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# BASIS OF DESIGN - FIRE SUPPRESSION

## CSI Division 21

### Pryor Data Center - PACHYDERM GLOBAL

**Parent Document:** [[Saga Pryor DC/Basis of Design/Erik\_BOD\_Updated/\_BOD - Exec Summary and TOC]]

## OVERVIEW

Fire protection systems protect personnel, IT equipment, and facility infrastructure while meeting NFPA, IBC, FM Global, and insurance requirements. Multi-layered approach includes early detection, automatic suppression, and clear egress paths.

**Design Philosophy:** - **Very early detection:** VESDA (Very Early Smoke Detection Apparatus) in data halls - **Zoned preaction sprinkler:** Primary suppression system for data halls - **Life safety first:** Clear egress, emergency lighting, notification - **Insurance compliance:** FM Global approval for premium reduction

## FIRE SUPPRESSION STRATEGY

### Data Hall 1 (10,000 SF White Space - Orange Zone CP 4)

**System Type: ZONED PREACTION SPRINKLER (Primary System)**

**Configuration:** - **Type:** Zoned dual-interlock preaction system - **Zones:** Multiple independent zones for targeted suppression control - **Activation sequence:** 1. VESDA detects smoke → pre-alarm (investigate) 2. Second detection zone confirms → alarm 3. Heat activation (sprinkler fusible link) → water release to specific zone only - **Benefit:** Dry pipe until both smoke + heat detected; zoned activation limits water discharge area - **Sprinkler heads:** ESFR (Early Suppression Fast Response), K-25.2 - **Coverage:** Per NFPA 13 (130-200 SF per head for data center) - **Water demand:** [ROM] 1,500-2,000 GPM @ 70 psi (full system) - **Zoned demand:** Lower flow rate per zone activation (typical 500-800 GPM per zone)

**DDC Cabinet Integrated Suppression:** - DDC cabinets include factory-integrated fire suppression - Coordinates with building preaction system - Provides additional protection at cabinet level

### Data Hall 2 (Future Fit-Out)

* Same system type as Data Hall 1
* Installed with shell or deferred to tenant fit-out

### Prefabricated Power Delivery Modules (PDMs)

**2 × Outdoor PDMs (Phase 1)**

**System Type:** Clean agent or other suppression per NFPA standards

**Configuration:** - Factory-installed clean agent (FM-200, Novec 1230) or water mist per NFPA 2001/NFPA 750 - Cylinder bank sized for PDM enclosure volume - Automatic discharge on smoke detection - Manual abort button (30-second delay) - **Rationale:** Protects UPS, switchboards, batteries without water damage - **Red Zone - CP 5** security classification

**Cost:** Integrated in PDM package (~$50-100K per PDM)

### Generator Enclosures

**6 × Outdoor Generator Sets**

**System Type:** Portable fire extinguishers only

**Rationale:** - Open-air enclosures with natural ventilation - Diesel fuel fire risk (Class B) - Fixed suppression not typically required for outdoor gen sets - Portable extinguishers: 2 × 20 lb ABC per generator

**Optional:** Pre-engineered suppression system if required by AHJ or insurance - Cost: +$25-50K per generator

## MECHANICAL ROOMS & CHILLER YARD

### Indoor Mechanical Spaces

**System Type:** Wet pipe sprinkler

**Configuration:** - Standard NFPA 13 coverage - Sprinkler heads: 130-200 SF per head - Avoid heads directly above electrical panels (sidewall heads if needed)

### Outdoor Chiller Yard (~50,000 SF)

**System Type:** Portable fire extinguishers

**Rationale:** - Open-air equipment (natural smoke/heat dissipation) - Fixed suppression not required for outdoor chillers - Extinguishers: 2 × 20 lb ABC per chiller plant zone

## OFFICE, NOC, SUPPORT SPACES

### System Type: WET PIPE SPRINKLER

**Coverage:** - Standard commercial spacing per NFPA 13 - Light hazard occupancy (offices) - Sprinkler heads: ~130 SF per head

**Special Areas:**

**Network Operations Center (NOC - Red Zone CP 5):** - Consider preaction or clean agent if NOC contains critical equipment - Standard wet pipe acceptable for office areas - Raised floor: Not Applicable (slab-on-grade)

**MPOE/MMR (Fiber Entrance Rooms - Red Zone CP 5):** - Preaction dry pipe or clean agent (protects carrier equipment) - Coordinate with carrier requirements - Critical telecommunications infrastructure protection

**Storm Shelter/Safe Room (FEMA 361 Compliant Prefabricated Module):** - Integrated fire suppression per module manufacturer (typically wet pipe or clean agent) - 20 person capacity, Level 1 location - Emergency lighting and signage per FEMA P-361

## FIRE DETECTION & ALARM SYSTEM

### Detection Technology by Zone

**Data Halls (Critical Detection):** - **Type:** VESDA (Very Early Smoke Detection Apparatus) or equivalent ASD - **Sampling points:** Air sampling pipes at ceiling level - Holes every 10-15 ft along pipe - 4-6 sampling pipes per data hall - **Sensitivity levels:** - Alert: 0.005% obscuration/ft (investigate, no evacuation) - Action: 0.015% obscuration/ft (pre-alarm, prepare suppression) - Fire 1: 0.03% obscuration/ft (alarm, evacuate, suppress) - Fire 2: 0.05% obscuration/ft (full alarm) - **Response time:** <60 seconds from smoke event to alert - **Integration:** BMS, DCIM, fire alarm panel

**PDMs (Electrical Rooms):** - Spot-type photoelectric smoke detectors (addressable) - Heat detectors (rate-of-rise + fixed temp 135°F) - Integration with clean agent suppression system

**Mechanical Rooms:** - Spot-type smoke detectors (every 500 SF) - Heat detectors (135°F fixed temp)

**Office/NOC/Support Spaces:** - Spot-type smoke detectors per NFPA 72 - Spacing: Every 500-900 SF depending on ceiling height - Duct smoke detectors in HVAC supply/return

**Generator Yard:** - Heat detectors in enclosed gen set housings (if applicable) - No detection required for open-air enclosures

### Fire Alarm Control Panel (FACP)

**System Configuration:** - **Type:** Addressable, intelligent fire alarm system - **Manufacturer:** [TBD - e.g., Notifier, Simplex, Edwards] - **Network:** Fiber backbone, redundant pathways - **Zones:** Separate addressable zones for each major area - **Annunciation:** Remote annunciators at NOC, main entrance, loading dock

**Integration:** - **BMS:** Status monitoring, alarm forwarding - **Access control:** Unlock all doors on alarm - **HVAC:** Shutdown air handlers, close smoke dampers - **Suppression systems:** Trigger preaction/clean agent discharge

**Remote Monitoring:** - Central station monitoring (UL-listed service) - Direct dial to fire department (if permitted by AHJ) - NOC 24/7 monitoring with alarm escalation procedures

### Notification Appliances

**Audible:** - Horns/speakers at 90 dB minimum (15 dB above ambient) - Voice evacuation capability (EVAC panels) - Distinct tones for alert vs. alarm

**Visual:** - Strobes per NFPA 72 (ADA compliant) - Red strobes in all occupied areas - Minimum 75 candela in public areas

## FIRE WATER SUPPLY

### Municipal Water Connection

**If Available:** - 8-12” fire service connection (separate from domestic) - Underground loop with PIV (post indicator valve) and FDC (fire department connection) - Backflow preventer: Double-check valve assembly - Hydrant spacing: ~300 ft around perimeter

**Demand Calculation:** - Design basis: ESFR sprinklers in data hall (most demanding) - Estimated demand: 1,500-2,000 GPM @ 70 psi for 2 hours - Duration: ~180,000-240,000 gallons

### Fire Pump & Storage (If Municipal Service Inadequate)

**Fire Pump:** - **Type:** Electric or diesel-driven (diesel preferred for reliability) - **Capacity:** Sized to meet demand (1,500-2,000 GPM @ 70 psi) - **Rating:** UL-listed per NFPA 20 - **Location:** Separate fire pump room (non-freezing) - **Controller:** Automatic start on pressure drop

**Storage Tank:** - **Capacity:** 250,000-300,000 gallons (includes hose stream allowance) - **Type:** Bolted steel or welded steel, API 650 - **Location:** Outdoor, adjacent to fire pump room - **Makeup:** Municipal water or periodic water delivery (if no utility) - **Heating:** Tank heater if subject to freezing

**Cost:** ~$750K-1.5M (pump + tank + installation)

## EGRESS & LIFE SAFETY

### Occupancy & Load

**Data Halls:** - Classification: Group B (Business) per IBC Section 304 - Occupant load: ~10 persons (one person per 100 SF gross)

**Support Spaces:** - Offices, NOC, break rooms: Group B - Total facility load: 20-30 persons

### Egress Requirements

**Exit Count:** - Minimum 2 exits from each data hall (IBC Section 1006) - Exits remotely located (diagonal separation)

**Exit Width:** - Minimum 36” clear width per IBC - Preferred 44” (allows equipment carts)

**Travel Distance:** - Maximum 200 ft to nearest exit (unsprinklered areas) - Maximum 300 ft (sprinklered areas) per IBC Table 1017.2 - Data hall travel distance: [ROM] <150 ft (compliant)

**Doors:** - Panic hardware on exit doors (no keys required for egress) - Magnetic hold-open with fire alarm release - Self-closing on alarm

### Containment

**Containment:** Not Applicable (DDC cabinets provide integrated cooling - no hot/cold aisle containment required)

### Emergency Lighting

**Coverage:** - All egress paths, stairwells, data halls - Battery-backed LED fixtures (90-minute runtime minimum) - Illumination: 1 fc average, 0.1 fc minimum per NFPA 101

**Exit Signs:** - Illuminated LED exit signs (battery-backed) - Red or green letters (AHJ preference) - Maximum 100 ft spacing in corridors

## PORTABLE FIRE EXTINGUISHERS

### Distribution

**Class A/C (Offices, Data Halls):** - Type: ABC dry chemical or clean agent (Halotron for data halls) - Size: 10-20 lb - Spacing: Maximum 75 ft travel distance per NFPA 10

**Class B (Generator Yard, Mechanical):** - Type: ABC dry chemical or Purple K - Size: 20 lb - Spacing: Maximum 50 ft travel distance

**Special Locations:** - Data hall entrances: 2 × 20 lb Halotron - Generator sets: 2 × 20 lb ABC per generator - Mechanical rooms: 2 × 20 lb ABC per room

### Mounting & Signage

* Wall-mounted brackets (5 ft AFF to handle)
* Signage: “FIRE EXTINGUISHER” with directional arrow
* Inspections: Annual inspection, 6-year maintenance, 12-year hydrostatic test

## CODES AND STANDARDS

* **NFPA 13** (Installation of Sprinkler Systems)
* **NFPA 72** (National Fire Alarm and Signaling Code)
* **NFPA 75** (Fire Protection of Information Technology Equipment)
* **NFPA 2001** (Clean Agent Fire Extinguishing Systems)
* **NFPA 101** (Life Safety Code)
* **NFPA 20** (Installation of Stationary Pumps for Fire Protection)
* **IBC 2021** (International Building Code), Oklahoma amendments
* **FM Global Data Sheet 5-4** (Transformers)
* **FM Global Data Sheet 5-32** (General Storage)

## INSURANCE & FM GLOBAL APPROVAL

### FM Global Requirements (Data Center)

**Suppression:** - Preaction dry pipe or clean agent in data halls - ESFR sprinklers (if wet/preaction) - Clean agent in UPS/electrical rooms

**Detection:** - VESDA or equivalent very early smoke detection - Dual-stage alarming (alert + alarm)

**Egress:** - Clear exit paths, emergency lighting, notification

**Testing:** - Quarterly fire alarm testing - Annual sprinkler flow testing - VESDA calibration every 6-12 months

**Benefits of Compliance:** - 20-30% insurance premium reduction - Faster claim processing - Risk engineering support from FM Global

## COST SUMMARY

| System | Cost Estimate |
| --- | --- |
| **Data Hall Preaction (10,000 SF)** | $300-500K |
| **Data Hall Clean Agent (Alternative)** | +$500-800K |
| **PDM Integrated Suppression (2 units)** | Included in PDM cost |
| **Wet Pipe (Support Spaces)** | $150-250K |
| **VESDA Detection (Data Halls)** | $100-200K |
| **Fire Alarm System (Addressable)** | $150-250K |
| **Fire Pump + Storage (If Needed)** | $750K-1.5M |
| **Portable Extinguishers** | $15-25K |
| **Total (Preaction Option)** | **$1.5-2.7M** |
| **Total (Clean Agent Option)** | **$2.0-3.5M** |

**Tags:** #pryor-dc #fire-suppression #preaction #clean-agent #vesda #nfpa #tier-iii

**Next Steps:** 1. Coordinate with insurance broker for FM Global approval requirements 2. Fire water availability study (municipal service or on-site storage) 3. Hydraulic sprinkler calculations (if preaction selected) 4. Clean agent design calculations (if gas suppression selected) 5. VESDA sampling point layout and airflow modeling

**Document Control:** - **Source:** Pryor\_Bod\_EVS\_Rev01.md and Erik\_BOD reference - **Date Updated:** October 29, 2025 - **Prepared by:** EVS / PGCIS Team - **Key Updates:** Preaction vs. clean agent analysis, VESDA specifications, FM Global compliance