ALPHA TESTING OF A SYSTEM FOR CREATING ON-DEMAND POSITIVE-AND NEGATIVE–PRESSURE ISOLATION ENVIRONMENTS IN TYPICAL EMERGENCY DEPARTMENT ROOMS

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STUDY OBJECTIVE:

In the face of heightened concerns over nuclear, biological or chemical (NBC) terrorist attack or accident , in the federal government has mandated an increase in the number of positive and negative pressure isolation rooms. Currently these rooms represent a scarce hospital resource, especially in Eds that may have only 1 or 2 available. It would be useful to be able to create "on demand" isolation rooms to provide surge capacity and to meet federal guidelines. In this private-public partnership, we undertook the development and testing of a portable environmental control system that can create either positive– or negative– pressure isolation environments in an otherwise typical hospital or emergency department room. This Alpha test was designed to determine the ability of the system to produce a stable positive or negative pressure environment, consistent with CDC guidelines, within typical emergency department patient care rooms.

MATERIALS AND METHODS:

IsolationAirTM (Air Innovations, Syracuse, NY) creates positive or negative pressure through air-ducting mechanisms. The system also maintains room temperature and uses HEPA filtration and ultra-violet light to remove air contaminants within the patient room. The system can operate in complete isolation from the existing hospital HAVAC system, or it can be tied to the existing system with air exchange limited to only decontaminated air. Once personnel are familiar with the equipment, set up requires approximately ½ hour.

We tested IsolationAirTM in two separate ED rooms: a 125 square foot single-bed room and a 288 square foot two-bed room. Test parameters were taken from CDC guidelines for isolation rooms and included (1) create a minimum of .01" of water pressure gradient between the study room and the adjoining hallway space; (2) significantly reduce particle counts (0.5 microns or larger); (3) maintain ambient temperatures between 70°-75° F; and (4) provide a minimum of twelve complete room-air changes per hour.

RESULTS:

In the single-bed room, IsolationAirTM was able to create .015" to 0.22" of positive pressure and -.034 to -.052 of negative pressure, reduce particle counts from 6,480 to 255 per cubic foot, perform 36 room-air changes per hour, and maintain a temperature of 70°F. In the larger room, the system achieved .011" of positive pressure, -.01" to -.017 of negative pressure, reductions in particle counts from 34,254 to 1,630 per cubic foot, 16 room- air changes per hour, and a temperature maintained at 75°F.

Alpha Testing Technical Results

Performance	Single room – 125 sqft	Double room – 288 sqft
Air changes per hour	36	16
Negative pressure control	-0.034" to -0.052" note 1	-0.01" to -0.017" note 1
Positive pressure control	+0.015" to +0.022" note 1	+0.003" to +0.011" note 1
Particle reduction (0.5m /ft3) note 1	6,480 to 225 in 2 hours	34,254 to 1,630 in 3 hours
Temperature control	70F +/- 1.5F	75F +/- 1.5F note 2
Power	110 volts / 1 phase / 60 hertz	
Circuit Size (Amps)	20	

Controls/Components

Temperature control	R-134a refrigerant with ON/OFF control
Filtration	HEPA 99.997% efficient @ 0.3 microns
UV	Single bulb upstream of HEPA for maximum impact
Condenser air	Exhausted to return air grill or directly outside
Condensate	Drain line to sink

Note 1: Pressure measured as a differential between patient room and adjoining hallway highest values are based on results with additional temporary door seals, lowest figures are without any additional seals
Note 2: AIA recommends temperature control capability of at least 75F so we tested to that point, we could have also held 70F
Note 3: Room particle counts based on measuring total particle concentration of 0.5 micron particles per cubic foot of room air, tests done with a laser particle counter positioned over patient bed, room was unoccupied during test
Note 4: Air Innovations makes no guarantees that that these test results can be duplicated in any similar sized space; many variables such as room leakage and initial airborne contamination levels can effect IsolationAir's performance

CONCLUSION:

IsolationAirTM met or exceeded CDC guidelines for positive- and negative pressure isolation environments in otherwise typical ED rooms. This technology could be useful to hospitals and Eds in their efforts to meet federal guidelines and ensure adequate surge capacity, particularly with regards to potential NBC events.

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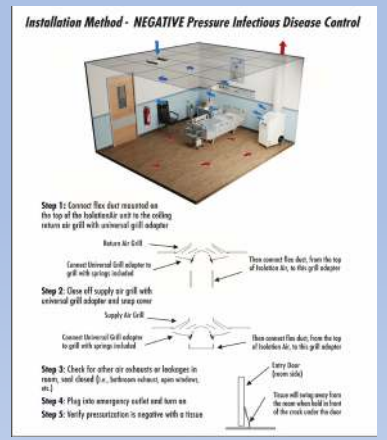

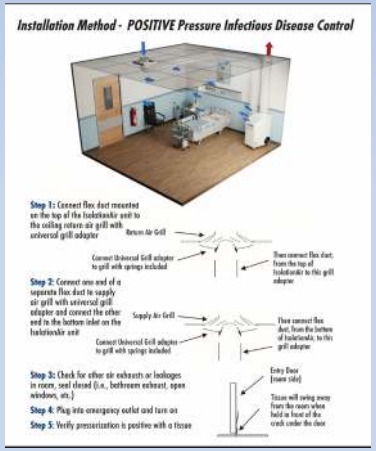

FEATURES:

- Rapidly converts any standard patient room into an isolation room- in less than 1 hour
- Helps hospitals meet critical benchmarks established by the U.S. department of Health and Human Services:
  - Surge Capacity: Isolation
  - Surge Capacity: Trauma and Burn
  - Preparedness for Pandemic Influenza
- Combines known technologies into an easy-to-deploy portable unit:
  - HEPA filtration for airborne viruses and bacteria trapped on the HEPA
  - Pressure control either negative or positive
  - Infectious disease control (TB, SARS, smallpox, ect.) requires negative
  - Protective environment control (burn, immuno-suppressed) is positive
  - Temperature control – the room becomes isolated from the central system (Only air having passed through both UV and HEPA will be returned to hospital HVAC)
- Meets CDC, AIA and ASHRAE guidelines for new construction or renovation:
  - 12 air changes per hour via HEPA filters
  - (Each IsolationAir unit conditions rooms up to 375 sqft with 8' ceiling)
  - Pressure differential of 0.01" minimum between room and adjoining spaces
  - (May require additional seals around doors or other significant leak points in large rooms with poorly sealed doors.)
  - Continuous operation when plugged into emergency generator outlet
  - Provides stable temperature control for patient comfort

AiR INNOVATIONS

US Patent No. 7,251,953