

CONTENTS

OPENING REMARKS AND INVITED PAPERS

Opening Remarks	3
<i>A. Birkhofer</i>	
Probabilistic safety analysis as a component of periodic safety reassessment of Swedish NPPs — Experience from the eighties and prospects for the nineties (IAEA-SM-321/1)	7
<i>L. Carlsson, L. Hammar</i>	
Regulatory and licensing uses of PSA (IAEA-SM-321/2)	17
<i>R. Caro</i>	

METHODOLOGY (Session 2A)

An approach to modelling operator behaviour in integrated dynamic accident sequence analysis (IAEA-SM-321/4)	35
<i>A.P. Macwan, K.S. Hsueh, A. Mosleh</i>	
Reliability analysis of large systems by the Markovian technique — Development of the camera software (IAEA-SM-321/5)	47
<i>B. Arien, D. Lamy, J. Devooght, C. Smidts</i>	
Japanese benchmark exercise on fault tree analysis — Current status (IAEA-SM-321/6)	61
<i>N. Watanabe, M. Kondo, K. Abe</i>	
Применение вероятностного анализа безопасности к оценке текущего уровня безопасности атомной станции (IAEA-SM-321/7)	73
<i>Н.Ф. Бирюкова, А.М. Букринский, Г.И. Грозовский, Ю.А. Каменев, А.В. Печинкин</i>	
<i>(Use of probabilistic safety assessment to evaluate the current safety level of a nuclear power plant: N.F. Biryukova, A.M. Bukrinskij, G.I. Grozovskij, Yu.A. Kamenev, A.V. Pechinkin)</i>	
Role of probabilistic safety criteria in nuclear power plant safety (IAEA-SM-321/8)	95
<i>L. Lederman, F. Niehaus</i>	
Event trees and dynamic event trees: Applications to steam generator tube rupture accidents (IAEA-SM-321/9)	109
<i>C. Acosta, N. Siu</i>	

REGULATORY APPLICATIONS (Session 2B)

Approach to regulatory review of Swiss probabilistic safety assessments (IAEA-SM-321/10)	125
<i>U. Schmocker, S. Chakraborty, H. Deutschmann, R. Fenske, H.P. Isaak, M. Khatib-Rahbar, E.G. Cazzoli, N. Hanan</i>	
Regulatory review of PSA studies made for operating Finnish nuclear power plants and its implications for regulatory decision making and living PSA (IAEA-SM-321/11)	135
<i>R.K. Virolainen</i>	
Aspects of the AECB PSA validation programme (IAEA-SM-321/12)	147
<i>S.D. Unwin, G.J.K. Asmis, A. Wild</i>	
The use of Level 1 PRA in regulatory decision making in the Republic of South Africa (IAEA-SM-321/13)	149
<i>H.M. Kussman</i>	
Applications of the probabilistic safety assessment in the Mexican regulatory process (IAEA-SM-321/14)	161
<i>J.A. Becerra Pérez</i>	
Integral approach to the use of probabilistic safety assessment in Turkey with special emphasis on problem areas (IAEA-SM-321/15)	171
<i>I. Koca, M. Atak</i>	

PSA USE AND APPLICATIONS — PART I (Session 3A)

Allowed outage time revision for the Paks nuclear power plant (IAEA-SM-321/16)	179
<i>A. Bareith, E. Holló, Z. Karsa, T. Szikszai, J. Tóth</i>	
PSA application for accident management at the 23 MW research reactor FRJ-2 (IAEA-SM-321/17)	191
<i>W. Hennings, J. Wolters, I.K. Gibson, N.J. Holloway, K. Stevens</i>	
Uncertainty and sensitivity studies supporting the interpretation of the results of TVO I/II PRA (IAEA-SM-321/18)	203
<i>J. Holmberg, R. Himanen</i>	
Event analysis using plant specific PSA (IAEA-SM-321/19)	217
<i>B. Tomic, V. Tolstykh, P. Baranowsky, M. Sattison</i>	
Computerizing the Level 2 PSA/PRA (IAEA-SM-321/20)	233
<i>P.J. Fulford, R.R. Sherry, D.M. Bucheit, Y.C. Chou</i>	
Les techniques probabilistes comme aide efficace pour la conception des réacteurs futurs (IAEA-SM-321/21)	245
<i>A. Ellia-Hervy, D. Lange</i>	

APPLICATIONS TO PROCESS FACILITIES (Session 3B(1)) and INTERNATIONAL ACTIVITIES (Session 3B(2))

PSAs in the nuclear and process industry: Opportunities for interchange of experience (IAEA-SM-321/22)	253
<i>S. Haddad, S. Hirschberg</i>	
Methodology for assessment of safety risk due to potential accidents in US gaseous diffusion plants (IAEA-SM-321/23)	273
<i>J.H. Turner, D.U. O’Kain</i>	
Safety risk assessment for ESA space programmes (IAEA-SM-321/24)	279
<i>C. Preyssl, M. Panicucci, P. Peltonen</i>	
Overview of the involvement of the Commission of the European Communities in the development and use of probabilistic safety assessment (IAEA-SM-321/25)	291
<i>H.W. Kalfsbeek, G.N. Kelly, A. Poucet</i>	
Performed and ongoing activities by the principal working group on risk assessment (PWG 5) of the Committee for Safety of Nuclear Installations of the OECD (CSNI-OECD) (IAEA-SM-321/26)	303
<i>B. Liwång, M. Hertrich, S. Chakraborty, M. Versteeg</i>	
Co-ordinated research programme on reference studies on probabilistic modelling of accident sequences (IAEA-SM-321/27)	311
<i>S. Hirschberg, A.M. Bukrinskij, A. Ellia-Hervy, H. Shapiro</i>	

OPERATING EXPERIENCE AND AGEING (Session 4A)

Calculations of core damage frequency increase due to aging under a given maintenance programme (IAEA-SM-321/28)	327
<i>W.E. Vesely, M.H. Hassan</i>	
Issues in the estimation of ageing in event frequencies (IAEA-SM-321/29) ..	337
<i>V.M. Bier</i>	
Concepts of a software based maintenance efficiency analysis using performance indicators (IAEA-SM-321/30)	349
<i>C. Kirchsteiger, H. Böck</i>	
La prise en compte du retour d’expérience dans les EPS et les perspectives de développement d’un outil d’aide à la décision en matière de maintenance (IAEA-SM-321/31)	359
<i>J.-M. De Guio, G. Zwingelstein</i>	
Definition of initiating events for PSA uses (IAEA-SM-321/32)	373
<i>D. Ilberg, B. Tomic, R. Bloomquist</i>	
Overview of IAEA activities in the area of probabilistic safety assessment (IAEA-SM-321/33)	389
<i>S. Hirschberg, L. Lederman, F. Niehaus</i>	

PSA USE AND APPLICATIONS — PART II (Session 4B)

Influence of a high pressure injection system on the large break LOCA event tree (IAEA-SM-321/34)	405
<i>M. Kožuh, A. Stritar, B. Mavko, A. Prošek, D. Vojnović</i>	
A new approach to decision making in different phases of PSA studies (IAEA-SM-321/35)	413
<i>D. Serbanescu</i>	
Optimization of WWER-440 technical specifications by means of probabilistic methods (IAEA-SM-321/36)	423
<i>H. Nováková, Z. Kovács</i>	
Third generation safety and accident integration (IAEA-SM-321/37)	431
<i>T. Sato</i>	
Integrated use of neural networks and safety assessment for operational safety (IAEA-SM-321/38)	441
<i>A.V. Gheorghe</i>	
Initiating event identification for PSA and consequence analysis for CANDU 3 (IAEA-SM-321/39)	449
<i>R.K. Jaitly, P.J. Allen</i>	

PSA RESULTS AND INSIGHTS — PART I (Session 5A)

L'EPS 1300 — Résultats et perspectives (IAEA-SM-321/40)	463
<i>J.-P. Berger, C. Ancelin, J.-M. De Guio</i>	
Amélioration du refroidissement après une brèche non isolable du circuit primaire (IAEA-SM-321/42)	477
<i>R. Bertrand, J.L. Chambon, F. Ducamp</i>	
Evaluation probabiliste des risques associés aux accidents de réactivité (IAEA-SM-321/44)	487
<i>M. Champ, J.-L. Caron, A. Chesnel, J.M.P. Lanore</i>	
Etude probabiliste de sûreté des REP français: importance des états hors puissance (IAEA-SM-321/45)	495
<i>J.M.P. Lanore, M. Champ</i>	

COMMON CAUSE AND EXTERNAL EVENTS (Session 5B)

Procedure for common cause failure assessment (IAEA-SM-321/46)	505
<i>J.K. Vaurio</i>	
Common cause failure analysis of high redundancy systems — Safety/relief valve data analysis and reference BWR application (IAEA-SM-321/47) ...	517
<i>T. Mankamo, S. Björe, S. Erixon, J.A.G. Johanson, M. Kosonen</i>	

Coupling mechanism classification for common cause failure analysis (IAEA-SM-321/48)	535
<i>A. Afzali, A. Mosleh</i>	
Analysis of non-simultaneous common mode failures: Application to the reliability study of the decay heat removal of the RNR 1500 project (IAEA-SM-321/49)	549
<i>M.H.E. Natta, M.A. Bloch, G. Hubert, Ph. Lauret</i>	
Probabilistic safety analysis of Loviisa I: Advancements in fire risk analysis methodology (IAEA-SM-321/50)	565
<i>M. Lehto, P. Louko, A. Norta, J.K. Vaurio</i>	

PSA RESULTS AND INSIGHTS – PART II (Session 6A)

Testing frequencies of safety related pumps and valves: Probabilistic safety assessment versus United States industry codes (IAEA-SM-321/52)	579
<i>J.H. Bickel</i>	
Experience from international peer reviews of probabilistic safety assessments (IAEA-SM-321/53)	589
<i>S. Hirschberg</i>	
Probabilistic safety assessment of Kola Unit 1 (WWER-440) (IAEA-SM-321/54)	605
<i>O. Kovalevich, E. Shubejko, V. Shejn, B. Kubintsev, S. Volkovitskij, A. Lubarskij</i>	

HUMAN FACTORS (Session 6B)

Use of PSA insights for research reactor operator training (IAEA-SM-321/56)	615
<i>B.G. Göktepe, B. Sevdik, H. Anaç</i>	
Probabilistic human reliability analysis: The lessons derived for plant operation at Electricité de France (IAEA-SM-321/57)	625
<i>F. Mosneron-Dupin, G. Saliou, R. Lars</i>	

LIVING PSA (Session 7)

A review of computer programs applied in Level 1 probabilistic safety assessment (IAEA-SM-321/58)	641
<i>D. Ilberg, L. Lederman</i>	

Safety evaluation by use of living PSA and safety indicators — Current status and future development of models and tools within the Nordic project safety evaluation, NKS/SIK-1 (IAEA-SM-321/59)	659
<i>J.A.G. Johanson, L. Gunsell, K. Laakso, P. Hellström</i>	
Development of the GO-FLOW reliability analysis support system (IAEA-SM-321/61)	677
<i>T. Matsuoka, M. Kobayashi</i>	
From LESSEPS 1300 to the application of computerized PSAs to operational safety (IAEA-SM-321/62)	689
<i>C. Ancelin, A. Dubreuil Chambardel</i>	
The use of PC based probabilistic safety assessment models (IAEA-SM-321/63)	701
<i>P. Kafka, H. Kunitz</i>	

PSA LEVEL 2 AND LEVEL 3 (Session 8)

Use of Level 2 and Level 3 PSA for regulatory decision making in South Africa (IAEA-SM-321/64)	715
<i>T.F. Hill</i>	
Comparison of methods for containment analysis in probabilistic safety assessment (IAEA-SM-321/65)	731
<i>H. James, M.J. Harris, S.F. Hall</i>	
Characterization of fission product releases resulting from severe reactor accidents in light water reactors (IAEA-SM-321/66)	743
<i>M. Khatib-Rahbar, E.G. Cazzoli, I.K. Madni, H.P. Isaak, S.L. Chan, U. Schmocker</i>	

POSTER PRESENTATIONS

Use of PSA and its development and trends in Czechoslovakia (IAEA-SM-321/67P)	757
<i>J. Dušek</i>	
Evaluating Kanupp operating experience using PSA (IAEA-SM-321/68P)	759
<i>M.A. Habib, M.A. Qamar, M. Iqbal</i>	
Reliability of a reactor detection function: Sensitivity study using the differential model of equivalent parameters (IAEA-SM-321/69P)	761
<i>R. Coudray, M. Eid, P. Sardain</i>	

Optimal operational strategies for an inspected component (IAEA-SM-321/70P)	763
<i>U. Pulkkinen, S.P. Uryas'ev</i>	
Integrated approach to human error prediction combining cognitive model and response model (IAEA-SM-321/71P)	764
<i>W.D. Jung, T.W. Kim, C.K. Park</i>	
Human potential capacity, real capacity and performance models: Models and connections (IAEA-SM-321/73P)	766
<i>M. Škof, G. Molan</i>	
PSA in support of operation of the Krško nuclear power plant (IAEA-SM-321/74P)	771
<i>J. Sušnik</i>	
Concepts of an overall reliability data collection and preparation scheme for the TRIGA reactor Vienna (IAEA-SM-321/75P)	773
<i>H. Böck, C. Kirchsteiger</i>	
Dynamic system reliability analysis with mixed component failure data (IAEA-SM-321/76P)	775
<i>M.H. Hassan, T. Aldemir</i>	
Development and experience with the ALLCUT-AUTO program use (IAEA-SM-321/77P)	778
<i>M.Ü. Azakhoğulları, U. Adalıoğlu</i>	
LIPSAS, a living PSA system for an LMFBR (IAEA-SM-321/78P)	780
<i>R. Nakai, Y. Kani</i>	
STUK living PSA code (SPSA) (IAEA-SM-321/79P)	782
<i>I.M. Niemelä</i>	
Development and testing of an expert system for fault tree construction (IAEA-SM-321/82P)	784
<i>M. Schwarzblat, J.C. Baker, J.E. Smith, J.W. Anderson</i>	
Application of PSA to final repositories (IAEA-SM-321/83P)	787
<i>H.P. Berg, D. Gründler, F. Peiffer</i>	
Application of PSA techniques in nuclear power plant safety and system design (IAEA-SM-321/84P)	789
<i>V.V.S. Sanyasi Rao, A.K. Babar, R.K. Saraf</i>	
Future nuclear power plants and probabilistic safety criteria (IAEA-SM-321/85P)	790
<i>A.N. Isaev</i>	
Computer developments for probabilistic safety assessments (IAEA-SM-321/89P)	792
<i>G. Martínez-Guriddi, M. González-Cuesta</i>	
ANCON 4.0: un código de análisis de fiabilidad y APS de primer nivel en computadoras personales (IAEA-SM-321/91P)	794
<i>J. Salomón Llanes, J.J. Rivero Oliva</i>	

Use of Markovian processes in computer technology for probabilistic safety assessment (IAEA-SM-321/92P)	795
<i>V.V. Taratunin, A.M. Panov</i>	
Методологический подход к оценке вероятности безошибочных действий персонала АЭС (IAEA-SM-321/93P)	796
<i>В.Н. Абрамова</i>	
<i>(Methodological approach to assessing the probability of fault free actions of NPP staff: V.N. Abramova)</i>	
Method for identification of dominant sequences in large event trees and applications to the Cernavoda probabilistic safety evaluation (IAEA-SM-321/95P)	798
<i>R. Gheorghe, L. Dinca</i>	
Cernavoda probabilistic safety evaluation and utilization of results to improve nuclear power plant safety (IAEA-SM-321/96P)	800
<i>I. Turcu, G. Georgescu, R. Gheorghe</i>	
Reliability evaluation of nuclear power plants using PSA method and its application plan (IAEA-SM-321/97P)	801
<i>K. Ohta, K. Oshima</i>	
Level 1 PSA for nuclear power plants (IAEA-SM-321/99P)	802
<i>M. Hirano, M. Hirose, M. Sugawara, T. Hashiba</i>	
Analysis of frequency and effects of transportation accidents in the vicinity of Paks nuclear power plant (IAEA-SM-321/100P)	804
<i>I. Kelemen</i>	
Experience in PSA utilization in enhanced safety reactor design (IAEA-SM-321/101P)	806
<i>B.A. Averbakh, A.M. Bakhmetev, O.B. Samojlov, E.V. Frolov, S.P. Linkov</i>	

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Rapporteurs

<i>J.M.P. Lanore</i>	811
<i>S.F. Hall</i>	814
<i>J.H. Bickel</i>	817
<i>M. Gregorič</i>	820

CLOSING SESSION

<i>S. Chakraborty</i>	827
<i>F. Niehaus</i>	829

Chairmen of Sessions	831
Secretariat of the Symposium	832
List of Participants	833
Author Index	855
Transliteration Index	857
Index of Papers and Posters by Number	859