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STEP BY STEP GUIDE AND PRACTICAL TIPS FOR ESTABLISHING THE STERILE CHEMOTHERAPY DRUG ADMIXING UNIT

[1] Dr. Mannu Jaiswar, [2] Dr. Tejinder Singh, [3] Dr. Shubham Gandhi, [4] Dr. Vijay dabero

[1] Pharm. D, Oncology Clinical pharmacist,

[2] Senior Medical Oncology Consultant,

[3] DNB Medical Oncology resident,

[4] MBBS, MD, Clinical Pharmacologists.

ABSTRACT:

This study aimed to determine the safe handling and chemotherapy compounding of the drug or hazardous material with proper precautions and followed by the updated guidelines and protocols. Aseptic compounding units are critical in the pharmaceutical field, especially for handling hazardous medications like chemotherapy drugs. Chemotherapy drugs or hazardous materials are very toxic in nature and harmful to healthcare workers. There will be special facilities for managing the spillage of chemotherapy drugs with the appropriate precautions and safety kits which are suitable for that particular respective hazardous material. The person who is handling the hazardous material should be well trained and also have good knowledge about the particular spillage of the materials.

Objectives: The aim of these Model Standards is to provide pharmacists and pharmacy technicians who compound hazardous sterile preparations with the standards necessary to evaluate their practice, develop service-related procedures and implement appropriate quality controls for both patients and compounding personnel, with a view to guaranteeing the overall quality and safety of sterile preparations. The Model Standards will come into effect in each province/territory once they have been adopted by the respective provincial/territorial pharmacy regulatory authorities. These Model Standards represent the minimum requirements to be applied in compounding sterile preparations; however, it is always possible to exceed these standards. The use of other technologies, techniques, materials and procedures may be acceptable. [1,2]

INTRODUCTION:

[3] The toxic properties of cytostatic drugs have been well known since the 1940s when they began to be used in the oncological field. [4] However, it took nearly four decades before Falck Et al.

[5] Pharmacist is considered to be a part of a big cycle of patient care & an integral part of clinical decision making which includes professional medical staff, nurses and medical team assistants. This cycle of care ensures optimal medical care for patients in general and for Cancer patients in Specific.

[6] Oncology pharmacy is cancer patient centered service, where the pharmacist role is to be. Identifying patients 'drugs need including treatment management protocols, supportive and palliative care and preventing drug related problems. Also, clinical research which finally leads to improve outcomes for patient and whole community. Proper implementation of oncology pharmacy service is important to ensure patient`s safety, optimization of medication use, and close monitoring and follow up for the patients during receiving their medications and after treatment.

The compounding of sterile preparations requires high-quality standards to ensure preparation quality and safety. Parenteral therapies are becoming more complex, and patients may now receive continuous antibiotic therapy or chemotherapy, among other therapies, for several days at home. Consequently, greater attention must be paid to the environment in which these preparations are prepared, the training of personnel and quality assurance procedures to prevent complications and protect the public more generally.

The standards in this chapter are intended to apply to all persons who prepare CSPs and all places where CSPs are prepared (e.g., hospitals and other healthcare institutions, patient treatment Clinics, pharmacies, physicians' practice facilities, and other locations and facilities in which CSPs are prepared, stored, and transported). Persons who perform sterile compounding include pharmacists, nurses, pharmacy technicians, and physicians. These terms recognize that most sterile compounding is performed by or under the supervision of pharmacists in pharmacies and also that this chapter applies to all healthcare personnel who prepare, store, and transport CSPs.

3.1 Biosafety cabinet

3.1.1 Laminar Hood

- Laminar Air Flow is an enclosed bench designed to prevent contaminations like biological particles or any particle sensitive device.
- This closed cabinet is usually made up of stainless steel without any gap or joints where spores might collect.
- Laminar Hoods are equipped with a shortwave ultraviolet germicidal lamp to sterilize the shell
- Use: Laminar Air Flow provides a work area with aseptic/sterile conditions for the tissue culture.

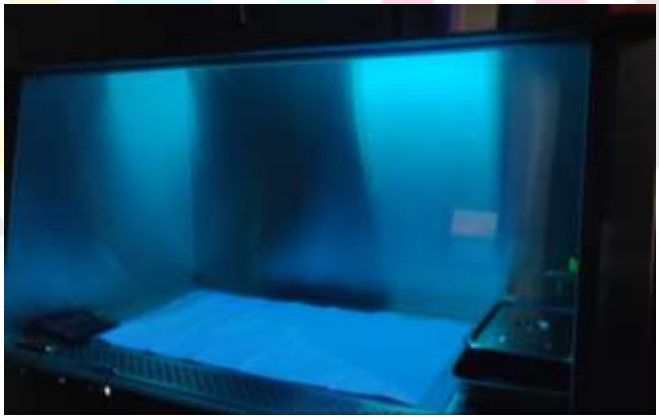

Figure: 1 Bio Safety Cabinet

- **Type of laminar air flow –**
  a) Vertical Laminar Air Flow Cabinets: Vertical laminar air flow is a type of airflow that moves in a vertical direction at a consistent speed and in a uniform direction.

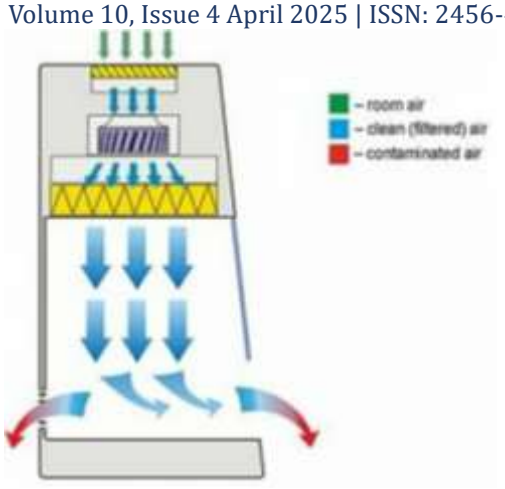

Figure: 2 Vertical Laminar Air Flow Cabinet

a) Horizontal Laminar Air Flow Cabinets :
Horizontal laminar air flow is a controlled, uniform movement of air in a horizontal direction.

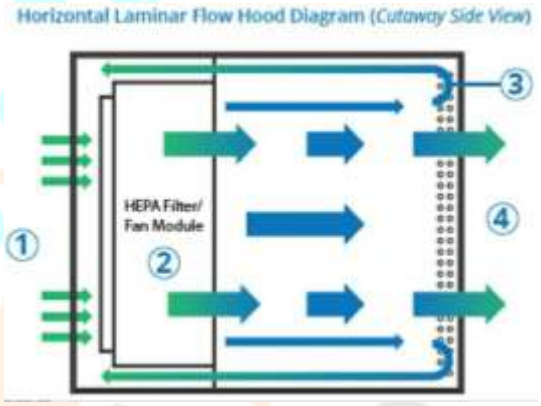

Figure: 3 Horizontal Laminar Air Flow Cabinet

3.1.2 Under pad

- Under pads is to prevent the direct contact during preparation of cytotoxic drugs between vial and surface of Biosafety cabinet.
- It also prevents from the direct contact of cytotoxic drug spillage to the surface of the Biosafety cabinet.
- It also prevents from any other types of contamination.

3.1.3 Sterile Empty tray

- It prevent from contamination form other media.
- It used to discard the excess amount of normal saline (NS) or dextrose or any other diluent during preparation

3.1.4 Bacillol

- Bacillol is highly recommend for disinfecting of electronic equipment.
- It also effective against all types of bacteria, fungi and virus.
- It used as disinfectant for the purpose of cleaning the Biosafety cabinet, while before doing cytotoxic drug preparation.
- The pass box from which the diluted drug are transferred that is also cleaned by Bacillol.

3.2 Personal protective equipment and clothing

PPE adapted and approved for the compounding of hazardous sterile preparations must be worn during such compounding activities.

- **Gloves-** Gloves used in the clean room, in the clean area of the anteroom and during aseptic processes in all C-PECs (including isolators) must be

- Non-powdered
- Compliant with standard D-6978-05 of ASTM International (formerly the American Society for Testing and Materials)
- Sterile (outer glove only).

Non-sterile gloves that meet the ASTM International standard can be used in unpacking areas, the "dirty" area of the anteroom and storage areas and can be worn under sterile gloves for aseptic processes.

For the following activities, personnel must wear two pairs of gloves meeting the ASTM International Standard:

- Unpacking
- Cleaning and disinfecting the clean room
- Disinfecting the C-PEC
- Compounding of hazardous preparations
- Managing a spill
- Disposing of hazardous products.

- **Glove changes-**
  Both pairs of gloves must be discarded and replaced at the earliest of the manufacturer's limit for permeation of the gloves, every 30 minutes or immediately if a tear, puncture or contamination has occurred or is suspected or after every compounding.
- **Gown-**
  The gown must have been tested by the manufacturer for resistance to permeability by hazardous drugs. It must close in the back (i.e., no open front), and it must have long sleeves with fitted cuffs at the wrists. The gown must be discarded and replaced at the earliest of the manufacturer's time limit for permeation of the gown or after 2–3 hours of continuous compounding work or after each removal or after a contamination has occurred or is suspected. A gown is required for unpacking a damaged hazardous drug or if a spill of hazardous material has occurred.
- **Hair cover-**
  A disposable hair cover must be worn during the compounding of hazardous sterile preparations. It must be changed after each removal or if it becomes contaminated.
- **Mask-**
  No mask is needed for unpacking hazardous drugs that have been received from the supplier in impervious plastic. However, if a hazardous drug shipment has been damaged before receipt, a chemical cartridge respirator is required during unpacking. Surgical masks do not provide respiratory protection against drug exposure and therefore should not be used when respiratory protection from hazardous drug exposure is required. For most activities, an N95 or N100 mask (NIOSH-approved) will protect against airborne particles. However, N95 or N100 masks offer no protection from vapours, gases and little protection from direct liquid splashes. A chemical cartridge respirator with a pre-filter must be worn in the presence of vapours, gas and particles (e.g., dust) or if there has been a spill. A cartridge that protects against the chlorine found in chlorinated disinfectants used for cleaning the C-PEC or for chemical decontamination after a spill may also be considered, to help prevent irritation of airways. Any mask (including N95 or N100 masks and chemical cartridge respirators) must first be fit-tested. The mask must be changed at the earliest of the following: after 3.5 hours of continuous compounding work, after each removal or if contamination has occurred or is suspected.

- **Goggles and face shield or full face-piece respirator-**
  Goggles and a face shield or full face-piece respirator must be worn when working at or above eye level, when deactivating, decontaminating and cleaning underneath the work surface of a C-PEC, when cleaning up a spill, when there is risk of splashes to the face and eyes and when unpacking suspected damaged drugs.
- **Shoe covers-**
  Shoe covers prevent the contamination of shoes and subsequent spread of contamination to other areas of the facility. Two pairs of disposable shoe covers are required at all times in the clean area of the anteroom and in the clean room, even if dedicated shoes are worn. The shoe covers must be changed after each removal or in the event of contamination, spill or breakage. Shoe covers worn in hazardous drug compounding areas are not to be worn outside the controlled area.
- **Uniform-**
  Compounding personnel shall wear clean room scrubs, not street clothes. Use of clean room scrubs reduces the risk of contaminating the environment through clothing.[7,8,9,10]

3.3 UV Passing Box

Pass box is the medium from which the prepared drug pass form the site of drug preparation area to patient side. Pass box cleaning process is done on the daily basis to maintain the sterility of UV pass box. Pass Box is utilized for the aseptic transfer of materials between two controlled areas without the need for personnel intervention.

3.4 Chiller Box

The boxes are cleaned with Bacillol and are used to deliver medicine in patient care area. Ice packs are kept inside the chiller box so that the temparature of box is maintained while transferring medicine from preparation area to patient care area. With the help of chiller box the cold chain medicine can be easily transferred from one place to another place.

3.5 Refrigerator

The refrigerator is used in two ways for storing unused and balance dose of patients. There are some cytotoxic drugs which can be used for multiple doses such kind of vial are stored in refrigerator instead of discarding the medicine. The refrigerator temperature should be maintained between 2 to 8 °C.

3.6 Three types of colour coded dustbins

a) **White Puncture proof container (sharp container)**
   All type of needles & metal sharps are discarded into white container.
b) **Yellow colour with cytotoxic symbol**
   All type of empty vials, syringes, used under pads, mask, gloves and PPE kit.
c) **Black colour**
   All type of vial cartons, paper, syringes cover and polythene.

A. **B.** **C.**

Figure: 4. (A) Sharp container, (B) Cytotoxic medicinal waste container, (C) Normal waste container

3.7 Heating, ventilation and air conditioning system for controlled rooms (clean room, anteroom)

- The air in controlled rooms must be "clean," and levels of airborne particulates must be controlled. Thus, the facility's heating, ventilation and air conditioning (HVAC) system must be designed to minimize the risk of airborne contamination in controlled rooms.
- It must also be designed to achieve and maintain the appropriate ISO class for clean rooms and anterooms.
- The air supplied to areas used for sterile preparations must pass through a high-efficiency particulate air (HEPA) filter to ensure a very high level of sterility.
- All sources that generate particles must be controlled to achieve and maintain the ISO class for clean rooms and anterooms used to compound sterile preparations.
- The air quality in controlled rooms must comply with ISO 14644-1, according to the specifications listed in appendix (2), under dynamic operating conditions.
- At the bottom of the walls, return air intakes should be installed to force particles to flow downward.
- An air conditioning system must be included in the HVAC system to help ensure the comfort of personnel wearing personal protective equipment (PPE). [11]

3.8 Viable Air Sampling

- Evaluation of airborne microorganisms using volumetric collection methods in the controlled air environments shall be performed by properly trained individuals for all compounding risk levels.
- Impaction shall be the preferred method of volumetric air sampling.
- For low-, medium-, and high-risk level compounding, air sampling shall be performed at locations that are prone to contamination during compounding activities and during other activities like staging, labeling, gowning, and cleaning.
- Locations shall include zones of air backwash turbulence within laminar airflow workbench and other areas where air backwash turbulence may enter the compounding area.
- For low-risk level CSPs with 12-hour or less BUD, air sampling shall be performed at locations inside the ISO Class 5 environment and other areas that are in close proximity to the ISO class 5 environment, during the certification of the primary engineering control.
- Consideration should be given to the overall effect the chosen sampling method will have on the unidirectional airflow within a compounding environment.

a) Air Sampling Device

- The instructions in the manufacturer's user manual for verification and use of electric air samplers that actively collect volumes of air for evaluation shall be followed.
- A sufficient volume of air (400–1000 litres) shall be tested at each location in order to maximize sensitivity.
- It is recommended that compounding personnel also refer to USP Chapter ⟨1116) that can provide more information on the use of volumetric air samplers and volume of air that should be sampled to detect environmental bioburden excursions.

b) Air Sampling Frequency and Process

- Air sampling shall be performed at least semiannually (i.e. every 6 months), as part of the re-certification of facilities and equipment for area where primary engineering controls are located.
- A sufficient volume of air shall be sampled and the manufacturer's guidelines for use of the electronic air sampling equipment followed.
- Any facility construction or equipment servicing may require the need to perform air sampling during these events. [12]

c) Negative Pressure Room

- A room that is at a Lower pressure than the adjacent spaces and, therefore, the net flow of air is into the room. [13]

d) Positive Pressure Room

- A room that is at a higher pressure than the adjacent spaces and therefore, the net airflow is out of the room. [14]

3.9 Cleaning and Disinfecting the Sterile Compounding Areas

- Trained personnel write detailed procedures including cleansers, disinfectants, and non-shedding wipe and mop materials.
- Trained compounding personnel are responsible for developing, implementing, and practicing the procedures for cleaning and disinfecting the DCAs written in the SOPs.
- Cleaning and disinfecting shall occur before compounding is performed. Items shall be removed from all areas to be cleaned and surfaces shall be cleaned by removing loose material and residue from spills, e.g., water-soluble solid residues are removed with sterile Water (for Injection or Irrigation) and low-shedding wipes. This shall be followed by wiping with a residue-free disinfecting agent, such as sterile 70% IPA, which is allowed to dry before compounding begins.
- Work surfaces in ISO Class 7 and 8 areas and segregated compounding areas are cleaned at least daily.
- Dust and debris shall be removed when necessary from storage sites for compounding ingredients and supplies, using a method that does not degrade the ISO Class 7 or 8 air quality.
- Floors in ISO Class 7 and 8 areas are cleaned daily when no compounding occurs.
- IPA (70% isopropyl alcohol) remains on surfaces to be disinfected for at least 30 seconds before such are used to prepare CSPs.
- Emptied shelving, walls, and ceilings in ante-areas are cleaned and disinfected at least monthly.
- Mopping shall be performed by trained personnel using approved agents and procedures described in the written SOPs.
- Cleaning and disinfecting agents, their schedules of use and methods of application shall be in accordance with written SOPs and followed by custodial and/or compounding personnel.
- All cleaning materials, such as wipers, sponges, and mops, shall be nonshedding, preferably composed of synthetic micro fibers, and dedicated to use in the buffer area, or ante-area, and segregated compounding areas and shall not be removed from these areas except for disposal.
- If cleaning materials are reused (e.g., mops), procedures shall be developed (based on manufacturer recommendations) that ensure that the effectiveness of the cleaning device is maintained and repeated use does not add to the bioburden of the area being cleaned.
- After the disinfectant is sprayed or wiped on a surface to be disinfected, the disinfectant shall be allowed to dry, and during this time the item shall not be used for compounding purposes. [15]

3.10 The Steps of Establishing a Chemotherapy Drug Preparation Unit

3.10.1 Physical place

In adherence with the standard part of physical place for the reconstitution of cytotoxic drug , as outlined in standard documents of JCI protocol for clean room specification for cytotoxic drug reconstitution. Supplementary spaces within this regulated working environment may encompass changing rooms designed for donning personal protective equipment during work activities, as well as areas designated for the storage of medications. The prescribed minimum area for establishing a regulated working environment equipped

with a Biological Safety Cabinet (BSC) is 14 square meters. Additionally, an additional 6 square Meters of space is mandated for each supplementary hood within the facility.

3.10.2 Room construction

In adherence to international standards, encompassing Joint commission international (JCI) the designated location for Biological Safety Cabinets (BSCs) is within the clean room. Its pressure should be maintained at a negative level compared to adjoining rooms. A Minimum pressure difference of 2.5 Pascal's between the clean room and the anteroom is imperative to ensure a consistent Inward airflow. Continuous monitoring of room pressure is essential and necessitates the installation of pressure monitors. The placement of this facility may be proximate to the chemotherapy drug injection unit. The overarching objective of regulating the work environment is to eliminate or mitigate particulate matter within the environment associated with injectable drugs. This is achieved through meticulous environmental cleaning practices, the use of requisite personal protective equipment during transitions from particle contaminated areas to cleaner zones.

3.10.3 Microbiology

To ensure the sterility of Biosafety cabinet for preparing the cytotoxic drugs and injectable for patients. For that the laboratory test is being done twice in month for that samples needed such as

- **Laminar air flow**
  The sample of laminar air flow is collected with help of Petri dish , the petri dish is kept in side the laminar air flow for 30 minutes then the sample gets collected then is sent for incubation for 24 hours and is assesses for any kind of bacterial growth present or not.
- **Eye wash water**
  The sample of eye wash is collected in container then send for incubation for 24 hours and to assess if there is any kind of bacterial growth present or not.
- **Hand wash**
  The sample of hand wash is collected with the help of slides then sent for incubation for 24 hours to assess if there is any kind of bacterial growth present or not. [16]
- **Preparation**
  A preparation, or a CSP, that is a sterile drug or nutrient compounded in a licensed pharmacy or other healthcare-related facility pursuant to the order of a licensed prescriber; the article may or may not contain sterile products. [17]

3.11 Requirements and skills

- Licensed pharmacist.
- Should have at least 5 years of experience in practice as oncology pharmacist.
- Have the Knowledge of oncology disease states, familiarity with evidence-based, Treatment, including standard-of-care treatment guidelines.
- Basic knowledge of compounding and sterile preparation principles, stability, Compatibility, administration.
- Basic Knowledge of safe handling, administration, and disposal of hazardous medications
- Annual competency of the staff involved in handling, compounding , and disposal of hazardous medications
- Experience of reimbursement practices (payment models and patient assistance Programs).
- Ability to communicate effectively with department staff and healthcare professionals.
- Familiarity with availability, structure, and design of clinical trials.
- Post-graduate certification in oncology pharmacy, is recommended.
- Must have an accredited certification in healthcare administration, health systems pharmacy administration or business administration. [18]

3.12 Responsibility of compounding personnel

Compounding personnel are responsible for ensuring that CSPs are accurately identified, measured, diluted, and mixed and are correctly purified, sterilized, packaged, sealed, labeled, stored, dispensed, and distributed. These performance responsibilities include maintaining appropriate cleanliness conditions and providing labeling and supplementary instructions for the proper clinical administration of CSPs.

The skill and knowledge of personnel who prepare CSPs. The rigor of in-process quality-control checks and of postcompounding quality inspection and testing increases with the potential hazard of the route of administration. For example, Nonsterility, excessive bacterial endotoxin

Contamination, large errors in strength of correct ingredients, and incorrect ingredients in CSPs are potentially more dangerous to patients when the CSPs are administered into the vascular and central nervous systems than when administered by most other routes. [19]

3.13 Safe handling of hazardous medications

Hazardous drugs (HDs) are defined by their association with genotoxicity, carcinogenicity, teratogenicity, fertility impairment or reproductive toxicity, and/or serious organ toxicity at low doses.

The examples of control in the context of hazardous drugs include the following:

a) Accommodation in a different position within the organization that does not involve the handling of hazardous drugs (elimination, substitution).
b) Biologic safety cabinets (engineering controls).
c) Educational programs (administrative controls).
d) Gloves and gowns (personal protective equipment [PPE]. [20]

3.14 During preparation

A. Cleaning of the cabinets

- Wear PPE before entering the clean room.
- The cabinet shall be cleaned at the start and the end of each work session.
- Wipe all internal surfaces with sterile alcohol 70% before the start of each work session.
- The top surface of the cabinet shall be cleaned first, followed by the left and right side and lastly, the working bench
- The top surface, left and right side and working bench of the cabinet are wiped from the least contaminated area to the most contaminated area using overlapping strokes.
- All soiled wipes shall be thrown into the clinical waste bag
- After the completion of aseptic preparation, clean the cabinet according to the above procedure using sterile alcohol 70%.

B. Aseptic Processing

- When preparing compounded sterile preparations, compounding personnel must follow strict aseptic procedures.
- Compounding must occur in the critical area (15-20 cm from the front of) to ensure the sterility of the preparation.
- Each preparation must be completed from start to finish before compounding of another preparation is begun.
- Before reintroduction into the PEC or after contact with a microbiologically contaminated surface, gloved hands must be disinfected with sterile 70% isopropyl alcohol.
- If gloves are torn, they must be removed and hand hygiene performed. [21]

3.15 CSP Microbial Contamination risk levels

Proper training and evaluation of personnel, proper cleansing and garbing of personnel, proper cleaning and disinfecting of compounding work environments, and proper maintenance and monitoring of controlled environmental locations (all of which are detailed in their respective sections).

a) Low-Risk Level CSPs

- Aseptic manipulations within an ISO Class 5 environment using three or fewer sterile products and entries into any container.
- In absence of passing sterility test, store not more than 48 hours at controlled room temperature, 14 days at cold temperature, and 45 days in solid frozen state at −25° to – 10° or colder.
- Media-fill test at least annually by compounding personnel.

b) Low-Risk Level CSPs with 12-Hour or Less BUD

- Fully comply with all four specific criteria.
- Sinks should not be located adjacent to the ISO Class 5 primary engineering control.
- Sinks should be separated from the immediate area of the ISO Class 5 primary engineering control device.

c) Medium-Risk Level CSPs

- Aseptic manipulations within an ISO Class 5 environment using prolonged and complex mixing and transfer, more than three sterile products and entries into any container, and pooling ingredients from multiple sterile products to prepare multiple CSPs.
- In absence of passing sterility test, store not more than 30 hours at controlled room temperature, 9 days at cold temperature, and 45 Days in solid frozen state at −25° to −10° or colder.
- Media-fill test at least annually by compounding personnel.

d) High-Risk Level CSPs

- Confirmed presence of nonsterile ingredients and devices, or confirmed or suspected exposure of sterile ingredients for more than one hour to air quality inferior to ISO Class 5 before final sterilization.
- Sterilization method verified to achieve sterility for the quantity and type of containers.
- Meet allowable limits for bacterial endotoxins. Maintain acceptable strength and purity of ingredients and integrity of containers after sterilization.
- In absence of passing sterility test, store not more than 24 hours at controlled room temperature, 3 days at cold temperature, and 45 days in solid frozen state at −25° to −10° or colder.
- Media-fill test at least semi-annually by compounding personnel. [22]

3.16 Policy and procedures for compounding sterile preparation

Organizational practices employed for compounding sterile preparations are in compliance with USP standards related to sterile compounding.

The organization implements well-defined policies and procedures to guide the compounding of sterile preparations.

Standardized workflow processes that include quality control, PROCESS CHANGE CONTROL, and documentation are implemented by the organization, recognizing that workflow processes may vary depending on the type and quantity of CSPs prepared and the sophistication of technology employed in each organization or location.

Detailed policies to guide BATCH compounding of CSPs have been implemented by the organization.

A Master Formulation Record is maintained for each BATCH of prepared CSPs and includes the following information-

- Preparation name, strength, and dosage form
- Physical description of the final preparation
- Identities and amounts of all ingredients
- Appropriate container–closure systems
- Complete instructions for preparing the CSP, including equipment, supplies, and description of the compounding steps
- Beyond-use date (BUD) and storage requirements
- Quality control procedures (e.g., visual inspection). [23]

3.17 Packaging and labelling

Packaging and labelling is very important regarding patient safety. A labelling is help to identify or distinguished between two same class drugs for different patients.

Labels for single compounded preparations must, at a Minimum, include the following:

- Patient name
- Patient UHID number
- Route of administration (SC/IV/IM)
- Date of administration
- Drug name
- Dose
- Dilution
- Infusion rate /flow rate of infusion
- Storage condition
- Compounding pharmacy name and signature
- Shelf life after reconstitution [24]

3.18 Systemic compounding or admixturing work flow of Cytotoxic drugs

Protocols written by Oncology clinicians & cross check by Oncology Clinical pharmacist

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Drugs are intended by nursing staff & dispensing done by registered pharmacist

↓

All indented drug send to compounding or admixture unit with proper handling & cold chain medicine are sent in cool box with ice pack

↓

All drugs and non-drugs should sent inside the admixing area through the pass box (UV light)

↓

Once the compounding or admixing of drug is completed then it is passed outside through the pass box (UV light)

↓

Before administration to the patient it is cross verified by clinician, pharmacist or nursing incharge.

Figure: 5. Cytotoxic drug preparation area

3.19 CACI (Compounding aseptic containment isolated)

The CACI must be positioned in an ISO Class 7 clean room or better, under negative pressure and adjoining an ISO Class 7 anteroom. However, the CACI may be positioned in an environment where the air particles exceed ISO Class 7 if all of the following conditions are met:

- The room has negative pressure (at least 2.5 Pa negative pressure relative to adjacent spaces).
- The CACI maintains an ISO Class 5 environment at all times during compounding, including when ingredients, equipment and devices are being transferred into and out of the CACI.
- Particulate sampling from 15 to 30 cm upstream of the critical exposure site within the CACI.
- The sterile compounding supervisor must obtain the following information from the manufacturer:
    - Documentation indicating that the CACI meets established standards when installed in an environment where the number of particles exceeds ISO Class 7 specifications;
    - The waiting time required to achieve ISO Class 5 air quality after materials have been transferred, before aseptic processing is started (i.e., the recovery time).
    - Compounding personnel working in a CACI must comply with the garbing procedure for compounding of hazardous sterile preparations, both to maintain air quality and to protect themselves from spills.
    - C-PECs must be maintained in accordance with the manufacturer's recommendations but certified according to the testing standards detailed in the Controlled Environment Testing Association (CETA).
    - Every 6 months
    - When relocated
    - After major repairs
    - When viable air sampling indicates that the C-PEC may not be in compliance with specifications.
    - C-PEC pre-filters must be accessible. They should be inspected every 6 months and replaced if necessary or as recommended by the manufacturer. Washable pre-filters must not be used.
    - HEPA filters shall be verified during installation and certification to ensure there are no leaks or damage to the filters after they have been transported or installed.
    - Preventive maintenance for C-PECs and other equipment must be performed when no compounding is in progress, before cleaning and disinfection operations.

- All C-PEC maintenance and certification, including maintenance of filters and pre-filters, must be documented on a form and entered in the general maintenance log (paper-based or computerized).
- The sterile compounding supervisor must ensure that C-PEC maintenance and certification have been performed. The supervisor must review the results or ensure that the results have been reviewed and corrective measures taken, as appropriate. The supervisor must sign the maintenance form or log. [25,26,27,28,29]

ABRIVATION

- CSPs – Compounded sterile preparation
- NS- Normal saline
- C-PECs- Containment primary engeneering control
- ASTM- American society testing for material
- NIOSH- National institute for occupational safety and health (United States)
- PPE kit- Personal protective equipment
- HVAC- heating, ventilation and air conditioning
- ISO- International Organization for Standardization
- HEPA- High efficiency particulate air
- BUD- Beyond use date
- DCA – Direct compounding area
- SOPs- Standard operating procedure
- IPA – Isopropyl alcohol
- BSC – Biological safety cabinet
- JCI – Joint comission international
- HDs -Hazardous drugs
- PEC – Primary engeneering control
- CACI - compounding aseptic containment isolated
- CETA- Control environment testing association
- USP – United States Pharmacopeia

CONCLUSION

Aseptic compounding of chemotherapy drugs essential and important for better patient outcomes and also the aseptic compounding can reduce the chances of infections.

Self protection is required in case of any accident exposure during handling and compounding chemotherapy drugs and also it prevents from any kind of contamination .

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