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Advantages and Disadvantages of using the ASHRAE 110-1995 Tracer Gas Test Method for the Chemical Laboratory Hood Certification

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ASHRAE 110-1995

- ASHRAE 110-1995: Method of Testing Performance of Laboratory Fume Hoods
  - American Society of Heating, Refrigerating, and Air Conditioning Engineers
  - Utilizes sulfur hexafluoride tracer gas for hood containment test

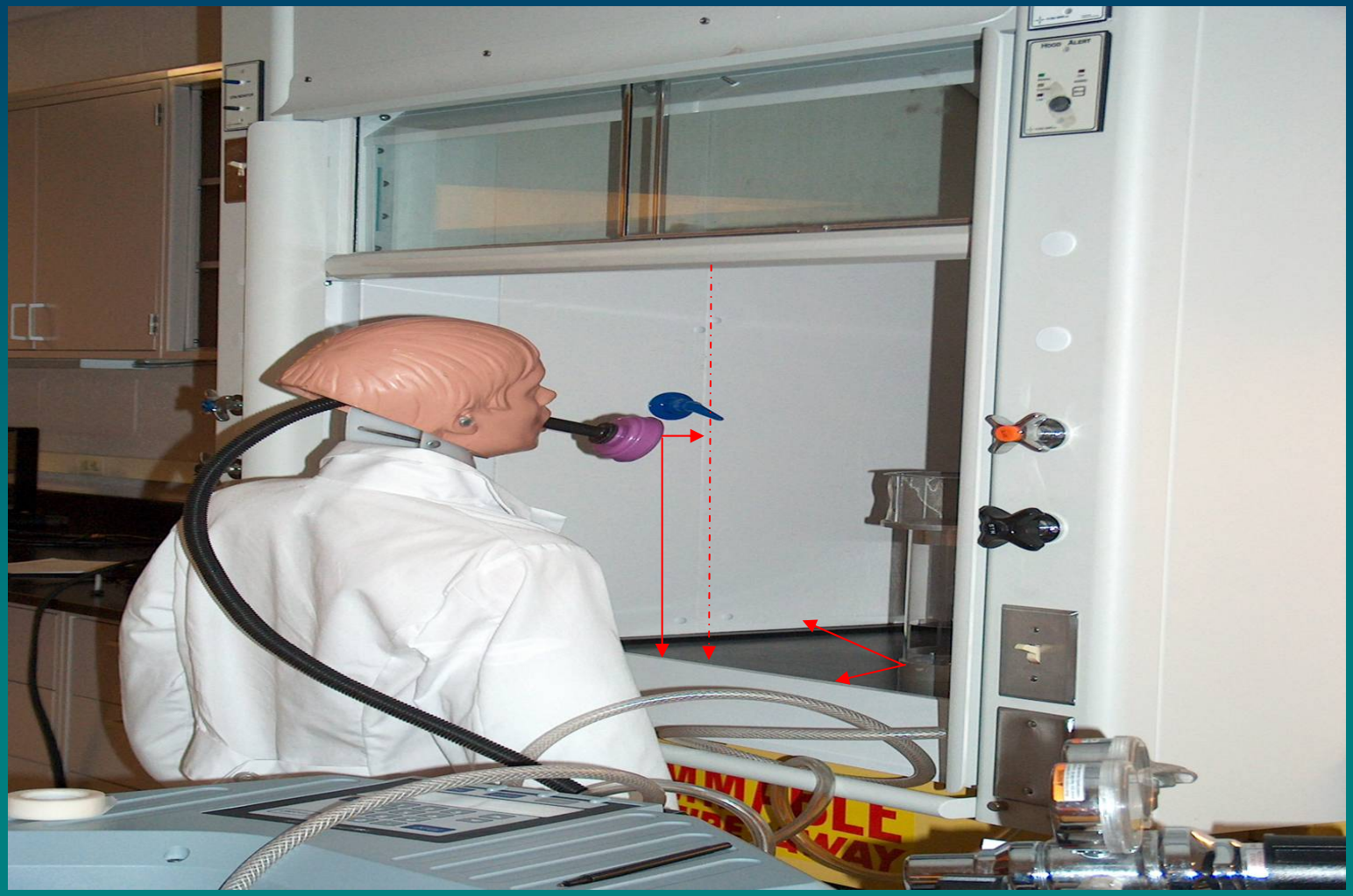
ANSI Z9.5-1992

- ANSI Z9.5-1992: Laboratory Ventilation Standard
  - American National Standards Institute
  - Developed based on the chemical hood average face velocity
  - 80-120 fpm with no single measurement more than ± 20% of the average

ANSI Z9.5-2003

- ANSI Z9.5-2003: Laboratory Ventilation Standard
  - Revised version of ANSI-1992
  - Face velocity alone is not an indicator of chemical hood performance
  - Recommends using a containment test method such as the ASHRAE 110

ASHRAE 110-1995 Test



ASHRAE 110-1995 Test Procedure

Step 1: Face velocity measurement

ASHRAE 110-1995 Test Procedure

- Step 2: Local visualization test, using smoke tubes

  - Chemical hood fails the test If smoke escapes

ASHRAE 110-1995 Test Procedure

- Step 3: Large volume visualization test, using large volume smoke generator

- Chemical hood fails the test If smoke escapes

ASHRAE 110-1995 Test Procedure

- Step 4:Static tracer gas test
  - left
  - Right
  - Center
  - Five minutes each
  - 4 L/Min at 30 PSI

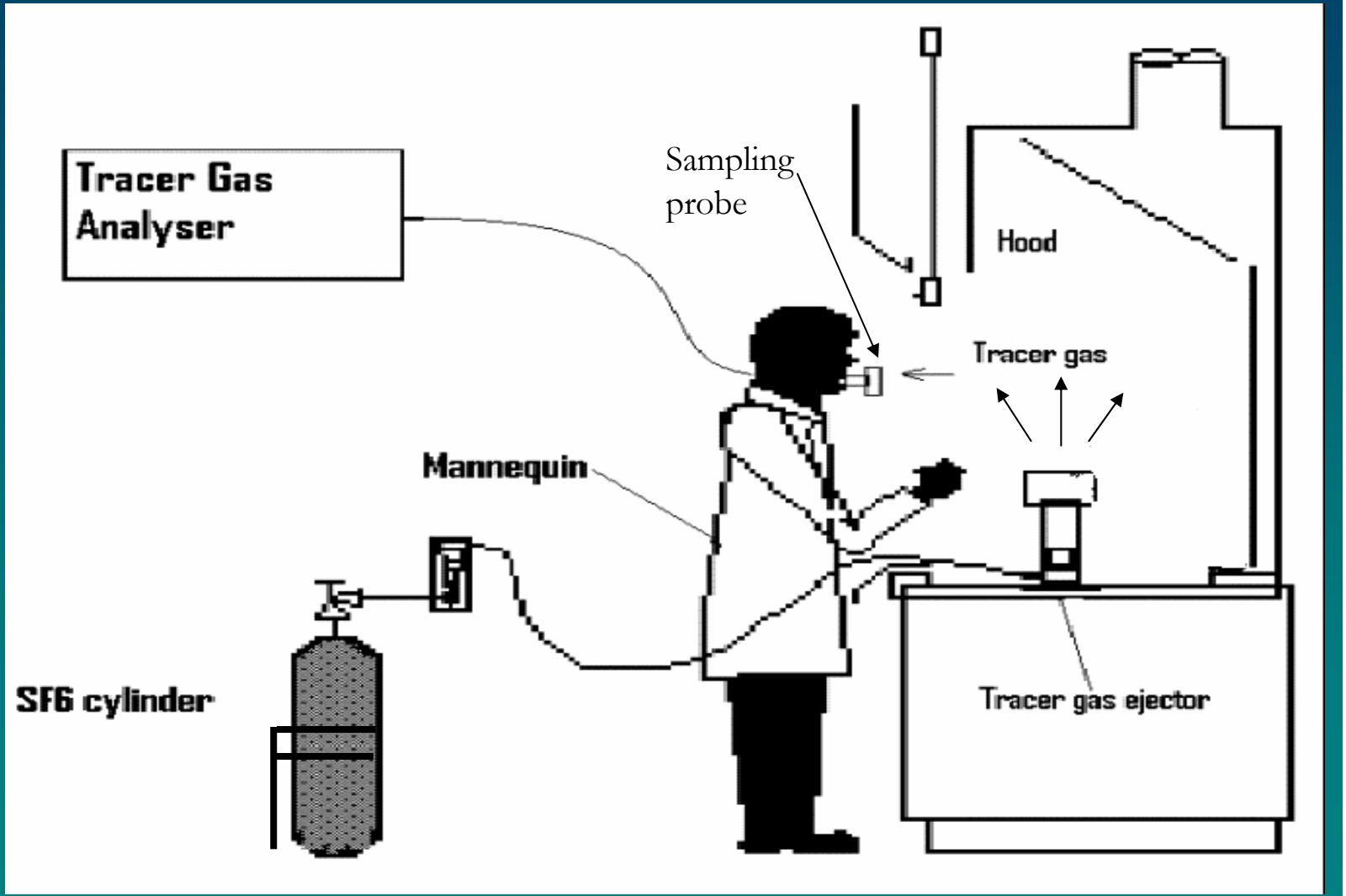
- If average concentrations for SF_6 was more than 100 part per billion (PPB) hood failed the test

ASHRAE 110-1995 Test Procedure

- Step 5: Dynamic tracer gas test
  - Sash movement effect
  - Three sash opening and closing cycles
  - Two minutes each

- If average concentrations for SF_6 was more than 100 part per billion (PPB) hood failed the test

ASHRAE 110-1995 Test Procedure



Chemical Laboratory Hoods

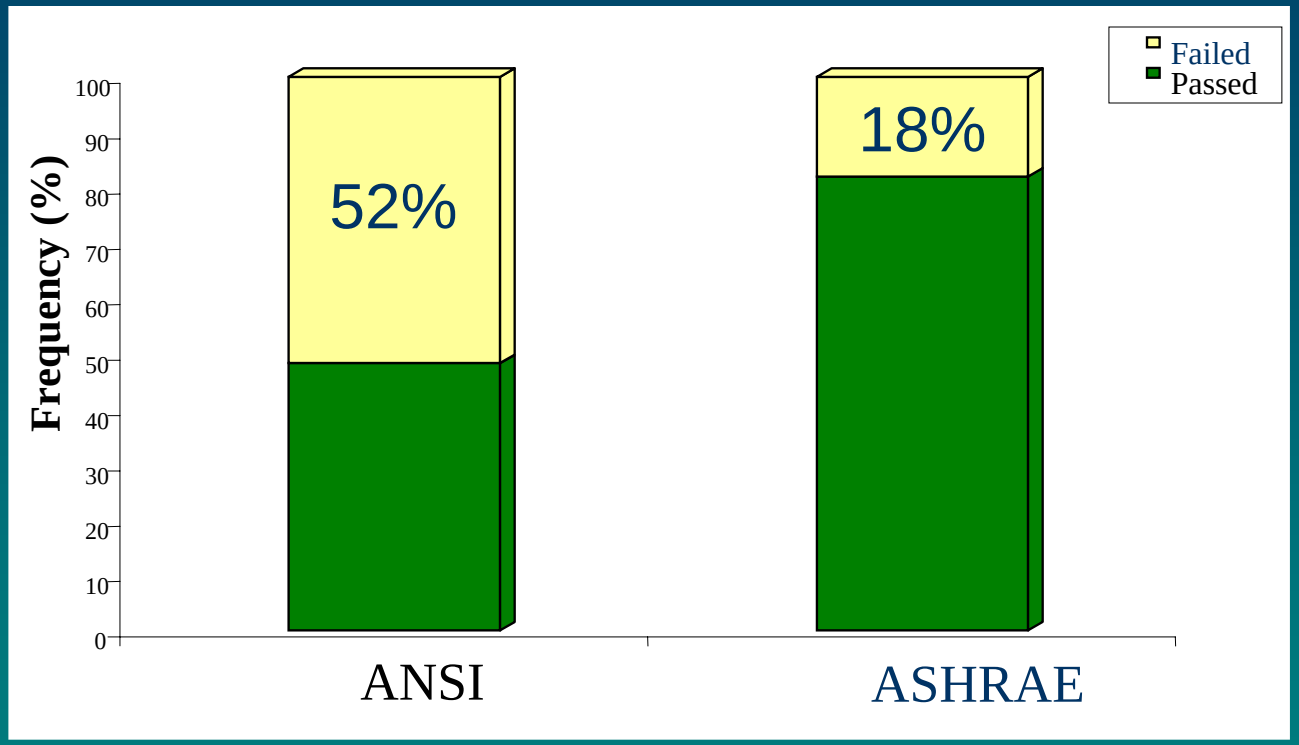
- 484 tests were performed on chemical hoods using the ASHRAE 110 method (as installed and as used)

- Three types of chemical hoods:
  - VAV: Variable Air Volume
  - CAV: Constant Air Volume
  - Low Flow: 60-70 fpm face velocity

Chemical Laboratory Hoods

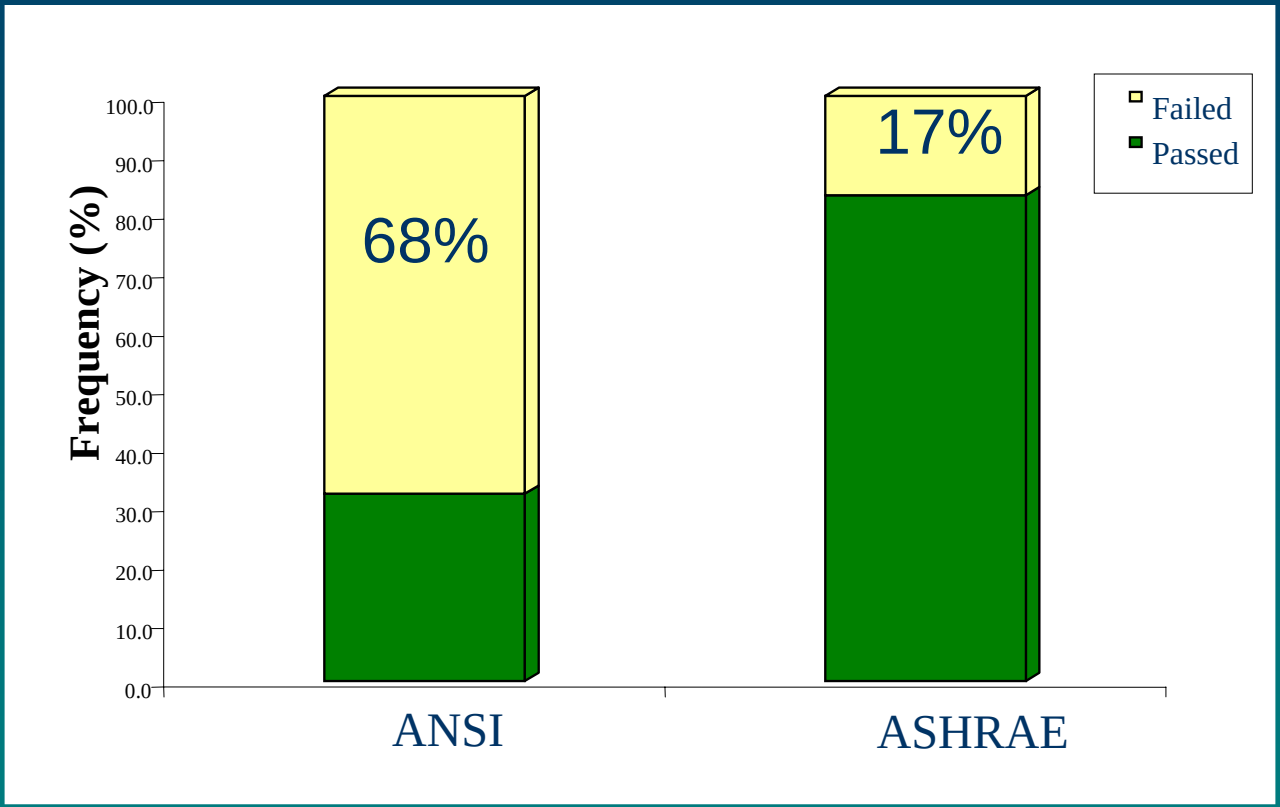
Chemical hoods	Frequency	Percent (%)
Low Flow	108	22.3
VAV	201	41.5
CAV	175	36.2
Total	**484**	**100**

Advantage (VAV Hoods)



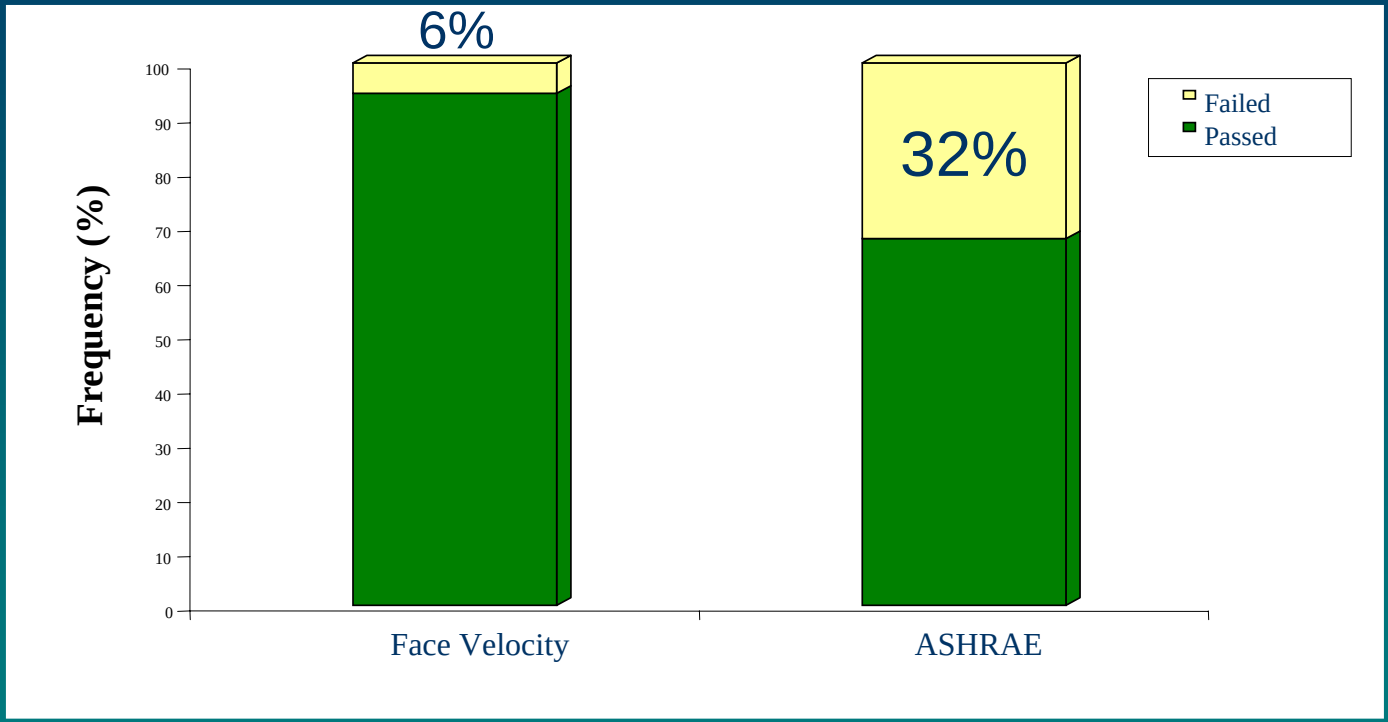
- 34% less hood failure when ASHRAE 110 test was utilized

Advantage (CAV Hoods)



- 51% less hood failure when ASHRAE 110 test was utilized

Advantage (Low Flow Hoods)



- Internal operating procedure (IOP): 60 fpm average face velocity
- IOP was changed to 70 fpm

Advantage

- Ability to establish lower face velocities for CAV hoods
- Ability to use Low Flow Hoods
  - Energy cost saving
  - Increasing number of the hoods without major modifications
  - Noise attenuation

Advantage

- Identifying system design problems
  - Air supply diffusers location and type
  - Lab layout and hood location
  - Re-entrainment
  - Unjustified use of low flow hoods
    - Small rooms
    - Single hood rooms

- Identifying hood design problems
  - Sash replacement

Advantage

- Identifying maintenance problems
  - Room air balance
  - Ruptured duct
  - VAV control system malfunction
    - Re-establishing the face velocity as sash moves
    - Maintaining constant velocity at fully closed position

Advantage

- Using as a standard to test new hoods
  - Testing hood before being approved for new projects
  - Hoods that were not able to pass ASHRAE 110 test
- A scientific approach rather than a routine test
- Automatically tests the effect of factors such as cross drafts and loading on hood performance

Disadvantage

- Initial cost
  - About $20,000 equipment
    - Test is not required annually
- SF6 cost
  - About $ 20 per hood
- Time
  - Minimum 1-2 hours per hood
  - Can be a full time job

Disadvantage

- Hood Access and loading
  - Not enough space to access the hood
  - Not enough space inside the hood to place the ejector

Disadvantage

- Interference
- Subjective and non-standardized large volume smoke test
  - Is it a true predictor of the tracer gas outcome?
  - Smoke release rate?
- No peak level for tracer gas leak
- Relating the tracer gas leak concentration to human exposure
- SF_6 : a greenhouse gas

Conclusion

- The ASHRAE 110 test method was found to be a better method to test the hood containment
- Initial cost of the ASHRAE 110 test can be justified by its advantages
- Periodic face velocity test still is needed to check any deviation from the benchmark face velocity (face velocity at which the chemical hood passed the ASHRAE 110)
- Further studies are necessary to improve the ASHRAE 110 test method

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Thanks For Your Attention

Question?

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