

Radon Mitigation Exhaust Diffusion

Do we need to vent
ASD systems above the roof?

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This talk → ASD systems - Exhaust at Grade (EAG)?
is about → How does radon exhaust diffuse?

- 1) Canadians & Europeans **allow EAG**. (Exhaust At Grade)
- 2) No US based **EAG** research has been done in the last 25 years.
- 3) This study is based on modifying a single ASD system with a variable speed fan and **EAG**.
- 4) Exhaust velocity was varied from **20 to 40 to 69 CFM**.
The exhaust outlet was varied from **3" to 4" size**.
- 5) **CRM's** were placed on each level of the house and in the **backyard** and at **eight locations around the ASD exhaust**.
- 6) CRM was also used to measure **Radon level in the exhaust**.
- 7) **Weather data** was measured at grade and at the roof.
- 8) Each sequence was run for **3 to 8 days**

ASD exhaust above the roof began:
October 1993 EPA Radon Mitigation Standards

This guidance appears to be based on the initial failures in the 1985-87 PA 38 home study. Half of the 27 homes with ASD systems did or probably did have re-entrainment because ASD EXHAUST WAS DIRECTED AGAINST THE BUILDINGS SIDING.

In 1989-90 radon system re-entrainment was fixed by exhausting radon directly away or above the roof.

October 1993 - 3rd Edition of the “Technical Guidance for Active Soil Depressurization Systems” states:

“The very limited data which are available directly comparing above-eave and grade-level exhausts suggest that grade-level exhausts, directed horizontally to grade and aimed 90* away from the house, can result in re-entrainment no more severe than that experience when the exhaust is discharged vertically above the eave. (PA 38 home study).”

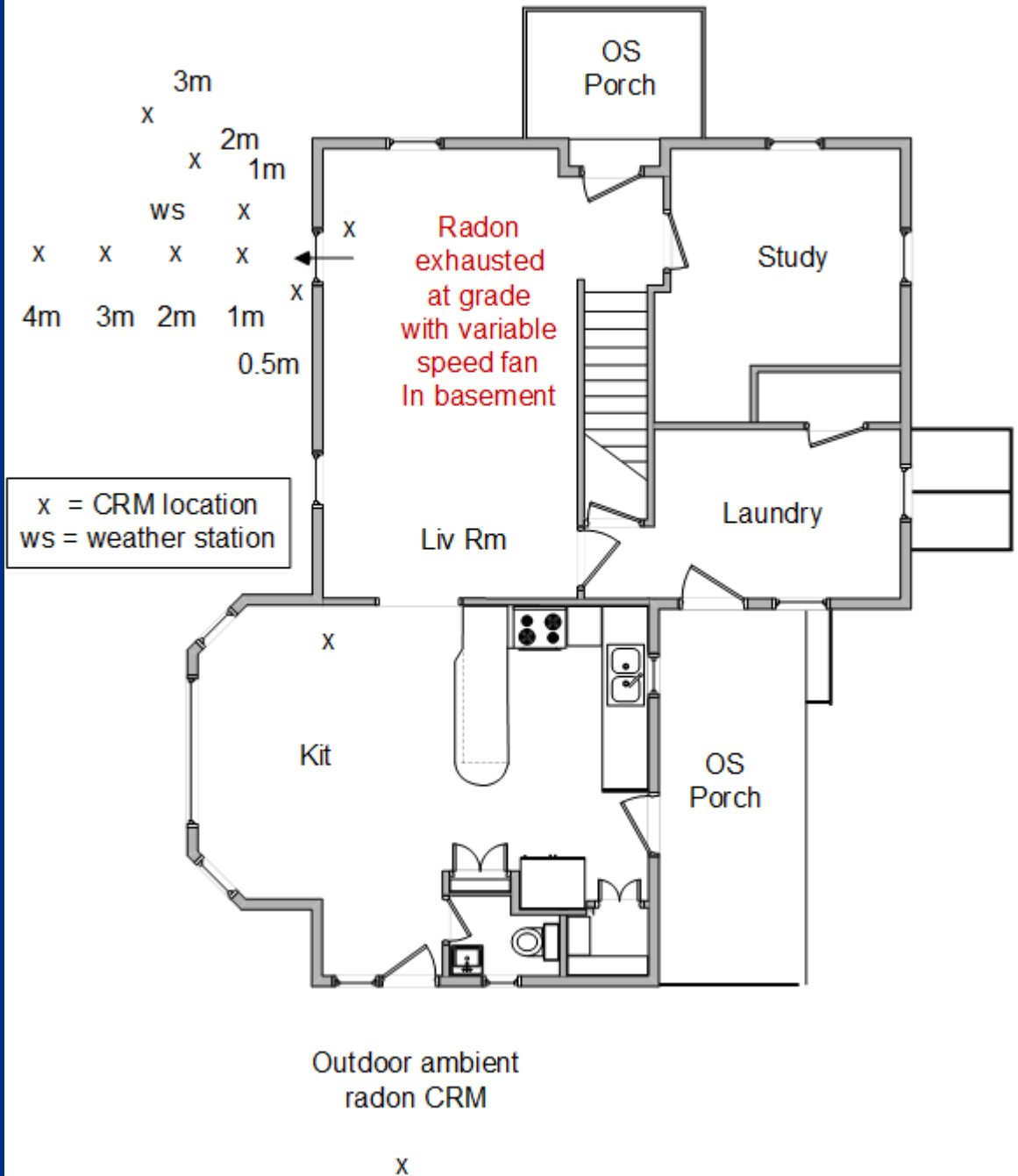
Bill's Study

How does AEG diffuse

ASD system
airflow was
varied
from 20 CFM
to 40 CFM
to 69 CFM

Exhaust port
varied from
3" to 4"

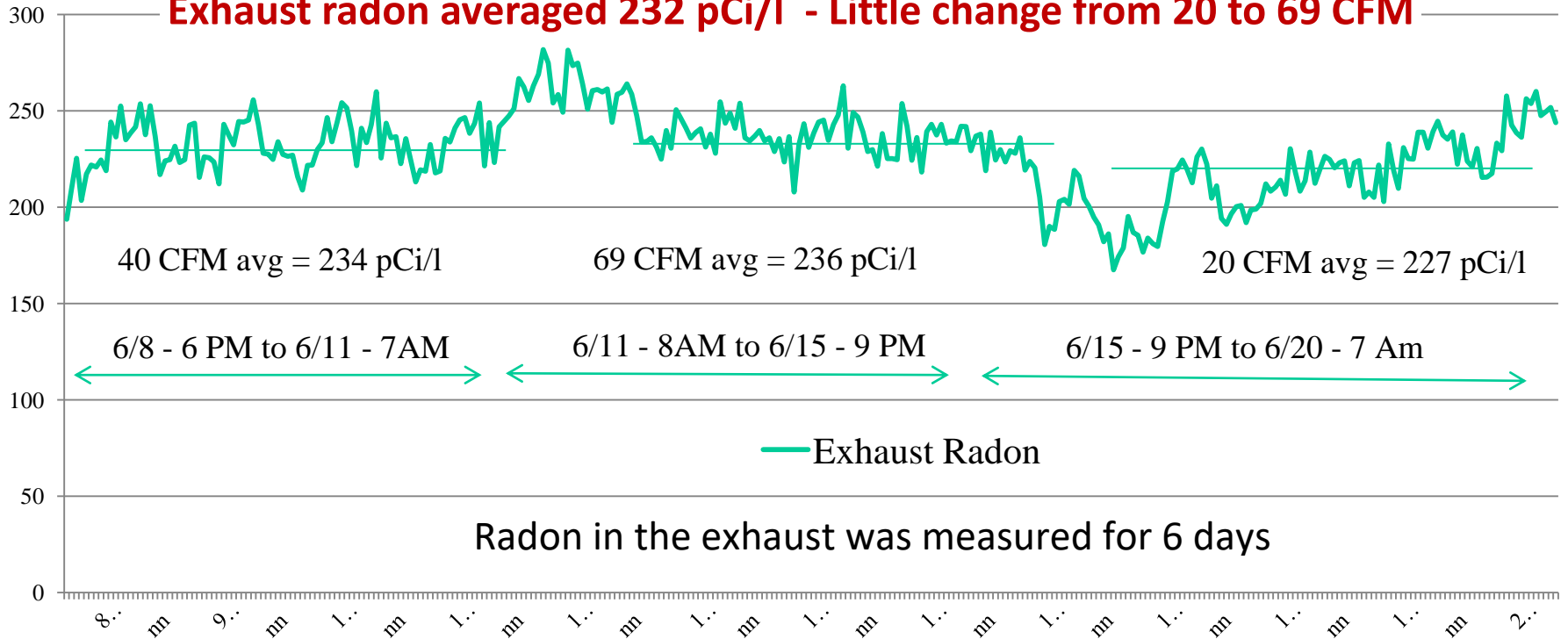
Each variation
was run from
3 to 8 days



RadonEye and Corentium Pro's were taped to exclude Thoron



Exhaust radon averaged 232 pCi/l - Little change from 20 to 69 CFM



Radon in the exhaust was measured for 6 days

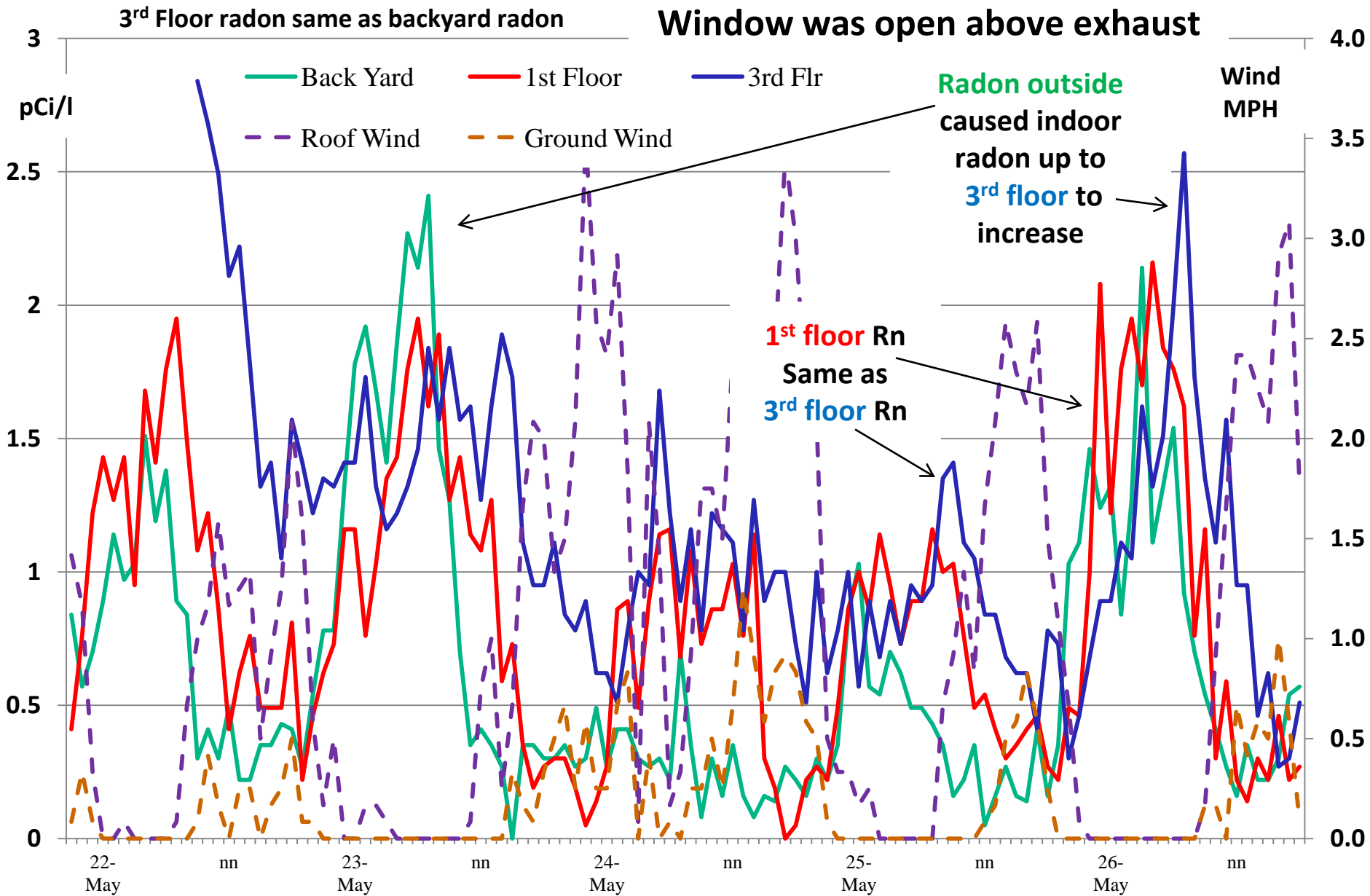
CRM's were placed
in Tyvek envelopes

CRM next to exhaust averaged
0.5 pCi/l above ambient

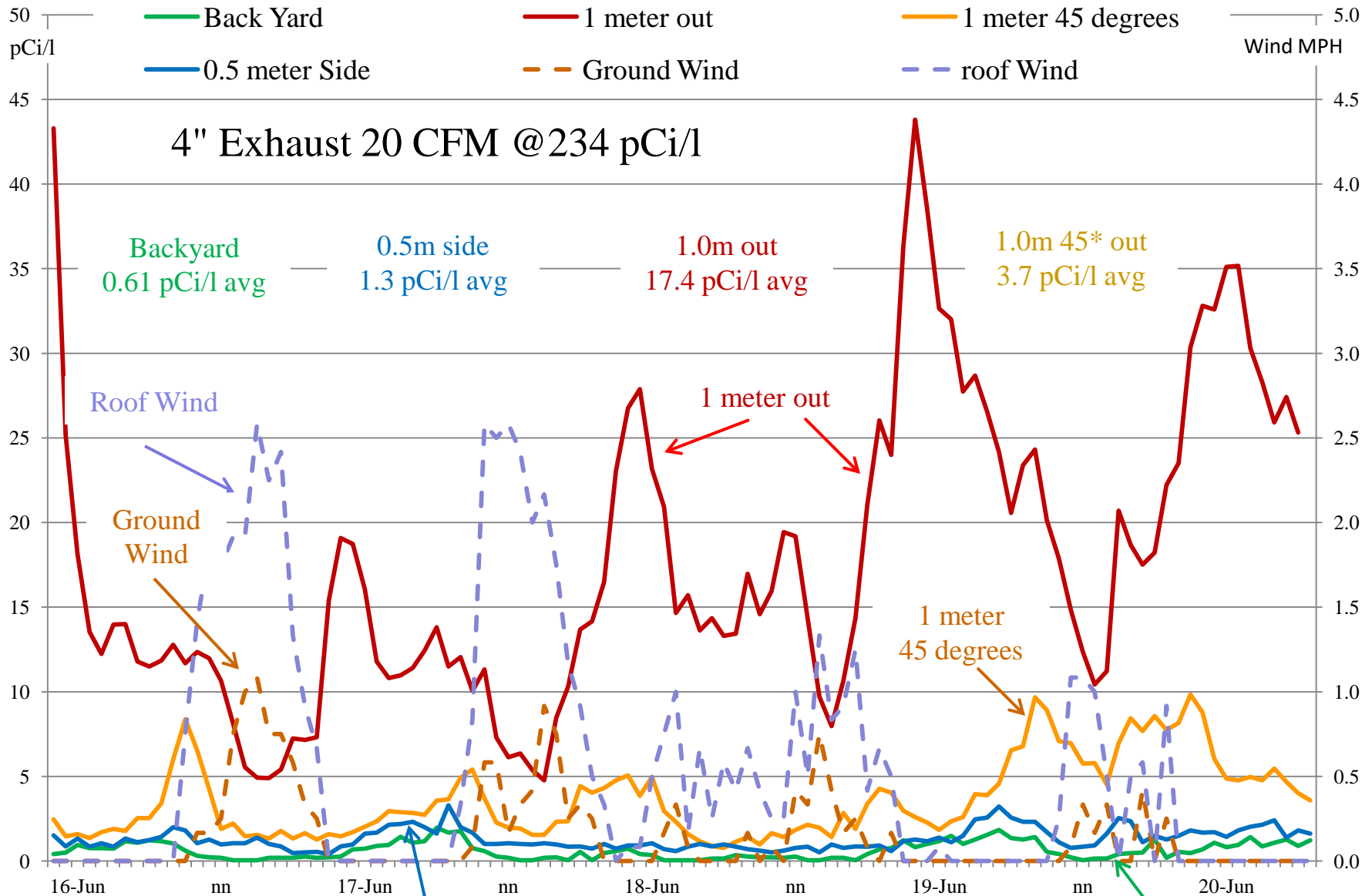


In one 5 day
period
window was
left open
with 40 cfm
exhaust





1st Floor & 3rd Floor - track Outdoor Radon - which correlates to wind



Radon average 0.5 meters beside exhaust was 0.5 pCi/l above Ambient

Average Percentage of Exhaust Radon with distance from 3" & 4" outlet

If exhaust is
300 vs 1000 pCi/l:

Distance from exhaust	20 CFM	40 CFM	69 CFM
1.0 meter out	7.1%	12.4%	15.8%
2.0 meters out	0.7%	3.7%	4.2%
3.0 meters out	0.3%	1.5%	1.8%
4.0 meters out	0.1%	0.4%	0.6%
1.0 meter 45*	1.5%	2.2%	1.2%
2.0 meters 45*	0.6%	1.5%	1.4%
3.0 meters 45*	0.1%	0.6%	0.5%
0.5 meters side	0.3%	0.2%	0.1%

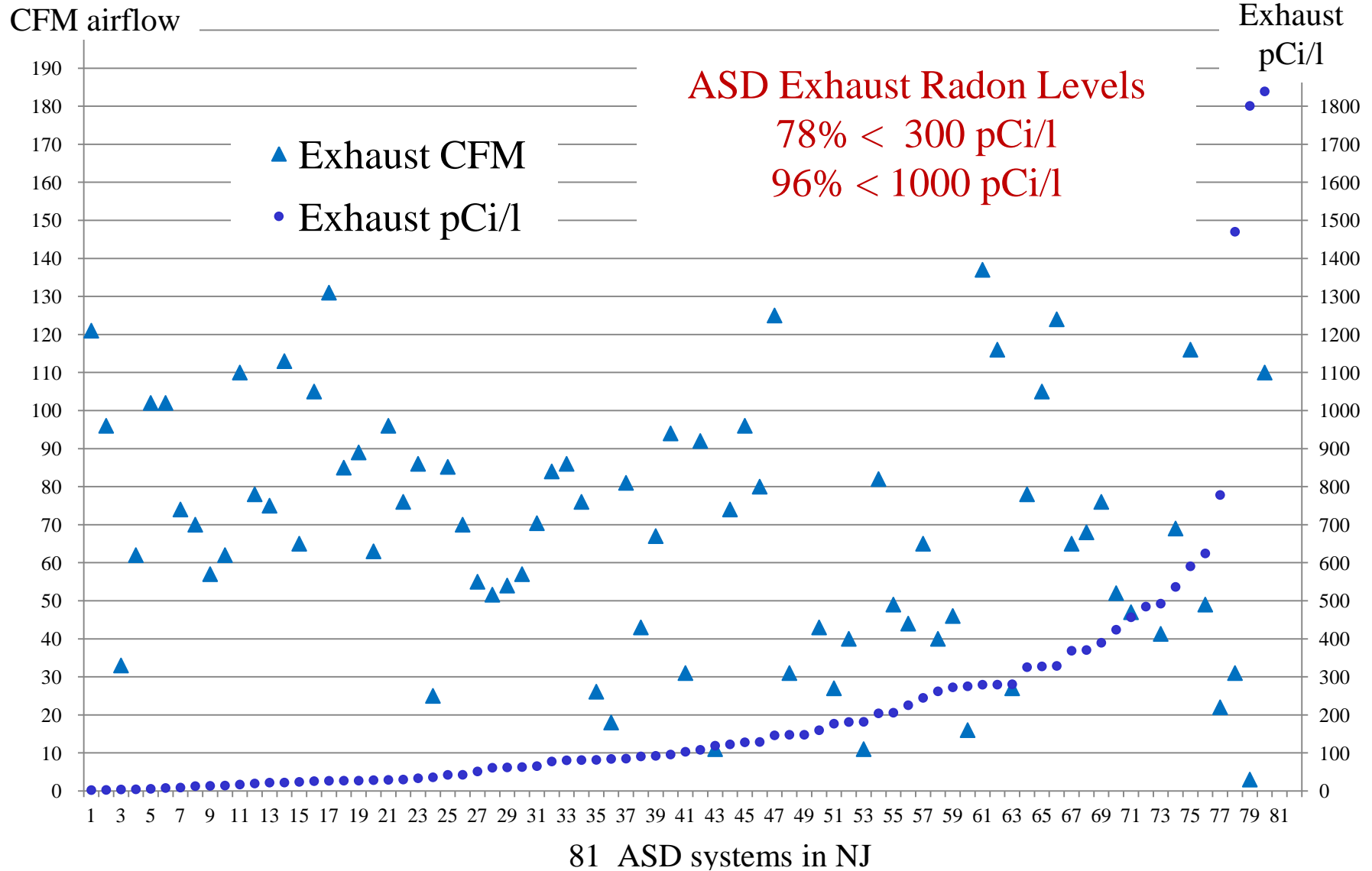
Exhaust Rn	300 Pci/l	1000 pCi/l
0.1%	0.3	1.0
1%	3.0	10.0
10%	30.0	100.0
25%	75.0	250.0

Note:

Radon in direct
airstream
elevated for
3 to 4 meters.

Radon next to
outlet is
extremely low.

1991 NJ Mitigation Study measured Radon exhaust in 81 systems



Conclusions:

- 1) EPA research concluded in 1990 that ASD EAG directed outward does not cause significant re-entrainment.
- 2) During periods of no wind, outdoor and indoor radon levels up to the 3rd floor, rose up to 2.0 pCi/l in this study.
- 3) If EAG is directed away from the house no significant radon accumulates around the exhaust location.
- 4) At one meter from exhaust location the radon levels can be 10% to 25% of the exhaust concentration.
- 5) Radon levels are close to ambient at about four meters
- 6) At 45 degrees from the exhaust direction there is an average of 1% to 2% of the exhaust concentration with higher spikes depending on wind direction.