LightningMaster® Corporation

We wrote the book on lightning and static protection

Lightning and Static Protection

Bruce Kaiser, President Lightning Master Corporation

www.LightningMaster.com

Tank Ignitions

LightningMaster Corporation

About Lightning Master

Industry Leaders

Lightning Master principals actively participate in furthering the industry through principal membership on national code writing committees including:

NFPA 780
The National Fire Protection Association Committee on Lightning Protection
API 545
Committee on Standard for Lightning Protection for Hydrocarbon Storage Tanks
NFPA 781
Committee on Lightning Protection using Early Streamer Emitting Air Terminals
IEEE 1576
Working Group, Standard for Lightning Protection Using Charge Transfer System

Lightning Propagation

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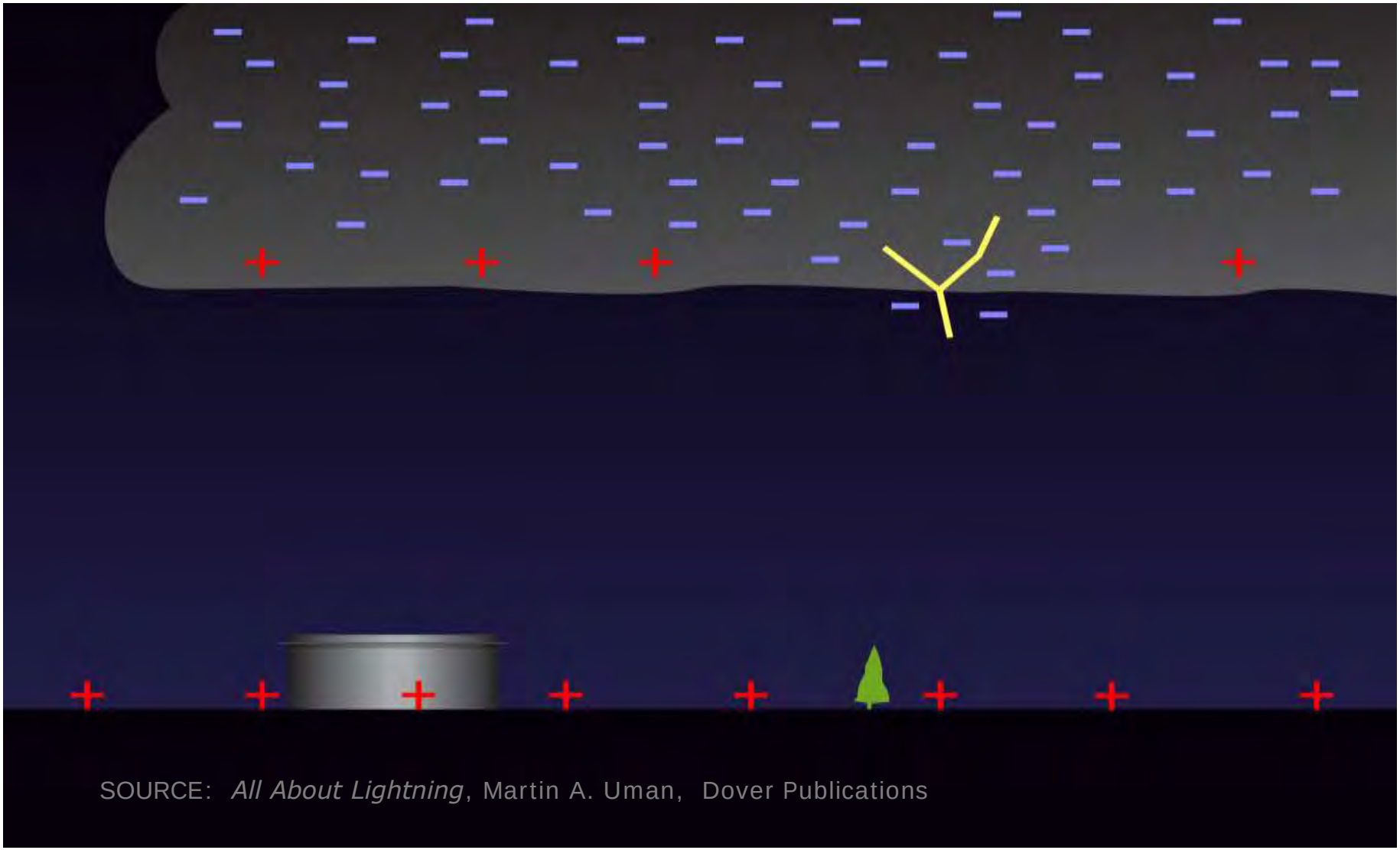

SOURCE: *All About Lightning*, Martin A. Uman, Dover Publications

4 Types of Lightning Damage

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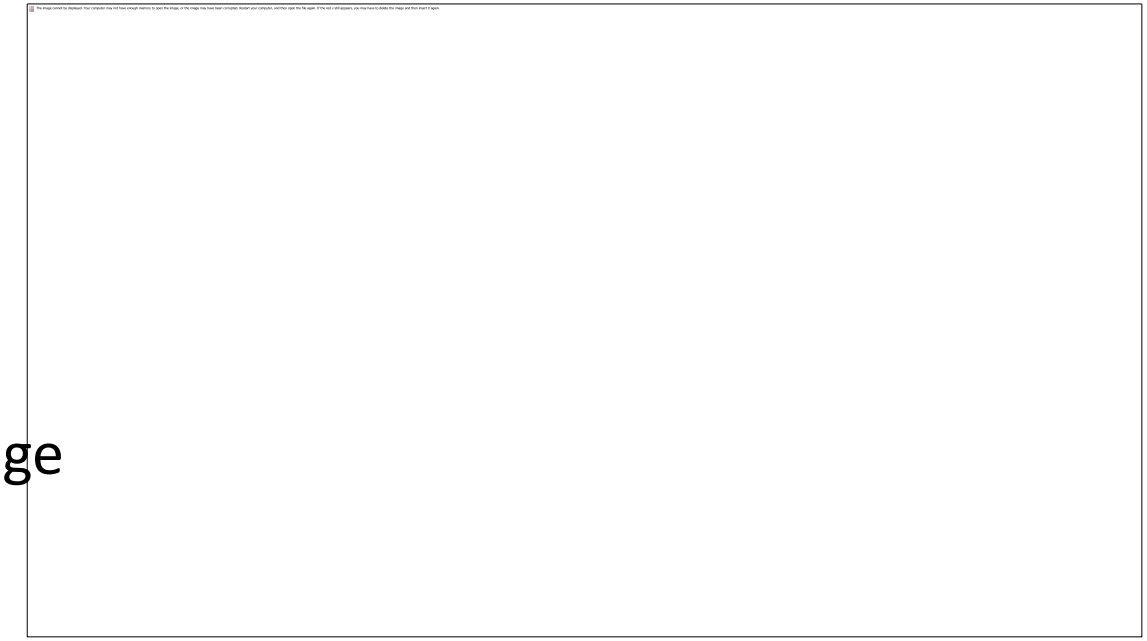

1. Physical damage
2. Secondary effect damage
3. EMP damage
4. Damage caused by changes in ground reference potential

Single Point Grounding

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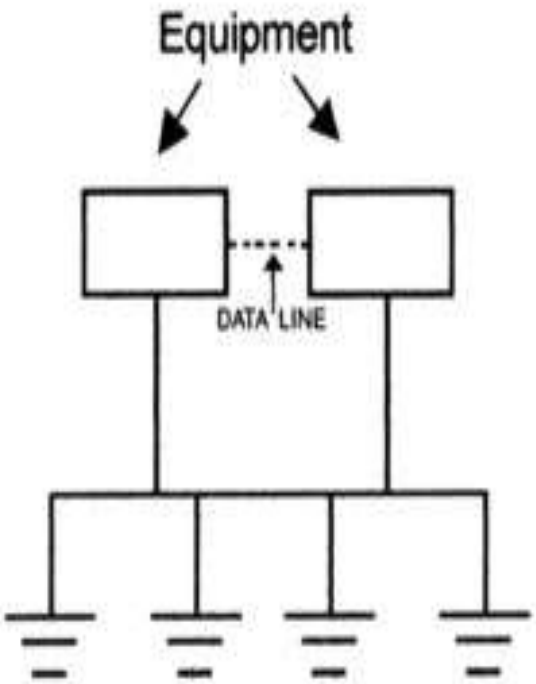
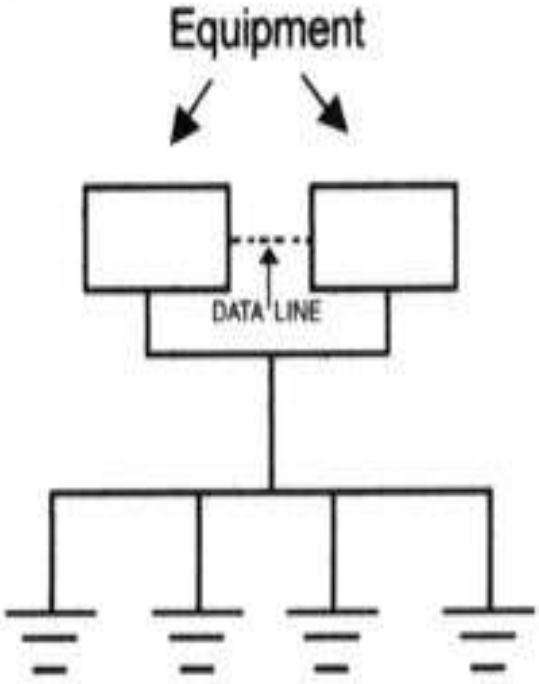


Mutiple-point ground potential referencing (can cause current flow through equipment)



Single-point ground potential referencing (prevents current flow through equipment)

Surge Suppression

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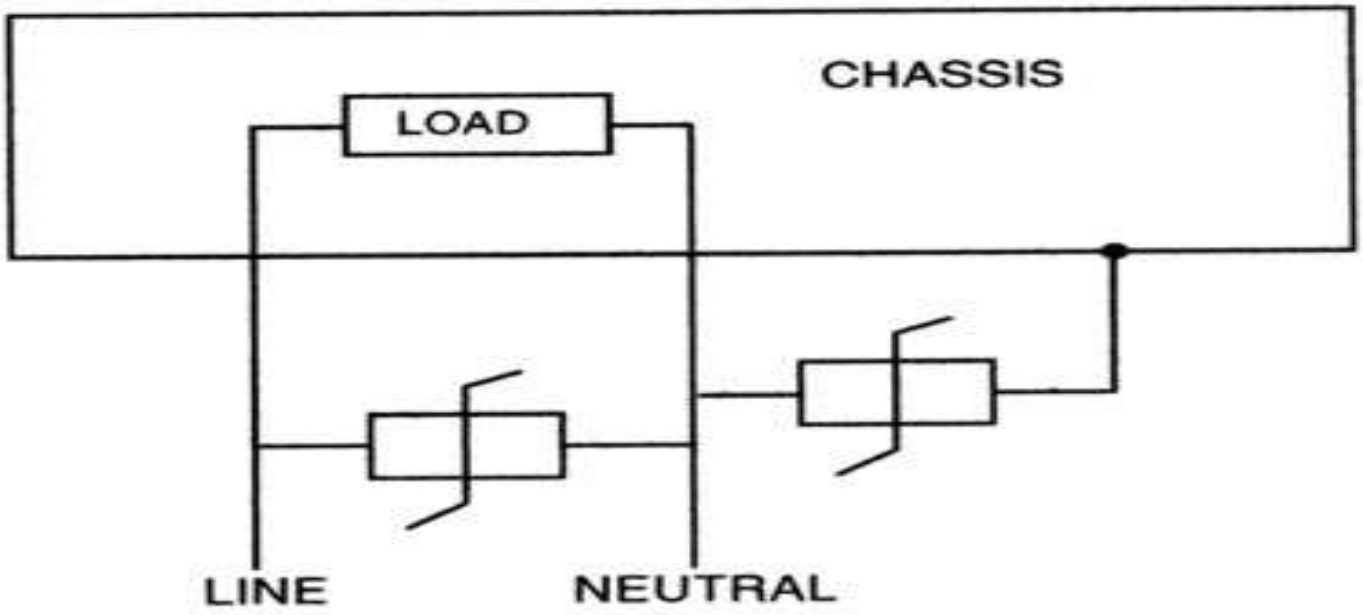
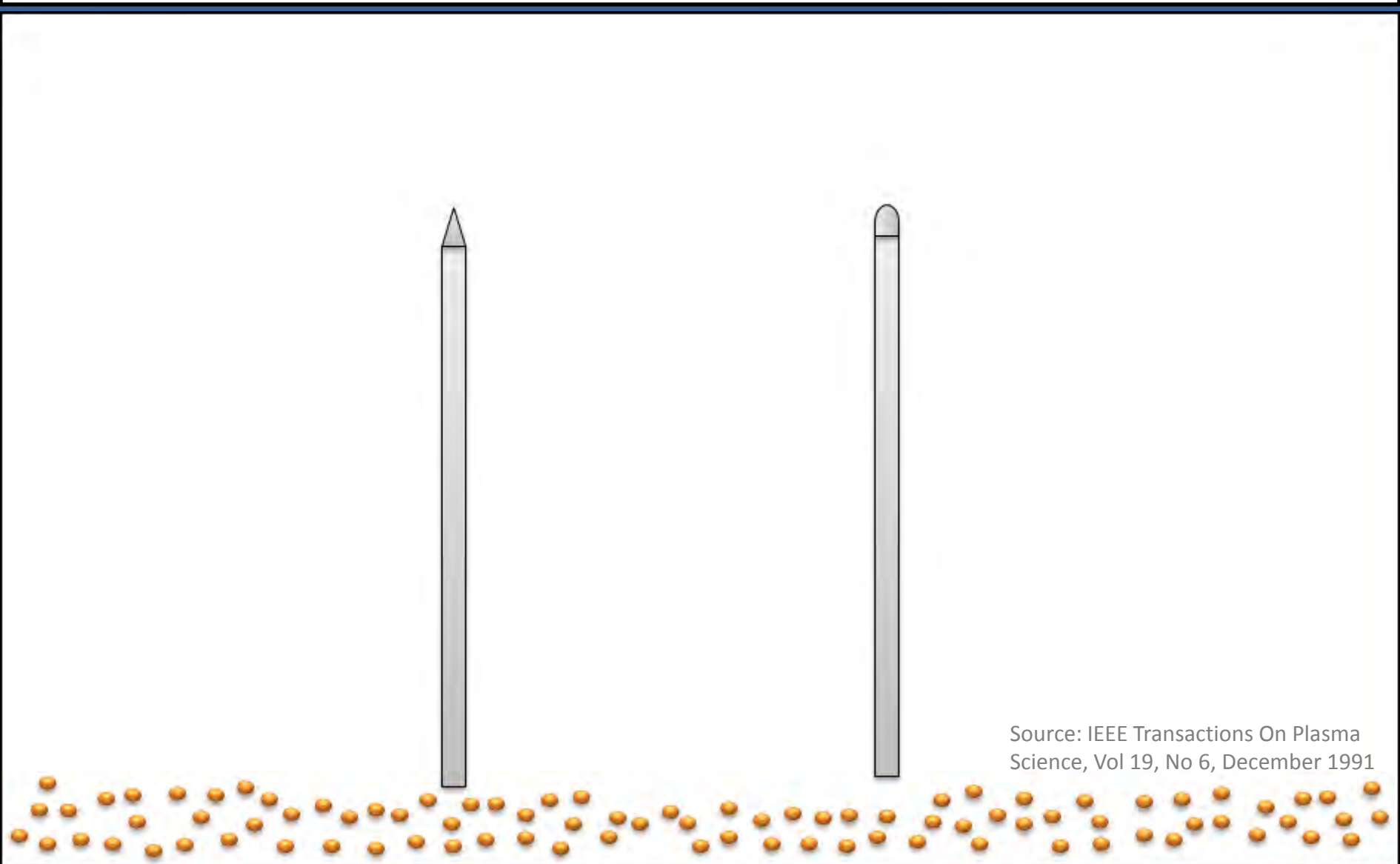


Discharge Phenomena



Source: IEEE Transactions On Plasma Science, Vol 19, No 6, December 1991

Point Discharge Principle

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$$\mathcal{E} = \frac{Q}{4\pi \in r^2} \qquad D = \frac{Q}{4\pi \in r^2}$$

where:

$\mathcal{E}$ = *electric field intensity*

Q = *charge (in coulombs)*

$\in$ = *permittivity of space*

r = *radius*

System Design Meets NFPA 780

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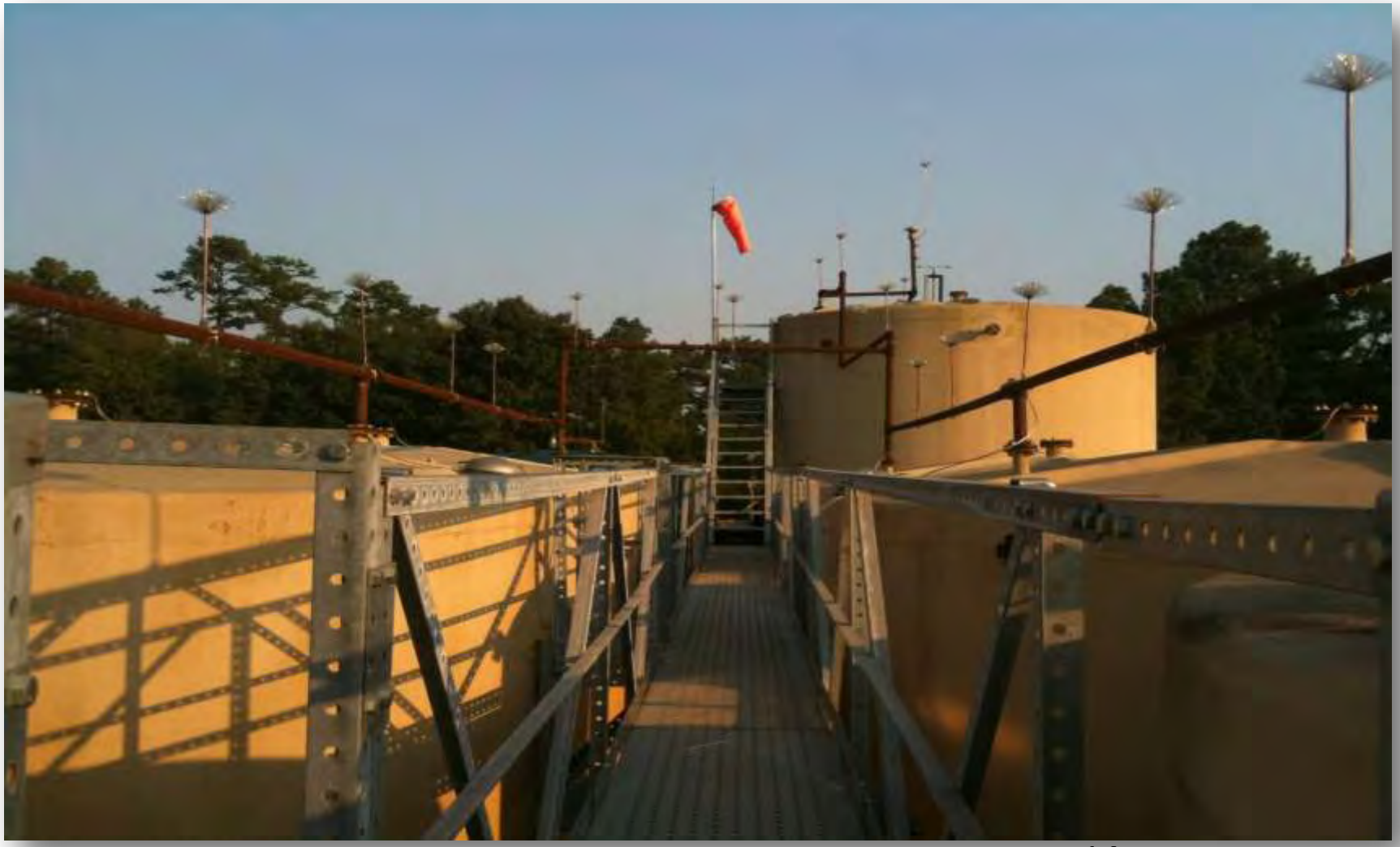

In-Tank Static Ignition Factors

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1. Flammable Mixture
2. Source of Ignition
3. Static Charge building to incendive level

Eliminate source of Ignition through bonding and grounding

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Bond All Masses of Inductance

a. Thief Hatch

b. Valves

c. Piping

d. Carbon Veil

e. Etc.

Vertical and Horizontal Application

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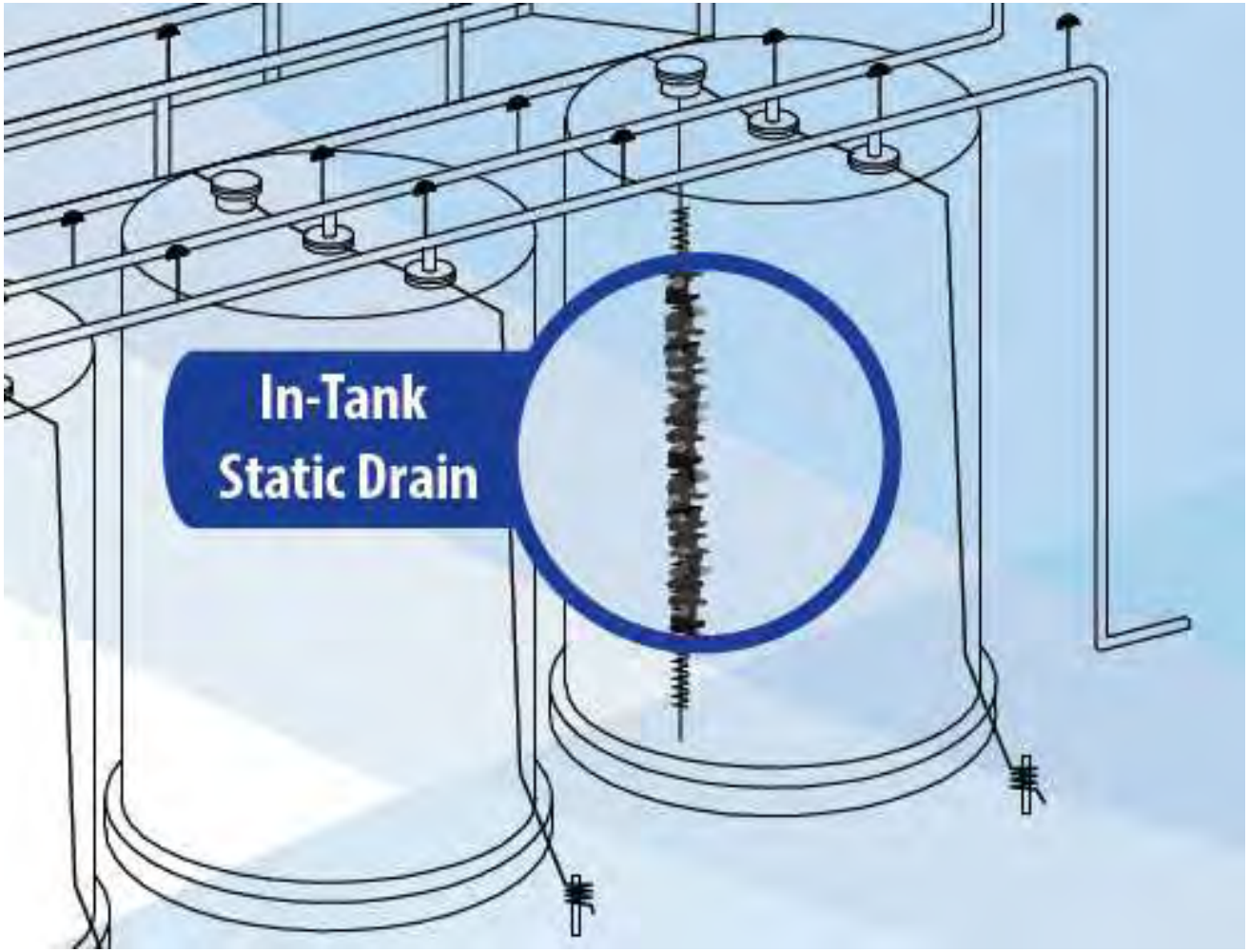
Lightning Master In Tank Static Drain



Guided Wave Radar Systems and Static

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"The radar level sensor systems stopped tripping off line. Operating personnel found an immediate improvement in reliability and reduced down time."

Floating Roof Tanks

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Lightning Current

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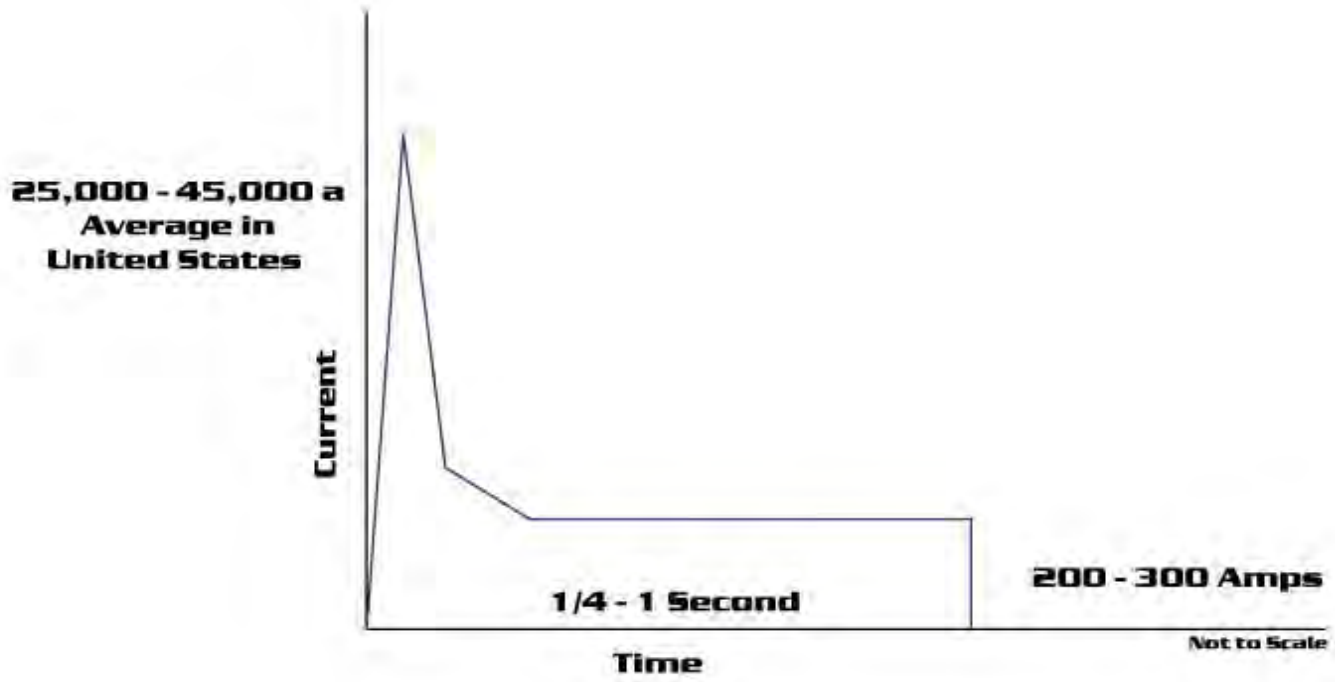

Comparison of Methods

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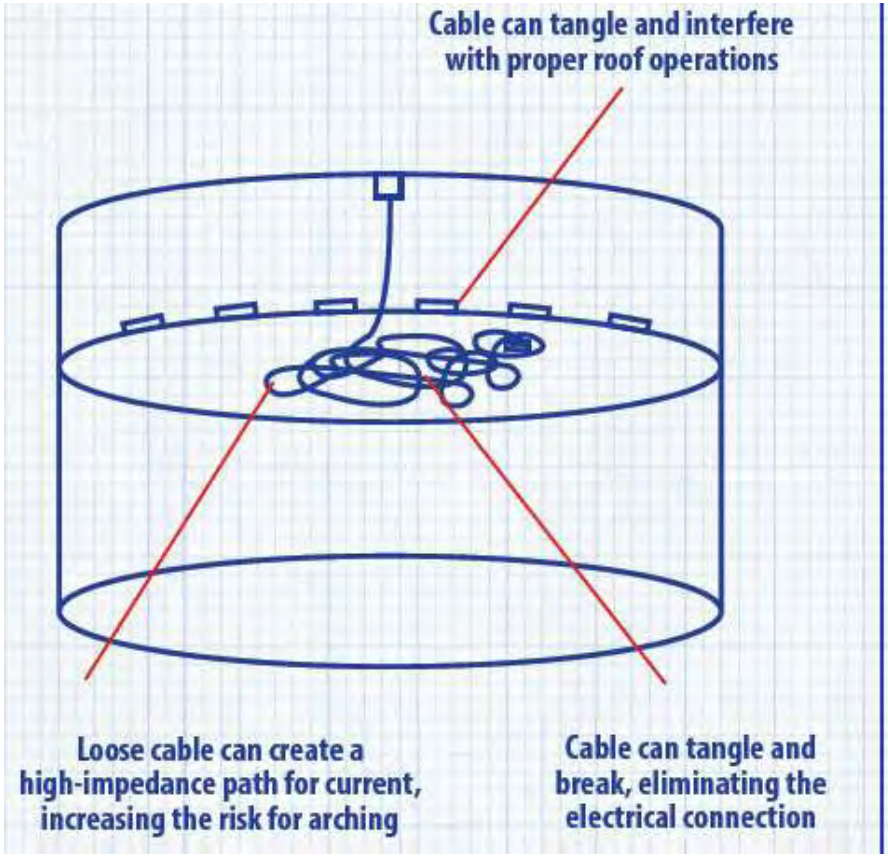
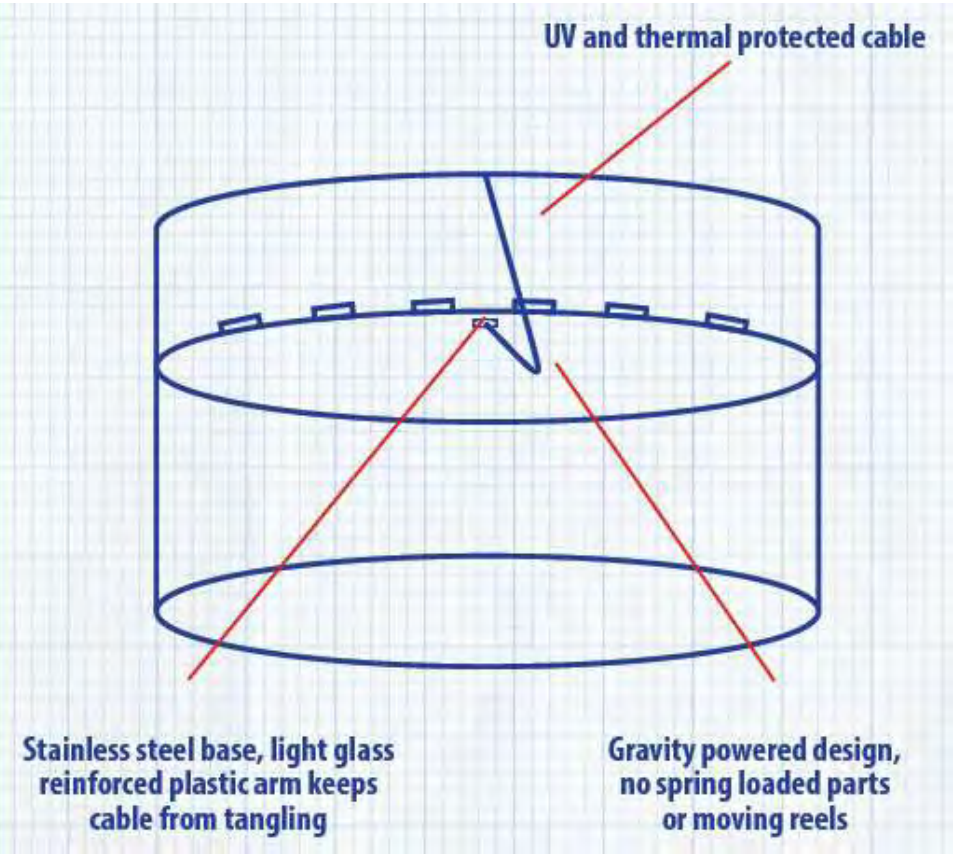
Simple Cable



Movable Arm Grounding System



Lightning Master MAGS

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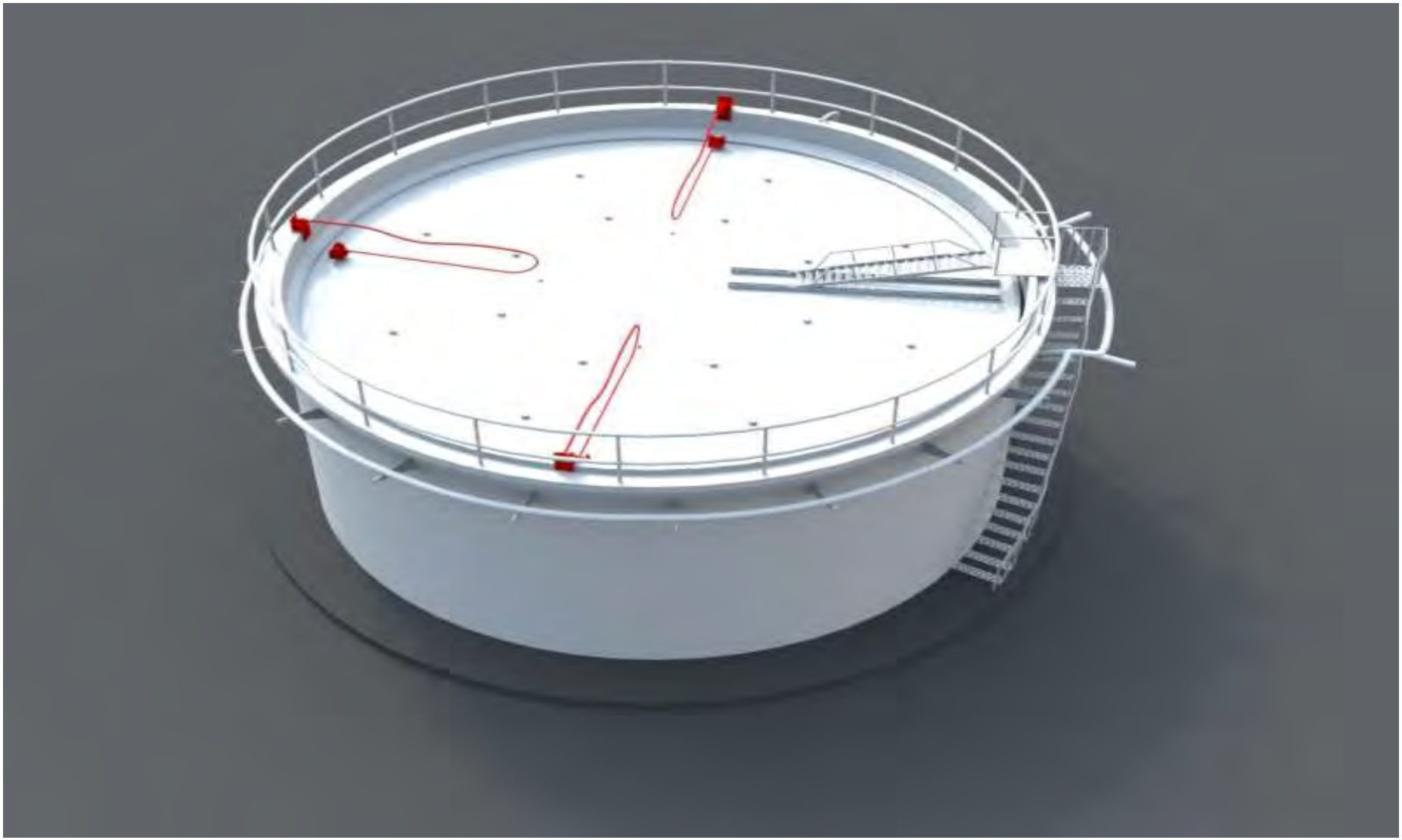

Dome Roof Considerations

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Colonial Pipelines Aluminum Dome Roof Lightning Strike Incident
June 2012
Greensboro, North Carolina



“Colonial protects its tanks with systems designed to deflect electrical charges into the ground. Security cameras reveal that late in the brief storm a tremendous lightning strike came down in the area of the tank battery, (Douglas said). There seems little doubt that the lightning hit the tank, with the electrical grounding system failing to prevent a fire.”

Source: Fireworld Article Archive

Dome Roof Considerations

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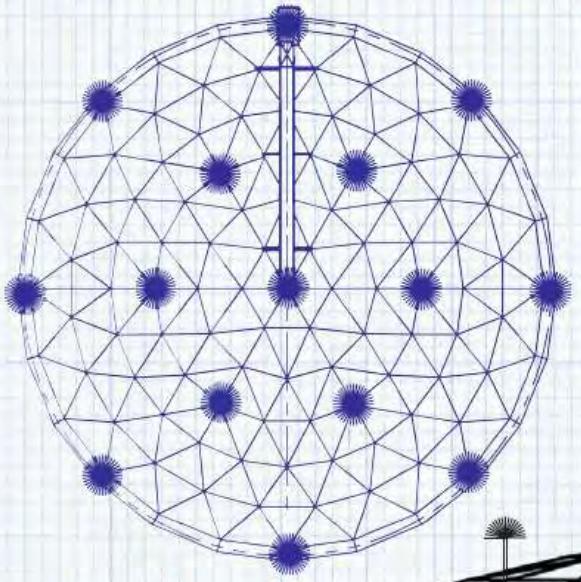
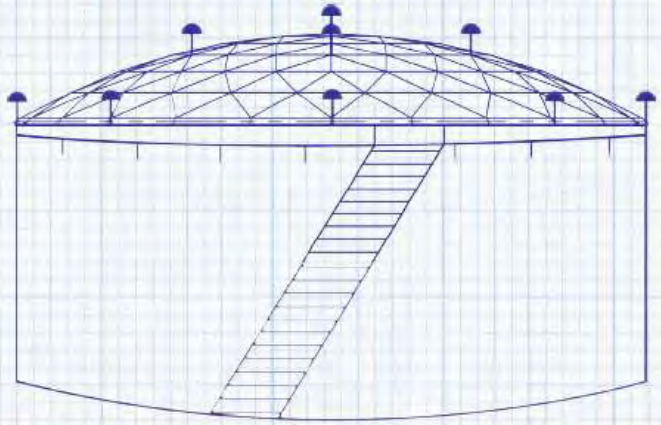
TOP VIEW OF HMT DOME WITH LIGHTNING MASTER STREAMER-DELAYING AIR TERMINALS





SIDE VIEW OF HMT TANK AND DOME WITH LIGHTNING MASTER STREAMER-DELAYING AIR TERMINALS

API AND NFPA COMPLIANT LIGHTNING PROTECTION

CLOSE-UP VIEW OF HMT DOME TOP WITH LIGHTNING MASTER STREAMER-DELAYING AIR TERMINALS

Lightning Density Map

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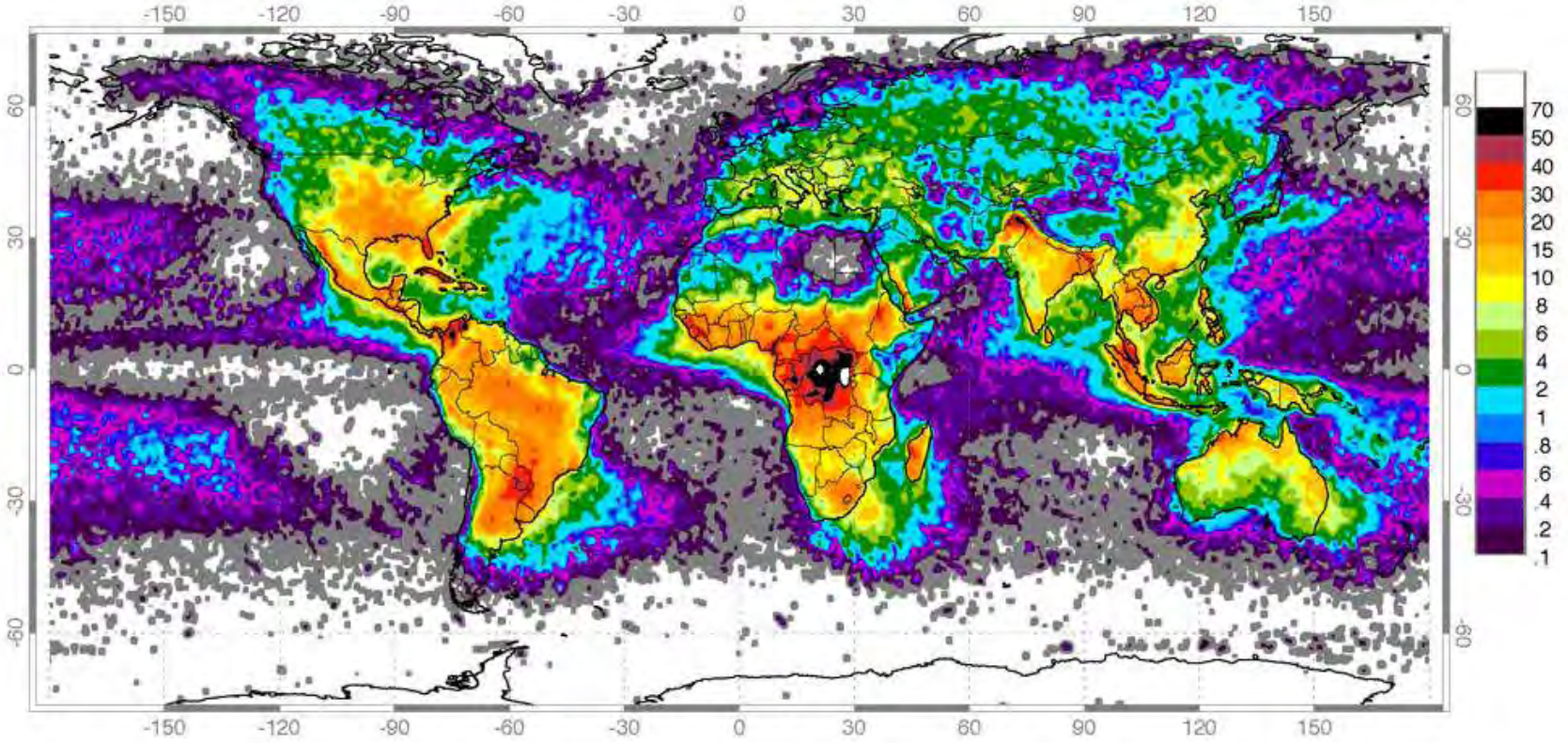

Units: Flashes/sq km/year – Source: NSSTC Lightning Team

Questions

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We wrote the book on lightning and static protection for industrial facilities

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