Small Room Testing…2500 cu.ft. or less

Some compromises can be made is small rooms for two reasons:

They are not likely to have a large fire that would threaten the rest of the building.

Once trained personnel arrive and open the door, the enclosure integrity (and some of the agent) is lost anyway so shorter retention times can be considered.

1) Selection of a retention time.

Select an appropriate retention time for the specific enclosure. NFPA 2001 states "... the design concentration ... shall be maintained for a sufficient period of time to allow effective emergency action by trained personnel". Yet most specifications state it must be 10 minutes. Why? I would suggest the following guidelines for rooms that do not have the possibility of a deep seated fire. Determine how long it would take for personnel to arrive then use this as the specified retention time. As soon as they enter a small room, the integrity is compromised anyway.

My suggestion is for room volumes(cu. ft.) of:	2500	1250	625	350
That, the minimum retention time (min.) be :	8	6	4	3

provided that it is reasonable to expect that
"trained personnel could show up in that time.

The maximum leakage area allowed				
if the time was 10 minutes is	50	25	12.5	7 (sq.in.) respectively
If the retention time was reduced as above				
the leakage areas could be a more reasonable	62	42	32	23 (sq.in.) respectively.

This last row is more in keeping with how tight rooms can be made as they get smaller. For example each room regardless of size must have a door and door usually leak about 5 to 20 sq.in. depending on how well they are weather-stripped. To try to achieve a total of 7 sq.in. in this room is not really practical.

2) Test the room to get the most accurate prediction of retention time.

When we were in the habit of discharge testing small rooms with Halon 1301, it was common for small rooms to fail that test. Now that we commonly test small rooms using the door fan and Appendix B, these rooms similarly fail this test.

The results are similar between the door fan test and the discharge test except in one instance - if the upper half of the room leaks a lot more than the lower half, then, the Appendix B test will be overly conservative and may fail a room that a discharge test would pass.

Reason; On the first test, the total leakage of the whole room is measured. The assumption is then made that half the leaks are in the floor and the other half in the ceiling. This usually gives a very conservative (shortest retention time) result because most of the leaks are usually above the ceiling where the agent will not leak out. If the ceiling leaks can be measured or calculated the actual hole in the floor can be used to make the retention prediction. Where most of the leaks are in the ceiling this prediction will be much longer.

There are several solutions to this measurement problem:

- perform double fan ceiling neutralization test on rooms with a T-bar ceiling. This test will separate the below ceiling leaks from the above by allowing one fan to depressurize the above ceiling space while the other depressurizes the below ceiling space. The fan speeds are altered until smoke at the T-bar ceiling neither rises nor falls indicating a balanced condition.
- cover the ceiling with plastic and re-test to measure below ceiling leaks alone. Use this test where the above ceiling space cannot be pressurized or where two fans and flex duct are not available. This is time consuming in all but the smallest rooms
- do an audit of the leaks and determine from this what the lower leaks are compared to the above ceiling leaks. Section 4-7.2.3 of NFPA 2001 in the 1996 version, allows for the use of a smoke pencil and blower door fan unit only and section B-1.2.2.5 allows for the technical judgment in assessing upper Vs lower leaks. This is the basis for the following spreadsheet method of quantifying this ratio. Use this table as an example (from BCLA%.XLS): an example follows

Spreadsheet for calculating BCLA based on a visual leak audit

est. upper leaks	sq. in. est.	% full speed	corrected est. leak	scaled down to
wall to ceiling joint	122	50%	61	49.5
upper slab penetrations	60	100%	60	48.7
upward duct openings	140	25%	35	28.4
upper open conduits	10	10%	1	0.8
total upper leaks			157	127.4
est. lower leaks				
wall to lower slab joint	25	10%	2.5	2.0
lower slab penetrations	5	100%	5	4.1
lower open conduits	0	100%	0	0.0
downward duct openings	0	100%	0	0.0
door leaks	10	50%	5	4.1
window leaks	0	100%	0	0.0
stub wall leaks	50	75%	37.5	30.4
total lower leaks			50	40.6
est. total lower and upper			207	
actual lower and upper ELA			168	
factor			1.23	

The calculated BCLA =	40.6	sq. in.	which is	24% of the ELA