Interoffice

VLB ARRAY MEMO No. 378

National Radio Astronomy Observatory

Socorro, New Mexico

August 15, 1984

To: B. Peery

From: Jon Spargo, VLA Safety Officer

Subject: Antenna Site Control Building

In VLBA memos 363 & 374 to name two of many, the subject of the proximity of the control building to the antenna was discussed. Here I would like to amplify some points and propose some new guidelines for the location of the building based on fire protection and exposure, safety and security.

Since no detailed plans of building construction exist yet, I will present my arguments in general terms assuming that these concepts will be explored in some detail at a future date.

As a starting point a worst case analysis assumes the following conditions:

1. Site layout as proposed in VLBA Memo 123 with the building about 26 ft from the nearest part of the antenna structure.

2. Building layout as shown in VLBA Memo 123.

3. Construction, contents and fire protection as outlined in memo 363.

4. Antenna structure coated with 1 inch of polyurethane insulation and painted white.

5. Antenna equipped with smoke and power phase loss detectors, either of which shuts off power to the antenna upon activation.

With these assumptions it is quite reasonable to assume that a fire in the control building would completely destroy that building. As well it would expose the antenna to high temperatures. Depending on weather conditions, the minimum damage would probably be severe blistering of paint, melting of insulation and thermal weakening of smaller structural members. The maximum damage would involve the paint and insulation catching fire followed by weakening of major structural members which could lead to the collapse of the structure. This would be followed by fire consumption of all combustible materials. The antenna would be a total loss.

As well there is also a danger of fire starting in the antenna and spreading to the building. This danger is somewhat a minimized if the proposed construction of the antennas follows standards set forth in RP-1. The risk would be further reduced if an automatic fire suppression system were installed in the antenna.

Under these conditions then, I would recommend location of the building at minimum of 150' ft from the nearest point of the antenna structure. Under most conditions, a fire in either structure would probably not involve the other structure.

As with any situation there are many compromises that can be made. In this case there are 4 main factors that I feel affect the building location.

1. Type of building construction.
2. Type of fire protection in building
3. Combustibility of Antenna Materials.
4. Antenna protection systems including fire suppression.

There are also some additional considerations that should be factored in.

1. Building and Antenna security.
2. Safety for personnel working on and around the antenna.
3. Clearance for major mechanical work on the antenna.

Many of these are inter-related. For example, the type of building construction affects fire protection and exposure, safety and security. If the building were to be constructed of reinforced concrete walls with a minimum number of windows, the exposure risk to the antenna from a building fire would be reduced. If a fully automatic fire detection and suppression system were added to the building you could probably locate the the building directly under the antenna and have little or no risk as far as antenna exposure to fire in concerned. This type of construction also lends itself to building security. A wall construction of this type is difficult to penetrate in contrast to a cinder block wall which could be broken through in less than 5 minutes with a modest sized hammer!

While a building of this type would be good for the reasons listed above it would present other problems. Provisions would have to be made to allow for fire department crews to ventilate the building (probably through the roof) so that they could attack a fire inside the building.

Again I point out the safety aspect of visibility for operating the antenna locally. See Memo 374.

One further reduction of fire hazard at the antenna would be to use "Foamglas" type insulation. Foamglass is fire proof, rodent proof, weather proof but would require twice the thickness of urethane. This would drastically reduce the fuel load of the antenna and would probably be worth the extra cost in terms of protection.

I also wonder about access to the antenna with heavy equipment in the case where major structural repairs or modifications have to be made at the point where there is only about 26 ft clearance between the building and antenna.

As for the building layout I feel that the contents and function of each room is somewhat arbitrary as long as good design practice is followed with regard to safety and fire protection. Federal Standard RP-1 is an excellent source for this information. As well we should consider a pressure tank/sprinkler system. Attached is a portion of NFPA-13 which deals with pressure tanks. My estimate is that a 3K gallon tank would fully protect the building for a reasonable cost. However, careful attention should be paid to room size, fuel load, sprinkler head type and location, window and door types and locations, air-conditioning, wall penetrations for cable runs and under floor detection and suppression.

JS/bmg

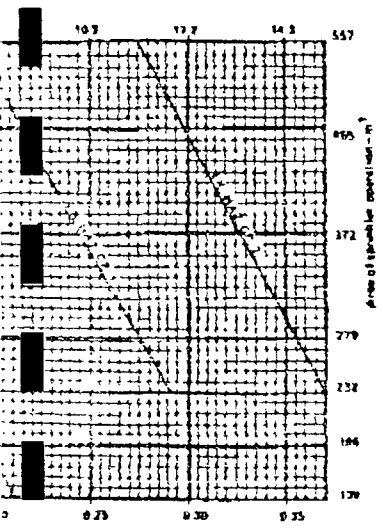
cc: P. Napier
C. Bignell

...s for Determining Density, ...er Supply Requirements for ...ed Sprinkler Systems

...p... Requirements

...side ...e...	gpm	Total Combined Inside and Outside Hose — gpm	Duration in Minutes
...50 or ...	100	100	30
...50 or ...	100	250	60-90
...50 or ...	100	250	60-90
...50	100	500	60-120
...50	100	500	90-120
...50 or ...	100	1000	120

...n Curves



.../sq ft = 40.746 (L/min)/m².

...2-2.1(B)

...-5.2* Supervision. When a single fire pump constitutes the sole sprinkler supply, it shall be provided with supervisory service from an approved central station, proprietary, remote station system or equivalent.

...-6 Pressure Tanks.

2-6.1 Acceptability.

...-6.1.1 A pressure tank sized in accordance with Table 2-2.1(A) or 2-2.1(B) is an acceptable water supply source. (*See NFPA 22, Water Tanks for Private Fire Protection.*)

...-6.1.2 Pressure tanks shall be provided with an approved means for automatically maintaining the required air pressure. When a pressure tank is the sole water supply there shall also be provided an approved trouble alarm to indicate low air pressure and low water level with the alarm supplied from an electrical branch circuit independent of the air compressor.

2-6.1.3 Pressure tanks shall not be used to supply other than sprinklers and hand hose attached to sprinkler piping.

2-6.2 Capacity.

2-6.2.1 The size of the pressure tank required shall be in accordance with Table 2-2.1(A) or 2-2.1(B) and shall include the extra capacity needed to fill dry-pipe systems when installed. Minimum requirements when pressure tanks are not the sole water supply source shall be as indicated in 2-6.2.2, 2-6.2.3, and 2-6.2.4.

2-6.2.2 Light Hazard Occupancy. Amount of available water, not less than 2,000 gal (7570 L).

2-6.2.3 Ordinary Hazard Occupancy. Amount of available water, not less than 3,000 gal (11 355 L) for Groups 1 and 2. For Group 3, refer to authority having jurisdiction.

2-6.2.4 Extra Hazard and Woodworker Occupancies. Refer to authority having jurisdiction.

2-6.2.5 For high-rise buildings, see Chapter 8.

2-6.3* Water Level and Air Pressure. Unless otherwise approved by the authority having jurisdiction, the pressure tank shall be kept two-thirds full of water, and an air pressure of at least 75 psi (5.2 bars) by the gage shall be maintained. When the bottom of the tank is located below the highest sprinklers served, the air pressure by the gage shall be at least 75 psi (5.2 bars) plus three times the pressure caused by the column of water in the sprinkler system above the tank bottom.

2-7 Fire Department Connections.

2-7.1 A fire department connection shall be provided as described in this section.

Exception: When permission of the authority having jurisdiction has been obtained for its omission.

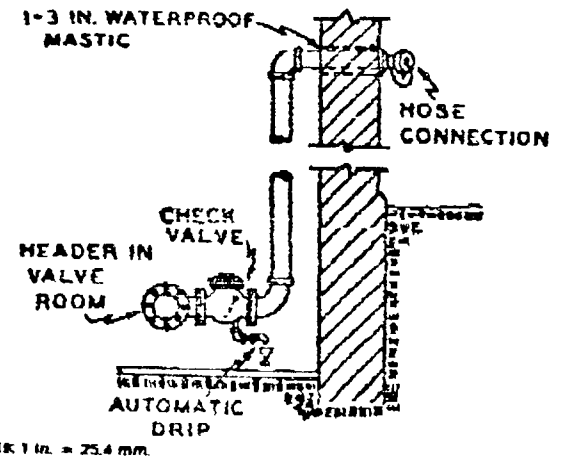


Figure 2-7.1 Fire Department Connection.

2-7.2* Size. Pipe size shall be not less than 4 in. for fire engine connections and not less than 6 in. for fire boat connections, except that 3-in. pipe may be used to connect a single hose connection to a 3-in. or smaller riser.