


## Reasoned Responses to Natural, Accidental, and Intentional Threats

Kansas City ASHRAE Chapter

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© September 10, 2007




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## ASHRAE Guideline 29



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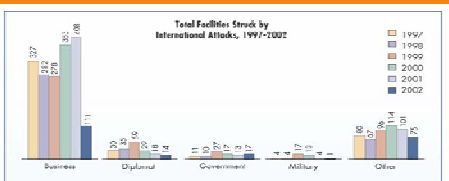
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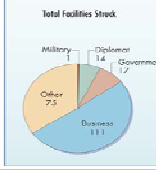


## Threats Vary by Building End Use

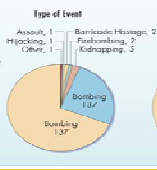
FEMA E155



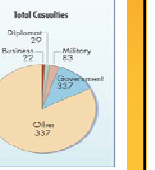
Year	Business	Diplomat	Government	Military	Other
1997	137	19	11	4	86
1998	151	14	7	1	14
1999	278	18	11	1	14
2000	188	11	7	1	14
2001	11	1	1	1	1
2002	11	1	1	1	1



Category	Count
Business	111
Other	75
Military	1
Diplomat	14
Government	17



Event Type	Count
Bombing	137
Assault	1
Hostage	1
Other	1
Barrierride Hijacking	2
Firebombing	2
Kidnapping	2



Category	Count
Business	92
Other	53
Military	1
Diplomat	20
Government	327

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## Nearby Threats

- Chemical Plants
- Hazmat Storage
- High Profile Target
- Railroads
- Canals/Rivers
- Tunnels
- Reservoirs
- Power Plants




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## Thousands evacuate Latin America's tallest building; handmade explosive found

A total of 10,800 people were evacuated from the 55-floor building, which opened in 2003.  
Associated Press; August 30, 2007

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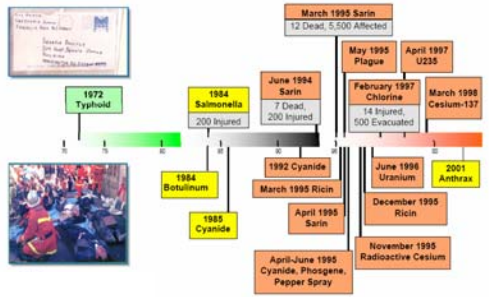
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## CBR Incident History

FEMA E155



Year	Incident	Impact
1972	Typhoid	
1984	Salmonella	200 Injured
1984	Botulinum	
1985	Cyanide	
1992	Cyanide	
June 1994	Sarin	7 Dead, 200 Injured
March 1995	Ricin	
April 1995	Sarin	
April-June 1995	Cyanide, Phosgene, Pepper Spray	
March 1995	Sarin	12 Dead, 5,500 Affected
May 1995	Plague	U235
February 1997	Chlorine	14 Injured, 500 Evacuated
June 1998	Uranium	
November 1998	Radioactive Cesium	
March 1998	Cesium-137	
December 1995	Ricin	
2001	Anthrax	

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## Risk Management

Is a process to

- identify, assess, and reduce loss to an acceptable level,
- implement options, and
- monitor performance

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## Risk Management

Risk has two components:

- Loss or harm—i.e., cost
- Probability of occurrence

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## Risk Management

Management is controlling, handling, or directing

It Is Multidimensional

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**Who does a risk assessment and why?**

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**Risk assessment—  
To Do or Not To Do?**

- Losses become known
- Probabilities become known
- Develop plans of action or inaction

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**The Benefits of  
Risk Management**

- Provide safety to occupants
- Maintain/enhance employee morale
- Lessen impact/losses
- Lead to a quick return to business

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### Summary

- Know what risk management is
- Learn what is in the Guideline
- Learn the reasons risk assessments are performed
- Know what the Guideline is not
- Study the benefits of risk management

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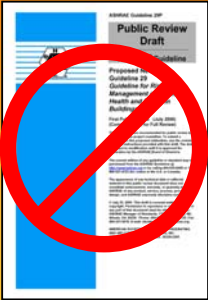
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### Guideline 29 Is Not



- Mandatory
- A Code
- A Guide to Risk Management
- Criteria for Risk Categories

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### Fire, Life Safety, and Security

- Fire and life safety can have opposing goals from security
- Security Vulnerability Assessment (SVA) assesses assets, vulnerabilities, consequences, and countermeasures




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### Additional Benefits?

Are there additional benefits for exceeding the minimum requirements?

- Possible reduction of insurance premiums
- Authorities Having Jurisdiction (AHJ) may provide relief in other areas of protection
- Corporate image may improve



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### Food, Kitchens, Storage, and Serving Areas

- Start with sanitary design
- Follow proper food handling techniques
- Maintain proper temperatures
- Limit access
- Monitor at all times

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### Water Supply

- Control against unauthorized access
  - All water lines
  - Water storage tanks
  - Wells
  - Ice-making machines

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## What an HVAC System Must Do

1. It moves treated ventilation air from the outdoors into the space
2. It moves contaminated air from the space to the outdoors
3. It adds moisture to or removes moisture from the space to control the space humidity within a comfort range
4. It adds heat to or removes heat from the space to control the temperature of the space within a comfort zone
5. It creates an ambient air velocity within the space

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## Design for Normal Conditions

Ventilation

- Indoor air quality
- Thermal comfort
- Positive pressure



Infiltration

- Energy consumption
- Indoor air quality
- Thermal comfort

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## Design versus Reality

<i>DESIGN GOALS</i>	<i>REALITY</i>
<ul style="list-style-type: none"> <li>• Ventilation system design values</li> <li>• Excess supply air</li> <li>• Little infiltration occurs due to airflow control and tight envelopes</li> </ul>	<ul style="list-style-type: none"> <li>• System airflows not at design values</li> <li>• Significant infiltration due to leaky building envelopes and system imbalances</li> </ul>

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**Good system performance requires good system maintenance**



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**Isolate lobbies and mailrooms to keep contaminants out of the rest of the building**



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**Ventilation and Infiltration:  
Design for Security**

- Provide excess supply air for pressurization
- Use zoned airflow control to isolate vulnerable spaces
- Tighten building envelopes to support pressurization

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### Ventilation and Infiltration: Multiple Benefits

1. Tight envelope and excess supply air
  - Lower energy consumption
  - Better IAQ and moisture control
  - Less agent entry - with good filtration!
2. Tight interior partitions; air distribution control
  - Reduced pressures from stack effect
  - Control interior airflows
  - Able to isolate spaces

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### Air Cleaning Considerations

- Know your building and HVAC system!
  - Outdoor Air requirements (ASHRAE 62)
  - Can building be pressurized with ventilation air?
  - Is building operating as designed?
- Determine air cleaning options and relative effectiveness and costs of each option
- Owners must make decisions based on threats and vulnerability
- Designers/engineers make decisions based on technology options and economics

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### HVAC Air Cleaning Design Options

Lowest Cost

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OPTIONS

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Highest Cost

\$10+/ft<sup>2</sup> new  
\$25+/ft<sup>2</sup> retrofit  
\$2.50/ft<sup>2</sup>/year  
(\$ added to "normal" HVAC costs)

- Particulate Filtration of Outdoor Air
- Particulate Filtration of Recirculated Air
  - HVAC system filters
  - Separate point-of-use systems
- Gas Filtration of Outdoor and Recirculated Air

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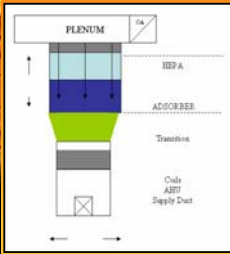
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### Protective Measures for Air Cleaning



- Consider all-air systems
- Provide particulate air cleaning at MERV 13 and MERV 17 (HEPA) for most critical areas
- Use technologies with proven standards (e.g., ASHRAE, ASTM, ASME, etc.) and test and re-commission system accordingly
- Do not design a control system based on contaminant sensors and active response
- Provide for replacement

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### Air Cleaning Benefits: Occupants

- Good indoor air quality is noticeable!
  - Affects customers
  - Increases employee productivity
  - Reduces health costs for respiratory illness
- Higher degrees of HVAC design and air filtration can provide benefits in extraordinary incidents
  - Extends time for evacuation
  - Extends time for shelter-in-place
  - Provides collection of forensic evidence

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### Air Cleaning Benefits: Other

- HVAC Operating Costs:
  - Cleaner coils reduce pressure drop and provide more efficient heat transfer
  - Cost savings by reducing outdoor air when justified
  - Controls alert operators to unusual conditions
- Improved filtration will provide benefit:
  - Enhanced filtration should be continuous, passive, and verifiable
  - Enhanced filtration = health and productivity benefits

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### Discrete Sets of Building Systems Must be “Resilient”

- **Continuously Perform during Normal Conditions** and
- **Provide for Extraordinary Conditions**
  - ✓ **Preparedness for likely “Threats”**
  - ✓ **Emergency Operations during Response Modes**
  - ✓ **Support Operations during Recovery Modes**

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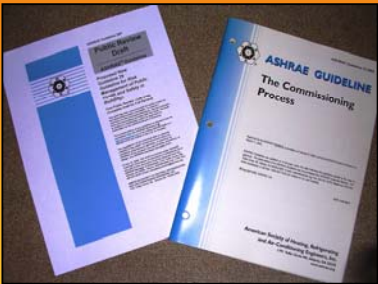
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### ASHRAE Guidelines 0 and 29



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### Performance Criteria Defined in Guideline 29

1. Health
2. Safety
3. Welfare
4. Exposures (e.g., thermal, air quality, lighting, acoustics)
5. System performance
6. Economics

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**Operations and Maintenance Guidance in ASHRAE 29**

1. Commissioning and Vulnerability Assessments
2. Completeness, Availability, and Sensitivity of Documentation
3. Performance of Public Address Systems
4. Site and Building Security
5. Plans for Normal Operations
6. Plans for Emergency Operations
7. Personnel Protection

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**“Continuous Commissioning” Requirements in ASHRAE Guideline 0-2005**

1. Maintain the Owner’s Project Requirements (OPRs) to reflect changes in use and operation of the facility
2. Maintain the Basis of Design to reflect changes in systems and assemblies due to renovations or in response to changes in the OPRs
3. Periodically evaluate achieving the current OPRs and previous benchmarks by appropriate tests
4. Maintain the Systems Manual to reflect changes in OPRs, Basis of Design, and systems/assemblies
5. Continuously train operations and maintenance personnel and occupants on current OPRs, Basis of Design, and changes in systems and assemblies

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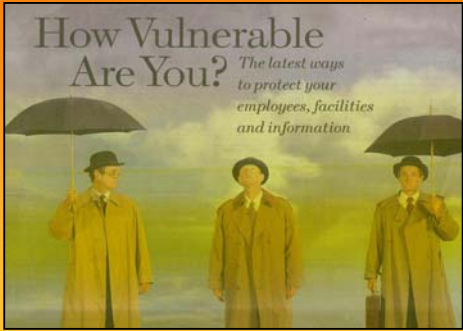
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**How Vulnerable Are You?** *The latest ways to protect your employees, facilities and information*

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**Natural Incidents-Lightning**



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**Natural Incidents-Storms**



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**Natural Incidents-Tornados**



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**Natural Incidents-Hurricanes**



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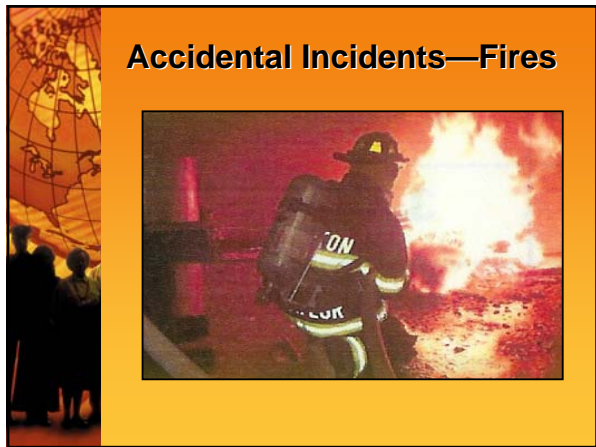
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**Accidental Incidents—Fires**



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**Accidental Incidents**



August 14, 2003, Northeast Blackout

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## Terrorist's Motto

- We only have to be successful once!
- You have to be successful every time!

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## Infrastructure Reliability



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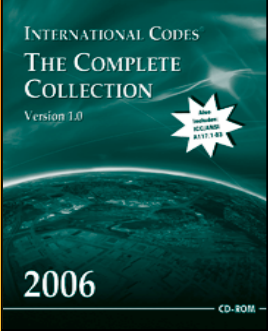

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**Workshop Report on  
Building Code Provisions**

**TISP Website**

<http://www.tisp.org/files/pdf/385/summary.pdf>

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**Designer Responsibility  
The New Standard of Care**



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**Designer Liability**



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## Building Security Council

- Building Ratings
- Certification
- Information
- Training

<http://www.buildingsecuritycouncil.org>

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## Conclusions

- More dimensions and practices must be added to business as usual
- Risk evaluation
- Vulnerability analyses
- Measure implementation
- Maintenance and operation
- The standard of care

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## Questions?

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