Managing Water Supply Security: Threats and Response Measures

Amit Chanan
State Water Corporation, Australia

Presentation Outline

• Define Water Security & the need for preparedness
• Discuss Natural hazards, primarily drought and flood security
  – Highlight some examples
• Introduce International Water Association’s Specialist group on Water Security and Safety Management
  – Acknowledgement
    Some information/material used in this presentation is sourced from the IWA specialist group, in particular from the Chairman – Mr Bruno Nguyen, Eau De Paris, France.
What is Water Security?

• ‘Water security involves protection of vulnerable water systems, protection against water related hazards such as floods and droughts, sustainable development of water resources and safeguarding access to water functions and services.’ (UNESCO Institute of Water Education)

• First decade of this century has been marked by several natural disasters that caused significant damage to water supply systems and direct impact on the population:
  – major flooding in eastern Europe,
  – tsunami in Asia and Africa,
  – earthquakes in Pakistan and India,
  – worst drought on record in Australia,
  – hurricane Katrina in America.

• In a crisis situation, the quality and level of preparedness make the difference between chaos and an efficient response.

Why Preparedness is Important?

• Water supply is a continuous activity, therefore we need to be ready for crisis happening at any time.
• Water supply interruption or insufficient pressure or bad water quality, often have flow on effects:
  – Fire fighting inability
  – Disease and sanitation issues
  – Health and disruption of normal life
• Water utilities will be held responsible:
  – for their lack of anticipation,
  – for their lack of preparation,
  – for their inappropriate or insufficient reaction.
Risk management never leads to 100% security or zero risks. It just helps water suppliers to know at what level they are and if this level fits with their goals.
Understanding the nature of Risk

- For natural hazards that have already been recorded in the past in the same region, the question is not ‘IF’, but ‘WHEN’ will it happen.
- Risks vary from immediate effect to longer time to fully expand:
  - earthquakes = minutes
  - floods = days - weeks
  - droughts = weeks - months
  - man made threats = ?
- The notion of risk has been re-defined since 9/11 to a tremendously and unforeseen higher level never reached before
  - Matters of safety are now definitely part of the job.

Planning for Natural Disasters

- Some questions to consider:
  - How well do we know our system?
    - What are the critical components?
      - What is their current condition to withstand design risks?
  - What is the worst that can happen?
    - What impact will the worst case scenario have on our infrastructure?
    - Are we prepared to accept that risk?
      - What do national/international risk management guidelines say?
      - What is community’s expectation?
      - What are the political expectations?
  - If risk not acceptable how do we fix the problem?
    - Do we have capital investment for infrastructure upgrade?
  - If the worst does happen – do we have disaster response strategy?
    - Is everyone’s role defined?
    - Other emergency services aware of the disaster response actions?
Supply Network Components

A schematic drawing of the water distribution system of Prague and customers outside Prague

Document Image Not Available

Asset Criticality & Risk Profile

Graphical Representation of the Risk Cost (x and y axis) and MEERA replacement costs (circle area) of State Water assets

All assets, using 2014 probability of failure

Source: PK, 44.
Risk Assessment Tools

Flood Risk Management Process

- Water utilities are one of the many players in dealing with flood situation
  - Management committee allows participation of local governments, planners and emergency services
• Typical outcome of a flood study
• Size of flood – Peak Discharge in PMF event is 1.5 times > 100 year event
• Whole floodplain has very short effective warning time
• Rate of Rise of floodwaters is very rapid, with critical durations of 1 to 2 hours.

Protect Critical Components
Wyangala Dam Flood Risk
An Extreme Hazard Dam because of large population downstream and high economic value (~ over $4.5 billion).

Drivers for the Upgrade

- Flood studies show that dam spillway can not safely pass a probable maximum flood (PMF)
- To comply with NSW Dams Safety Committee’s requirements, extreme hazard dams must be able to pass PMF,
- A dam failure will result in significant loss of life and an economic loss of over $4.5 billion
8 Radial Gates, Each 14.6m wide x 12.7m high

- Existing spillway capacity - 18,600m³/s at DCF;
- Revised PMF outflow - appx 26,300m³/s

Auxiliary Spillway
Physical Models of the Spillway

Auxiliary Spillway Gates Added to the Model 1 : 80 Scale Model

Testing the Auxiliary Spillway

Flow in the Existing Spillway

View of Main and Auxiliary Spillway

Outcomes from Model Investigation

- Gate raising by additional 1.4m through some modifications, can pass about 3,000 m³/s extra
  - from 18,100 m³/s to approximately, 21,000 m³/s
- Further increase of reservoir level will cause overtopping of the spillway bridge and the gates.
Drought Security Challenge

- National water demand increased by 59% between 1984 and 1997.
- 67% of national water consumption is attributed to agriculture.

Climate Change pressures
Climate Change pressures

![Climate Change pressures map]

Climate Change pressures

![Climate Change pressures map]
Securing Water for the Future

- The Australian Government is investing $12.9 billion in *Water for the Future* – a 10-year initiative to prepare Australia for a future with less water.

*Water for the Future* is built on four key priorities:
- Taking action on climate change,
- Using water wisely,
- Securing water supplies, and
- Supporting healthy rivers and wetlands.

- Australian Government is buying back water entitlements from willing sellers for the environment. Water entitlements purchased in 2007-08 totalled 24 GL (billion litres) at a cost of $34.4 million.

Securing Urban Supplies

- Government is providing more than $1.5 billion to improve water security by becoming more efficient with the water that is available, and finding new sources of water that are less dependent on rainfall, such as recycling, stormwater harvesting and desalination:
  - $254.8 million program will help communities of 50,000 people or fewer to secure their water supplies.
  - $250 million National Rainwater and Greywater Initiatives
  - $200 million will be provided to local municipalities in the Murray-Darling Basin to help them plan for a future with less water and associated local water savings.
• Experience in urban water sector
• Total urban water budget must be accounted
  - Sydney’s wastewater & stormwater discharge is 50% more than its water demand (640,000 ML)

Recent Policy Developments

“...current piecemeal approach to water management planning cannot continue. ...A strategic plan is required for the greater Sydney water supply....”

“Adaptive management approach, a flexible management process that operates across community, industry and government focusing on outcomes is needed”

2006 Metropolitan Water Plan sets out how the NSW Government will achieve the objectives of providing a secure supply of water for Sydney,
Kogarah Town Square Redevelopment

42% Reduction in scheme water demand
7000 kL / year of savings in potable water

Kogarah Town Square
Water Reuse Schemes

• Treats sewage for irrigation use throughout Kogarah LGA
  - 750kL/day

Rural – Urban Interface

• With over 70% of nation’s water being used by agriculture sector, making that sector water efficient is key for Australia
• The Australian Government has committed $5.8 billion to help irrigators make better use of the water that is available by upgrading infrastructure.
  - Over $4.6 million was provided just last year to 13 irrigation water providers around Australia to develop long-term plans to upgrade and rationalise irrigation infrastructure
  - Government invested $99 million in the Wimmera Mallee pipeline which involves replacing 16,000 km of open channels with 8,000 km of pipeline for the supply of stock and domestic water across a regional Victoria.
### Man-made threats to Water Security

<table>
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<th>Year</th>
<th>Number of incidents (*)</th>
<th>Incidents on reservoirs</th>
<th>Incidents linked to security</th>
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<tr>
<td>2002</td>
<td>34</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>2003</td>
<td>44</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>2004</td>
<td>42</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>2005</td>
<td>27</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>2006</td>
<td>39</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>186</td>
<td>20</td>
<td>39</td>
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(*) of all kinds on potable water or not, pipe bursts, significant leaks, significant pollutions, intrusions...

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### Examples Of Protection

- **Controlled Door Access**
- **Outside Lightning**
- **Protection of Windows**
- **Door Protection**
Protection Measures....

Badges
Readers

Doors

Motion
detectors

Motorized
Lock

VIDEO CONTROL
### Water Security & Safety Management Specialist Group

This Specialist Group has been created in 2006.

- Objectives and Scope of the Specialist Group
  - Natural Disaster Preparedness and Response
  - Man-made Disaster Preparedness and Response
  - Vulnerability & Risk Management Models
  - Research, Development and Emerging Technology Solutions
  - Professional Training, Public Education and Communication
  - Others to be proposed

- Guiding principle for the development of technical activities

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<th>Vice Chair</th>
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<td>Bruno Nguyen</td>
<td>Ilan Juran</td>
<td>Amit Chanan</td>
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### What is the Specialist Group working on?

**“Best Practices”:**

- Define measures to be taken in order to ensure continuous drinking water supply and waste water operation.

**Management of crisis situations in the water supply:**

- Create an international database on water related or water concerned crisis situations and to record the lessons learned.
- Use the IWA International Network to provide links and be used as a reservoir of experts ready to offer online help and advice in water issues whenever and wherever it is needed. The W2SM specialist group will offer its help in setting up and organizing this response.

**R&D:**

- Keep up to date and informed on recent R&D and new technologies in the field of Water Security and Safety Management and their in site testing reported by group members.
Building Resilience with Research

- Decentralised Water Reuse Technologies
  - High Rate Stormwater Treatment System
  - Low-cost Rainwater Harvesting & Treatment
  - Energy use Optimisation for Membranes
  - Policy Framework to facilitate Decentralised Water Reuse Schemes
- Evaporation loss reduction from reservoirs
  - Other loss reduction/leakage reduction techniques
- Security Measures
  - Rapid online detection techniques for contaminants (biological and chemical)
  - Other cost effective infrastructure security options, particularly network security
- Desalination process optimisation

Water Jobs

- According to APESMA
  - Unless there are significant changes we will see an erosion of engineering and technical expertise in the water industry, particularly the public sector
    - greater proportion of the work will be outsourced to private consulting
  - There is a high potential for the water industry to become privatised as governments increasingly devolve service responsibilities.
National Water Skills Strategy

• COAG was informed of looming skill shortage in July 2008
  - Half of those employed in 2018, will be recruited during next 8 years.

• Corporatization of water companies and low levels of recruitment in 1980s-1990s
  - Competing demand from mining and construction sectors

• New technologies need new skills
  - Desalination, water reuse, membrane technology etc