

Understanding the New FM Global Approval Standard for Cooling Towers

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Topics of Discussion

- ◆ Who is FM Global?
- ◆ What is the “New” Standard
- ◆ Needs, benefits and challenges
 - Owner opportunities
 - Specifying FM Approval
 - Confirming compliance



Who is FM Global?

FM Global...

- ◆ US-based, 175 year old insurance cooperative
- ◆ World's largest insurance company covering 27% of world's commercial assets, including District Energy Facilities
 - Insures 130,000+ locations in 130+ countries
- ◆ Insures property damage and business interruption
- ◆ Believes “*loss is preventable through engineering*”

Who is FM Global?

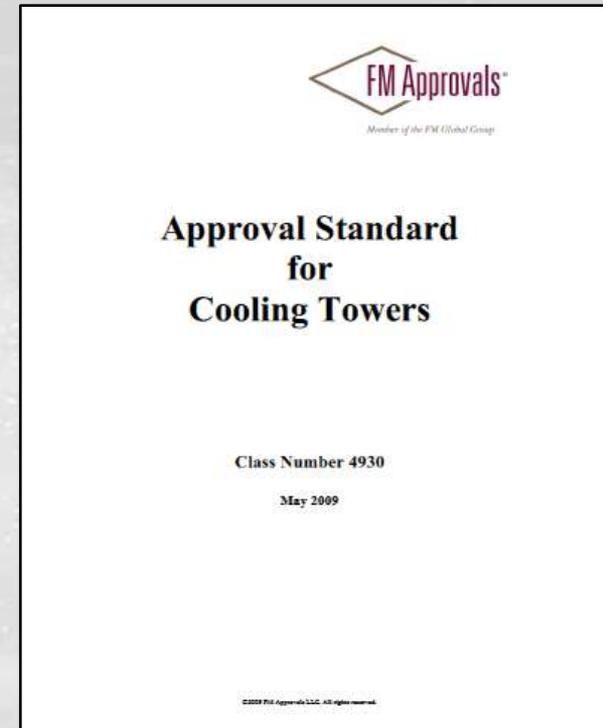
FM Approvals...

- ◆ Subsidiary of FM Global
- ◆ Defines standards and conducts verification tests
- ◆ Provides independent third-party certification of building materials/products, including cooling towers
- ◆ Similar to Underwriters Laboratory
 - “UL certifies, validates, tests, inspects, audits, advises and educates. UL helps safeguard people, products and places in important ways, facilitating trade and providing peace of mind.”*

The New Standard

Published May 2009

- Establishes a comprehensive technical design definition
- Desires to reduce the risk of exposure due to natural hazards
 - Seismic, wind, fire, ice, and snow
- Stated intention is to facilitate technological development



Qualification

Discussion centered around Field-Erected cooling towers – the most difficult type of tower to modify for compliance



FM Approval – Then and Now

Pre-May 2010

Historic Test Protocol

- Full-scale burn test
- Examination of combustible component manufacturing
- Annual quality control audits of combustible components
- Component flammability testing

Post-May 2010

New Approval Standard

- Full-scale burn test
- Examination of combustible component manufacturing
- Annual quality control audits of combustible components
- Component flammability testing

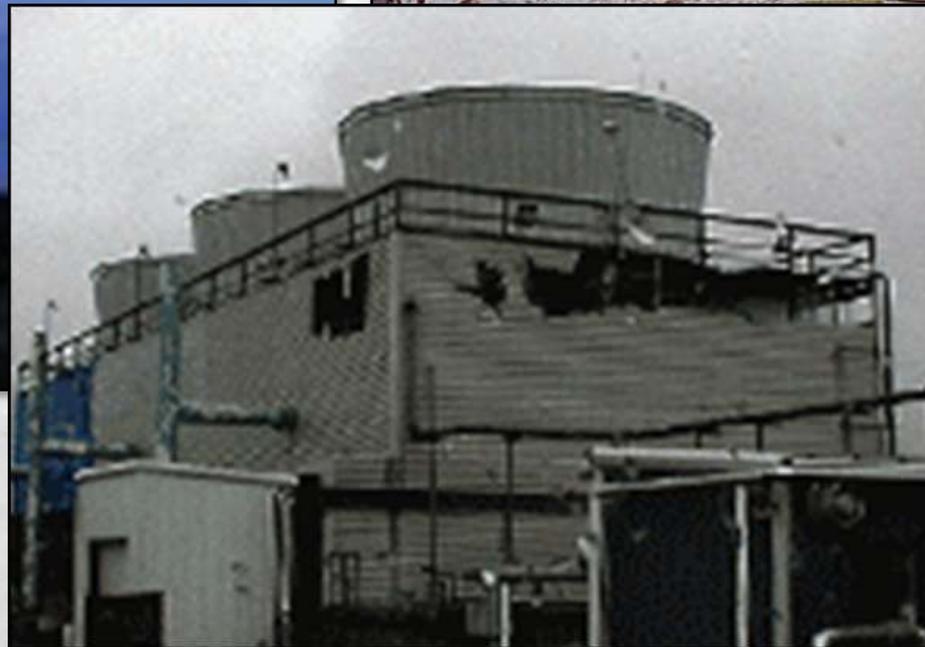
FM Approval – Then and Now

Historic Test Protocol

- No missile impact testing

New Approval Standard

- Missile impact testing of exposed components
 - Exterior walls and fan cylinders
- Large and small missile tests
 - 9 lbs, 2"x4" @ 50 fps
 - 2g steel balls @ 130 fps



RESEARCH POWERED SOLUTIONS



Missile (Air Borne Debris) Testing

Objective

- Confirm fan cylinder deflection will not result in contact with an operating fan
- Less than 10% air leakage of cylinder and casing



FM Approval – Then and Now

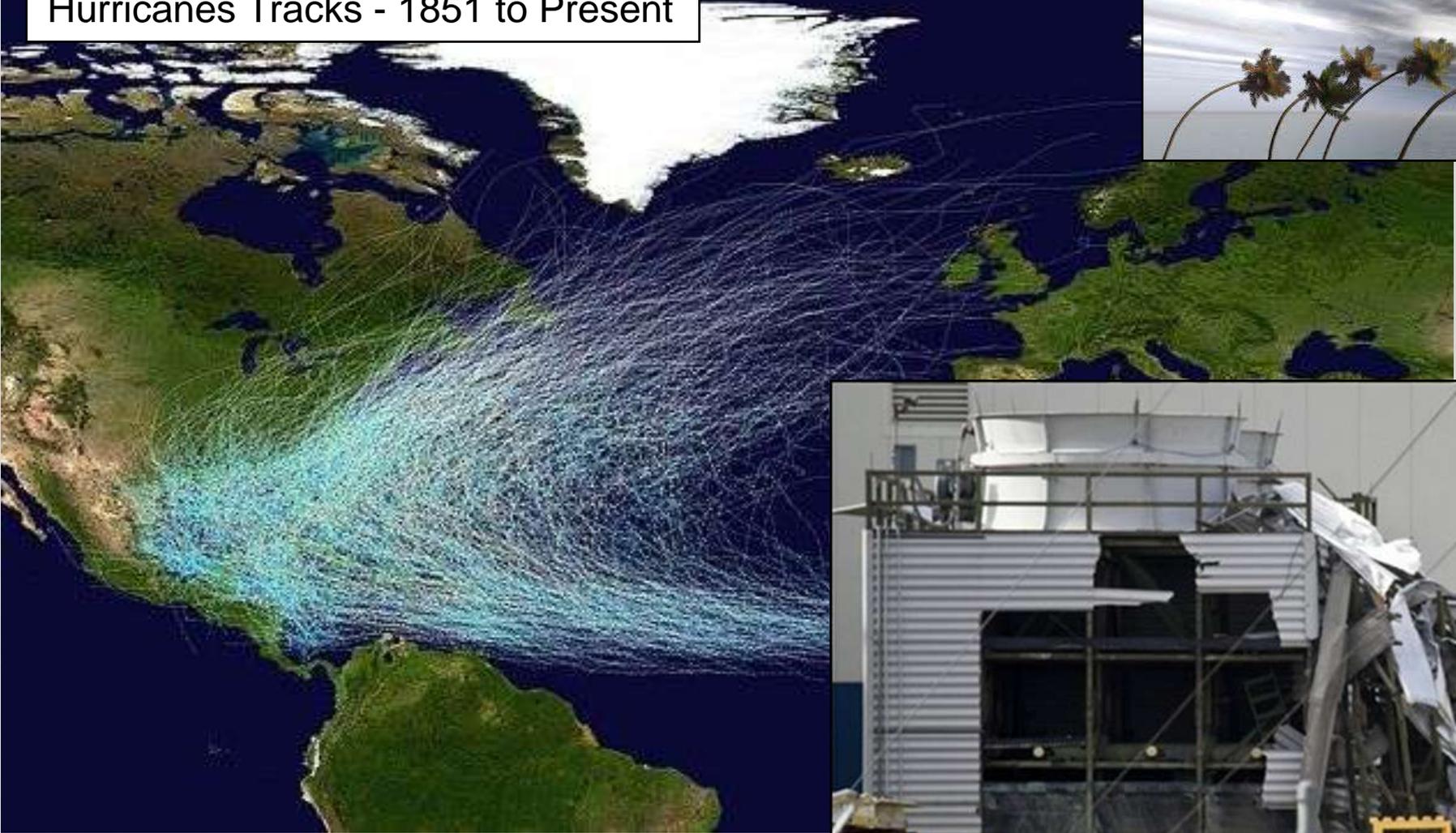
Historic Test Protocol

- No missile impact testing
- No air pressure testing

New Approval Standard

- Missile impact testing of exposed components
- Static & cyclic air pressure testing of wall panels
 - 60s static up to 120 psf windward
 - 60s static up to 168 psf leeward
 - 9,000 cycles per configuration

Hurricanes Tracks - 1851 to Present



Pressure Testing



Objective

- Zero cracking or signs of failure
- For exterior installations, shall be tested both undamaged and after damage from missile impact testing

FM Approval – Then and Now

Historic Test Protocol

- No missile impact testing
- No air pressure testing
- No structural evaluation

New Approval Standard

- Missile impact testing of exposed components
- Static & cyclic air pressure testing of wall panels
- Engineering definition & evaluation of structural design
 - Dead and live loads including wind, seismic, snow, and ice

Design Methodology Review

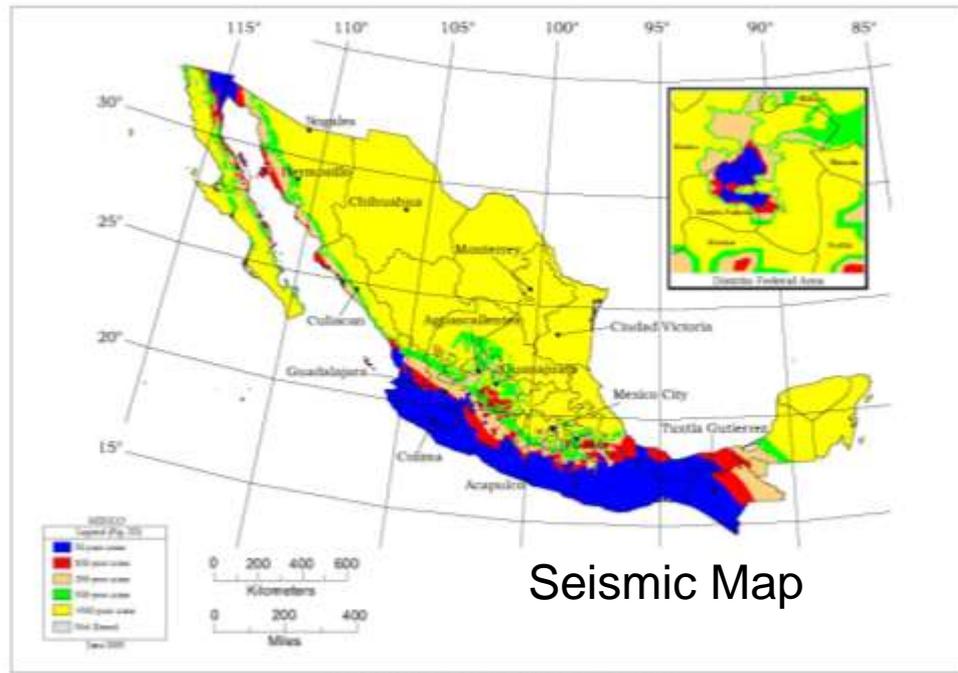


Fig. 20 Earthquake zones, Mexico, for engineering purposes.

Earthquakes

FM Global Property Loss Prevention Data Sheets

Page 30
1-2

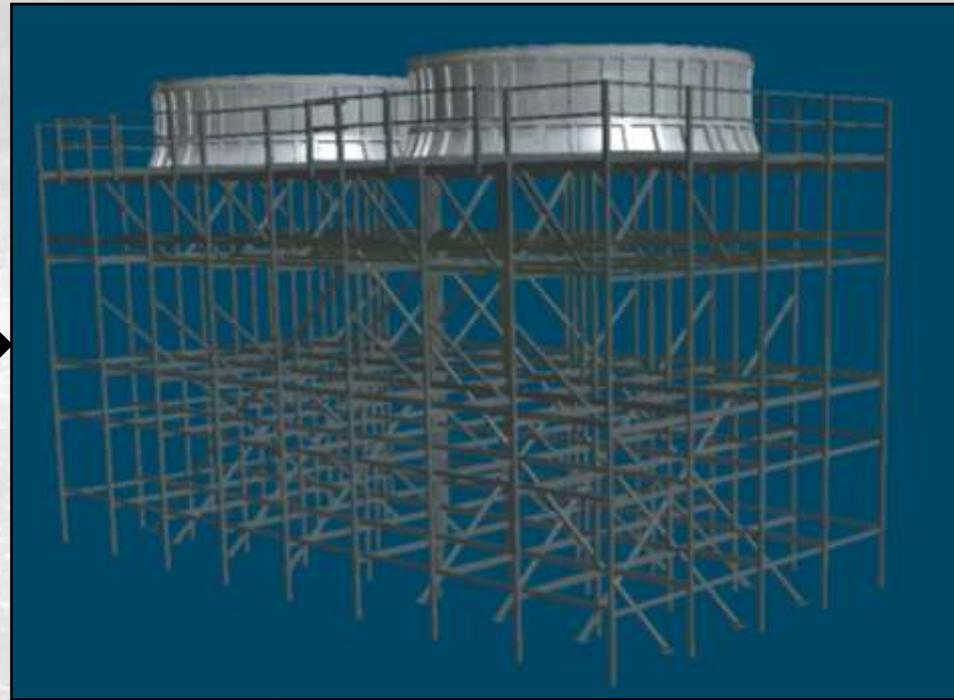
- Defines enhanced design parameters (ex. $I=1.25$)
- Global standard (ex. addresses seismic design in Non-ASCE 7 areas outside of USA)
- Requires the tower to remain “**Intact and Operational**” following an event

Is “Intact and Operational” Important?

Wind Exposure Damage



Design Methodology Review



FM Approval – Then and Now

Historic Test Protocol

- Redundancy: N + 1 cell tower arrangement or thermally oversized cells
 - Based on FM Property Loss Prevention Data Sheets

New Approval Standard

- Redundancy: Remaining tower must provide at least 75% of design capacity after a fire event

“Approved For Use without a Fire Protection System”

FM Approval - Fire

Designing to Achieve 75% Capacity After Fire Event

Multi-Cell Category	
Design Cell Qty.	Minimum Thermal Capacity Required
One	150% (2* @ 75%)
Two	150% (2@75% or 3@50%)
Three	112.5% (3@37.5% or 4@25% → 100%)
Four and Over	100%

***Cannot Build a Single Cell Tower that is Approved in the Multi-Cell Category!!!**

FM Approval - Fire

Designing to Achieve 75% Capacity After Fire Event

Single-Cell Category	
Design Cell Qty.	Minimum Thermal Capacity Required
One	100% (1 @ 100%)
Two	100% (2 @ 50%)
Three	100% (3 @ 33.3%)
Four and Over	100%

Multi-Cell Approval Fire Test



Objective

- Contain fire damage from spreading beyond the cell of origin
- Cannot go “over, under, through, or around” perimeter

FM Approval - Fire

Designing to Achieve 75% Capacity After Fire Event

Multi-Cell Category	
Design Cell Qty.	Minimum Thermal Capacity Required
One	150% (2* @ 75%)
Two	150% (2@75% or 3@50%)
Three	112.5% (3@37.5% or 4@25% → 100%)
Four and Over	100%

***Cannot Build a Single Cell Tower that is Approved in the Multi-Cell Category!!!**

Single-Cell Approval Fire Test



Objective

- Retain 75% thermal capacity in cell of origin

Owner Opportunities

FM Approved Products Serve

- ◆ Owners insured by FM Global
- ◆ Owners that do not want fire protection systems
- ◆ Owners concerned about damage due to fires and natural hazards
- ◆ Owners that cannot tolerate interruption to operations

District Energy Owner Benefits

Reliability Improvements ...

- ...Assurance of 75% minimum capacity after fire
- ...Improved/Expanded structural design standards
- ...Exposure tested exterior tower systems
- ...Reduced down time from natural hazards
- ...Elimination of fire protection systems
- ...Quality-audited cooling tower system

Designers: How to Specify

Suggested Text

Cooling tower shall be FM Approved, designed and constructed per the Approval Standard for Cooling Towers, dated May 2009.

Supplier shall submit a copy of the Certificate of Compliance issued by FM Approvals, dated after May 31, 2010.

Demonstration of Compliance



Designers: How to Specify

- ◆ Specify appropriate thermal capacity and quantity of cells
- ◆ Multi-cell approved units (below 4 cells) require 75% capacity with one cell out of service
 - Specify design capacity based on colder supply/return water temperatures (reduced approach)
 - Specify alternate capacity (temperatures and flow) based on one cell out of service
- ◆ No redundancy required for single cell towers, but must be approved under the Standard's single cell guidelines

In Summary

The New FM Approval Standard for Cooling Towers ...

- ◆ Improves reliability through enhanced equipment design standards and hazard exposure testing
- ◆ Helps mitigate owner losses from exposure to fire and other natural hazards
- ◆ Advances the state-of-the-art for cooling tower design
- ◆ Offers the only independent third party review of cooling tower design and manufacturing