

Understanding the New FM Global Approval Standard for Cooling Towers

Don Dobney

Director, EvapTech Commercial Sales

Steve Benz

Director, Global Thermal Storage and District Energy

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?

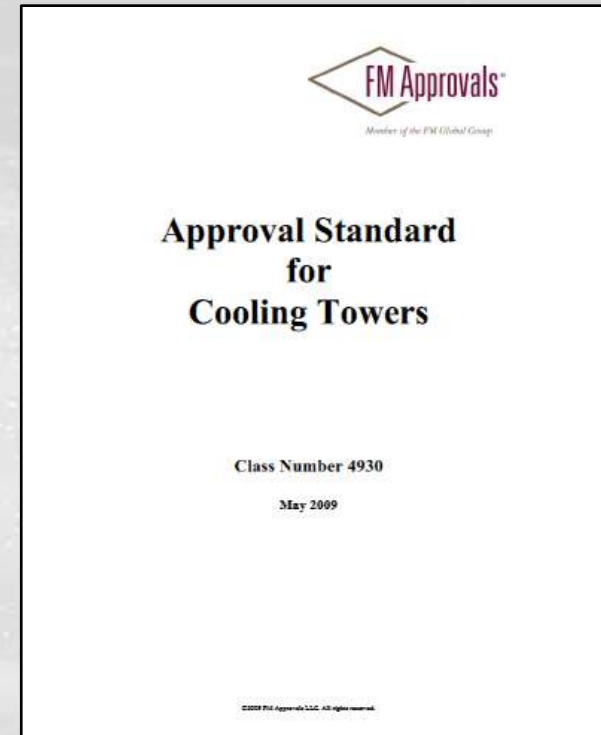
FM Approvals...

- ◆ 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

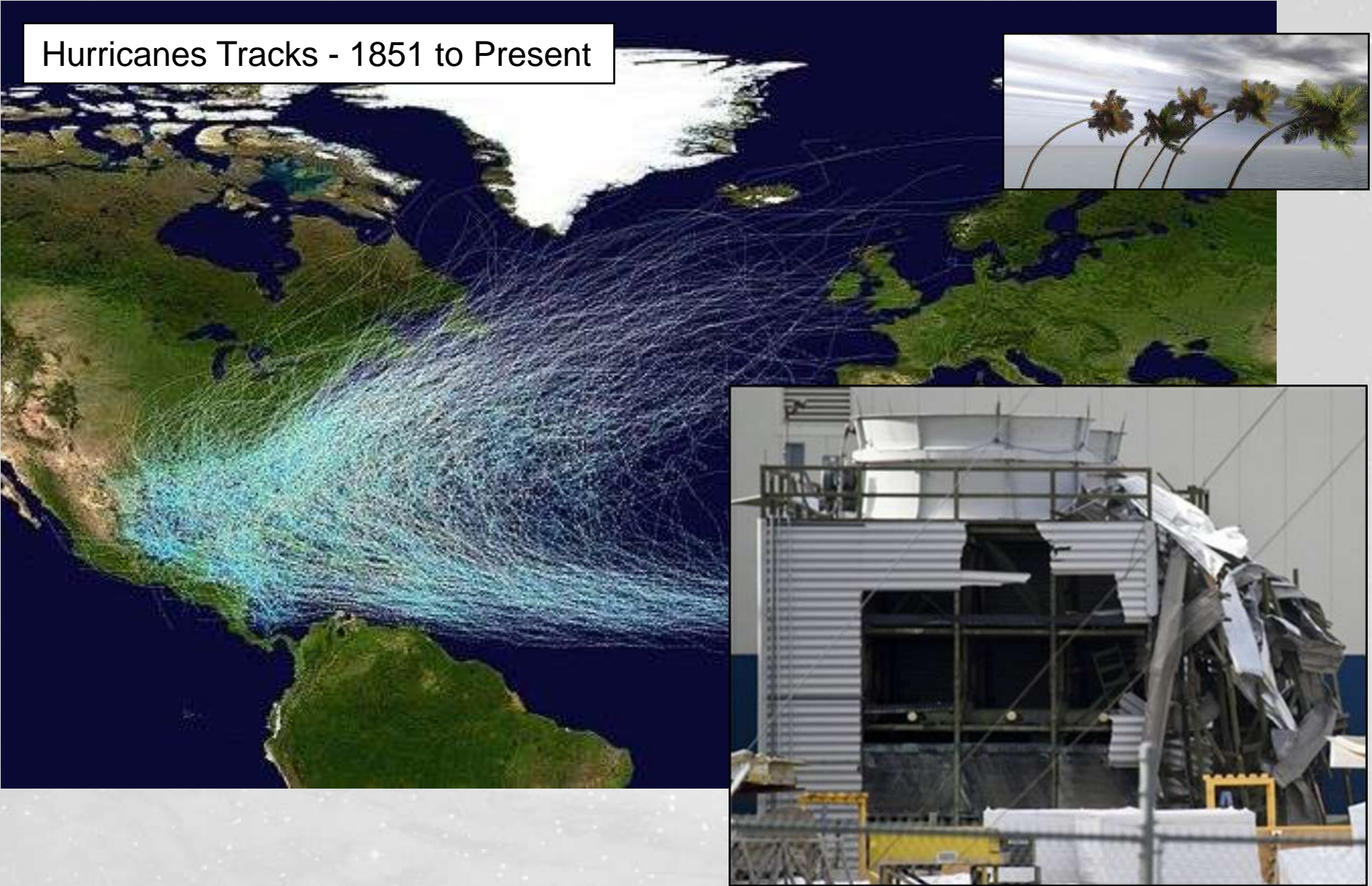
Historic Test Protocol

- 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

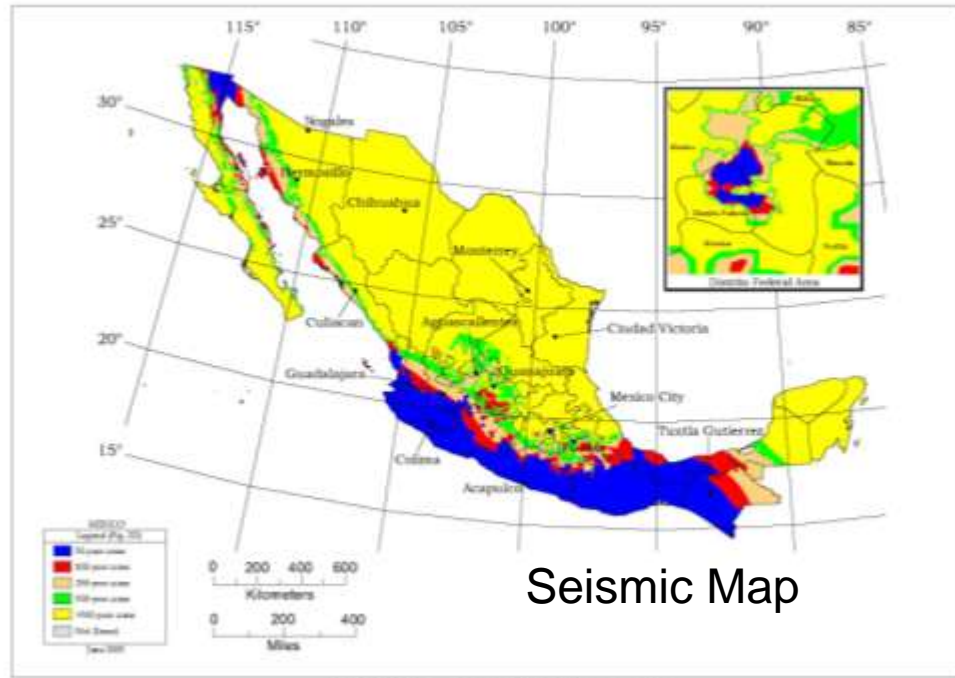
Historic Test Protocol

- 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



Earthquakes
FEM Global Property Loss Prevention Data Sheets
Page 50
1-2

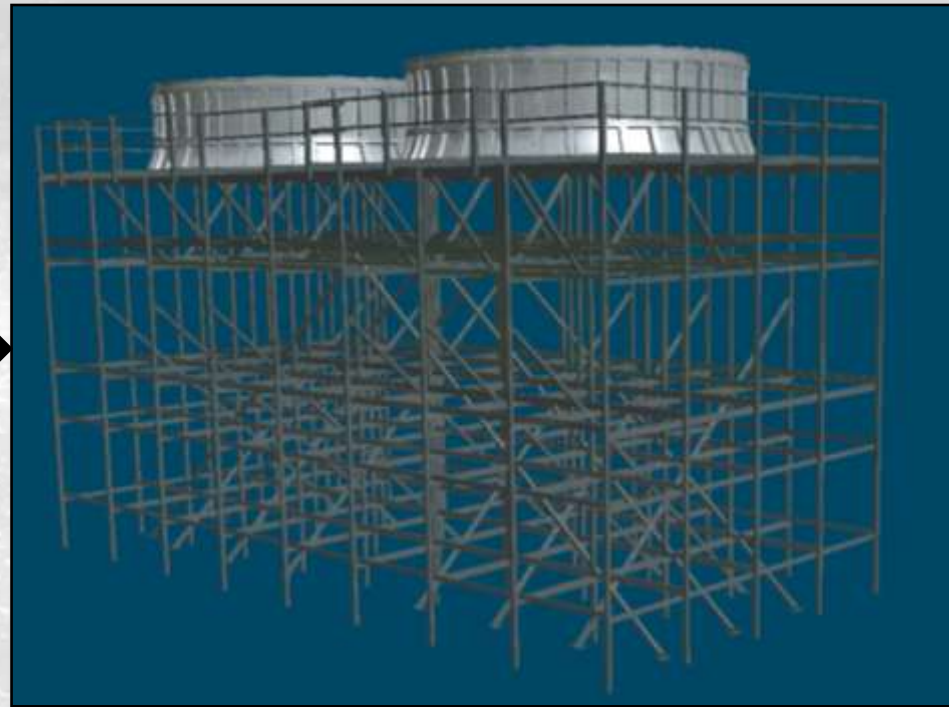
- Defines enhanced design parameters (ex. $I=1.25$)
- Global standard (ex. addresses seismic design in Non-ASCE 7 areas outside of USA)
- Requires the tower to remain “**Intact and Operational**” following an event

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

	<h2>Certificate of Compliance</h2>
	<p>This certificate is issued for the following:</p>
	<p>EvapTech Series ES Cooling Towers Single Cell and Multi-Cell Field Erected Induced Draft Counterflow Cooling Towers</p>
	<p>Prepared for:</p>
	<p>EvapTech, Inc 8331 Nieman Road Lenexa, KS 66214 United States</p>
	<p>FM Approvals Class: 4930</p>
	<p>Approval Identification: 0003040899 Approval Granted: 9/5/2013</p>
	<p>To verify the availability of the Approved product, please refer to www.approvalguide.com</p>
	<p>Said Approval is subject to satisfactory field performance, continuing Surveillance Audits, and strict conformity to the constructions as shown in the Approval Guide, an online resource of FM Approvals.</p>
	
	<p>Cynthia Frank Group Manager - Materials FM Approvals 1151 Boston-Providence Turnpike Norwood, MA 02062</p>
 <p>Member of the FM Global Group</p>	

Approval Date Must be
After May 31, 2010

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