Disclosure

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All other planners, presenters, and reviewers of this session report no financial relationships relevant to this activity.

Learning Objectives

- Review the USP 797 sampling requirement.
- Explain the role of UV-C in improving air quality and reducing airborne bacteria and fungus.
- List the types of sampling agars for viable bacteria and fungus.

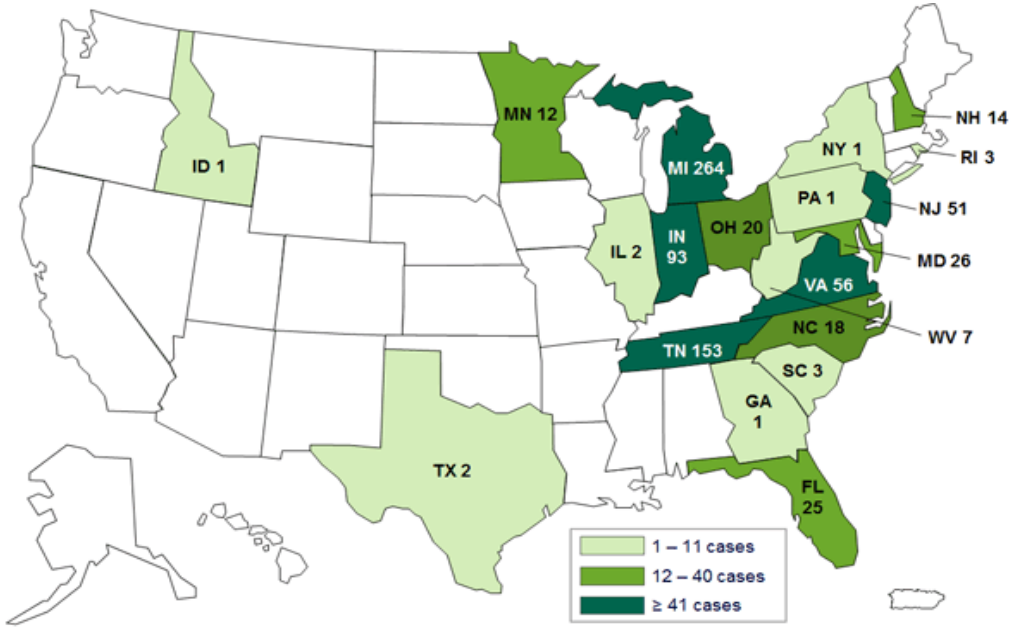
Self-Assessment Questions

1. (True or False) Part of the overview of USP 797 sampling requirements include sampling for viable fungus.
2. (True or False) USP 797 requires taking action in your ISO class 5 room if you measure more than 1 CFU per cubic meter of air.
3. (True or False) Malt Extract Agar (MEA) is used to sample bacteria.

Patient Safety – Compounding Pharmacy

Multistate fungal meningitis outbreak in 2012

- Linked steroid injections
- 753 cases affected
- 20 states
- 64 deaths



Source: https://www.cdc.gov/hai/outbreaks/meningitis.html

What is USP 797?

- USP 797 refers to chapter 797 “Pharmaceutical Compounding – Sterile Preparations” in the USP National Formulary. It is the first set of enforceable sterile compounding standards issued by the United States Pharmacopeia (USP).
- It describes the guidelines, procedures and compliance requirements for compounding sterile preparations and sets the standards that apply to all settings in which sterile preparations are compounded.
- USP <797> applies to the compounding of both hazardous and non-hazardous drugs

Prevent Patient Harm From

- Microbial contamination
- Excessive bacterial endotoxins
- Variability in the intended strength of correct ingredients
- Unintended chemical and physical contaminants
- Ingredients of inappropriate quality

What Is The USP 797 Compliance Standard For Non-viable Particulates

- In critical areas such as Class 100 or ISO 5 (area in immediate proximity of exposed sterilized containers/closures and filling/closing operations), the particle per cubic meter must be no more than 3520 particles/m^3 in a size of 0.5 micrometers or larger when counted at representative locations normally not more than 1 foot away from the work site, within the airflow, and during filling/closing operations.
- Supporting areas, or clean room areas where the laminar flow stations are located, must meet at least Class 100,000 (ISO 8) air quality.

Clean Rooms

Clean Air Classification	ISO Designation	>0.5 um particles/m^3
100	5	3,520
1,000	6	35,200
10,000	7	352,000
100,000	8	3,520,000

Non-Viable Particulates

- The nature of your activities conducted in a supporting clean room area determines its classification.
- FDA recommends that the area immediately adjacent to the aseptic processing line meet, at a minimum, Class 10,000 (ISO 7) standards under dynamic conditions.
- Manufacturers can also classify this area as Class 1,000 (ISO 6) or maintain the entire aseptic filling room at Class 100 (ISO 5).
- An area classified at a Class 100,000 (ISO 8) air cleanliness level is appropriate for less critical activities (e.g., equipment cleaning).

USP 800 Key Aspects

- Maintain list of hazardous drugs - review annually.
- Types of exposure and staff responsibilities when handling hazardous drugs - Designate compounding supervisor
- Facilities: receipt, storage, compounding and containment supplemental engineering controls.
- Environmental Quality and Control – Surface wipe sampling every 6 months.
- Personal Protective Equipment
- Hazard communications, personnel training
- Labeling, packaging and transport, dispensing final dosage forms, compounding and administering
- Deactivation/decontamination, cleaning and disinfection, spill control, disposal, documentation and standard operating procedures

Medical Surveillance

- Minimize adverse health effects in persons potentially exposed to hazardous drugs
- Proactive approach for early detection of health problems that compares trends overtime with an employee's baseline health status

Pharmacy Case Study

- Located in Memphis, Tennessee
- Freestanding hospital with 255 beds
- Part of the larger Healthcare System
- Each year, the hospital treats over 250,000 patients from across the country and world
- 2780 total pharmacy orders/day
- 44 compounding pharmacists; 45 compounding technicians

Barriers to Compliance

USP 797 common non-compliant issues

- Facility design and workflow
- Ceiling penetration issues
- Lack of proper cleaning and disinfection
- Lack of environmental testing and follow up

Pharmacy Case Study

Protocol for Pre-Installation Testing

- Pre-installation testing conducted fall of 2016
- Independent third party collected all samples
- Air sampling - SAS 180 high volume impingement air sampler.
- Surface sampling - Rodac type contact plates
- Bacteria samples - TSA with blood (tryptic soy agar) plates
- Fungus samples - MEA (malt extract agar) plates

Pharmacy Case Study

Testing Areas

- Pharmacy work space 5152 square feet
- Clean room 264 square feet
- Ante Room 600 square feet
- Chemo Room 88 square feet

Pharmacy Case Study

Sample Locations for Pre-Installation Testing

- Anteroom
- Break room
- Storage room
- Work rooms
- IV room
- Chemotherapy prep room
- Interior & Exterior Hallways

Sampling Process

Rodac Plates

Blood Agar Plates

Installation Process

Dispensing & Processing

Ante Room

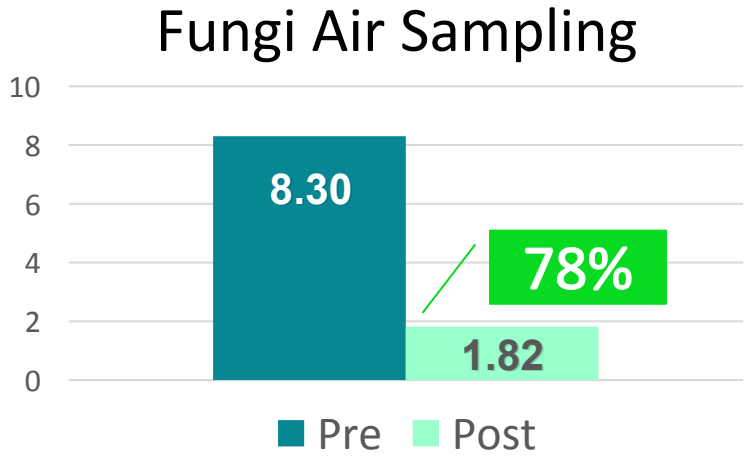
Receiving

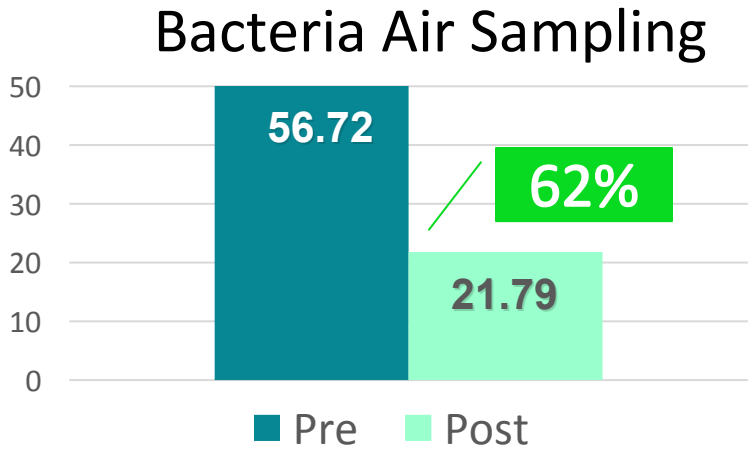
Pharmacy Case Study

Protocol for Post-Installation Testing

- Post-installation testing (once all units were installed) was conducted in spring of 2017.
- Independent lab analyzed the samples for total bacterial and fungal counts.
- Samples were handled as required.
- All counts were noted and recorded.
- An correction was performed for all air sampling samples using the SAS 219-hole impactor correction hole factor.

Results





Overall **78%** reduction in bacteria & **53%** in fungi.

Results – Anteroom

	Pre CFUs	Post CFUs	% Decrease
Fungi	1.8	0.18	90%
Bacteria	35.3	4.85	86%

Air Fungal Data

	Mean CFU/m^3 Pre-installation	Mean CFU/m^3 Post-installation	Mean CFU/m^3 Change	95% CI	p-value
Exterior Hall	10.75	14.10	+3.375	-11.64, 4.89	0.396
IV Rm (ISO 7)	3.25	0	-3.250	-4.44, 10.94	0.351
Chemo Rm (ISO 7)	2.25	0.38	-1.875	-0.70, 4.45	0.131
Interior Hall	10.50	2.14	-8.71	3.04, 14.39	0.008
Breakroom	11	2.50	-8.50	3.92, 13.08	0.003
Storage Rm	25.6	2.60	-23	-9.68, 55.68	0.140
Ante-Rm (ISO 7)	1.8	0.18	-1.56	0.63, 2.50	0.003
Work area one	11.5	6.10	-5.50	-3.67, 14.67	0.219
Work area two	7	2.25	-4.75	0.55, 8.95	0.031
Overall	8.30	1.82	-6.48	2.78,10.17	<0.001

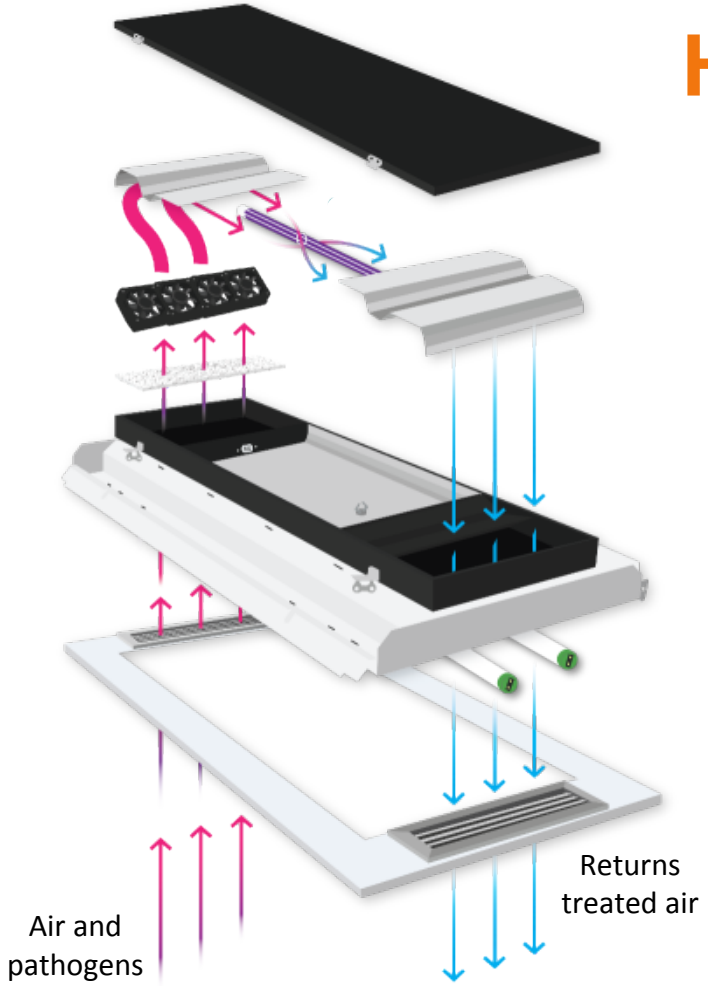
Results – IV Compounding Room

	Pre CFUs	Post CFUs	% Decrease
Fungi	3.25	0	**100%**
Bacteria	1.5	0.125	**92%**

Air Bacteria Data

	Mean CFU/m³ Pre-installation	*Mean CFU/m³ Post-installation*	*Mean CFU/m³Change*	*95% CI*	*p-value*
Exterior Hall	95.13	59.8	-35.38	14.00,84.75	0.141
IV Rm (ISO 7)	1.5	0.125	-1.38	0.36,2.39	0.014
Chemo Rm (ISO 7)	27.6	8	-19.63	3.89,35,36	0.020
Interior Hall	74.3	74.9	+.063	-109.3,108.1	0.990
Breakroom	87.3	20.8	-66.50	41.48,91.52	<0.001
Storage Rm	110.9	34	-76.88	76.88,20.15	0.013
Ante-Rm (ISO 7)	35.3	4.85	-30.44	5.85,55.02	0.019
Work area one	86.6	29	-57.63	6.18,109.10	0.032
Work area two	51.8	19.6	-32.13	-0.01,64.26	0.050
Overall	56.72	21.79	34.93	18.47,51.39	<0.001

How it Works



Executive Summary

- Augment current engineering controls to improve air quality.
- Deployment shielded UV air purification technology – installation of 52 UV-C units in the pharmacy.
- 24/7 operation in occupied spaces.
- System uses UV-C light and filtration to draw in and treat environmental air.
- Preliminary study results showed statistically significant reduction in bacterial and fungal colony counts post installation of UV-C technology.

Journey to Compliance USP 797, D. Guimera

Conclusions

- In conjunction with appropriate personnel training and environmental cleaning, a UV-C air purification system can help decrease air and surface bacteria and fungal CFUs in compounding clean rooms.
- Preliminary testing has shown a significant decrease in bacteria and fungal CFUs in buffer ISO 7 areas (clean and ante rooms) when a new technology using UV-C light and filtration systems was installed to reduce air borne bacterial and fungal CFUs in areas adjacent to those ISO 7 areas.
- This is a promising use of technology, particularly with the ability to constantly filter the environmental air using the UV-C air purification.

Key Takeaways

- Key Takeaway #1
- UV-C air purification, in addition to environmental cleaning, can reduce the number of bacterial and fungal CFUs in the air in the compounding pharmacy area.
- Key Takeaway #2
- Data shows a significant decrease in bacterial and fungal CFUs in adjacent ISO 7 areas once the UV-C systems were installed in those areas.
- Key Takeaway #3
- By reducing the contamination in the anteroom, the contamination is also reduced in the compounding area.

References

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