Site Hardening –
Lessons from the Field

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Site Hardening Checklist

- **Grounding/Lightning Protection**
  - How much is too much… or how little isn't enough? How do you check it?
- **Air Handling**
  - Does it go through the gear, instead of around?
- **Physical Security**
  - Can we keep most of the critters out (both four and two legged)?
  - What about the weather?
- **IT Security**
  - Keeping out a different kind of critter
- **Backup Systems**
  - They're only as good as the last time you saw them running…

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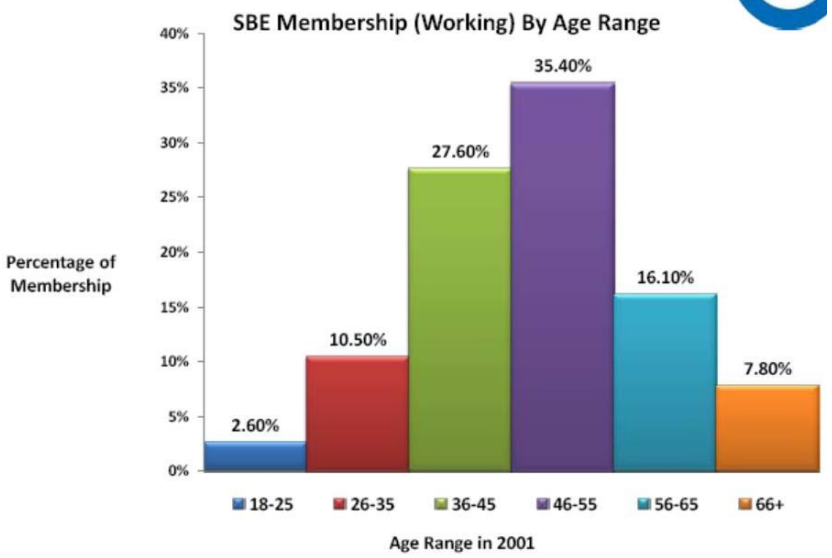
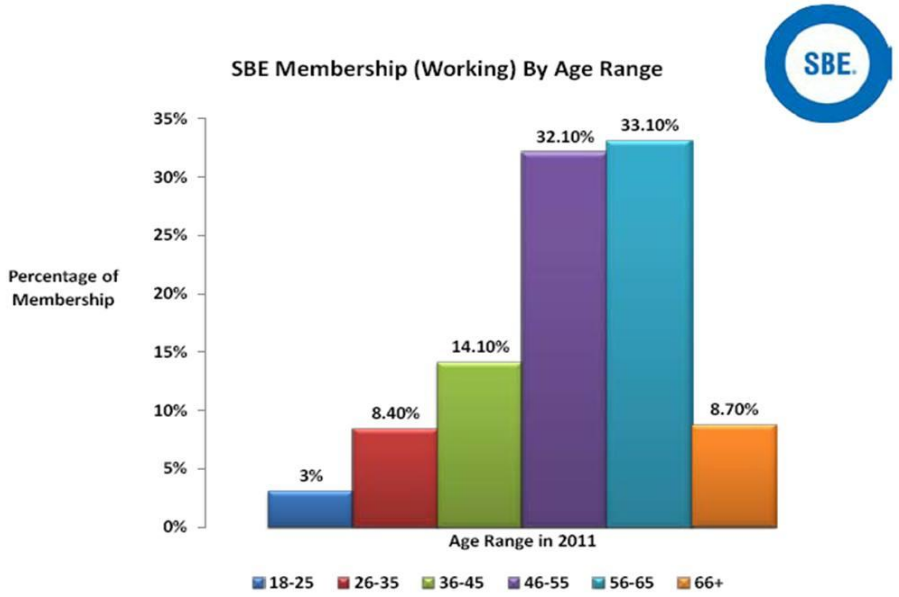
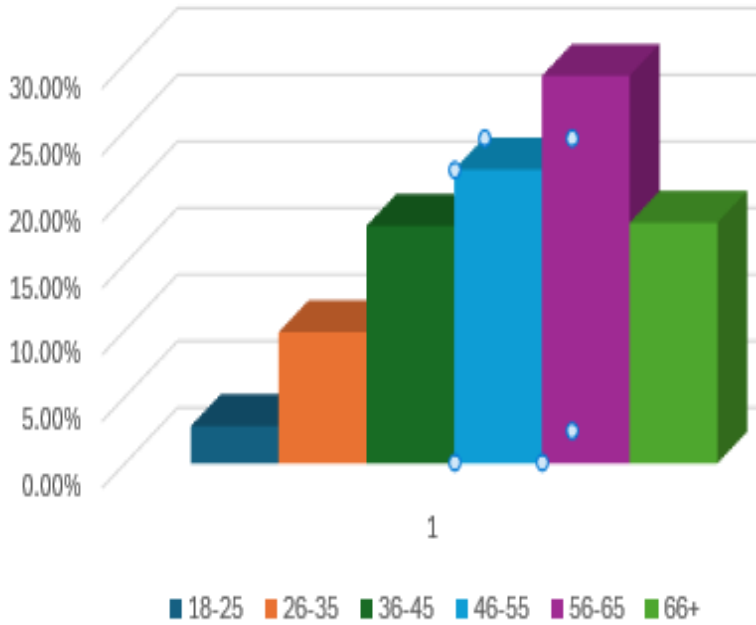
Aging Demographic



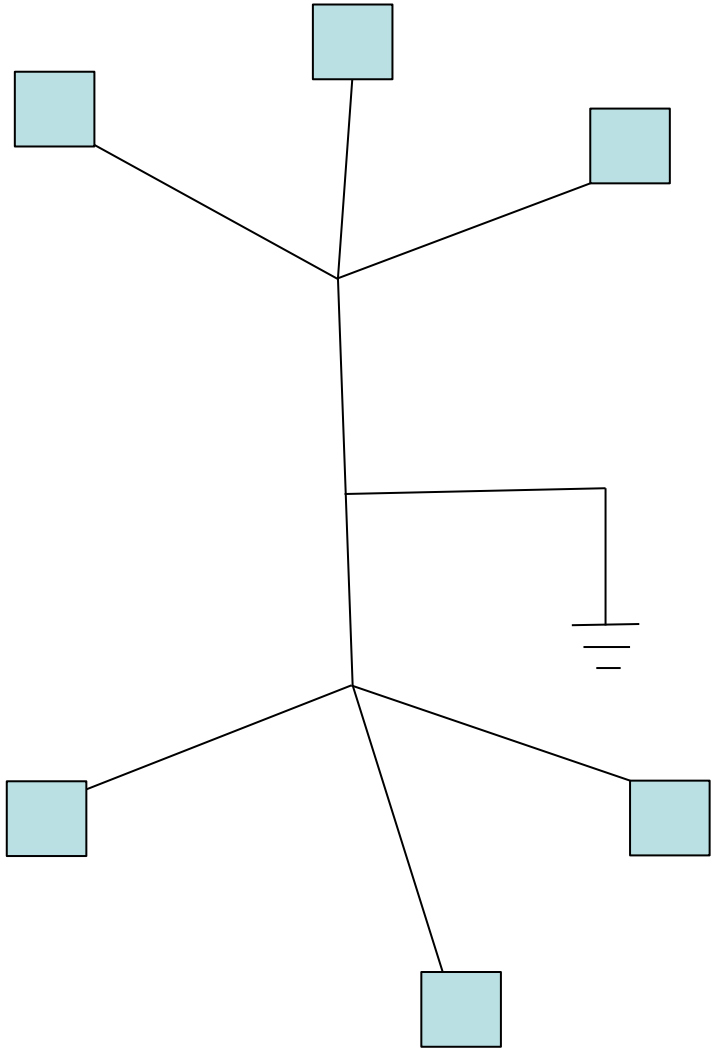




	18-25	26-35	36-45	46-55	56-65	66+
2001	2.6	10.5	27.6	35.4	16.1	7.8
2011	3	8.4	14.1	32.1	33.1	8.7
2024	2.8	9.9	18.1	22.1	29.1	18.1

Get Well Grounded…

- But not too well grounded
  - Too many grounds cause issues too.
- Single point (star) grounding is the key
  - One ground per item, where possible.
  - Establish reference ground(s).
  - Use a tree, if need be.



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Get Well Grounded…

Buss bar for AC grounds

- Tied to station reference ground
- All primary equipment connected

Bulkhead ground for coax cables

- Best done where cables enter building
- Connected to station reference ground
- Keep ground leads as short as possible

Get Well Grounded…

MAKE SURE YOUR GROUND CONNECTION IS ACTUALLY GROUND!!!

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Maintenance

- Grounding is important
  - Not just the installation, but the actual type of connection.
  - If you do it right, you won't have to redo it at night!

Get Well Grounded…

Ground rods are good – but they work better if they are driven straight into the ground. Preferably into the water table, or a chemically augmented ground point.

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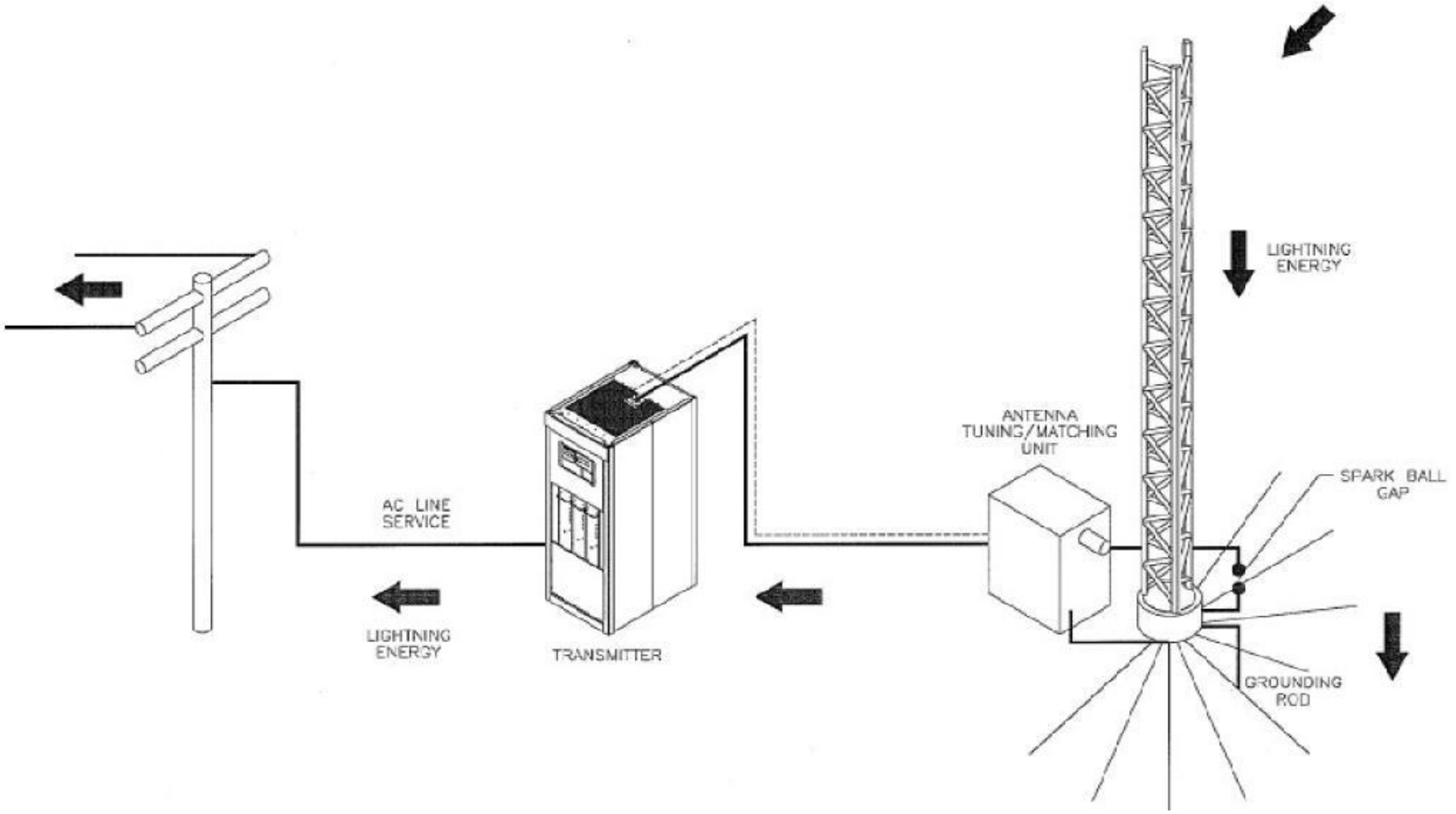
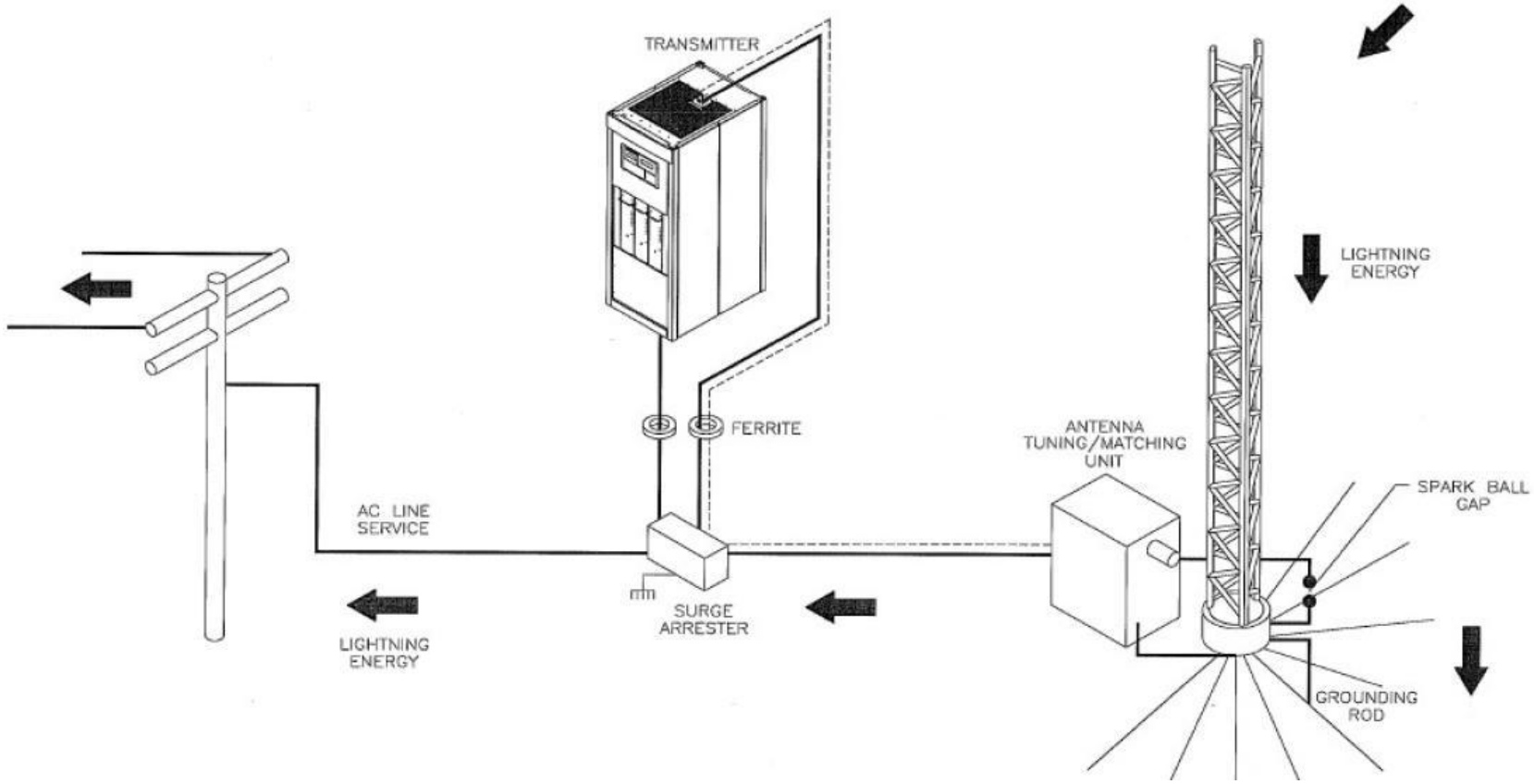
Always Use Protection

AC Power line protectors are a must – and they MUST be connected to your station reference ground.

Typical Site



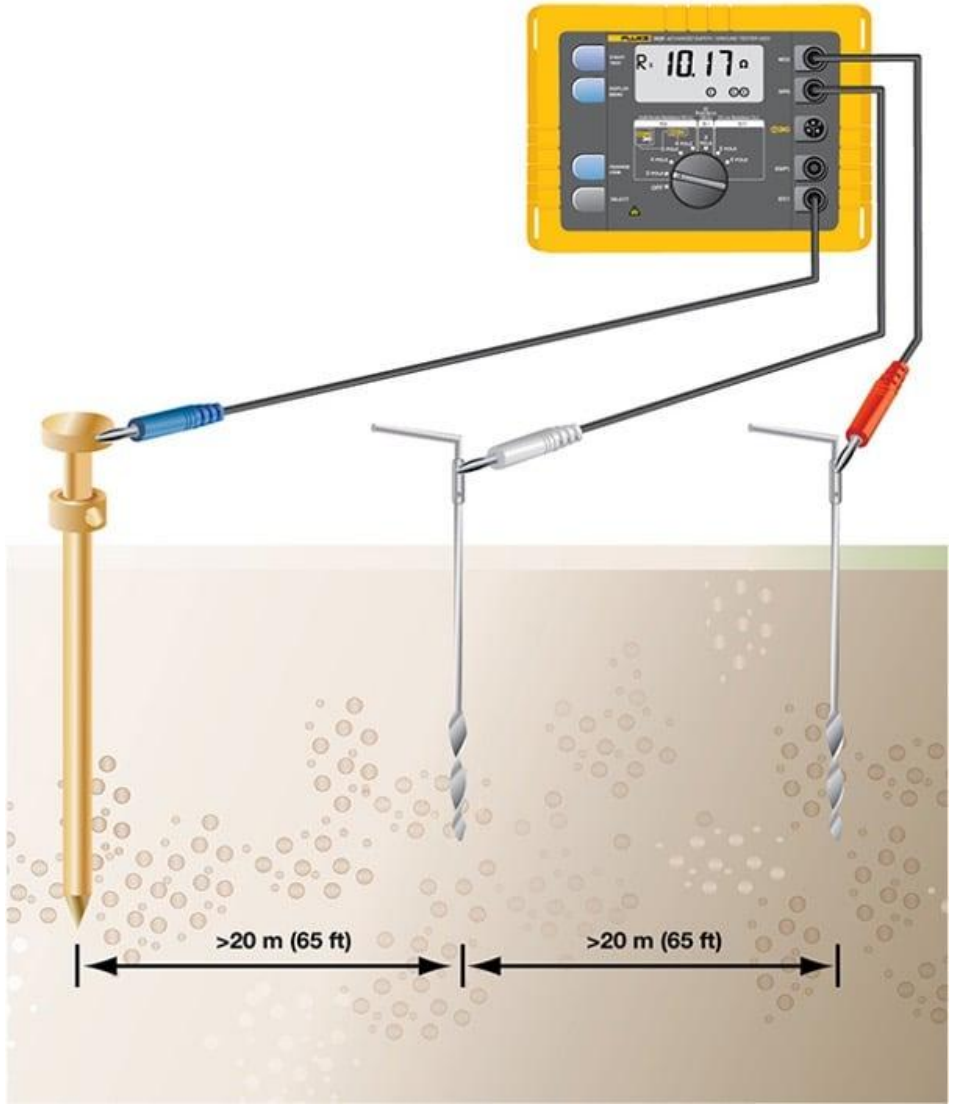
Installation of Surge Protector



- Measuring ground resistance
  - Lower is better, but knowing what it is will help decide how much copper you'll need (remember it can vary seasonally).

    (Fluke 1625-2 GEO Earth Ground Tester shown

  - Current divider – use lowest resistance conductors possible
    - Resistance of 4" strap: .000063 ohms/ft (1/32")
    - Resistance of 2AWG copper cable: 0.000156 ohms/ft (more than 2.5 times that of strap)
    - Good to remember that conduit, or 12AWG electrical safety ground wires, are significantly higher in comparison (0.0016 ohms/ft for 12AWG wire).



Cooling

Air handling is very much a cost vs. benefits discussion

-These days, computerized equipment, keeping the site (or at least the equipment) cool is more important than ever

-In hot, dusty environments, air conditioning is sometimes the only viable solution

-In cooler climates, with sufficient incoming air filtration, cooling with outside air can be quite acceptable

-Points to consider:

-Airflow direction (ideally, cooler air will come into the transmitter/equipment intakes, not shooting past it, or coming into the building at the other end).

-Positive pressure – more air should be brought into the building than is exhausted. If the transmitter is ducted, exhaust airflow should be higher than the airflow throughput of the transmitter, with incoming airflow even higher than that.

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Cooling

- Points to Consider
  - If using forced air:
    - intake air must be filtered
    - draw in more air than is exhausted, to maintain positive pressure
    - exhaust more air than the transmitter airflow requirement
    - allow for redundancy (use louvres to allow warm air to heat room in cold weather, use multiple blowers to avoid overheating in the event of a failure)
  - If using chilled air (air conditioning):
    - allow sufficient headroom for building convection (heat from sun, and other equipment in building
    - use redundant systems… if you require 5T of air conditioning, consider using two three ton units and alternate the main monthly
    - remember maintenance (clean filters and condenser coils as required)

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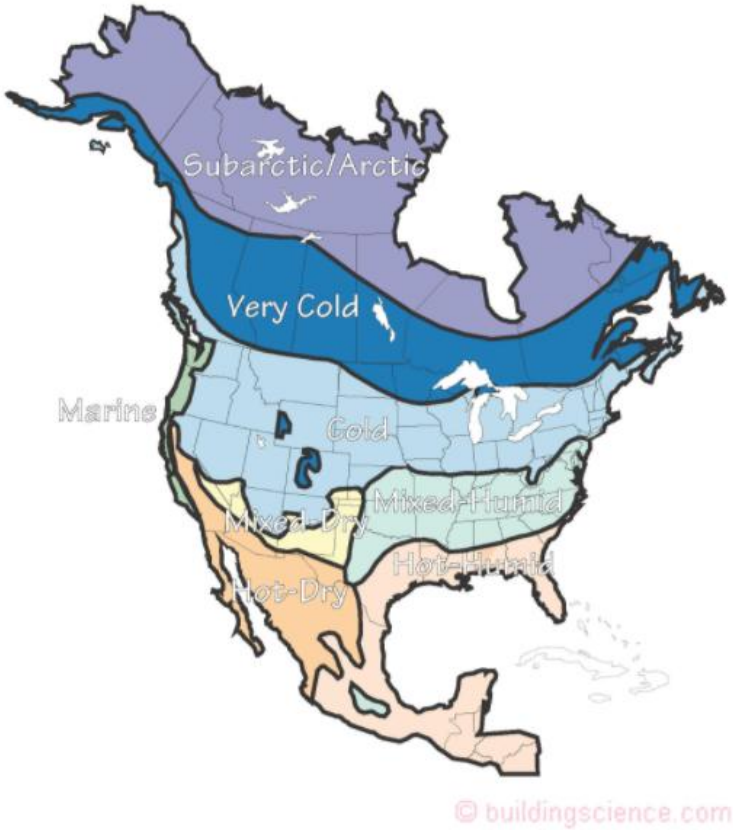
Know your environment



https://www.buildingscience.com/documents/building-science-insights/bsi-120-understanding-walls

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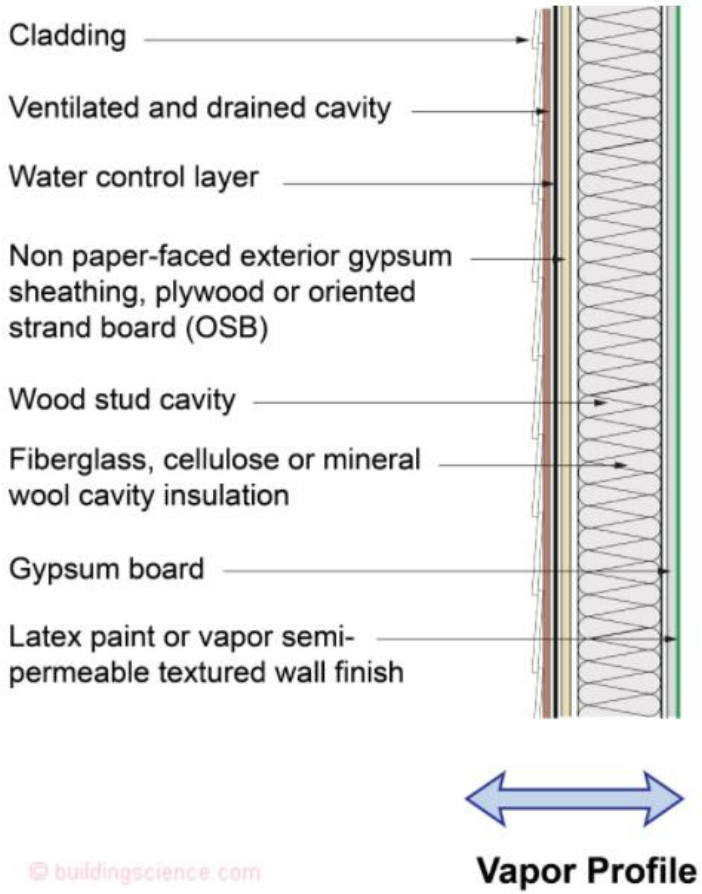
Know your building



https://www.buildingscience.com/documents/building-science-insights/bsi-120-understanding-walls

Cooling

Calculate transmitter heat load:

TPO/efficiency = power consumed *

Power consumed – TPO = waste heat (in watts)

Waste heat * 3.413 = BTU/hr

BTU/hr/12,000 = tons of AC required

Eg: 10kW/0.72 = 13.889 kW of power consumption
13.889 – 10kW) = 3888.9 watts wasted as heat
3888.9 * 3.413 = 13,273 BTU/hr
13,273/12,000 = 1.11 tons of air conditioning

* - allow for modulation in AM transmitters… multiplying by 1.25 will be close

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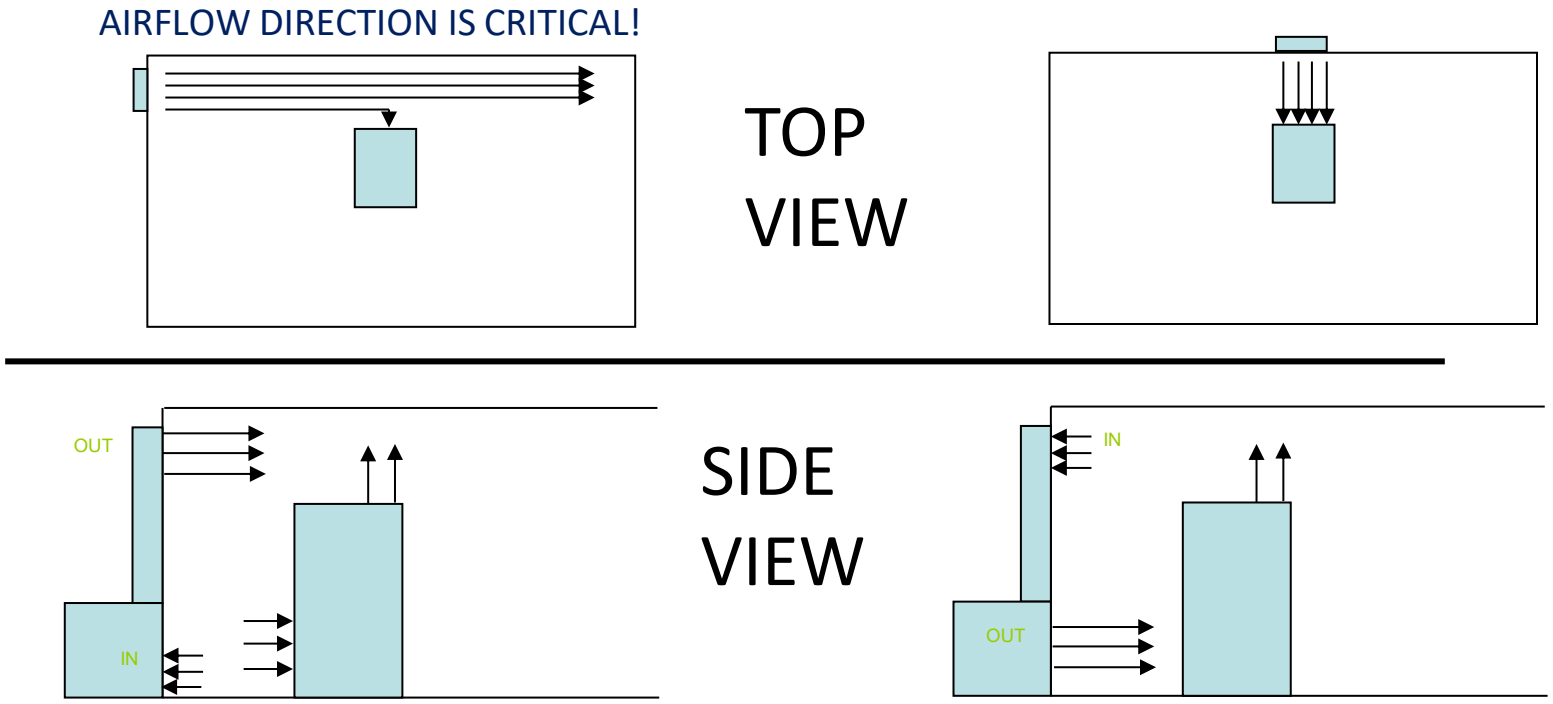
Cooling

- POSITIVE PRESSURE!
  - More air into building than out of it
  - Allow for transmitter airflow
    - For example, transmitter requires 1500 CFM
      - Bring 3000 CFM of filtered air into building
      - Exhaust 2000 CFM
- If you install louvres in ducting, you can cycle exhaust air into room in winter for heating.

Cooling



Excellent resource on air conditioning calculations:
https://www.radioworld.com/tech-and-gear/how-to-beat-the-summer-heat

Safety

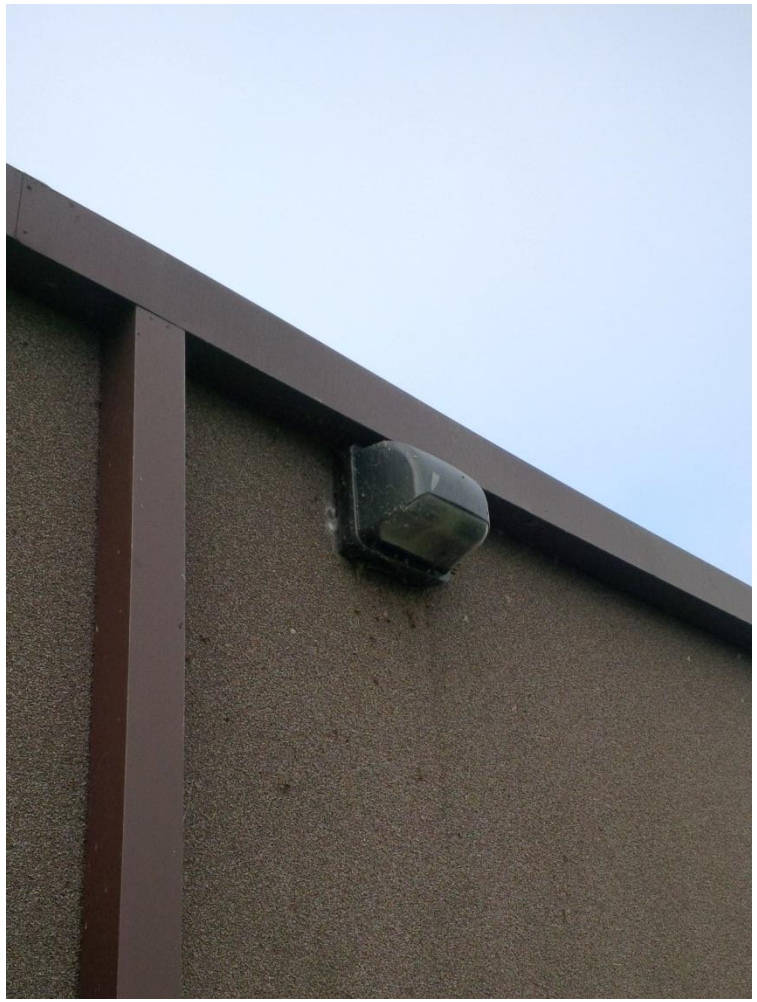
- Ensure use of proper safety equipment is mandatory
  - Ladders rated for working with electricity (and make sure ladders are used, don't stand on chairs!)
  - Equipment should be secured when not in use.

Physical Security

Physical Security

Floodlights are relatively cheap

A well lit site is less likely to be robbed or vandalized.



Physical Security

Web accessible cameras are cheap.

They won't prevent break-ins or theft, but they can provide a record.

In connection with motion sensors tied into the remote control, they can provide a way to see what's going on and provide faster police response. This can help limit damage and loss.

Physical Security

A high-quality peephole lets you see who's at the door.

It's also harder to shoot through!

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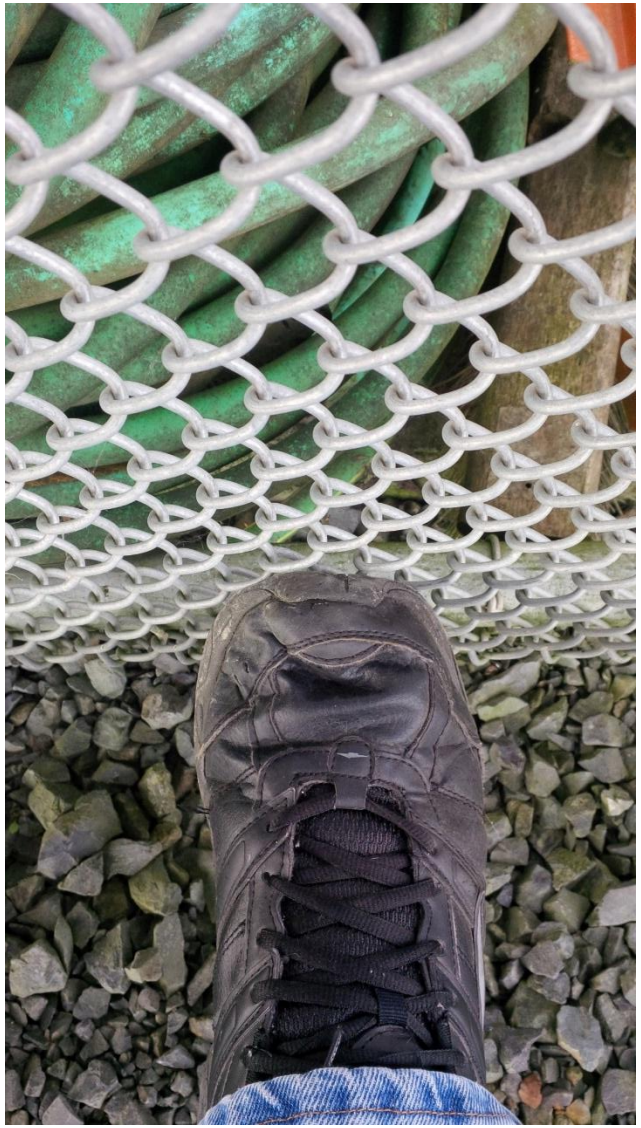
Physical Security

Anti-climb fencing can also be useful

It also takes a lot longer to cut through

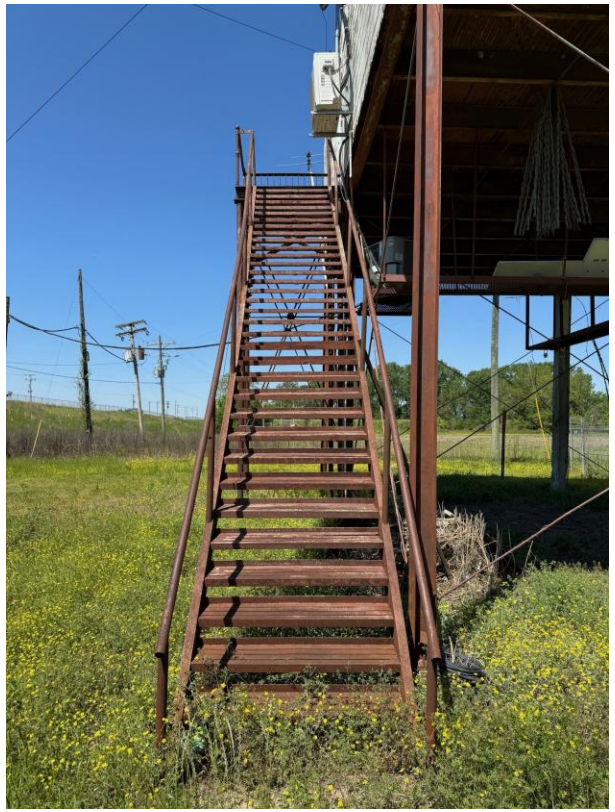


Physical Security

Obviously, a well fenced area is harder to get into!

Environmental Security

- Hundred-year storms are rapidly becoming ten-year storms
  - Stilts and dikes are becoming more necessary… use caution with dikes



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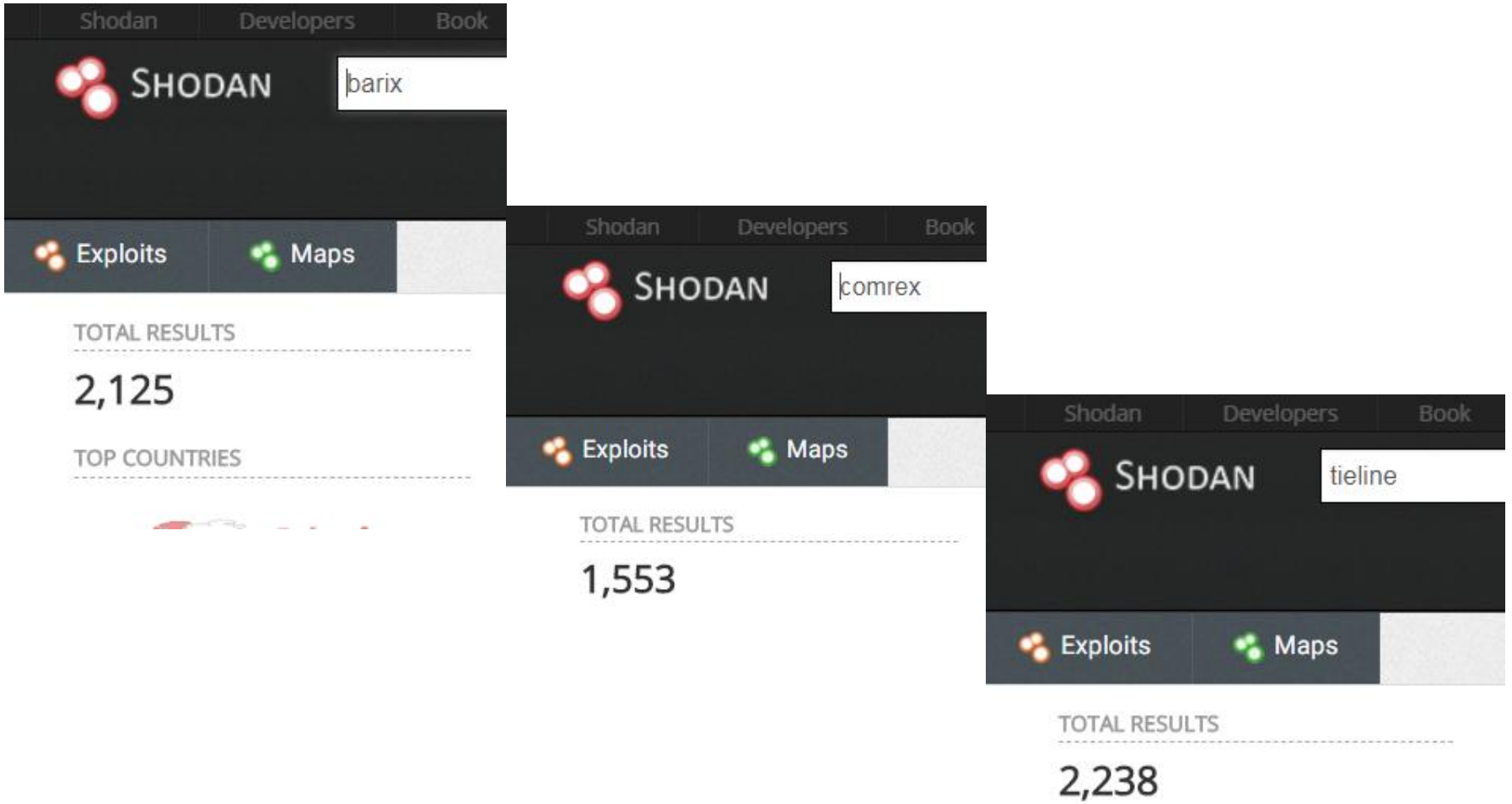
IT Security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barix
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Regular View | Raw Data

// TAGS: self-signed

// LAST SEEN: 2024-09-24

General Information

Country	**United States**
City	**Salt Lake City**
Organization	**AvidBit**
ISP	**AvidBit**
ASN	**AS394142**

Open Ports

8080 | 8443 | 8889 | 9999

// 8080 / TCP -1134636668 | 2024-09-14T17:31:51.488654

Login :: MBR1200B

```
HTTP/1.1 200 OK
Server: CradlepointHTTPService/1.0.0
Content-Type: text/html
Date: Sat, 14 Sep 2024 17:31:49 GMT
X-Frame-Options: DENY
Cache-Control: no-store, no-cache, private, max-age=0
Expires: -1
Pragma: no-cache
Transfer-Encoding: chunked
```

Web Technologies

Wrapping it all up…

- Keep it grounded
- Move that air
- Keep things clean
- Be Safe and watch security
- IT Security matters too!
- Do a full assessment of each site and create a punch list… it’s hard to improve if you don’t know where to begin

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THANK YOU!

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