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Upper-Air UV Go / No-Go Pack: Qualify the Room, Prove the Air

Operational checklists, safety commissioning sheets, maintenance accountability logs, and baseline pilot protocols for healthcare facility directors.

TOOL 1: ROOM-QUALIFIER CHECKLIST (CDC PHYSICAL SPACE CRITERIA)

FIELD AUDIT FORM

Use this tool before pilot approval or capital procurement. Low ceilings and still air are where upper-air UV systems underperform. Document room geometry and ventilation dynamics for every candidate space.

Facility / Building:	.....	**Audit Date:**	.....
Room ID & Clinical Use:	.....	**Auditor Name:**	.....

Audit Item	CDC & Engineering Standard	Room Measured Value	Status Finding
Ceiling Height Measurement	**CDC Threshold:** Minimum 8.0 ft (2.44 m); 8.5 ft (2.59 m) strongly preferred to establish upper disinfection zone.	Measured Height: _____ ft _____ in	☐ ≥8.5 ft (Preferred GO) ☐ 8.0–8.4 ft (Min GO) ☐ <8.0 ft (**NO-GO**)
Vertical Air Movement Check	**Movement Mandate:** Requires active vertical mixing (HVAC supply/return velocity or auxiliary fans) to lift bioaerosols into UV zone.	Supply/Return Layout:	☐ Active Airflow (GO) ☐ Stagnant / Still Air *(Flag: Underperform)*
Airway Stagnation Flag	Low ceilings (<8 ft) combined with still air will cause severe upper-air UV underperformance.	Thermal/convection notes:	☐ Clear of Stagnation ☐ Requires Mixing Fans
Upper Zone Obstructions	Verify no patient ceiling lifts, large pendant arms, or architectural bulkheads obstruct beam spread.	Obstruction audit:	☐ Unobstructed (GO) ☐ Obstructions Present

Room Determination: ☐ **QUALIFIED (GO)** ☐ **CONDITIONAL (FIX AIR MIXING / FANS)** ☐ **DISQUALIFIED (NO-GO)**

TOOL 2: OCCUPIED-ZONE SAFETY COMMISSIONING SHEET (254 NM LIMIT)

SURVEYOR SIGN-OFF SHEET

Accepted Exposure Limit: 254 nm UV irradiance must not exceed **6.0 mJ/cm² over an 8-hour period** in the occupied zone. The occupied zone must be measured, not assumed, using a calibrated meter at eye level.

Meter Make & Model:	.....	**Calibration Cert Date:**	.....

Test Location	Meter Position & Height	Measured Irradiance (µW/cm²)	Calculated 8-Hr Dose (Limit: ≤6.0 mJ/cm²)
Bedside / Patient Position	Eye level seated / in bed (approx. 3.5–4.0 ft)	Reading: _____ µW/cm²	Dose: _____ mJ/cm² ☐ PASS ☐ FAIL
Staff Workstation / Desk	Eye level seated (approx. 4.0 ft)	Reading: _____ µW/cm²	Dose: _____ mJ/cm² ☐ PASS ☐ FAIL
Room Center / Standing Area	Eye level standing (approx. 5.5–6.0 ft)	Reading: _____ µW/cm²	Dose: _____ mJ/cm² ☐ PASS ☐ FAIL
Doorway / Entry Perimeter	Eye level standing (approx. 5.5–6.0 ft)	Reading: _____ µW/cm²	Dose: _____ mJ/cm² ☐ PASS ☐ FAIL

Recommissioning Triggers: Occupied-zone safety MUST be physically re-metered after: (1) any lamp replacement or ballast service, (2) fixture louvre/baffle angle adjustment, (3) ceiling tile or wall surface repainting/reflection change, or (4) room partition/furniture alteration.

Commissioning Lead Sign-Off: Name: _____ Signature: _____ Date: _____

TOOL 3: MAINTENANCE ACCOUNTABILITY LOG (PREVENTING QUIET FAILURES)

ENVIRONMENT OF CARE BINDER LOG

UV systems fail quietly through **dusty lamps**, **dead lamps left in place**, and **fans switched off**. Lamps need scheduled cleaning and replacement, and an inspectable log with an assigned owner name.

Date	Room & Fixture ID	Lamp Cleaned? (Optical Wipe)	Lamp Burning? (Not Burned Out)	Fan Operational? (Airflow Active)	Eye-Level Safe? (≤6.0 mJ/cm²)	Owner Name & Technician Sign
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	

Standard Operating Cadence: Monthly optical cleaning of lamp surfaces and louvres; monthly fan operational check; semi-annual eye-level radiometer metering; annual lamp replacement regardless of visual glow.

TOOL 4: BASELINE-FIRST PILOT WORKSHEET (CMS §482.41 / §482.42 FRAMEWORK)

INFECTION CONTROL PILOT TRACKER

Under CMS Conditions of Participation (42 CFR §482.41 Physical Environment and 42 CFR §482.42 Infection Control), an engineered air control must prove clinical efficacy. A pilot that cannot show before-and-after air measurements in the same occupied spaces, across a respiratory season, demonstrates a purchase, not a result.

Designated Pilot Ward:	.....	**Respiratory Season:**	.....
Infection Prevention Lead:	.....	**Facility Director:**	.....

Pilot Evaluation Domain	CHAIR Stated Program Target	Baseline Measurement (Pre-UV / Control Season)	Active Pilot Measurement (Same Occupied Space)
Airborne Pathogens (Real-time clinical space bioaerosol load)	**>90% reduction** in airborne pathogens measured in real time in clinical rooms.	Baseline CFU or particle count: ..... Date range: _____	Active UV CFU or particle count: ..... Achieved Reduction: _____%
Surface Contamination (Secondary settling on clinical contact points)	**>50% reduction** in surface contamination across occupied patient areas.	Baseline swab / ATP level: ..... Date range: _____	Active UV swab / ATP level: ..... Achieved Reduction: _____%
Onward Transmission (Acquired respiratory illness across season)	**>30% reduction** in onward transmission of respiratory illness (Flu/COVID/RSV).	Baseline ward transmission rate: ..... Prior season cases: _____	Active pilot transmission rate: ..... Achieved Reduction: _____%

The "Same-Space" Comparative Discipline: Measurements must compare identical patient rooms and waiting areas under active clinical occupancy. Testing in empty rooms, administrative suites, or during low-census periods invalidates the infection prevention compliance record.

Regulatory Compliance Gate	Documentation Requirement (CMS CoP)	Surveyor Verification
42 CFR §482.41(c)(2) Physical Environment: Facilities & Equipment Maintenance	Documented commissioning, eye-level safety radiation levels (≤6.0 mJ/cm^2), and scheduled lamp cleaning logs signed by physical plant.	☐ On File in EC Binder ☐ Surveyor-Ready
42 CFR §482.42(a)(1) Infection Control: Surveillance & Prevention Plan	Documented baseline-vs-active clinical space air sampling and bioburden reduction logs approved by Infection Prevention Committee.	☐ Approved by IP Comm ☐ Recorded in Minutes

TOOL 5: EQUIVALENT CLEAN-AIR REFERENCE & COST PLANNER (ASHRAE 241)

ENGINEERING QUICK REFERENCE

Under **ASHRAE Standard 241** (Control of Infectious Aerosols), ventilation, filtration, and air cleaning like UV are counted together as **equivalent clean airflow (eACH)**. It does not rank technologies; it sets the clean-air target and lets a facility combine methods. The question is never "UV or ventilation" — it is verified clean air delivered, at what cost, and with what upkeep.

Testing / Standard Context	Reported Engineering Parameters & Performance	Operational Takeaway
Leeds Chamber Context (Aug 2022, Dr. L. Fletcher)	Aerobiology chamber ventilated at **6 ACH baseline**. Continuous bioaerosol release: *S. aureus*, *P. aeruginosa*, and virus surrogate Phi-6. • Lowest setting: **97% to 98% reduction** • Maximum setting: **99.1% to 99.7% reduction** • Equivalent clean air: **216 to 1,994 eACH**	Proves extreme germicidal power in a controlled 6 ACH chamber. However, chamber air is well-mixed; hospital wards have complex partitions and drafts.
Conventional UV Devices (Leeds Chamber Baseline)	Best conventional upper-room UV device previously evaluated in the Leeds aerobiology chamber achieved roughly **8 to 12 eACH**.	SaniLume fan-assisted unit generated significantly higher eACH due to forced air movement through the fixture.
Lima, Peru Field Trial (2009 Clinical Study)	Human TB ward air vented to animal chambers on alternating days: • Control days (no UV): **35% infection rate** • Active days (UV + mixing fans): **9.5% infection rate**	Real-world clinical proof: upper-air UV with active mixing fans reduced onward transmission by >70%.
ASHRAE 241 Clean Air Framing	Combines outdoor air (ACH_vent) + filtered air (ACH_filt) + UV disinfection (eACH_uv) = Total Equivalent Clean Air.	Calculate whether upper-air UV adds clean air cheaper than increasing HVAC air handler capacity.

CAPITAL & OPERATIONAL COST PLANNER ($5,000 / BED BENCHMARK)

HEALTH ECONOMICS WORKSHEET

CHAIR estimates upper-air UV capital cost at approximately **$5,000 per bed** plus a few hundred dollars per year to run (power and lamp replacement). Use this worksheet to compare against mechanical HVAC ductwork and air handler upgrades.

Expense Component	CHAIR Program Benchmark	Facility Budgeted Cost / Bed
Capital Equipment Cost	Approx. $5,000 per bed installed	$_____ / bed
Annual Operating Power	Approx. $100–$200 / bed / year	$_____ / bed / year
Annual Lamp Replacement	Approx. $100–$150 / bed / year (scheduled annual swap)	$_____ / bed / year
Facility Maintenance Labor	Monthly wipe down + semi-annual metering (~2 hrs/bed/yr)	$_____ / bed / year
Total Estimated 1st-Year Cost	**~$5,400 / bed**	**$_____ / bed**

Procurement Prerequisite Rule: "Letters of intent are not installations. Studies remain subject to funding. Base facility commitments on verified baseline-first pilot data, eye-level safety metering (≤6.0 mJ/cm^2), and documented room qualification (≥8.0 ft ceiling + air movement)."