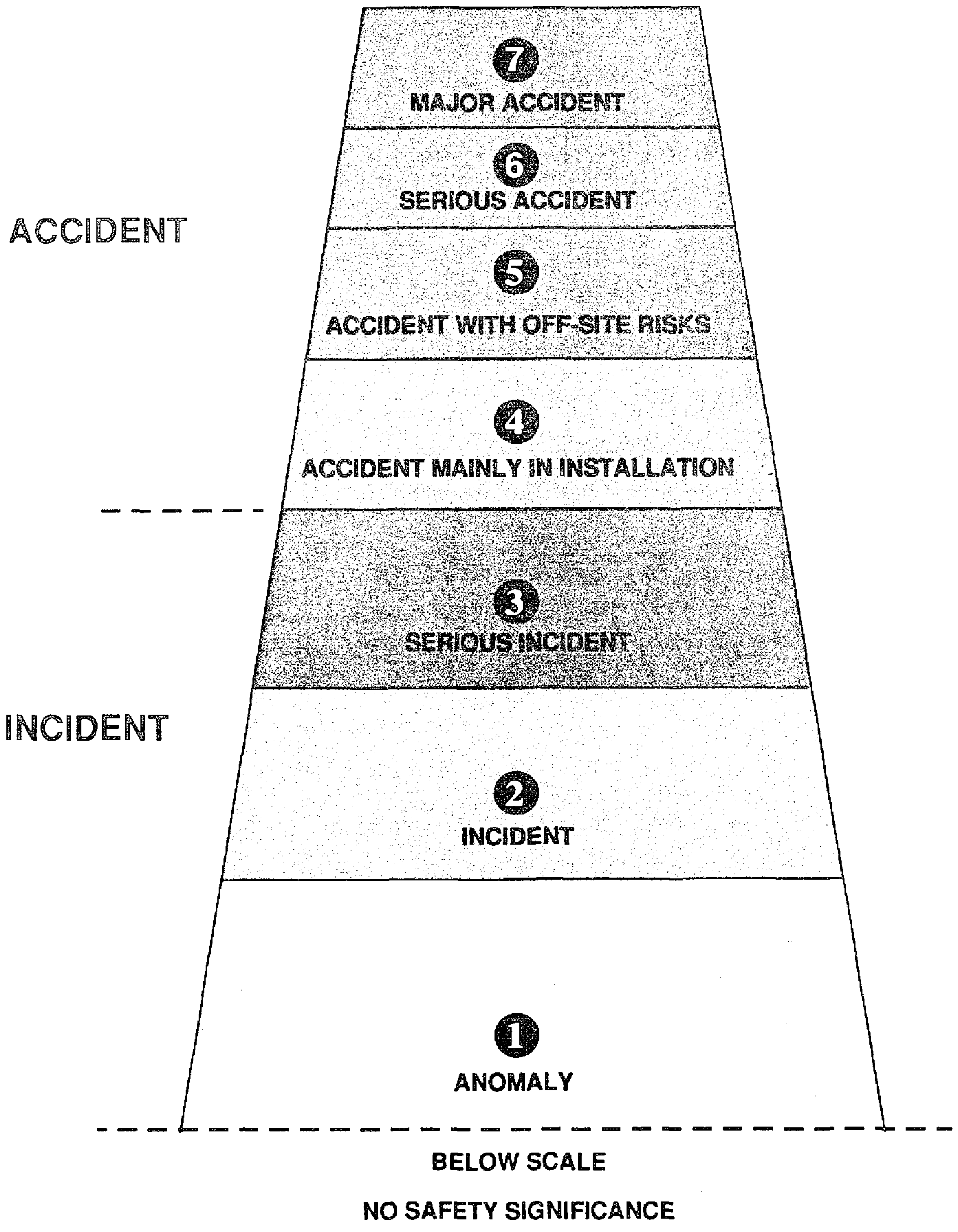
NPP**	Country	Date
Gorki	USSR	22 May - 15 June 1989
Borssele	Netherlands	21 Aug. - 1 Sept. 1989
Guangdong	P.R. China	27 Nov. - 8 Dec. 1989
Forsmark 1&2	Sweden	5 - 23 March 1990
Borssele	Netherlands	18 - 29 June 1990
Cernavoda	Romania	15 - 25 October 1990
Dodewaard	Netherlands	6 - 17 May 1991
Kori 3&4	R.O.K.	27 - 31 May 1991 26 Aug. - 6 Sept. 1991
Borssele	Netherlands	9 - 13 Sept. 1991 14 - 25 Oct. 1991
Dodewaard	Netherlands	1992
Krsko	Yugoslavia	1992
Cernavoda	Romania	1993

* Additional requests are presently expected for IPERS for Muehleberg (Switzerland) to be carried out 1991 and for Cofrentes (Spain) to be carried out 1992.

** Several IPERS missions may be requested for plant corresponding to different stages of completion of a PSA.

The International Nuclear Event Scale

For prompt communication of safety significance



Background

The International Nuclear Event Scale is a means for promptly communicating to the public in consistent terms the safety significance of events reported at nuclear power plants. By putting events into proper perspective, the Scale can facilitate a common understanding between the nuclear community, the media, and the public.

The Scale was designed by an international group of experts convened jointly by the International Atomic Energy Agency and the Nuclear Energy Agency of the Organisation for Economic Co-operation and Development. The group was guided in its work by the findings from a series of international meetings held to discuss general principles underlying such a scale. The Scale also reflects the experience gained from the use of similar scales in France and Japan and from considerations of possible scales in several other countries.

The Scale is being applied initially for a trial period of about one year, during which the international agencies and user countries will monitor its progress. It would be revised, as necessary, based on user experience and feedback from the nuclear community, the media, and the public. The Scale is designed for use initially at nuclear power plants, but its application to events at other nuclear installations is desirable. To that end, the international agencies and user countries will consider what modifications might be needed to encompass the wider range of conditions which can prevail at other nuclear installations.

The Scale is designed for prompt assessment following an event. Internationally agreed guidance is available to assist those classifying events, but engineering judgement must play a role in fixing the appropriate level. Those using the Scale can also draw on validation experience gained by classifying events previously reported in several countries for different types of nuclear power reactors. Where necessary, justification for classifying an event at a particular level can be given. An event can be reclassified at a later date based on further analysis or developments, but reclassification should be kept to a minimum.

The Scale does not replace criteria adopted nationally and internationally for the reporting, description, definition, and technical analysis of nuclear events. Nor should it be used to compare safety performance in different countries. If a radiological emergency occurs in the vicinity of a nuclear power plant, existing national emergency planning will take precedence over the use of the Scale.

Although broadly comparable, detailed nuclear safety criteria and the associated terminology may vary from country to country. Although the Scale is designed to allow for this variance, a user country may wish to clarify it in the national context.

Using the scale

Events classified on the Scale (see back page) relate only to nuclear or radiological safety. These are classified at seven levels. The levels, their descriptors and detailed criteria are shown opposite, together with examples of classified nuclear events which have occurred at nuclear power plants. The lower levels (1–3) are termed incidents, and the upper levels (4–7) accidents. Events which have no safety significance are classified as Below Scale/Level Zero. Industrial accidents or other events which are not related to nuclear plant operations are not classified on the scale; these are termed Out of Scale.

As a rough guide, it might be expected that about ten times fewer events would be classified at each successively higher level of the Scale.

The matrix opposite explains the underlying logic of the Scale. Key words indicate generally the safety significance and are not intended to be precise or definitive. Events are considered in terms of three broad criteria represented by each of the columns: off-site impact, on-site impact, and defence-in-depth degradation.

The first criterion applies to events resulting in releases of radioactivity off-site. Understandably, the public is most concerned with such external releases. Level 7, the highest in this column, corresponds to a major nuclear accident with widespread health and environmental consequences. Level 3, the lowest point in this column, represents a very small release that would result in a radiation dose to the most exposed members of the public equivalent to a fraction of the prescribed annual dose limit for the public. Such a dose is typically about a tenth of the average annual dose from exposure to natural background radiation.

The second criterion considers the on-site impact of the event. The range is from Level 5, typically representing a situation of severe damage to the nuclear reactor core, down to Level 3 at which there is major contamination and/or overexposure of workers.

The third criterion applies to events involving the degradation of a plant's defence-in-depth. All plants are designed such that a succession of safety systems act to prevent major on-site and off-site impacts. The defence-in-depth considerations classify events as Levels 3 through 1.

An event which has characteristics represented by more than one criterion is always classified at the highest level according to any one criterion.

Examples of classified nuclear events

• The 1986 accident at the Chernobyl nuclear power plant in the Soviet Union had widespread environmental and human health effects. It is thus classified as Level 7.

• The 1957 accident at the air-cooled graphite reactor at Windscale (now Sellafield) facility in the United Kingdom involved an external release of radioactive fission products. Based on the off-site impact of this event, it is classified as Level 5.

• The 1979 accident at the Three Mile Island nuclear power plant in the United States resulted in a severely damaged reactor core. The off-site release of radioactivity was very limited. The event is classified as Level 5, based on the on-site impact.

• The 1980 accident at the Saint-Laurent nuclear power plant in France resulted in partial damage to the reactor core, but there was no external release of radioactivity. It is classified as Level 4, based on the on-site impact.

• The 1989 incident at the Vandellos nuclear power plant in Spain did not result in an external release of radioactivity, nor was there damage to the reactor core or contamination on site. However, the damage to the plant's safety systems degraded the defence-in-depth significantly. The event is classified as Level 3, based on the defence-in-depth criterion.

• From experience in validating the Scale, the majority of reported events were found to be below Level 3. Although no examples of these events are given here, countries using the Scale may wish to provide examples of events at these lower levels.

Underlying logic of the scale

(Criteria given in matrix are broad indicators only)

LEVEL/ DESCRIPTOR	CRITERIA OFF-SITE IMPACT	ON-SITE IMPACT	DEFENCE-IN-DEPTH DEGRADATION
7 MAJOR ACCIDENT	MAJOR RELEASE: WIDESPREAD HEALTH AND ENVIRONMENTAL EFFECTS		
6 SERIOUS ACCIDENT	SIGNIFICANT RELEASE: FULL IMPLEMENTATION OF LOCAL EMERGENCY PLANS		
5 ACCIDENT WITH OFF-SITE RISKS	LIMITED RELEASE: PARTIAL IMPLEMENTATION OF LOCAL EMERGENCY PLANS	SEVERE CORE DAMAGE	
4 ACCIDENT MAINLY IN INSTALLATION	MINOR RELEASE: PUBLIC EXPOSURE OF THE ORDER OF PRESCRIBED LIMITS	PARTIAL CORE DAMAGE ACUTE HEALTH EFFECTS TO WORKERS	
3 SERIOUS INCIDENT	VERY SMALL RELEASE: PUBLIC EXPOSURE AT A FRACTION OF PRESCRIBED LIMITS	MAJOR CONTAMINATION OVEREXPOSURE OF WORKERS	NEAR ACCIDENT — LOSS OF DEFENCE-IN-DEPTH PROVISIONS
2 INCIDENT			INCIDENTS WITH POTENTIAL SAFETY CONSEQUENCES
1 ANOMALY			DEVIATIONS FROM AUTHORIZED FUNCTIONAL DOMAINS
0 /BELOW SCALE			NO SAFETY SIGNIFICANCE

The International Nuclear Event Scale

for prompt communication of safety significance

LEVEL	DESCRIPTOR	CRITERIA	EXAMPLES
ACCIDENTS 7	MAJOR ACCIDENT	• External release of a large fraction of the reactor core inventory typically involving a mixture of short and long-lived radioactive fission products (in quantities radiologically equivalent to more than tens of thousands terabecquerels of iodine-131). Possibility of acute health effects. Delayed health effects over a wide area, possibly involving more than one country. Long-term environmental consequences.	Chernobyl, USSR 1986
6	SERIOUS ACCIDENT	• External release of fission products (in quantities radiologically equivalent to the order of thousands to tens of thousands of terabecquerels of iodine-131). Full implementation of local emergency plans most likely needed to limit serious health effects.	
5	ACCIDENT WITH OFF-SITE RISKS	◦ External release of fission products (in quantities radiologically equivalent to the order of hundreds to thousands of terabecquerels of iodine-131). Partial implementation of emergency plans (e.g. local sheltering and/or evacuation) required in some cases to lessen the likelihood of health effects. ◦ Severe damage to large fraction of the core due to mechanical effects and/or melting.	Windscale, UK 1957 Three Mile Island, USA, 1979
4	ACCIDENT MAINLY IN INSTALLATION	◦ External release of radioactivity resulting in a dose to the most exposed individual off-site of the order of a few millisieverts.* Need for off-site protective actions generally unlikely except possibly for local food control. ◦ Some damage to reactor core due to mechanical effects and/or melting. ◦ Worker doses that can lead to acute health effects (of the order of 1 Sievert).**	Saint-Laurent, France, 1980
INCIDENTS 3	SERIOUS INCIDENT	• External release of radioactivity above authorized limits, resulting in a dose to the most exposed individual off site of the order of tenths of a millisievert.* Off-site protective measures not needed. ◦ High radiation levels and/or contamination on-site due to equipment failures or operational incidents. Overexposure of workers (individual doses exceeding 50 millisieverts).** • Incidents in which a further failure of safety systems could lead to accident conditions, or a situation in which safety systems would be unable to prevent an accident if certain initiators were to occur.	Vandellos, Spain 1989
2	INCIDENT	◦ Technical incidents or anomalies which, although not directly or immediately affecting plant safety, are liable to lead to subsequent re-evaluation of safety provisions.	
1	ANOMALY	◦ Functional or operational anomalies which do not pose a risk but which indicate a lack of safety provisions. This may be due to equipment failure, human error or procedural inadequacies. (Such anomalies should be distinguished from situations where operational limits and conditions are not exceeded and which are properly managed in accordance with adequate procedures. These are typically "below scale".)	
BELOW SCALE/ZERO	NO SAFETY SIGNIFICANCE		

April 1990

* *The doses are expressed in terms of effective dose equivalent (whole body dose). Those criteria where appropriate also can be expressed in terms of corresponding annual effluent discharge limits authorized by National authorities.*

** *These doses are also expressed, for simplicity, in terms of effective dose equivalents (sieverts), although the doses in the range involving acute health effects should be expressed in terms of absorbed dose (grays).*

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ASSESSMENT OF OSART FOLLOW-UP VISITS

1. A typical OSART consists of a Team Leader, twelve experts and two or three observers from developing countries. The Team Leader and two or three of the experts are IAEA staff members; one of the Agency experts is responsible for liaison between the IAEA and the host country/plant (Country Officer). The remaining experts - drawn from Member States - are persons who have nuclear power plant or regulatory experience in one or more OSART/Pre-OSART review areas (see Table 1).

2. During each OSART/Pre-OSART mission, the experts review operational/pre-operational safety practices against accepted international good practices and make proposals for improvement. The proposals take two forms: recommendations aimed at the root causes of shortcomings; and suggestions indicating useful expansions of or superior alternatives to ongoing safety-related activities. They are conveyed in detail direct to the nuclear power plant operator/utility in Technical Notes and in summary to the Government of the Member State in an IAEA OSART/Pre-OSART Report submitted through official channels. An indication of the issues raised and proposals made by OSARTs is given in the Annex to this paper.

3. From the beginning of the OSART programme, the Secretariat has requested that it be provided with information on the implementation of OSART proposals. There developed an unstructured feedback process which was replaced in 1987 by a more formalized process involving, after the OSART/Pre-OSART mission, a one-week follow-up visit by the Team Leader, the Country Officer and one or more other members of the original team. The purpose of a follow-up visit is to determine the status of all proposals made in the Technical Notes and to assess whether follow-up actions have been adequately discharged and/or whether progress on uncompleted actions is satisfactory.

4. In advance of a follow-up visit, the nuclear power plant operator/utility prepares documentation outlining the progress made in implementing the OSART/Pre-OSART proposals and provides information on upgrading carried out independently of OSART/Pre-OSART activities. Discussions at the nuclear power plant during the follow-up visit lead to detailed documentation of the follow-up results and the production of a follow-up report, which is submitted to the Member State.

5. The follow-up process is supported by guidance material covering: the purpose of follow-up visits; team composition; the funding, timing and duration of visits; preparations to be made by the nuclear power plant operator/utility; follow-up review procedures; and reporting of the outcome. The guidance material includes sample schedules for follow-up visits and examples of the documents which the nuclear power plant operator/utility is required to produce in advance of the mission.

6. The principle of voluntary co-operation between Member States and the Agency which applies in the case of OSART/Pre-OSART missions applies also in that of follow-up visits - i.e. these are also carried out in response to official requests made by Member States, which can express preferences regarding emphasis on particular review areas. Follow-up visits have in fact become an integral part of the OSART programme, being discussed and agreed upon at the preparatory meetings for OSART/Pre-OSART missions.

7. Although there is no lack of willingness to pursue excellence in operational safety and to move towards the adoption of best international practices, circumstances - political, economic or technical - can have a major impact on the implementation of OSART/Pre-OSART proposals: industrialized Member States may, once convinced of the relevance of proposed improvements, be capable of implementing proposals without delay, whereas developing Member States - and countries in Eastern Europe - sometimes face obstacles that are difficult and time-consuming to overcome.

8. In some Member States, the regulatory authorities like to become actively involved in follow-up visits in order to review and define more clearly their own positions on some of the key issues raised during OSART/Pre-OSART missions. In other Member States, a meeting involving regulatory authorities at the end of the follow-up visit sometimes serves the same purpose.

9. Since the introduction of the follow-up process there have been twelve follow-up visits, most of them taking place 12-18 months after the OSART/Pre-OSART mission. Typically, the follow-up team has spent a week with the plant manager and senior plant personnel assessing their response to each proposal and making technical comments supplemented by a broad categorization indicating whether an issue can be regarded as "resolved", whether "satisfactory progress" or "little or no progress" has been made in resolving an issue, or whether a proposal should be "withdrawn" (see Table 2, which summarizes the outcome of the most recent follow up visits).

10. There is generally only one follow-up visit for each OSART/Pre-OSART mission, and so, in cases where little or no progress has been made in resolving issues, the onus is clearly on the regulatory bodies in question to assume the task of tracking nuclear power plant operator/utility actions in order to ensure satisfactory completion. The Secretariat would, however, be willing to organize additional follow-up visits if it were requested to do so. Also, it would inform a Member State at the end of a follow-up visit if it considered a further follow-up visit to be essential; this might happen if, for example, work on major issues was outstanding.

11. The fact that only few proposals have been withdrawn is one of the indications that OSART/Pre-OSART missions are effective in identifying valid operational safety issues. Also, as the vast majority of the issues are in the first two categories, "resolved" and "satisfactory progress", it may be concluded that nuclear power plant operators/utilities and Member States are taking OSART/Pre-OSART missions seriously and making worthwhile improvements in operational safety.

TABLE 1

OSART Review Areas

Management, Organization and Administration

Training and Qualification

Operations

Maintenance

Technical Support

Radiation Protection

Chemistry

Emergency Planning and Preparedness

Pre-OSART Review Areas

Project Management

Quality Assurance in Construction

Civil Engineering Works

Mechanical Engineering Works

Electrical Engineering Works

Commissioning, Start-up and Acceptance Testing

Preparation for Operation

Training and Qualification

Radiation Protection

Emergency Planning and Preparedness

TABLE 2

SUMMARY OF THE RESULTS OF OSART FOLLOW-UP VISITS

REVIEW AREA	ISSUES RESOLVED	SATISFACTORY PROGRESS	LITTLE OR NO PROGRESS	PROPOSAL(S) WITHDRAWN	TOTAL
Management, Org. &Administration	38	39	12	1	90
Training & Qualification	67	63	14	--	144
Operations	63	57	14	9	143
Maintenance	33	42	5	2	82
Technical Support	59	49	13	--	121
Radiation Protection	29	21	11	8	69
Chemistry	33	38	9	--	80
Emergency Plan. & Preparedness	67	43	25	--	135
Total (%)	389 (45)	352 (41)	103 (12)	20 (2)	864 (100)

The above table summarizes the results of OSART follow-up visits to nine plants:

Barsebäck (Sweden)	30 Oct - 3 Nov 1989
Forsmark (Sweden)	30 Oct - 3 Nov 1989
Krsko (Yugoslavia)	30 May - 1 June 1990
Rovenskaya (USSR)	25-29 June 1990
Oldbury (UK)	15-19 October 1990
Dukovany (Czechoslovakia)	12-16 November 1990
Paks (Hungary)	25 Feb - 1 Mar 1991
Oskarshamn (Sweden)	11-15 March 1991
Cofrentes (Spain)	13-17 May 1991

ANNEX: SUMMARY OF ISSUES RAISED AND PROPOSALS MADE BY RECENT OSARTs

The following has been taken from 'OSART Mission Highlights, 1989-1990' which is to be published shortly in the IAEA-TECDOC series. This will be the fourth such summary of OSART missions. Previous summaries are IAEA-TECDOCS-458, 497 and 570.

Extracts of each of the eight OSART review areas are given below.

Management, Organization and Administration

Important functions were not always managed in a systematic, structured manner. In some cases attention was drawn to the fact that the plant manager or his deputy had too many organizational units reporting directly to him. In these cases some intermediate level manager positions were proposed.

In some cases there was a need for managers to be more involved in the daily work and to visit plant areas since this would enable them to better assess plant conditions and give them an opportunity to meet members of staff at their place of work so indicating management's interest and concern in all aspects of the power plant's life.

In most cases there were adequate quality assurance programmes in place but improvements were necessary. Proposals included auditing techniques and quality control programmes.

Training and Qualification

Most training programmes were found to be satisfactory but were sometimes resource limited. In most cases full time instructors were well qualified but plant personnel used as regular part time lecturers or who supervised on-the-job training were in need of training in instructional skills.

Initial training programmes were generally of good quality but capable of improvement in such areas as upgrading simulator training, developing accident management training and having a more structured on-the-job training programme.

At many plants the continuing (or refresher) training programmes were not as good as the initial training programme. Programmes for control room staff were generally satisfactory but this was not generally the case for other personnel groups such as maintenance or technical support.

Operations

Operating procedures and instructions were generally well prepared in all the plants visited; systems were in place to control their updating. However, improvements were necessary in systems controlling temporary changes to procedures. Several improvements were recommended for emergency procedures and their use.

The operating history of the plants visited showed high plant availabilities which were improving. The number of reactor scrams was reducing because of good application of root cause analyses. At one plant, however, the setting up of a scram reduction committee was proposed plus the formalising of approval to restart by senior personnel.

Maintenance

The organization of maintenance activities differed widely but at most plants it was found to be effective and efficient. Only at a few plants was it necessary to propose that the maintenance structure be simplified.

Most plants had suitable work control and maintenance history systems which were computerized. OSARTs have frequently recommended that industrial safety programmes should be strengthened.

Outages were managed acceptably and all plants had satisfactory spare parts procurement and storage facilities although for some it was recommended that good environmental conditions or shelf life programmes were necessary to achieve desired results.

Technical Support

The importance of surveillance activities for safe and reliable operation of nuclear power plants was fully recognized and in most plants good surveillance test procedures were available. In some cases the content and format of the test procedures were not fully consistent and in others did not conform to good international practice. In general results were properly recorded but there were few programmes for comprehensive analysis of trends.

The basic elements of adequate evaluation and feedback of operational experience were in place. Many indications pointed to steady improvement in this area with closer co-operation between utilities, regulatory bodies and international institutions but in some plants greater measures were needed to make effective use of external operating experience in strengthening plant performance.

Plant modification programmes were generally found to be appropriately managed to ensure that proposed modifications were evaluated before implementation. At some plants, modifications were being developed to address severe accident concerns beyond the design basis of the plant.

Radiation Protection

Arrangements at power plants differed due to different regulatory systems and organizational structures but radiation protection programmes were generally satisfactory. Most plants set goals for annual collective dose. Exposure analysis (ALARA review) was common in connection with work planning. Several plants had found the use of digital self-reading dosimeters, invaluable in controlling doses. All plants used respirators but not all had a fit-testing programme.

Plant effluent discharge limits were often set as a proportion of the authorized limit. Noble gases were monitored at all plants but not all had sufficient range for accident conditions.

Environmental monitoring was carried out around all plants. Air sampling was generally done in populated areas and numerous other samples were analyzed including foodstuffs and drinking water.

Chemistry

All plants had chemical parameter limits based on technical specifications established by fuel and main component suppliers. All followed common international practices concerning chemical treatment of the reactor (primary) cooling system but there were exceptions concerning secondary water treatment.

Recording and reporting of chemistry results were satisfactory. Most used computer systems but graphical presentations for trend analysis and historical records could be more widely used. Laboratories were properly equipped according to current international practices. Some advice was given to add on-line monitors.

All plants had installed post-accident sampling systems but some of these could be improved.

Emergency Planning and Preparedness

The basic elements of adequate on-site and off-site emergency plans existed at all plants. In some cases, recommendations were made for improving the interfaces among the various organisations and for improving the implementing procedures.

Emergency response facilities were adequate. Improvements were suggested with regard to control room habitability and provision of an auxiliary shutdown facility.

Comprehensive training programmes were generally in place. All plants recognised the need for periodic, comprehensive, integrated exercises involving all on-site and off-site emergency response organisations but in some cases there was a need to upgrade training programmes and frequency and scope of exercises.