

International Workshop Agreement

IWA 5

Emergency preparedness

* * * *

État de préparation en cas de catastrophe

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). ISO's technical work is normally carried out through ISO technical committees in which each ISO member body has the right to be represented. International organizations, governmental and nongovernmental, in liaison with ISO, also take part in the work.

In order to respond to urgent market requirements, ISO has also introduced the possibility of preparing documents through a workshop mechanism, external to its normal committee processes. These documents are published by ISO as International Workshop Agreements. Proposals to hold such workshops may come from any source and are subject to approval by the ISO Technical Management Board which also designates an ISO member body to assist the proposer in the organization of the workshop. International Workshop Agreements are approved by consensus amongst the individual participants in such workshops. Although it is permissible that competing International Workshop Agreements exist on the same subject, an International Workshop Agreement shall not conflict with an existing ISO or IEC standard.

An International Workshop Agreement is reviewed after three years, under the responsibility of the member body designated by the Technical Management Board, in order to decide whether it will be confirmed for a further three years, transferred to an ISO technical body for revision, or withdrawn. If the International Workshop Agreement is confirmed, it is reviewed again after a further three years, at which time it must be either revised by the relevant ISO technical body or withdrawn.

Attention is drawn to the possibility that some of the elements of this International Workshop Agreement may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Workshop Agreement IWA 5 was created via the discussions at a workshop organized jointly by the American National Standards Institute (ANSI) and the New York University (NYU) International Center for Enterprise Preparedness (InterCEP), and held in Florence, Italy, 24-26 April 2006.

Participation

The following individuals, from organizations based in seventeen different countries, attended and participated in the 24-26 April 2006 workshop meeting:

First Name	Last Name	Organization	Country
David	Adamson	British Standards Institution	United Kingdom
Azlan	Adnan	University of Technology Malaysia	Malaysia
Isaac	Akerman	Standards Institution of Israel	Israel
Eiji	Aoki	Cabinet Office of GOJ	Japan
George	Arnold	ISO/IEC SAG on Security Chairman	USA
Kevin	Becker	Organizational Resilience International	USA
Mark	Bezzina	Standards Australia	Australia
Lloyd	Bokman	NFPA 1600 Technical Committee	USA
Timothy	Bowen	BearingPoint Inc	USA
Keith	Brannon	International Organization for Standardization	Switzerland
Jerry	Brashear	RAMCAP/ASME Innovative Technologies Institute, LLC	USA
Joseph	Broz	Midwest Research Institute	USA
Karen	Coyne	CoVeris	USA
Ihab	Dana	Credit Suisse	USA
Matt	Deane	American National Standards Institute	USA
Margaret	Della	New York University - International Center for Enterprise Preparedness	USA
Nicki	Dennis	British Standards Institution	United Kingdom
Olivier	Dreser	Commissariat à l'Energie Atomique	France
Manabu	Eto	Japanese Industrial Standards Committee	Japan
Chris	Green	HBOS plc	United Kingdom
Pamela	Greenlaw	U.S. Department of Homeland Security	USA
Giulio	Gullotta	Federal Office of Civil Protection and Disaster Assistance	Germany
Levis	Guy-Obiakor	Private Citizen	Trinidad and Tobago
Viktoria	Hagelstedt	Swedish Emergency Management Agency	Sweden
Philip	Handley	Mason Communications	United Kingdom
Wayne	Harrop	Coventry University	United Kingdom
Gunnar	Hem	Directorate for Civil Protection and Emergency Planning	Norway
Kathleen	Higgins	National Institute of Standards and Technology	USA
Eui-Sik	Hwang	Korean Standards Association	Republic of Korea
Masaki	Inoue	Japanese Standards Association	Japan
Graeme	Jannaway	Jannaway & Associates	Canada
Martin	Johanson	Department of Fire Safety Engineering, Lund University	Sweden
Sungwook	Jung	Korean Standards Association	Republic of Korea
Hong	Kim	Korean Standards Association	Republic of Korea

First Name	Last Name	Organization	Country
Didier	Kimmel	CEA	USA
Mary Jo	Kuffner	University of Illinois at Chicago-SPH-CADE	USA
Krister	Kumlin	Swedish Emergency Management Agency	Sweden
ZhongQuiang	Li	China National Institute of Standardization	China
David	Leslie	Marsh Ltd	United Kingdom
Andreas	Malm	4C Strategies AB	Sweden
Husam	Mansour	Canadian Standards Association	Canada
Anders	Mattson	Saab Security Solutions	Sweden
Thomas	McKenna	International Atomic Energy Agency	Austria
Ron	Meyers	Canadian Standards Association	Canada
Patricia	Milligen	U.S. Nuclear Regulatory Commission	USA
Colleen	Monahan	University of Illinois at Chicago-SPH-CADE	USA
Ichiro	Nakajima	Tohoku University	Japan
Otto	Nederlof	Draeger Safety / CEN BT 161 WG EMS	Netherlands
Peter	Nilsson	Lund University Department of Fire Safety Engineering	Sweden
Ove	Njaa	University of Stavanger	Norway
Nick	Okabe	Tokio Marine & Nichido Risk Consulting	Japan
Bruno	Olsson	Ericsson Microwave	Sweden
Takahiro	Ono	Ministry of Economy Trade and Industry	Japan
Michael	Penders	Environmental Security International	USA
Brad	Penuel	New York University - Center for Catastrophe Preparedness and Response	USA
Reneau	Railton	Cisco Systems	USA
Bill	Raisch	New York University - International Center for Enterprise Preparedness	USA
Gregory	Sanders	United Nations Development Programme	USA
Herman	Schipper	Netherlands Standardization Institute	Netherlands
Marc	Siegel	San Diego State University	Israel
Lykke	Silfwerbrand	Saab Security Solutions	Sweden
Richard	Silitonga	PT. Sucofindo	Indonesia
Christian	Sommade	French High Committee for Civil Defence	France
Donald	Spellman	Oak Ridge National Laboratory	USA
Fredric	Stany	4C Strategies	Sweden
Matt	Statler	New York University - International Center for Enterprise Preparedness	USA
Alice	Sturgeon	Treasury Board Secretariat, Government of Canada	Canada
Andrew	Tait	Core Systems Group, LLC	USA
Stefan	Tangen	Swedish Standards Institute	Sweden
David	Trebisacci	National Fire Protection Association	USA
Sheena	Vivian	Langley Emergency Program	Canada
Bob	Vondrasek	National Fire Protection Association	USA
Jinyu	Wang	China National Institute of Standardization	China
Kenji	Watanabe	Nagaoka University of Technology	Japan
Jeffrey	Weir	Organizational Resilience International	USA

First Name	Last Name	Organization	Country
Claudia	Werner	DVGW German Technical and Scientific Association for Gas and Water	Germany
Beth	Zimmerman	Emergency Management Accreditation Program	USA

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Background

The ISO Advisory Group on Security (AGS) was formed by the ISO Technical Management Board (TMB) and was tasked to review ISO and other organizations' existing work related to security, assess the needs of relevant stakeholders, and recommend what additional standards work should be undertaken to support international standardization needs related to security.

The ISO AGS issued its final report in January 2005. One of the report's fifteen recommendations was that ISO develop an International Workshop Agreement (IWA) on the subject of emergency preparedness. The rationale for utilizing the IWA process was that it would allow for the production of an immediate ISO deliverable, one that could further be evolved into an international standard by an ISO technical committee if appropriate. The American National Standards Institute's (ANSI) offer to serve as the lead member body for this international workshop was accepted by ISO.

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Introduction

The IWA meeting announcement stated the purpose for this initiative:

No international standard currently exists for emergency preparedness. Yet, recent large-scale disasters ranging from tsunamis and hurricanes to earthquakes and terrorism underscore the importance of consensus guidance and international coordination in emergency readiness, response, and recovery efforts. The purpose of the meeting will be to reach an International Workshop Agreement (IWA), to be published by ISO, for emergency preparedness and operational continuity.

Given the urgency of the need and the significant time frame necessary to develop a deliverable from the beginning, the decision was made to focus on existing, consensus-based national standards and guidance in the area of emergency preparedness. All ISO member bodies were informed of this meeting and requested to further publicize this event. The invitation further invited entities to submit existing standards for consideration by the workshop participants. The envisioned process was to review and evaluate the submitted standards at the IWA meeting, as well as their applicability for the IWA deliverable, to be published by ISO.

The New York University (NYU) International Center for Enterprise Preparedness (InterCEP) hosted the meeting on behalf of the US national body, 24-26 April 2006 at the Villa La Pietra International Conference Center of NYU in Florence, Italy. The Workshop Chairman was Bill Raisch of NYU InterCEP. The Workshop Moderator was Alice Sturgeon of the Treasury Board of Canada and member of the ISO/IEC Strategic Advisory Group on Security. The Workshop Secretariat was Matt Deane of ANSI.

Workshop Recommendations

The workshop recommendations are presented at the outset of this International Workshop Agreement to provide context for the rest of the report. The workshop participants reached consensus on the following recommendations:

1. In accordance with the ISO TMB resolution, the workshop confirms that the appropriate ISO technical committee to address this subject area further should be ISO/TC 223, *Societal security*.
2. For the purposes of this workshop, the participants understand emergency preparedness to include all aspects of activity known generically as:
 - Emergency planning
 - Emergency management
 - Operational continuity
 - Business continuity management
3. The workshop recognizes there are common elements, but that the disciplines of emergency preparedness/emergency management and business continuity management are distinct.
4. The workshop recommends to TC 223 that the common elements identified during this workshop (see Table 1) form the basis of an international family of standards for emergency management and business continuity.

The workshop recommends to TC 223 that NFPA 1600, BSI 25999, HB 221 and the work of the Japanese Industrial Standards Committee and Standards Institution of Israel be included in the international standards documents.

The workshop recommends to TC 223 that members nations be requested to submit detailed tactical/implementation level documents that could provide direction and guidance specifically in the area of emergency management.

ISO/IEC Guide 2 defines consensus as “General agreement, characterized by the absence of sustained opposition to substantial issues by any important part of the concerned interests and by a process that involves seeking to take into account the views of all parties concerned and to reconcile any conflicting arguments. Consensus need not imply unanimity.”

The 77 workshop participants were not unanimous in their support of the four recommendations. In the limited time during the workshop meeting, all viewpoints were given the opportunity to be heard and multiple attempts were made to reconcile conflicting positions. The following disapprovals and/or abstentions were recorded at the meeting for each of the four recommendations:

Recommendation #1 – 1 disapproval

Recommendation #2 – 7 disapprovals

Recommendation #3 – 1 disapproval

Recommendation #4 – 13 disapprovals, 6 abstentions

The remainder of this International Workshop Agreement will elaborate upon these recommendations, as well as include further output from the workshop that is useful in the area of emergency preparedness.

Emergency preparedness

1 Scope

This International Workshop Agreement (IWA)

- presents the consensus of the workshop participants on the subject of emergency preparedness in the form of the workshop recommendations,
- provides recommendations and guidance to ISO/TC 223 as the first step in a process that may eventually lead to the development of international standards on this subject, and
- provides the reader with some additional resources for further exploration of this area which is crucial to all organizations and entities.

2 Workshop Proceedings

The final agenda from the meeting is presented in Annex A.

The five national standards and guidance documents that served as the focal point for the IWA discussions were (see Annex B for further information) the following.

- NFPA 1600 - Standard on Disaster/Emergency Management and Business Continuity Programs
- HB 221 - Business Continuity Management
- BS25999 - Draft British Standard on Business Continuity Management
- Israeli Contributions on Security Management Systems: Management Standard and Accompanying Family of Standards
- Japanese Position Paper for IWA and Proposal about Guidelines for the Establishment of Framework on Emergency Preparedness

Following opening remarks from the ISO/TC 223 (*Societal security*) Chairman Designate that noted the commitment from his technical committee as the appropriate home for the formal development of international emergency preparedness standards, it was agreed that this IWA would be a one-time meeting and that the work of the group would be completed within the two and a half day timeframe.

Due to the detailed nature of many of the key terms for emergency preparedness, and the limited meeting time, the participants agreed that a comprehensive list of terms and definitions would not be included in this International Workshop Agreement. However, this is a very important deliverable and one that ISO/TC 223 should consider undertaking. An internationally agreed upon list of terms and definitions would be very useful to the preparedness community.

The workshop participants spent a significant amount of time discussing the meaning of emergency preparedness and the disciplines that it encompasses, as well as how the five input standards/guidance documents approach the subject matter. Breakout sessions were utilized to examine the workshop context and approach for addressing emergency management/emergency planning and business continuity management. Workshop participants agreed that while these are distinct disciplines (Recommendation #3), it would be appropriate to include each in the scope of the workshop (Recommendation #2).

The workshop utilized two breakout sessions, (1) emergency management and (2) business continuity, to discuss and determine the essential elements for each discipline. The output from each of these breakout sessions can be found in Annexes C and D. The content contained in each of these annexes is presented only for information and does not necessarily represent the consensus of each group as formal approval processes were not exercised within the breakout sessions.

A report from each breakout session was presented to the full workshop. Using the list from breakout session #1 as the base, participants went through each item and identified the common elements of both emergency management and business continuity management. Listed in Table 1 are the essential elements of both emergency management and business continuity management, as identified by the workshop participants. During the review exercise, there were no further differing elements identified at this high-level.

**Table 1 -
Essential Elements of Emergency Management
and Business Continuity Management**

- Program Management & Administration
 - Establishment of Roles, Responsibilities & Authorities
 - Coordination with Stakeholders
 - Stakeholder Requirements
 - "All Hazards Approach"
 - Research
- Laws and Authorities
 - Regulatory Considerations
- Hazard Identification, Risk Assessment and Impact Analysis
 - Human Impact
 - Hazard and threats
 - Risk (or Probability)
 - Vulnerability
 - Consequence
 - Intelligence
 - Cost-Benefit Analysis
- Hazard Mitigation & Prevention
 - Protection measures
- Resource Management
 - Resourcing
 - Operations Personnel / Human Resources
 - Capacity Planning
- Mutual Aid / Memorandum of Understanding (MOU)
- Planning
- Direction, Control and Coordination
 - Incident Management System
 - Emergency Operations Centers
 - Cooperation between Responding Agencies
- Communications and Warning
 - Warning and Informing
- Operations and Procedures
 - Mitigation
 - Preparedness
 - Response
 - Recovery
- Logistics and Facilities
- Training
- Exercises, Evaluations and Corrective Actions including
 - Quality Assurance
 - Performance Evaluation
- Crisis Communications and Public Information
- Finance and Administration

Throughout the workshop, participants discussed an international “family of standards” approach for emergency management and business continuity, as well as how the five input standards/guidance documents could potentially populate this “family.”

It was suggested that the family of standards approach could include a high-level framework standard that outlines essential program elements, under which specific implementation standards would be utilized to provide more detailed guidance to implement the program. However, the workshop participants were unable to reach consensus on this or any other structure for the international family of standards approach, and accordingly were unable to reach consensus on where the five input standards/guidance documents would be placed in such a family structure.

Nonetheless, workshop participants did reach consensus that the five input standards/guidance documents should be included in the family of standards work that occurs within ISO/TC 223. Further, they recommended that ISO/TC 223 issue a call for additional detailed tactical/implementation level documents that could provide direction and guidance, specifically in the area of emergency management (Recommendation #4).

3 Potential Future Work

On the final meeting day of the workshop, presentations were made on the following subjects, although there was insufficient time for substantive discussion:

- Emergency Communications
- Emergency Preparedness for Nuclear and Radiological Emergencies
- Preparedness for Emergencies at Local Level
- Human Impact Preparedness

Despite the lack of substantive discussion, it was noted that ISO/TC 223 may wish to consider these elements in their overall examination of emergency preparedness. It was further noted that human impact preparedness was an important area that is not currently being addressed in the international standards arena.

Workshop participants also proposed the following suggestions to ISO/TC 223:

- Consideration should be given to establishing a liaison with the ISO special working group on Risk Management to take advantage of the important work that they are doing in their risk management standards efforts.
- Consideration should be given to issuing an ISO/TC 223 position paper on the relationship between emergency preparedness and emergency management.

4 Conclusion

The ISO IWA meeting on emergency preparedness was at times challenging, but by the end of the session some common ground was achieved as well as important input for the future work of ISO/TC 223.

Perhaps the biggest challenge facing the IWA was that the Florence meeting was the first time that a widely diverse group of over seventy-five experts was coming together to discuss the subject of emergency preparedness at the international level and trying to achieve consensus on an IWA solution within two and a half days. Successful initiatives typically require a first meeting to share ideas and present possible solutions, followed by time after the meeting to process the information received, collaborate, and reexamine proposed solutions (and then a subsequent in-person meeting). The ISO IWA on emergency preparedness was determined to be a one-time event due to the recent re-activation of ISO/TC 223 and to avoid having parallel ISO efforts examining the same subject area over the longer term (especially since the formal ISO standardization activity is to occur within ISO/TC 223). Therefore, the workshop did not have the luxury of time following the initial meeting to work through issues and gradually build consensus.

However, some good work was produced in the short amount of time afforded via this IWA initiative. This included the following.

- The four workshop recommendations supported ISO/TC 223 as the appropriate home for further standards work; provided a scope of emergency preparedness; and supported the family of standards approach as a solution, identifying five key standards/guidance documents for the potential family.
- The essential elements table provides ISO/TC 223 with a starter list on the key elements that need to be included in emergency management and business continuity standardization.
- Some of the challenging issues involved with emergency preparedness and international standardization were observed first hand by the leadership of ISO/TC 223 and can be used as lessons learned for the work within that technical committee.
- This IWA publication exists as an interim deliverable until formal ISO standardization is created on this subject matter. It seeks to assist individuals needing emergency preparedness guidance by providing some initial guidance and further resources that can be explored to meet the user's needs.

Appreciation is extended to all the IWA participants and their organizations for their dedication to this particular ISO initiative, participation in the spirited debate, and continued efforts to achieve international standardization in the important area of emergency preparedness.

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Annex A (informative)

Final Agenda ISO International Workshop on Standardization for Emergency Preparedness, 24-26 April 2006, Florence, Italy

April 24, 2006

- 1. Opening Remarks**
 - Matt Deane, Workshop Secretariat
 - Bill Raisch, Workshop Chairman
- 2. Introduction of participants**
- 3. Workshop scope and goals**
 - Bill Raisch, Workshop Chairman
- 4. Background presentation on ISO and the IWA deliverable**
 - Matt Deane, Workshop Secretariat (on behalf of ISO)
- 5. Presentation from ISO/TC 223 -Societal Security**
 - Krister Kumlin, Chairman Designate
- 6. Presentations on Submitted Standards**

30-minute presentation and Q&A session for each

 - IWA N 03 – NFPA 1600 - Standard on Disaster/Emergency Management and Business Continuity Programs; *Presented by Lloyd Bokman*
 - IWA N 04 – HB 221 - Business Continuity Management; *Presented by Mark Bezzina*
 - IWA N 17 - Israeli Contributions on Security Management Systems: Management Standard and Accompanying Family of Standards; *Presented by Marc Siegel*
 - IWA N 19 –N 21 - Japanese Position Paper for IWA and Proposal about Guidelines for the Establishment of Framework on Emergency Preparedness; *Presented by Kenji Watanabe and Eiji Aoki*
 - IWA N 33 – BS25999 – Draft British Standard on Business Continuity Management; *Presented by Chris Green*
- 7. General Discussion on Presented Standards and Review of Comment Contributions Submitted Prior to the Meeting**
 - Alice Sturgeon, Workshop Moderator
 - IWA N 27 - Supplemental Definitions of Terms for the IWA Meeting
 - IWA N 30 - Third Draft Comparison Table of Input Standards/Documents for the IWA
 - IWA N 31 - Chairman's Contribution on the Summary of Input Documents to the Meeting and a Proposed Model for a Family of Standards
- 8. Begin Discussion on IWA Deliverable and Workshop Recommendations**
 - IWA N 29 - Draft Proposal of a Potential Format for Final IWA Report

April 25, 2006**1. Continued Discussion on IWA Deliverable and Workshop Recommendations**

In addition to the full workshop discussions, breakout sessions were held on the following:

- Four breakout groups discussed focus and strategy for the remainder of the IWA meeting
- Two breakout groups examined the essential elements of emergency management and business continuity

April 26, 2006**1. Continued Discussion on IWA Deliverable and Recommendations****2. Presentations and Discussion on Component/Related Standardization Needs**

- ETSI Special Committee EMTEL - Requirements for Emergency Communications Network Resiliency and Preparedness (TR 102 445), *Presented by Philip Handley*
- Emergency Preparedness for Nuclear and Radiological Emergencies (IAEA), *Presented by Tom McKenna*
- Awareness and Preparedness for Emergencies at Local Level (APELL), *Presented by Richard Silitonga*
- Human Impact Preparedness, *Presented by Kevin Becker*

3. Approval of Workshop Recommendations**4. Adjournment**

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Annex B (informative)

Submitted Standards/Guidance Documents

The following standards/guidance documents were reviewed during the IWA meeting.

Designation	Title	Source	To obtain
BS25999	Draft British Standard on Business Continuity Management	BSI www.bsi-global.com	E-mail: orders@bsi-global.com Tel: +44 (0)20 8996 9001
HB 221	Business Continuity Management	SA www.standards.org.au	Can be purchased at: www.saiglobal.com
NFPA 1600	Standard on Disaster/Emergency Management and Business Continuity Programs	NFPA www.nfpa.org	Freely available on NFPA website: http://www.nfpa.org/assets/files/pdf/nfpa1600.pdf
	Israeli Contributions on Security Management Systems: Management Standard and Accompanying Family of Standards	SII www.sii.org.il	E-mail: akermani@sii.org.il Tel: +972 3 6467853
	Japanese Position Paper for IWA and Proposal about Guidelines for the Establishment of Framework on Emergency Preparedness	JISC www.jisc.go.jp	E-mail: ono-takahiro@meti.go.jp Tel: +81-3-3501-9245

Annex C (informative)

Output from Breakout Session #1 on Emergency Management

Note: This annex is presented only for information and does not necessarily represent the consensus of the breakout session as formal approval processes were not undertaken.

The breakout session first attempted to classify the essential elements in phases, but then made the decision to capture high-level elements without the phase categorization.

Essential Elements

- Program Management & Administration - including
 - Establishment of Roles, Responsibilities & Authorities
 - Coordination with Stakeholders
 - Stakeholder Requirements,
 - "All Hazards Approach"
 - Research
- Laws and Authorities - including
 - Regulatory Considerations
- Hazard Identification, Risk Assessment and Impact Analysis - including
 - Human Impact
 - Hazard and threats
 - Risk (or Probability)
 - Vulnerability
 - Consequence
 - Intelligence
 - Cost-Benefit Analysis
- Hazard Mitigation & Prevention
 - Protection measures
- Resource Management including
 - Resourcing
 - Operations Personnel / Human Resources
 - Capacity Planning
- Mutual Aid / Memorandum of Understanding (MOU)
- Planning
- Direction, Control and Coordination - including
 - Incident Management System
 - Emergency Operations Centers
 - Cooperation between Responding Agencies
- Communications and Warning - including
 - Warning and Informing
- Operations and Procedures
 - Mitigation
 - Preparedness
 - Response
 - Recovery
- Logistics and Facilities
- Training
- Exercises, Evaluations and Corrective Actions including
 - Quality Assurance
 - Performance Evaluation
- Crisis Communications and Public Information
- Finance and Administration

Annex D (informative)

Output from Breakout Session #2 on Business Continuity (6 phases of the business continuity management system)

Note: This annex is presented only for information and memorandum and does not necessarily represent the consensus of the breakout session as formal approval processes were not undertaken.

Phase 1

Scope BC/Disaster Response Program, Understanding the Organization, Planning

- Seeking top management commitment
- Assemble team
- Define Scope
- Communicate the plan
- Describe the organization's products and activities, resources, systems, sub-systems and processes
- Audit or GAP assessment in order to benchmark to understand what you have now
- Legal and other requirements
- Risks and threats
- Vulnerability
- Setting targets and objectives
- SWOT

Phase 2

BC Program Launch Strategy Step-by-step task review

HB221:

Emergency Response
Continuity Response
Recovery Response
Alignment

NFPA 1600:

Strategic plan (Mission, vision, goals and objectives)
Emergency Op. plan
Mitigation plan
Recovery plan (Short term, long term)
Continuity plan

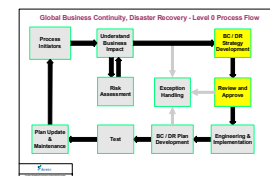
ISRAEL

4.3.4 Security Management Program

Step 2

BC & DR Strategy Development

“Critical” and “Supporting Critical”
processes & systems in priority/group order



BS25999-1:

Strategic Strategies
Activity Strategies
Human welfare Strategies
Asset resource Strategies

JISC:

BC Policy:
Annual BCP
Organisational structure and implementation