BRIEFING

⟨795⟩ Pharmaceutical Compounding—Nonsterile Preparations, *USP 41* page 6546. This proposed chapter revision is posted online at www.uspnf.com/notices/general-chapter-795-proposed-revisions with line numbers. Submit comments using the electronic submission form at https://usp.az1.qualtrics.com/jfe/form/SV_aWexhZowjRBbKnP.

The Compounding Expert Committee proposes to revise this chapter to improve clarity, respond to stakeholder input, and align with *Hazardous Drugs—Handling in Healthcare Settings* ⟨800⟩. Major proposed revisions to the chapter include:

1. Reorganization of the existing chapter to improve clarity and place key procedural information in boxes for easy reference.
2. Expanded guidance for assigning beyond-use dates (BUD) for compounded nonsterile preparations (CNSP) in the absence of stability information.
3. Removal of specific information on handling of hazardous drugs and addition of references to ⟨800⟩.

Additionally, minor editorial changes have been made to update this chapter to current *USP* style.

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⟨795⟩ PHARMACEUTICAL COMPOUNDING—NONSTERILE PREPARATIONS

Add the following:

▪1S (*USP42*)

Change to read:

~~INTRODUCTION~~

The purpose of this chapter is to provide compounders with guidance on applying good compounding practices for the preparation of nonsterile compounded formulations for dispensing and/or administration to humans or animals. Compounding is an integral part of pharmacy practice and is essential to the provision of healthcare. This chapter and applicable monographs on formulation help define good compounding practices. Furthermore, this chapter provides general information to enhance the compounder's ability in the compounding facility to extemporaneously compound preparations that are of acceptable strength, quality, and purity. Pharmacists, other healthcare professionals, and others engaged in the compounding of drug preparations should comply with applicable state and federal compounding laws, regulations, and guidelines.

CATEGORIES OF COMPOUNDING

In the three general categories of nonsterile compounding described in this section, different levels of experience, training, and physical facilities are associated with each category.

Criteria used to determine overall classification include:

- degree of difficulty or complexity of the compounding process
- stability information and warnings
- packaging and storage requirements
- dosage forms
- complexity of calculations
- local versus systemic biological disposition
- level of risk to the compounder
- potential for risk of harm to the patient.

See *Pharmaceutical Compounding—Sterile Preparations* ⟨797⟩ for risk levels associated with sterile preparations. Specialty areas such as radiopharmaceuticals require special training and are beyond the scope of this chapter. Compounders shall acquire and maintain knowledge and skills in all areas (e.g., dosage form, patient population, and medical specialty) for which they compound.

Description of Categories

SIMPLE

Making a preparation that has a *United States Pharmacopeia* (*USP*) compounding monograph or that appears in a peer-reviewed journal article that contains specific quantities of all components, compounding procedure and equipment, and stability data for that formulation with appropriate BUDs; or reconstituting or manipulating commercial products that may require the addition of one or more ingredients as directed by the

manufacturer. Examples include *Captopril Oral Solution*, *Indomethacin Topical Gel*, and *Potassium Bromide Oral Solution, Veterinary*.

MODERATE

Making a preparation that requires special calculations or procedures (such as calibration of dosage unit mold cavities) to determine quantities of components per preparation or per individualized dosage units; or making a preparation for which stability data for that specific formulation are not available. Examples include *Morphine Sulfate Suppositories*, diphenhydramine hydrochloride troches, and mixing two or more manufactured cream products when the stability of the mixture is not known.

COMPLEX

Making a preparation that requires special training, environment, facilities, equipment, and procedures to ensure appropriate therapeutic outcomes. Examples of possible complex preparation types include transdermal dosage forms, modified-release preparations, and some inserts and suppositories for systemic effects.

RESPONSIBILITIES OF THE COMPOUNDER

The compounder is responsible for compounding preparations of acceptable strength, quality, and purity and in accordance with the prescription or medication order. The compounder is also responsible for dispensing the finished preparation, with appropriate packaging and labeling, and in compliance with the requirements established by the applicable state agencies, state boards of pharmacy, federal law, and other regulatory agencies where appropriate. Individuals who are engaged in drug or dietary supplement compounding shall be proficient in compounding and should continually expand their compounding knowledge by participating in seminars and/or studying appropriate literature. They shall be knowledgeable about the contents of this chapter and should be familiar with ⟨797⟩, *Pharmaceutical Dosage Forms* ⟨1151⟩, *Pharmaceutical Calculations in Pharmacy Practice* ⟨1160⟩, *Quality Assurance in Pharmaceutical Compounding* ⟨1163⟩, *Prescription Balances and Volumetric Apparatus Used in Compounding* ⟨1176⟩, ⟨1191⟩, *Written Prescription Drug Information—Guidelines* ⟨1265⟩, and all applicable compounding laws, guidelines, and standards.

To ensure the quality of compounded preparations, compounders shall adhere to the following general principles (additional information on these general principles is provided in the sections that follow).

General Principles of Compounding

1. Personnel are appropriately trained and are capable of performing and qualified to perform their assigned duties. Such training should be documented.
2. Compounding ingredients of the appropriate identity, purity, and quality are purchased from reliable sources and are properly stored according to manufacturer specifications or *USP* standards.
3. Bulk component containers are labeled with appropriate Occupational Safety and Health Administration (OSHA) hazard communication labels (see *www.OSHA.gov*), and Material Safety Data Sheets (MSDSs) are available to compounding personnel for all drugs and chemicals used in compounding.
4. All equipment used in compounding is clean, properly maintained, and used appropriately.
5. The compounding environment is suitable for its intended purpose; and procedures are implemented to prevent cross-contamination, especially when compounding with drugs (e.g., hazardous drugs and known allergens like penicillin) that require special precautions.
6. Only authorized personnel are allowed in the immediate vicinity of the drug compounding operations.
7. There is assurance that processes are always carried out as intended or specified and are reproducible.
8. Compounding conditions and procedures are adequate for preventing errors.
9. All aspects of compounding are appropriately documented.
10. Adequate procedures and records exist for investigating and correcting failures or problems in compounding, testing, or the preparation itself.

COMPOUNDING PROCESS

The compounder is responsible for ensuring that each individual incidence of compounding meets the criteria given in this section (additional information on these criteria is provided in the sections that follow).

Criteria When Compounding Each Drug Preparation

1. The dose, safety, and intended use of the preparation or device has been evaluated for suitability in terms of:
    - the chemical and physical properties of the components
    - dosage form
    - therapeutic appropriateness and route of administration, including local and systemic biological disposition
    - legal limitations, if any.

2. A Master Formulation Record should be created before compounding a preparation for the first time. This record shall be followed each time that preparation is made. In addition, a Compounding Record should be completed each time a preparation is compounded.
3. Ingredients used in the formulation have their expected identity, quality, and purity. If the formulation is for humans, ingredients are not on a list of federally recognized drugs or specific drug products that have been withdrawn or removed from the market for safety or efficacy reasons (see *www.FDA.gov*). If the formulation is for food-producing animals, ingredients are not on a list of components prohibited for use in food-producing animals. Certificates of Analysis, when applicable, and MSDSs have been consulted for all ingredients used.
4. Compounding is done in an appropriately clean and sanitized area dedicated to this activity (see the section *Compounding Facilities*).
5. Only one preparation is compounded at one time in a specific workspace.
6. Appropriate compounding equipment has been selected and inspected for cleanliness and correct functioning and is properly used.
7. A reliable BUD is established to ensure that the finished preparation has its accepted potency, purity, quality, and characteristics, at least until the labeled BUD.
8. Personnel engaged in compounding maintain good hand hygiene and wear clean clothing appropriate to the type of compounding performed (e.g., hair bonnets, coats, gowns, gloves, facemasks, shoes, aprons, or other items) as needed for protection of personnel from chemical exposures and for prevention of drug contamination.
9. The preparation is made in accordance with this chapter, other official standards referenced in this chapter, and relevant scientific data and information.
10. Critical processes (including but not limited to weighing, measuring, and mixing) are verified by the compounder to ensure that procedures, when used, will consistently result in the expected qualities in the finished preparation.
11. The final preparation is assessed using factors such as weight, adequacy of mixing, clarity, odor, color, consistency, pH, and analytical testing as appropriate; and this information is recorded on the Compounding Record (see ⟨1163⟩).
12. The preparation is packaged as recommended in the *Packaging and Drug Preparation Containers* section of this chapter.
13. The preparation container is labeled according to all applicable state and federal laws. The labeling shall include the BUD and storage and handling information. The labeling should indicate that "this is a compounded preparation."

14. The Master Formulation Record and the Compounding Record have been reviewed by the compounder to ensure that errors have not occurred in the compounding process and that the preparation is suitable for use.
15. The preparation is delivered to the patient or caregiver with the appropriate consultation.

COMPOUNDING FACILITIES

Compounding facilities shall have an adequate space that is specifically designated for compounding of prescriptions. This space shall provide for the orderly placement of equipment and materials to prevent mixups among ingredients, containers, labels, in-process materials, and finished preparations and is designed, arranged, and used to prevent adventitious cross-contamination. Areas used for sterile preparations shall be separated and distinct from the nonsterile compounding area (see *Pharmaceutical Compounding—Sterile Preparations* ⟨797⟩, *Environmental Quality and Control*).

Potable water shall be supplied for hand and equipment washing. This water meets the standards prescribed in the Environmental Protection Agency's National Primary Drinking Water Regulations (40 CFR Part 141). *Purified Water* (see *Purified Water* monograph) shall be used for compounding nonsterile drug preparations when formulations indicate the inclusion of water. *Purified Water* should be used for rinsing equipment and utensils. In those cases when a water is used to prepare a sterile preparation, follow the appropriate monographs and general chapters (see *Water for Pharmaceutical Purposes* ⟨1231⟩).

The plumbing system shall be free of defects that could contribute to contamination of any compounded preparation. Adequate hand and equipment washing facilities shall be easily accessible to the compounding areas. Such facilities shall include, but are not limited to, hot and cold water, soap or detergent, and an air-drier or single-use towels. The areas used for compounding shall be maintained in clean, orderly, and sanitary conditions and shall be maintained in a good state of repair. Waste shall be held and disposed of in a sanitary and timely manner and in accordance with local, state, and federal guidelines.

The entire compounding and storage area should be well lighted. Heating, ventilation, and air conditioning systems shall be controlled to avoid decomposition and contamination of chemicals (see *Packaging and Storage Requirements* ⟨659⟩ and the manufacturers' labeled storage conditions). Appropriate temperature and humidity monitoring should be maintained as required for certain components and compounded dosage forms. All components, equipment, and containers shall be stored off the floor and in a

manner to prevent contamination and permit inspection and cleaning of the compounding and storage area.

Hazardous drugs shall be stored, prepared, and handled by appropriately trained personnel under conditions that protect the healthcare workers and other personnel. The following are references for the safe handling of antineoplastic and hazardous drugs in healthcare settings:

- OSHA Technical Manual—Section VI: Chapter 2, *Controlling Occupational Exposure to Hazardous Drugs*
- NIOSH Alert: *Preventing Occupational Exposure to Antineoplastic and Other Hazardous Drugs in Health Care Settings*[DHHS (NIOSH) Publication No. 2004-165] and updates.

Disposal of all hazardous drug wastes shall comply with all applicable federal and state regulations. All personnel who perform routine custodial waste removal and cleaning activities in storage and preparation areas for hazardous drugs shall be trained in appropriate procedures to protect themselves and prevent contamination.

COMPOUNDING EQUIPMENT

The equipment and utensils used for compounding of a drug preparation shall be of appropriate design and capacity. The equipment shall be of suitable composition that the surfaces that contact components are neither reactive, additive, nor sorptive and therefore will not affect or alter the purity of the compounded preparations. The types and sizes of equipment depend on the dosage forms and the quantities compounded (see ⟨1176⟩ and equipment manufacturers' instruction manuals).

Equipment shall be stored to protect it from contamination and shall be located to facilitate its use, maintenance, and cleaning. Automated, mechanical, electronic, and other types of equipment used in compounding or testing of compounded preparations shall be routinely inspected, calibrated as necessary, and checked to ensure proper performance. Immediately before compounding operations, the equipment shall be inspected by the compounder to determine its suitability for use. After use, the equipment shall be appropriately cleaned.

Extra care should be used when cleaning equipment used in compounding preparations that require special precaution (e.g., antibiotics and cytotoxic and other hazardous materials). When possible, special equipment should be dedicated for such use, or when the same equipment is being used for all drug products, appropriate procedures shall be in place to allow meticulous cleaning of equipment before use with other drugs. If possible, disposable equipment should be used to reduce chances of bioburden and cross-contamination.

COMPONENT SELECTION, HANDLING, AND STORAGE

The following guidelines shall be followed when selecting, handling, and storing components for compounded preparations.

1. A *United States Pharmacopeia* (*USP*), *National Formulary* (*NF*), or *Food Chemicals Codex* (*FCC*) substance is the recommended source of ingredients for compounding all preparations.
2. Compounders shall first attempt to use components manufactured in an FDA-registered facility. When components cannot be obtained from an FDA-registered facility, compounders shall use their professional judgment in selecting an acceptable and reliable source and shall establish purity and safety by reasonable means, which should include Certificate of Analysis, manufacturer reputation, and reliability of source.
3. Official compounded preparations are prepared from ingredients that meet requirements of the compendial monograph for those individual ingredients for which monographs are provided. These preparations may be labeled *USP* or *NF* as appropriate.
4. When components of compendial quality are not obtainable, components of high quality such as those that are chemically pure, analytical reagent grade, or American Chemical Society–certified may be used. However, these components should be used cautiously because the standards for analytical reagents or American Chemical Society–grade materials do not consider whether any impurity present raises human or animal safety concerns.
5. For components in containers that have an expiration date from the manufacturer or distributor, the material may be used in compounding before that expiration date (a) when the material is stored in its original container under conditions to avoid decomposition of the chemicals (see ⟨1191⟩ and ⟨659⟩, unless other conditions are noted on the label), (b) when there is minimal exposure of the remaining material each time material is withdrawn from the container, and (c) when any withdrawals from the container are performed by those trained in the proper handling of the material. If the component has been transferred to a different container, that container shall be identified with the component name, original supplier, lot or control number, transfer date, and expiration date and shall provide integrity that is equivalent to or better than that of the original container.
6. For components that do not have expiration dates assigned by the manufacturer or supplier, the compounder shall label the container with the date of receipt and assign a conservative expiration date, not to exceed three years after receipt, to the component (see

•*Labeling* ⟨7⟩*, Expiration Date and Beyond-Use Date*).• (CN 1-May-2018) based on the nature of the component and its degradation mechanism, the container in which it is packaged, and the storage conditions.

7. If a manufactured drug product is used as the source of active ingredient, the drug product shall be manufactured in an FDA-registered facility, and the manufacturer's product container shall be labeled with a batch control number and expiration date. When compounding with manufactured drug products, the compounder shall consider all ingredients, including excipients, present in the drug product relative to the intended use of the compounded preparation and the effect of manipulating the drug product on the therapeutic appropriateness and stability of the components.
8. If the preparation is intended for use as a dietary or nutritional supplement, then the compounder must adhere to this chapter and must also comply with any federal and state requirements. Generally, dietary supplements are prepared from ingredients that meet *USP*, *FCC*, or *NF* standards. Where such standards do not exist, substances may be used in dietary supplements if they have been shown to have acceptable food-grade quality using other suitable procedures.
9. When a component is derived from ruminant animals (e.g., bovine, caprine, ovine), the supplier shall provide written assurance that the component is in compliance with all federal laws governing processing, use, and importation requirements for these materials.
10. When compounding for humans, the compounder should consult the list of components that have been withdrawn or removed from the market for safety or efficacy reasons by FDA (see *www.FDA.gov*). When compounding for food-producing animals, the compounder should consult the list of components prohibited for use in food-producing animals.
11. All components used in the compounding of preparations must be stored as directed by the manufacturer, or according to *USP*, *NF*, or *FCC* monograph requirements, in a clean area, and under appropriate temperature and humidity conditions (controlled room temperature, refrigerator, or freezer). All components shall be stored off the floor, handled and stored to prevent contamination, and rotated so that the oldest stock is used first. All containers shall be properly labeled.

STABILITY CRITERIA AND BEYOND-USE DATING

The BUD is the date after which a compounded preparation shall not be used and is determined from the date when the preparation is compounded. Because compounded preparations are intended for administration

immediately or following short-term storage, their BUDs are assigned on the basis of criteria different from those applied to assigning expiration dates to manufactured drug products.

BUDs should be assigned conservatively. When assigning a BUD, compounders shall consult and apply drug-specific and general stability documentation and literature when available and should consider:

- the nature of the drug and its degradation mechanism
- the dosage form and its components
- the potential for microbial proliferation in the preparation
- the container in which it is packaged
- the expected storage conditions
- the intended duration of therapy (see *Labeling ⟨7⟩, Expiration Date and Beyond-Use Date*.). (CN 1-May-2018)

When a manufactured product is used as the source of the API for a nonsterile compounded preparation, the product expiration date cannot be used solely to assign a BUD for the compounded preparation. Instead, the compounder shall refer to the manufacturer for stability information and to the literature for applicable information on stability, compatibility, and degradation of ingredients; shall consider stability factors in ⟨1191⟩; and shall use his or her compounding education and experience. All stability data shall be carefully interpreted in relation to the actual compounded formulation.

At all steps in the compounding, dispensing, and storage process, the compounder shall observe the compounded drug preparation for signs of instability. For more specific details of some of the common physical signs of deterioration (see ⟨1191⟩, *Observing Products for Evidence of Instability*). However, excessive chemical degradation and other drug concentration loss due to reactions may be invisible more often than visible.

General Guidelines for Assigning Beyond-Use Dates

In the absence of stability information that is applicable to a specific drug and preparation, the following table presents maximum BUDs recommended for nonsterile compounded drug preparations that are packaged in tight, light-resistant containers and stored at controlled room temperature, unless otherwise indicated (see ⟨659⟩). Drugs or chemicals known to be labile to decomposition will require shorter BUDs.

BUD by Type of Formulation
For Nonaqueous Formulations—The BUD is not later than the time remaining until the earliest expiration date of any API or 6 months, whichever

BUD by Type of Formulation[a]
is earlier.
For Water-Containing Oral Formulations—The BUD is not later than 14 days when stored at controlled cold temperatures.
For Water-Containing Topical/Dermal and Mucosal Liquid and Semisolid Formulations—The BUD is not later than 30 days.
[a] These maximum BUDs are recommended for nonsterile compounded drug preparations in the absence of stability information that is applicable to a specific drug or preparation. The BUD shall not be later than the expiration date on the container of any component.

Susceptible preparations should contain suitable antimicrobial agents to protect against bacteria, yeast, and mold contamination inadvertently introduced during or after the compounding process. When antimicrobial preservatives are contraindicated in such compounded preparations, storage of the preparation at controlled cold temperature is necessary; to ensure proper storage and handling of such compounded preparations by the patient or caregiver, appropriate patient instruction and consultation is essential. Antimicrobial preservatives should not be used as a substitute for good compounding practices.

For information on assigning BUDs when repackaging drug products for dispensing or administration, see *General Notices and Requirements*, *Preservation*, *Packaging*, *Storage*, *and Labeling*, *Labeling*, *Expiration Date and Beyond-Use Date*, and *Packaging and Repackaging—Single-Unit Containers* ⟨1136⟩.

Assurance of sterility in a compounded sterile preparation is mandatory. Compounding and packaging of sterile drugs (including ophthalmic preparations) requires strict adherence to guidelines presented in ⟨797⟩ and in the manufacturers' labeling instructions.

PACKAGING AND DRUG PREPARATION CONTAINERS

The compounder shall ensure that the containers and container closures used in packaging compounded preparations meet *USP* requirements (see ⟨659⟩; *Containers—Glass* ⟨660⟩; *Plastic Packaging Systems and their Materials of Construction* ⟨661⟩; *Plastic Materials of Construction* ⟨661.1⟩; *Plastic Packaging Systems for Pharmaceutical Use* ⟨661.2⟩; *Containers—Performance Testing* ⟨671⟩; ⟨1136⟩); and when available, compounding monographs. Compounders are not expected to perform the tests described in these chapters but should be knowledgeable about the standards described in them. Container suppliers shall supply, upon request, verification of *USP* container compliance. Containers and container closures

intended for the compounding of sterile preparations must be handled as described in ⟨797⟩.

The containers and closures shall be made of suitable clean material in order not to alter the quality, strength, or purity of the compounded drug preparation. The container used depends on the physical and chemical properties of the compounded preparation. Container–drug interaction should be considered for substances that have sorptive or leaching properties.

The containers and closures shall be stored off the floor, handled and stored to prevent contamination, and rotated so that the oldest stock is used first. The containers and container closures shall be stored in such a way as to permit inspection and cleaning of the storage area.

COMPOUNDING DOCUMENTATION

Documentation, written or electronic, enables a compounder, whenever necessary, to systematically trace, evaluate, and replicate the steps included throughout the preparation process of a compounded preparation. All compounders who dispense prescriptions must comply with the record-keeping requirements of their state boards of pharmacy. When the compounder compounds a preparation according to the manufacturer's labeling instructions, then further documentation is not required. All other compounded preparations require further documentation as described in this section.

These records should be retained for the same period of time that is required for any prescription under state law. The record may be a copy of the prescription in written or machine-readable form and should include a Master Formulation Record and a Compounding Record.

Master Formulation Record

This record shall include:

- official or assigned name, strength, and dosage form of the preparation
- calculations needed to determine and verify quantities of components and doses of active pharmaceutical ingredients
- description of all ingredients and their quantities
- compatibility and stability information, including references when available
- equipment needed to prepare the preparation, when appropriate
- mixing instructions that should include:
    1. order of mixing
    2. mixing temperatures or other environmental controls
    3. duration of mixing

4. other factors pertinent to the replication of the preparation as compounded.

- sample labeling information, which shall contain, in addition to legally required information:
    1. generic name and quantity or concentration of each active ingredient
    2. assigned BUD
    3. storage conditions
    4. prescription or control number, whichever is applicable.

- container used in dispensing
- packaging and storage requirements
- description of final preparation
- quality control procedures and expected results.

Compounding Record

The Compounding Record shall contain:

- official or assigned name, strength, and dosage of the preparation
- Master Formulation Record reference for the preparation
- names and quantities of all components
- sources, lot numbers, and expiration dates of components
- total quantity compounded
- name of the person who prepared the preparation, name of the person who performed the quality control procedures, and name of the compounder who approved the preparation
- date of preparation
- assigned control or prescription number
- assigned BUD
- duplicate label as described in the Master Formulation Record
- description of final preparation
- results of quality control procedures (e.g., weight range of filled capsules, pH of aqueous liquids)
- documentation of any quality control issues and any adverse reactions or preparation problems reported by the patient or caregiver.

Standard Operating Procedures

All significant procedures performed in the compounding area should be covered by written standard operating procedures (SOPs). Procedures should be developed for the facility, equipment, personnel, preparation, packaging, and storage of compounded preparations to ensure accountability, accuracy, quality, safety, and uniformity in compounding.

Implementing SOPs establishes procedural consistency and also provides a reference for orientation and training of personnel.

Material Safety Data Sheets File

MSDSs shall be readily accessible to all employees working with drug substances or bulk chemicals located on the compounding facility premises. Employees should be instructed on how to retrieve and interpret needed information.

QUALITY CONTROL

The safety, quality, and performance of compounded preparations depend on correct ingredients and calculations, accurate and precise measurements, appropriate formulation conditions and procedures, and prudent pharmaceutical judgment. As a final check, the compounder shall review each procedure in the compounding process. To ensure accuracy and completeness, the compounder shall observe the finished preparation to ensure that it appears as expected and shall investigate any discrepancies and take appropriate corrective action before the prescription is dispensed to the patient.

Compounding Controls

1. The Master Formulation Record, the Compounding Record, and associated written procedures shall be followed in execution of the compounding process. Any deviation in procedures shall be documented.
2. The compounder shall check and recheck each procedure at each stage of the process. If possible, a trained second person should verify each critical step in the compounding process.
3. The compounder shall have established written procedures that describe the tests or examinations conducted on the compounded preparation (e.g., the degree of weight variation among capsules) to ensure their uniformity and integrity.
4. Appropriate control procedures shall be established to monitor the output and to verify the performance of compounding processes and equipment that may be responsible for causing variability in the final compounded preparations.
5. For further guidance on recommended quality control procedures, see ⟨1163⟩.

PATIENT COUNSELING

At the time of dispensing the prescription, the patient or the patient's agent shall be counseled about proper use, storage, handling, and disposal of the compounded preparation. The patient or the patient's agent shall also be instructed to report any adverse event and to observe and report to the compounder any changes in the physical characteristics of the compounded preparation (see ⟨1191⟩, *Responsibility of Pharmacists*). The compounder shall investigate and document any reported problem with a compounded preparation and shall take corrective action.

TRAINING

All personnel involved in the compounding, evaluation, packaging, and dispensing of compounded preparations shall be properly trained for the type of compounding conducted. It is the responsibility of the compounder to ensure that a training program has been implemented and that it is ongoing. Compounding personnel should be evaluated at least annually. Steps in the training procedure include the following:

- All employees involved in pharmaceutical compounding shall read and become familiar with this chapter. They should also be familiar with the contents of the *USP Pharmacists' Pharmacopeia* and other relevant publications, including how to read and interpret MSDSs.
- All employees shall read and become familiar with each of the procedures related to compounding, including those involving the facility, equipment, personnel, actual compounding, evaluation, packaging, storage, and dispensing.
- All personnel who compound hazardous drugs shall be fully trained in the storage, handling, and disposal of these drugs. This training shall occur before preparing or handling hazardous drugs. For information on training for personnel who compound hazardous drugs, see the references in *Compounding Facilities* earlier in this chapter.
- All training activities shall be documented. The compounder shall meet with employees to review their work and answer any questions the employees may have concerning compounding procedures.
- The compounder shall demonstrate the procedures for the employee and shall observe and guide the employee throughout the training process. The employee will then repeat the procedure without any assistance from, but under the direct supervision of, the compounder.
- When the employee has demonstrated to the compounder a verbal and functional knowledge of the procedure, then and only then will the employee be permitted to perform the procedure without direct supervision. However, the compounder should be physically present and shall approve all ingredients and their quantities and the final preparation.

- When the compounder is satisfied with the employee's knowledge and proficiency, the compounder will sign the documentation records to show that the employee was appropriately trained.
- The compounder shall continually monitor the work of the employee and ensure that the employee's calculations and work are accurate and adequately performed.
- The compounder is solely responsible for the finished preparation.

COMPOUNDING FOR ANIMAL PATIENTS

A compounder's responsibility for providing patients with high-quality compounded preparations extends beyond the human species. All portions of this chapter apply to compounded preparations formulated for animal patients. Intended use of any animal patient (e.g., companion, performance, food) shall be determined before compounding for that patient.

Because humans can consume animal patients as food, care must be taken to prevent drug residues from entering the human food chain when compounded preparations are used in animal patients. For this reason, all compounders preparing formulations for animals shall possess a functional knowledge of drug regulation and disposition in animal patients. Veterinarians are required by law to provide food-producing animal caregivers with an accurate length of time to withhold treated animal tissues (e.g., meat, milk, eggs) from the human food supply. This length of time is referred to as a withdrawal time (WDT) and must also, by law, be included on the dispensing label of every prescription prepared for a food-producing species.

Drug use in any performance animal is strictly regulated by federal and state governments, in addition to the governing bodies of each of the specific disciplines. Penalties for violation of these rules may be severe for all contributing to the violation, including the veterinarian, pharmacist, and caregiver.

The pharmacist shall be knowledgeable about the individual species' limitations in physiology and metabolic capacity that can result in toxicity when certain drugs or excipients are used in compounded preparations. For this reason, compounders making preparations for animals should use, when possible, formulations specifically developed for animal patients. If such formulations are not available, the compounder shall conduct a literature review to determine whether a specific component of the formula is toxic to the target species. Extrapolating compounding formulations intended for use in humans may not be appropriate for animal species and may contribute to negative outcomes.

Veterinarians and pharmacists making preparations for animal patients should be familiar with all state and federal regulations regarding drug use in animals, including but not limited to the Food, Drug, and Cosmetic Act; the

Animal Drug Amendment; the Animal Medicinal Drug Use Clarification Act; and FDA's Compliance Policy Guideline for Compounding of Drugs for Use in Animal Patients.

GLOSSARY

Active Pharmaceutical Ingredient (API): Any substance or mixture of substances intended to be used in the compounding of a drug preparation, thereby becoming the active ingredient in that preparation and furnishing pharmacological activity or other direct effect in the diagnosis, cure, mitigation, treatment, or prevention of disease in humans and animals or affecting the structure and function of the body.

Added Substances: Ingredients that are necessary to compound a preparation but are not intended or expected to cause a pharmacologic response if administered alone in the amount or concentration contained in a single dose of the compounded preparation. The term is used synonymously with the terms *inactive ingredients*, *excipients*, and *pharmaceutical ingredients.*

Beyond-Use Date (BUD): The date after which a compounded preparation shall not be used; determined from the date the preparation is compounded.

Component: Any ingredient used in the compounding of a drug preparation, including any active ingredient or added substance that is used in its preparation.

Compounder: A professional authorized by the appropriate jurisdiction to perform compounding pursuant to a prescription or medication order by a licensed prescriber.

Compounding: The preparation, mixing, assembling, altering, packaging, and labeling of a drug, drug-delivery device, or device in accordance with a licensed practitioner's prescription, medication order, or initiative based on the practitioner/patient/pharmacist/compounder relationship in the course of professional practice. Compounding includes the following:

- Preparation of drug dosage forms for both human and animal patients
- Preparation of drugs or devices in anticipation of prescription drug orders based on routine, regularly observed prescribing patterns
- Reconstitution or manipulation of commercial products that may require the addition of one or more ingredients
- Preparation of drugs or devices for the purposes of, or as an incident to, research (clinical or academic), teaching, or chemical analysis

- ~~Preparation of drugs and devices for prescriber's office use where permitted by federal and state law.~~

~~**Hazardous Drug:** Any drug identified by at least one of the following six criteria:~~

- ~~Carcinogenicity~~
- ~~Teratogenicity or developmental toxicity~~
- ~~Reproductive toxicity in humans~~
- ~~Organ toxicity at low doses in humans or animals~~
- ~~Genotoxicity~~
- ~~New drugs that mimic existing hazardous drugs in structure or toxicity [for examples see current National Institute for Occupational Safety and Health (NIOSH) publications].~~

~~**Manufacturing:** The production, propagation, conversion, or processing of a drug or device, either directly or indirectly, by extraction of the drug from substances of natural origin or by means of chemical or biological synthesis. Manufacturing may also include any packaging or repackaging of the substance(s) or labeling or relabeling of containers for resale by pharmacies, practitioners, or other persons.~~

~~**Preparation:** For the purposes of this chapter, a compounded drug dosage form or dietary supplement or a device to which a compounder has introduced a drug. This term will be used to describe compounded formulations; the term *product* will be used to describe manufactured pharmaceutical dosage forms. (For the definitions of *official substance* and *official products*, see *General Notices and Requirements*.)~~

~~**Stability:** The extent to which a preparation retains, within specified limits and throughout its period of storage and use, the same properties and characteristics that it possessed at the time of compounding (see *Stability Considerations in Dispensing Practice* ⟨1191⟩, the table *Criteria for Acceptable Levels of Stability*).~~

~~**Vehicle:** A component for internal or external use that is used as a carrier or diluent in which liquids, semisolids, or solids are dissolved or suspended. Examples include, but are not limited to, water, syrups, elixirs, oleaginous liquids, solid and semisolid carriers, and proprietary products.~~

1. INTRODUCTION AND SCOPE

This chapter describes the minimum standards to be followed when preparing compounded nonsterile preparations (CNSPs) for humans and animals. For purposes of this chapter, nonsterile compounding is defined as

combining, admixing, diluting, pooling, reconstituting other than as provided in the manufacturer package insert, or otherwise altering a drug or bulk drug substance to create a nonsterile medication. Reconstituting a conventionally manufactured nonsterile product in accordance with the directions contained in the approved labeling provided by the product's manufacturer is not considered compounding as long as the product is prepared for an individual patient and not stored for future use.

1.1 Scope

COMPOUNDED NONSTERILE PREPARATIONS AFFECTED

CNSPs that may be affected by this chapter include but are not limited to the following dosage forms:

- Solid oral preparations
- Liquid oral preparations
- Rectal preparations
- Vaginal preparations
- Topical preparations (i.e., creams, gels, irrigations for non-internal and non-surgical body cavities)
- Nasal and sinus preparations intended for local application
- Otic preparations

HANDLING OF HAZARDOUS DRUGS

Compounding of nonsterile hazardous drugs must also comply with *Hazardous Drugs—Handling in Healthcare Settings* ⟨800⟩.

AFFECTED PERSONNEL AND SETTINGS

This chapter applies to all persons who prepare CNSPs and all places where CNSPs are prepared. This includes but is not limited to pharmacists, technicians, physicians, veterinarians, dentists, naturopaths, chiropractors, and nurses, in all places including but not limited to pharmacies, hospitals and other healthcare institutions, patient treatment sites, and physicians' or veterinarians' practice sites.

The compounding facility's leadership and all personnel involved in preparing, storing, packaging, and transporting CNSPs are responsible for 1) ensuring that the applicable practices and quality standards in this chapter are continually and consistently applied to their operations, and 2) proactively identifying and remedying potential problems within their operations. Personnel engaged in the compounding of CNSPs must also comply with applicable laws and regulations of the regulatory jurisdiction.

The compounding facility must designate one or more individuals (i.e., the designated person) to be responsible and accountable for the performance and operation of the facility and personnel in the preparation of CNSPs. The responsibilities of the designated person include but are not limited to:

- Developing and implementing a training program
- Routinely monitoring and observing compounding activities and taking immediate corrective action if deficient practices are observed
- Demonstrating the procedures for personnel and observing and guiding personnel throughout the training process
- Evaluating whether individuals with certain conditions, such as rashes or respiratory illnesses, will be allowed to work in compounding areas before their conditions are resolved because these conditions carry the risk of contaminating the environment and CNSPs
- Ensuring that standard operating procedures (SOPs) are fully implemented. The designated person must ensure that follow-up is carried out if problems, deviations, or errors are identified
- Establishing, monitoring, and documenting procedures for the handling and storage of CNSPs and/or components of CNSPs

If the compounding facility has only one person responsible for all the compounding in the facility, then that person will become the designate.

2. PERSONNEL QUALIFICATIONS—TRAINING, EVALUATION, AND REQUALIFICATION

All personnel involved in the preparation and handling of CNSPs must be trained, must demonstrate competency, and must undergo annual refresher training. Training and competency of personnel must be documented as described in *14. Documentation*.

The designated person must develop a written training program that describes the required training, the frequency of training, and the process for evaluating the competency of personnel involved in nonsterile compounding and handling of CNSPs. This program must equip personnel with knowledge and training in the required skills necessary to perform their assigned tasks.

In addition to the initial and annual competency training and evaluation described in this section, the designated person should routinely monitor and observe compounding activities and must take immediate corrective action if deficient practices are observed. SOPs must describe procedures for the monitoring and observing of compounding activities and personnel.

Before independently beginning to prepare CNSPs, personnel must complete training and be able to demonstrate proficiency in the theoretical principles and hands-on skills of nonsterile manipulations for the type of compounding they will be performing. Proficiency must be demonstrated in at least the following core competencies:

- Hand hygiene
- Garbing

- Cleaning and sanitizing
- Component selection, handling, and transport
- Performing calculations
- Measuring and mixing
- Use of equipment
- Documentation of the compounding process (e.g., Master Formulation Records and Compounding Records)

Steps in the training procedure must include the following:

- Read and understand this chapter
- Have access to *USP* compounding monographs, other applicable general chapters, and other relevant literature
- Understand and interpret Certificates of Analysis (COAs) and Safety Data Sheets (SDS)
- Read and understand procedures related to their compounding duties, including those regarding the facility, equipment, personnel, garbing, actual compounding processes, evaluation, packaging, storage, transport, and dispensing

Additionally, the designated person must demonstrate the procedures for personnel, and must observe and guide personnel throughout the training process. The personnel will then be expected to repeat the procedures independently, but under the direct supervision of the designated person. An employee will be permitted to perform the procedure without direct supervision only after independently demonstrating understanding and competency to the designated person. Upon completion of the training program, the designated person must document that the employee has been trained and successfully completed competency assessments (see *14. Documentation*).

If the facility has only one person in the compounding operation, that person must document that they have obtained appropriate training outside of the facility and demonstrated competency, and they must comply with the other requirements of this chapter.

3. PERSONAL HYGIENE AND GARBING

Compounding personnel must maintain personal hygiene. Individuals that may have a higher risk of contaminating the CNSP and the environment (e.g., due to rashes, sunburn, recent tattoos or oozing sores, conjunctivitis, active respiratory infection) must report these conditions to the designated person. The designated person must evaluate whether these individuals will be allowed to work in compounding areas before their conditions are resolved because of the risk of contaminating the environment and CNSPs.

3.1 Personnel Preparation

Personnel engaged in compounding must maintain hand hygiene and wear clean clothing required for the type of compounding performed.

Before entering a designated compounding area, compounding staff must remove any items that are not easily cleanable and that might interfere with garbing. At a minimum, personnel must:

- Remove personal outer garments (e.g., bandanas, coats, hats, jackets, scarves, sweaters, vests)
- Remove all hand, wrist, and other exposed jewelry or piercing that can interfere with the effectiveness of the garb or hand hygiene (e.g., watches, rings that may tear gloves)
- Remove headphones and earphones
- Keep nails clean and neatly trimmed to minimize particle shedding and avoid glove punctures

3.2 Hand Hygiene

Hand hygiene is required when initially entering the compounding area and when re-entering the compounding area after a break. Hand hygiene is also required before initiating any compounding activity related to a new CNSP. Perform hand hygiene as described in *Box 3-1*. If gloves are already donned, wash hands with donned gloves. Gloves must be changed if they have been compromised (i.e., if they are torn or contain holes).

Box 3-1. Hand Hygiene Procedures

- Wash hands and forearms up to the elbows with soap and water for at least 30 s.
  Alcohol hand sanitizers alone are not sufficient.
- Dry hands and forearms to the elbows completely with disposable towels or wipes.
- Allow hands and forearms to dry thoroughly before donning gloves.

3.3 Garb and Glove Requirements

Gloves are required to be worn for all compounding activities. Other garb (e.g., shoe covers, head and facial hair covers, face masks, gowns) must be appropriate for the type of compounding performed as needed for the protection of personnel from chemical exposures and for prevention of preparation contamination. Garb must be stored to prevent contamination (e.g., away from sinks to avoid splashing onto garb). Visibly soiled garb or garb with tears or punctures must be changed immediately.

EXITING AND REENTERING COMPOUNDING AREA

When compounding personnel exit the compounding area during a work shift, if the gown is used but not soiled, it can be removed and retained in the compounding area and re-donned during the same work shift only. Gloves, shoe covers, hair covers, facial hair covers, face masks, or head coverings, if used, may not be reused and must be replaced with new ones. Non-disposable garb, such as goggles or respirators, if used, should be cleaned and sanitized with 70% isopropyl alcohol before re-use.

4. BUILDINGS AND FACILITIES

Compounding facilities must have a space that is specifically designated for compounding. Areas related to nonsterile compounding must be separated from areas not directly related to compounding. Areas intended for nonsterile compounding must be separated and distinct from the areas intended for sterile compounding (see *Pharmaceutical Compounding—Sterile Preparations* ⟨797⟩), except where permitted as described in ⟨800⟩. Compounding areas used to compound hazardous CNSPs must not be used for compounding nonhazardous CNSPs (see ⟨800⟩).

Compounding facilities must be designed and controlled to provide a well-lighted working environment, with temperature and humidity controls for the comfort of compounding personnel wearing the required garb. Heating, ventilation, and air conditioning systems must be designed and controlled to prevent decomposition and contamination of chemicals, components, and CNSPs (see also *12. CNSP Handling, Packaging, Storage, and Transport*). Temperature and humidity must be maintained as required for components and compounded preparations.

The facility must provide for the orderly placement of equipment and materials to prevent mix-ups among ingredients, containers, labels, in-process materials, and finished CNSPs. The space must be designed, arranged, and used in a way that prevents cross-contamination from noncompounding areas.

The surfaces of ceilings, walls, floors, fixtures, shelving, counters, and cabinets in a compounding area must be cleanable and must be kept clean. Carpet is not allowed in the compounding area. Surfaces should be resistant to damage by cleaning and sanitizing agents.

A source of hot and cold water and an easily accessible sink must be available for compounding. The sink must be emptied of all items and cleaned before being used to clean any equipment used in nonsterile compounding. The plumbing system must be free of defects that may contribute to the contamination of any CNSP. *Purified Water* should be used for rinsing equipment and utensils.

The areas used for compounding must be maintained in a clean, orderly, and sanitary condition, and in a good state of repair. All components, equipment, and containers must be stored off the floor and in a manner that

will prevent contamination and permit inspection and cleaning of the compounding and storage area. Waste must not be allowed to accumulate and must be disposed of in a sanitary manner. Waste disposal must comply with applicable laws and regulations of the regulatory jurisdiction.

5. CLEANING AND SANITIZING

Cleaning and sanitizing of the surfaces in the nonsterile compounding areas must occur on a regular basis at the minimum frequencies specified in *Table 1*. Cleaning and sanitizing must be repeated when spills occur and when surfaces, floors, and walls are visibly soiled.

Cleaning and sanitizing agents must be selected and used with consideration of compatibilities, effectiveness, and the potential to leave residues.

Table 1. Minimum Frequency for Cleaning and Sanitizing Surfaces in Nonsterile Compounding Areas

Site	Minimum Frequency
Floors	Daily, after spills, and when surface contamination (e.g., splashes) is known or suspected
Walls	Every 3 months, after spills, and when surface contamination (e.g., splashes) is known or suspected
Ceilings	Every 3 months, after spills, and when surface contamination (e.g., splashes) is known or suspected
Storage shelving	Every 3 months, after spills, and when surface contamination (e.g., splashes) is known or suspected

6. EQUIPMENT AND COMPONENTS

6.1 Equipment

The equipment and supplies used for compounding a CNSP must be suitable for the specific compounding process. Equipment surfaces that contact components must not be reactive, additive, or sorptive, and must not alter the quality of the CNSPs. When feasible, disposable or dedicated equipment should be used to reduce the chance of bioburden and cross-contamination.

Equipment must be stored in a manner to protect it from contamination and must be located to facilitate its use, maintenance, and cleaning. Automated, mechanical, electronic, and other types of equipment used in the compounding or testing of compounded preparations must be inspected prior to use and verified for accuracy at the frequency recommended by the manufacturer, and at least annually. Immediately after compounding, the

equipment must be cleaned to prevent cross-contamination of the next preparation.

Any weighing, measuring, or other manipulation of an active pharmaceutical ingredient (API) or added substance in powder form that could generate airborne contamination from drug particles must occur inside a containment device such as a containment ventilated enclosure (CVE) (i.e., powder containment hood). The CVE must be cleaned as described in *Table 2*. The CVE must be certified annually. If the CVE is not equipped with an exhaust alarm, the device should be certified every 6 months according to requirements such as the current Controlled Environment Testing Association (CETA) or American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRE) guidelines, or other jurisdictional standards.

Table 2. Minimum Frequency for Cleaning and Sanitizing Equipment in Nonsterile Compounding Areas

Site	Minimum Frequency
CVE and work surfaces outside the CVE	At the beginning and end of each shift, after spills, and when surface contamination is known or suspected. Clean and sanitize the horizontal work surface of the CVE between compounding of different drugs.
Equipment used in compounding operations	Before first use and thereafter in accordance with the manufacturer's recommendations. If no recommendation is available, after each use.

6.2 Components

Compounding personnel must establish, maintain, and follow written SOPs for the selection and inventory control of all components, including all ingredients (i.e., APIs, inactive ingredients), containers, and closures, from receipt to use in a CNSP.

SDSs must be readily accessible to all personnel working with drug substances or bulk chemicals located in the compounding facility. Personnel must be instructed on how to retrieve and interpret needed information.

COMPONENT SELECTION

The designated person is responsible for component selection. Compounders must use qualified vendors. A vendor is qualified when there is evidence to support its ability to supply a material that consistently meets all quality specifications. Qualification must include an evaluation of the vendor's reliability and registration/accreditation as required by applicable laws and regulations of the regulatory jurisdiction.

In the US, APIs used in compounding must be manufactured by an FDA-registered facility. Outside of the US, APIs used in compounding must comply with applicable laws and regulations of the regulatory jurisdiction. Each API must be accompanied by a valid COA that includes the specifications and test results and shows that the API meets an official *USP–NF* monograph, if one exists, and any additional specifications required to appropriately use the API in preparing the CNSP.

All ingredients other than APIs should be obtained from an FDA-registered facility. Outside of the US, the facility must comply with applicable laws and regulations of the regulatory jurisdiction. These ingredients should be accompanied by a valid COA that verifies that the ingredient meets an official monograph, if one exists, and any additional specifications for the ingredient. If ingredients other than APIs cannot be obtained from an FDA-registered facility, the designated person must select a material that is suitable for the intended use. The designated person must establish the identity, strength, purity, and quality of the API by reasonable means. These means may include visual inspections, evaluation of the COAs, and/or verification by analytically testing a sample to determine conformance with the COA.

Purified Water, or an equivalent quality of water, must be used to reconstitute conventionally manufactured nonsterile products when water quality is not stated in the manufacturer's labeling (see *Water for Pharmaceutical Purposes* ⟨1231⟩).

COMPONENT RECEIPT

Upon receipt, each lot of the component must be visually inspected to ensure that the labeling correctly identifies the component, and that the component meets the expected appearance. The lot must be examined for evidence of deterioration and other aspects of unacceptable quality (e.g., foreign objects, whether the outer packaging is damaged and whether temperature-sensing indicators show that the component has been exposed to excessive temperature excursions). If there is a compendial monograph for any ingredient received, the COA for the ingredient must be verified to ensure that the ingredient has met the acceptance criteria of all specified monograph tests for that lot and includes the test results. If the Master Formulation Record specifies certain component characteristics, the vendor-supplied COA must be verified to ensure that the component possesses those characteristics.

Any ingredient found to be of unacceptable quality must be promptly rejected, clearly labeled as rejected, and segregated from active stock to ensure that they are not inadvertently used. Any other lots of that ingredient from that vendor must be examined to determine whether the other lots demonstrate the same unacceptable quality.

The date of receipt by the compounding facility must be clearly and indelibly marked on each ingredient package, except for containers of conventionally manufactured products. For each ingredient, information including the receipt date, quantity received, supplier name, lot number, expiration date, and results of any in-house or third-party testing performed must be documented. The compounding facility must keep a written record of each shipment of components received in accordance with the recordkeeping requirements described in *14. Documentation*.

COMPONENT EVALUATION BEFORE USE

Before use, compounding personnel must visually re-inspect all components. Ingredient packages must be inspected to detect container breaks, looseness of the cap or closure, or deviation from the expected appearance, aroma, or texture of the contents that might have occurred during storage.

Compounding personnel must ascertain before use that ingredients are of the correct identity and have been stored under required conditions.

If the correct identity, strength, purity, and quality of ingredients and other components intended for preparation of CNSPs cannot be confirmed (e.g., containers of ingredients with damaged or incomplete labeling), they must be immediately rejected. If they are not immediately discarded, they must be clearly labeled as rejected, and segregated to prevent their use before disposal.

COMPONENT HANDLING AND STORAGE

All ingredients used to prepare CNSPs must be handled and stored in accordance with the manufacturer’s instructions or per applicable laws and regulations of the regulatory jurisdiction. The handing and storage must prevent contamination, mix-ups, and deterioration (e.g., loss of identity, strength, purity, and quality). If specific instructions are not available, ingredients must be stored in tightly closed containers under controlled temperature, humidity, and lighting conditions as detailed in this chapter. Moisture-sensitive ingredients must be stored in tight, well-closed containers.

Packages of ingredients that lack a vendor’s expiration date must not be used after 1 year from the date of receipt by the compounding facility. Once removed from the original container for compounding (e.g., weighing or mixing), components not used in compounding (e.g., excess after weighing) must be discarded and not returned to the original container.

The containers and closures used to package CNSPs must be stored off the floor, handled and stored in a manner that prevents contamination, and rotated so that the oldest stock is used first. The containers and container closures must be stored in a manner that permits inspection and cleaning of the storage area.

COMPONENT SPILL AND DISPOSAL

The facility must maintain chemical hazard and disposal information (e.g., SDSs) and must review and update its chemical hazard and disposal information annually. If a new chemical is used at the compounding facility, the chemical hazard and disposal information must be made accessible to compounding personnel before the chemical is made available for compounding.

The facility must have a spill kit in the designated compounding area. The condition and expiration date of the chemical spill kit should be verified annually and replaced as necessary. The capacity of the spill kit should be affixed to the packaging of the spill kit if not readily visible on the manufacturer's label.

In the case of spills, immediate remediation is necessary. The facility must have an SOP for the management of nonhazardous component spills and disposal. These activities must be documented and corrective action taken, if necessary. For information on the handling of hazardous drugs, see ⟨800⟩.

All personnel who may be required to remediate a spill must receive training in spill management of chemicals used and stored at the compounding facility. Refresher training must be conducted annually and documented for all personnel who may be required to clean up a spill.

The disposal of components must comply with applicable laws and regulations of the regulatory jurisdiction.

7. SOPS AND MASTER FORMULATION AND COMPOUNDING RECORDS

The compounding facility must establish and follow written SOPs for compounding CNSPs. A Master Formulation Record and Compounding Record is required for each CNSP.

7.1 Creating and Following SOPs

Facilities preparing CNSPs must develop SOPs on all aspects of the compounding operation. All personnel who conduct or oversee compounding activities must be trained in the SOPs and are responsible for ensuring that they are followed. All compounding personnel must:

- Be able to immediately recognize potential problems, deviations, or errors associated with preparing a CNSP (e.g., related to equipment, facilities, materials, personnel, compounding process, or testing) that

could potentially result in contamination or other adverse impacts on CNSP quality associated with their work duties
- Document and report any problems, deviations, or errors to the designated person, who must take corrective action

The designated person must ensure that SOPs are fully implemented. The designated person must ensure that follow-up occurs if problems, deviations, or errors are identified.

7.2 Creating Master Formulation Records

A Master Formulation is a detailed record of procedures that describes how the CNSP is to be prepared. A Master Formulation Record must be prepared for each unique formulation of a CNSP. CNSPs are then prepared according to the Master Formulation Record and the preparation information is documented on a Compounding Record. *Box 7-1* lists the information that must be included in a Master Formulation Record. Any changes or alterations to the Master Formulation Record must be performed only by the designated person, and all changes must be documented.

Box 7-1. Master Formulation Record

A Master Formulation Record must include at least the following information:

- Name, strength, and dosage form of the CNSP
- Physical description of the final CNSP
- Ingredient identities and amounts, and container–closure systems, including necessary characteristics of components (e.g., particle size, salt form, purity grade, solubility)
- Complete instructions for preparing the CNSP, including equipment, supplies, and a description of the compounding steps
- Beyond-use date (BUD) assignment and storage requirements
- Reference source of the BUD assignment and storage requirements
- Quality control procedures (e.g., pH, visual inspection)
- Any other information needed to describe the operation and ensure its repeatability (e.g., adjusting pH, temperature)

7.3 Creating Compounding Records

A Compounding Record documents the compounding of each CNSP. It must be created for each CNSP. The Compounding Record or inventory control system must permit traceability of all ingredients. The Master Formulation Record can be used as the basis for preparing the Compounding Record. For

example, a copy of the Master Formulation Record can be made that contains spaces for recording the information needed to complete the Compounding Record. It is critical that the Compounding Record document in detail any deviations from the process outlined in the Master Formulation Record and any problems or errors experienced during the compounding of the CNSP. *Box 7-2* lists the information that must be included in a Compounding Record. Each Compounding Record must be reviewed for completeness before the CNSP is released. The person completing the review must sign or initial and date the Compounding Record.

Box 7-2. Compounding Records

Compounding Records must include at least the following information:

- Name, strength, and dosage form of the CNSP
- Physical description of the final CNSP
- Master Formulation Record reference for the CNSP
- Date and time of preparation of the CNSP
- Assigned internal identification number (e.g., prescription or lot number)
- Signature or initials of individuals involved in each step
- Name, vendor or manufacturer, lot number, and expiration date of each ingredient and container–closure system
- Weight or measurement of each ingredient
- Documentation of the calculations made to determine and verify quantities and/or concentrations of components, if appropriate
- Documentation of quality control procedures in accordance with the SOP (e.g., pH, visual inspection)
- Any deviations from the Master Formulation Record, and any problems or errors experienced during the compounding of the CNSP
- Total quantity compounded
- BUD assignment and storage requirements
- Reference source of the BUD assignment and storage requirements

8. RELEASE TESTING

At the completion of compounding and before release and dispensing, the CNSP must be visually inspected to determine whether the physical appearance is as expected. The inspection must also confirm that the CNSP and its labeling match the Compounding Record and the prescription or medication order. Some CNSPs, as noted in their Master Formulation Record,

also must be visually checked for certain characteristics (e.g., emulsions must be checked for phase separation). All checks and inspections, and any other tests necessary to ensure the quality of the CNSP (e.g., pH, assays), must be detailed in the facility's SOPs and completed before release. Additional quality assurance and quality control activities are described in *11. Quality Assurance and Quality Control*. Pre-release inspection also must include a visual inspection of container–closure integrity (e.g., checking for leakage, cracks in the container, or improper seals). CNSPs with observed defects must be immediately discarded, or marked and segregated from acceptable units in a manner that prevents them from being released or dispensed.

When a CNSP will not be promptly released or dispensed after preparation, a release inspection must be conducted immediately before it is released or dispensed to ensure that the CNSP or the container–closure system does not exhibit any defects that may develop during storage (e.g., separation beyond what would be expected, precipitation, cloudiness, discoloration, or leakage).

9. LABELING

The term "labeling" designates all labels and other written, printed, or graphic matter on an article's immediate container or on, or in, any package or wrapper in which the article is enclosed, except any outer shipping container. The term "label" designates the part of the labeling on the immediate container. See *Labeling ⟨7⟩, Labels and Labeling for Products and Other Categories, Compounded Preparations*.

Every dispensed CNSP must be labeled with adequate, legible identifying information to prevent errors during storage, dispensing, and use. All labeling must be in compliance with applicable laws and regulations of the regulatory jurisdiction.

The label on the CNSP must, at a minimum, display the following information:

- Assigned internal identification number (e.g., prescription or lot number)
- Chemical and/or generic name(s), or active ingredient(s), and amounts or concentrations
- Dosage form
- Total amount or volume
- Storage conditions
- BUD
- Indication that the preparation is compounded

The labeling on the CSNP must, at a minimum, display the following information:

- Route of administration
- Any special handling instructions
- Any warning statements that are applicable
- Name, address, and contact information of the compounding facility if the CNSP is to be sent outside of the facility or healthcare system in which it was compounded

Labeling operations must be controlled to prevent labeling errors and CNSP mix-ups. A final check must be conducted to verify that the correct and complete label has been affixed to the finished CNSP. All labels must also comply with applicable laws and regulations of the regulatory jurisdiction.

10. ESTABLISHING BEYOND-USE DATES

Each CNSP label must state the date beyond which the preparation cannot be used and must be discarded (i.e., the BUD). The parameters described in this section must be considered before establishing these dates.

10.1 Terminology

A number of terms are used to describe the time period during which a drug can be expected to retain its desired characteristics so that it can be safely administered to a patient to achieve the desired therapeutic effect.

The "expiration date" identifies the time during which a conventionally manufactured drug product may be expected to maintain its labeled identity, strength, purity, and quality, provided that it is kept under the labeled storage conditions. The expiration date limits the time during which a conventionally manufactured product may be dispensed or used. Expiration dates are determined based on product-specific studies that evaluate the specific formulation of a conventionally manufactured product in the specific container in which it is to be stored and under the conditions to which it could be exposed. Temperature, humidity, and light are some of the factors that can affect whether and how much a product degrades over time. An expiration date is determined by taking representative samples from batches, placing them in storage under controlled conditions, and then testing them at scheduled intervals to determine whether they meet specifications throughout their labeled shelf lives. When an expiration date is stated only in terms of the month and the year, it is a representation that the intended expiration date is the last day of the stated month.

A BUD is the time period after which a CNSP must not be used. BUDs for CNSPs are calculated in terms of hours, days, or months.

The term "expiration date" is not appropriate for CNSPs because the types of full stability studies conducted by manufacturers to establish expiration dates for conventionally manufactured products are not typically performed for CNSPs. A BUD cannot be extended past the expiration date of any component in the CNSP.

10.2 Parameters to Consider in Establishing a BUD

BUDs for CNSPs should be established conservatively to ensure that the preparation maintains its required characteristics to minimize the risk to patients of receiving a contaminated or degraded preparation.

When establishing a BUD for a CNSP, it is critical that personnel carefully consider all of the possible ways that the physical or chemical characteristics of the CNSP could change over time. The following factors must be considered:

- The chemical and physical stability properties of the API and any added substances in the preparation (e.g., if the API and added substances in the preparation are known to degrade over time and/or under certain storage conditions, which would reduce the strength of the preparation and/or produce harmful impurities)
- The compatibility of the container–closure system with the finished preparation (e.g., consider leachables, interactions, adsorption, and storage conditions of the components)
- Degradation of the container–closure system, which can lead to a reduction in integrity of the CNSP
- The potential for microbial proliferation in the CNSP

10.3 Establishing a BUD for a CNSP

The BUDs indicate the days after the CNSP is prepared and beyond which the CNSP cannot be used. The day that the preparation is compounded is considered Day 1.

If there is a *USP–NF* compounded preparation monograph for the CNSP, the BUD specified in the monograph must be used, unless a shorter BUD is required as described below. If there is no *USP–NF* compounded preparation monograph for the CNSP, *Table 3* represents the maximum BUDs for CNSPs that are packaged in tight, light-resistant containers unless there is a CNSP-specific stability study as described below. The BUDs in *Table 3* are based on the ability of the CNSP to maintain chemical and physical stability and to suppress microbial growth. APIs or ingredients known to be susceptible to decomposition will require shorter BUDs (see *10.3 Establishing a BUD for a CNSP, Shorter Buds May Be Required*).

Table 3. Maximum BUD by Type of Preparation in the Absence of CNSP-Specific Stability Information

Type of Preparation	BUDs (days)	Storage Temperature[a]
Solid dosage forms[b]	180	Controlled room temperature
Preserved aqueous dosage forms[c]	30	Controlled room temperature
Non-preserved aqueous dosage forms[c]	14	Refrigerator
Nonaqueous dosage forms[d]	90	Controlled room temperature

[a] See *Packaging and Storage Requirements ⟨659⟩*.

[b] Capsules, tablets, granules, powders.

[c] An aqueous preparation is one that has a water activity (Aw) of >0.6 (e.g., emulsions, gels, creams, solutions, sprays, or suspensions).

[d] Any preparation other than solid dosage forms that have a reduced Aw of ≤0.6 (e.g., suppositories, ointments, fixed oils, or waxes).

The aqueous and nonaqueous dosage forms in *Table 3* are defined based on the water activity (Aw) of the most similar drug product described in *Application of Water Activity Determination to Nonsterile Pharmaceutical Products ⟨1112⟩*. In general, the use of Aw aids in assessing the susceptibility of CNSPs to microbial contamination and the potential for API degradation due to hydrolysis. Reduced Aw greatly assists in the prevention of microbial proliferation in conventionally manufactured products and is expected to convey the same benefit to CNSPs. The list of manufactured products in *Application of Water Activity Determination to Nonsterile Pharmaceutical Products ⟨1112⟩, Table 2* is not exhaustive. However, it does provide guidance on the Aw value of a particular CNSP and can assist personnel in determining the BUD by dosage form based on *Table 3*.

Susceptible CNSPs should contain suitable antimicrobial agents to protect against bacteria, yeast, and mold contamination from proliferation if inadvertently introduced during or after the compounding process. When antimicrobial agents are used, the compounder is responsible for ensuring an effective final preservative concentration for the particular CNSP (i.e., taking into account dilutions). When antimicrobial preservatives are contraindicated in a CNSP, storage of the preparation in a refrigerator is required if such storage does not change the physical or chemical properties of the CNSP (i.e., precipitation).

The BUDs specified in *Table 3* for aqueous dosage forms and nonaqueous dosage forms may be extended up to maximum of 180 days if there is a stability study (published or unpublished) using a stability-indicating assay for the specific API, CNSP, and container–closure that will be used.

If the BUD of the CNSP is extended beyond the BUDs in *Table 3*, an aqueous CNSP must first be tested for antimicrobial effectiveness (see *Antimicrobial Effectiveness Testing ⟨51⟩*) at the end of the proposed BUD

unless such testing was done as part of the referenced stability study. The test must be conducted once for a particular CNSP. If changes are made to the ingredients or storage conditions of the CNSP, the test must be conducted for the new preparation. When a range of API concentrations are compounded in the same CNSP formulation and stored under the same conditions, the antimicrobial effectiveness test can be conducted for the highest and lowest concentrations, and the results can be similarly extrapolated for the concentrations within the range studied (e.g., bracketed study design).

SHORTER BUDS MAY BE REQUIRED

A shorter BUD must be established under the following circumstances:

- If the API or any other ingredients in the CNSP have an expiration date that is earlier than the BUD date that could be assigned from *Table 3*, the expiry date supersedes the BUD and must be the assigned shortest date
- If the CNSP includes components from conventionally manufactured product(s), the BUD of the CNSP must not exceed the shortest remaining expiration date of any of those conventionally manufactured product(s)
- If the CNSP includes components from other compounded preparations, the BUD of the final CNSP must not exceed the shortest remaining BUD of any of those compounded preparations
- APIs or ingredients known to be susceptible to decomposition will require shorter BUDs.

The assigned BUD must not exceed 180 days regardless of stability information or antimicrobial activity.

11. QUALITY ASSURANCE AND QUALITY CONTROL

A quality assurance (QA) and quality control (QC) program is necessary to ensure that consistently high-quality CNSPs are prepared. QA is a set of written processes that, at a minimum, verifies, monitors, and reviews the adequacy of the compounding process. QC is the observation of techniques and activities that demonstrate that requirements are met.

Each facility must have a formal, written QA and QC program that establishes a system of adherence to procedures, prevention and detection of errors and other quality problems, and appropriate corrective actions when needed. A facility's QA program must be formally established and documented in SOPs that ensure that all aspects of the preparation of CNSPs are conducted in accordance with this chapter and applicable federal, state, and local laws and regulations. For further guidance on recommended

quality control procedures, see *Quality Assurance in Pharmaceutical Compounding* ⟨1163⟩.

The roles and duties of personnel responsible for each aspect of the QA program must be described in the SOPs. Designated personnel responsible for the QA program must have the training, experience, responsibility, and authority to perform these duties.

An annual assessment of the quality assurance and quality control programs must be documented. Noted deficiencies must be addressed through corrective action, which must be described in the facility's SOPs.

12. CNSP HANDLING, PACKAGING, STORAGE, AND TRANSPORT

SOPs must describe processes or techniques for storing, handling, packaging, and transporting CNSPs. Personnel who will be storing, handling, packaging, and transporting CNSPs within the facility must be trained in accordance with the facility's SOPs.

12.1 Handling of CNSPs

The designated person has the responsibility to establish, monitor, and document a program that will provide both the information and protections needed for safe handling and storage of CNSPs and/or any of the components of CNSPs. Garb, spill kits, and SDSs must be readily accessible. Hazard labels (if appropriate) should be on all chemical containers.

12.2 Packaging of CNSPs

Personnel must select and use packaging materials that will maintain the physical and chemical integrity and stability of the CNSPs. The containers and closures must be made of suitable clean material so as to not alter the identity, strength, purity, or quality, of the CNSP. Packaging materials must protect CNSPs from damage, leakage, contamination, degradation, and adsorption, while simultaneously protecting transport personnel from exposure. Container–drug interaction must be considered for substances that have sorptive or leaching properties. If the CNSP is sensitive to light, light-resistant packaging materials must be used.

12.3 Storing CNSPs within the Compounding Facility

To ensure that CNSP quality is retained during storage within the compounding facility, compounding personnel must monitor conditions in the storage area. A controlled room temperature area (see ⟨659⟩) must be either monitored manually at least once daily on days that compounding is performed or by a continuous temperature recording device to determine whether the temperature remains within the appropriate range for the CNSP. The results of the temperature readings must be documented on a temperature log or stored in the continuous temperature recording device, and must be retrievable. All temperature monitoring equipment must be

calibrated or verified for accuracy at least every 12 months or as recommended by the manufacturer.

The humidity of the storage room temperature area should be maintained at or below 60%.

The compounding facility must adhere to SOPs to detect and prevent temperature excursions within the controlled temperature area. When it is known that a CNSP has been exposed to temperatures either below or above the storage temperature limits for the CNSP, personnel must determine whether the CNSP integrity or quality has been compromised and, if so, the CNSP must be discarded.

12.4 Shipping and Transporting CNSPs

The facility must have written SOPs that describe appropriate shipping containers, insulating materials, and packaging materials based on the chemical and physical characteristics of the CNSP. The SOPs must indicate the mode of transportation and any special handling instructions that are required so the properly packed CNSPs are delivered in an undamaged and stable condition. When shipping or transporting CNSPs that require special handling outside of the compounding facility, personnel must include specific handling instructions on the exterior of the container.

13. COMPLAINT HANDLING AND ADVERSE EVENT REPORTING

Compounding facilities must develop and implement SOPs for complaint receipt, acknowledgment, and handling. Complaints may include concerns or reports on the quality and labeling of, or possible adverse reactions to, a specific CNSP.

13.1 Complaint Handling

The designated person must review all complaints to determine whether the complaint indicates a potential quality problem with the CNSP. If it does, a thorough investigation into the cause of the problem must be initiated and completed. The investigation must consider whether the quality problem extends to other CNSPs. Corrective action, if necessary, must be implemented for all potentially affected CNSPs. Consider whether to initiate a recall of potentially affected CNSPs and whether to cease nonsterile compounding processes until all underlying problems have been identified and corrected.

A readily retrievable written or electronic record of each complaint must be kept by the facility, regardless of the source of the complaint (e.g., e-mail, telephone, mail). The record must contain the name of the complainant, the date the complaint was received, the nature of the complaint, and the response to the complaint. In addition, to the extent that the information is known, the following should be recorded: the name and strength of the

CNSP, the prescription or medication order number, and the lot number, if one is assigned.

The record must also include the findings of any investigation and any follow-up. Records of complaints must be easily retrievable for review and evaluation for possible trends and must be retained in accordance with the record-keeping requirements in *14. Documentation*. A CNSP that is returned in connection with a complaint must be quarantined until it is destroyed after completion of the investigation and in accordance with applicable laws and regulations of the regulatory jurisdiction.

13.2 Adverse Event Reporting

Reports of potential adverse events involving a CNSP must be reviewed by the designated person. If the investigation into an adverse event reveals a quality problem with a CNSP that is likely to affect other patients, those patients and prescribers potentially affected must be informed. The designated person must review all adverse event reports as part of the QA and QC programs (see *11. Quality Assurance and Quality Control*). Adverse events must be reported in accordance with facility SOPs and all applicable state and local laws and regulations. In addition, adverse events associated with a CNSP should be reported to the FDA through the MedWatch program for human drugs and through Form FDA 1932a for animal drugs.

14. DOCUMENTATION

All facilities where CNSPs are prepared must have and maintain written or electronic documentation to demonstrate compliance with this chapter. This documentation must include, but is not limited to, the following:

- Personnel training, competency assessment, and qualification records including corrective actions for any failures
- Equipment records (e.g., calibration, verification, and maintenance reports)
- Receipt of components
- SOPs, Master Formulation Records, and Compounding Records
- Release testing, including corrective actions for any failures
- Information related to complaints and adverse events including corrective actions taken

Documentation must comply with all applicable laws and regulations of the regulatory jurisdiction. Records must be legible and stored in a manner that prevents their deterioration and/or loss. All required compounding records for a particular CNSP (e.g., Master Formulation Record, Compounding Record, and testing results) must be readily retrievable for at least 3 years

after preparation or as required by the applicable laws and regulations of the regulatory jurisdiction, whichever is longer.

GLOSSARY

Active pharmaceutical ingredient (API): Any substance or mixture of substances intended to be used in the compounding of a preparation, thereby becoming the active ingredient in that preparation and furnishing pharmacological activity or other direct effect in the diagnosis, cure, mitigation, treatment, or prevention of disease in humans and animals or affecting the structure and function of the body.

Added substances: Ingredients that are necessary to compound a preparation but are not intended or expected to cause a pharmacologic response if administered alone in the amount or concentration contained in a single dose of the compounded preparation. The term is used synonymously with the terms inactive ingredients, excipients, and pharmaceutical ingredients.

Article: An official article is an article that is recognized in *USP* or *NF*. Official articles include both official substances and official products. An official substance is a drug substance, excipient, dietary ingredient, other ingredient, or component of a finished device for which the monograph title includes no indication of the nature of the finished form. An official product is a drug product, dietary supplement, compounded preparation, or finished device for which a monograph is provided (see *General Notices, 2.20 Official Articles*).

Batch: More than one unit of CNSP prepared in a single process and intended to have uniform characteristics and quality within specified limits.

Beyond-use date (BUD): The date or time beyond which a CNSP must be discarded. The date or time is determined from the date or time when the preparation was compounded.

Certificate of analysis (COA): A report from the supplier of a component, container, or closure that accompanies the supplier's material and contains the specifications and results of all analyses and a description of the material.

Cleaning: The process of removing soil (e.g., organic and inorganic material) from objects and surfaces, normally accomplished by manually or mechanically using water with detergents or enzymatic products.

Component: Any ingredient used in the compounding of a drug preparation, including any active ingredient or added substance that is used in its preparation.

Compounded nonsterile preparation (CNSP): A preparation intended to be nonsterile created by combining, admixing, diluting, pooling, reconstituting other than as provided in the manufacturer package insert, or otherwise altering of a drug or bulk drug substance.

Compounder: Personnel trained to compound preparations.

Compounding: The combining, admixing, diluting, pooling, reconstituting other than as provided in the manufacturer package insert, or otherwise altering of a drug or bulk drug substance to create a nonsterile medication. Reconstituting a conventionally manufactured nonsterile product in accordance with the directions contained in approved labeling provided by the product's manufacturer is not considered compounding as long as the product is prepared for an individual patient and not stored for future use.

Container–closure system: The sum of packaging components that together contain and protect the dosage form. This includes primary packaging components and secondary packaging components, if the latter are intended to provide additional protection to the CNSP.

Containment ventilated enclosure (CVE): A full or partial enclosure that uses ventilation principles to capture, contain, and remove airborne contaminants through high-efficiency particulate air (HEPA) filtration and to prevent their release into the work environment.

Conventionally manufactured product: A pharmaceutical dosage form, usually the subject of an FDA-approved application that is manufactured under current good manufacturing practice conditions. Conventionally manufactured products are not compounded preparations.

Designated person: The compounding facility must designate one or more individuals to be responsible and accountable for the performance and operation of the facility and personnel in the preparation of CNSPs.

Disinfectant: A chemical agent used on inanimate surfaces and objects to destroy fungi, viruses, and bacteria, but not necessarily their spores.

Expiration date: The date until which a conventionally manufactured drug product may be expected to maintain its labeled identity, strength, purity, and quality, provided that it is kept under the labeled storage conditions.

Hazardous drug: Any drug identified by at least one of the following six criteria: carcinogenicity, teratogenicity or developmental toxicity, reproductive toxicity in humans, organ toxicity at low dose in humans or animals, genotoxicity, or new drugs that mimic existing hazardous drugs in structure or toxicity. See ⟨800⟩.

Label: A display of written, printed, or graphic matter on the immediate container of any article.

Labeling: All labels and other written, printed, or graphic matter that are 1) on any article or any of its containers or wrappers, or 2) accompanying such an article.

Purified Water: The minimal quality of source water for the production of Purified Water is drinking water whose attributes are prescribed by the US Environmental Protection Agency (EPA), the EU, Japan, or the World Health Organization (WHO). This source water may be purified using unit operations that include deionization, distillation, ion exchange, reverse osmosis, filtration, or other suitable purification procedures. (See *Water for Pharmaceutical Purposes ⟨1231⟩, 3. Waters Used for Pharmaceutical Manufacturing and Testing Purposes, 3.1 Bulk Monographed Waters and Steam, 3.1.1 Purified Water*.)

Preservative: A substance added to inhibit microbial growth or to prevent decomposition or undesirable chemical changes up until the BUD.

Quality assurance (QA): A set of written processes that, at a minimum, verifies, monitors, and reviews the adequacy of the compounding process.

Quality control (QC): The sampling, testing, and documentation of results that, taken together, ensure that specifications have been met before release of the CNSP.

Reconstitution: The process of adding a diluent to a powdered medication to prepare a solution or suspension.

Release testing: Testing or visual inspection performed to ensure that a preparation meets appropriate quality characteristics.

Sanitizing agent: An agent for reducing, on inanimate surfaces, the number of all forms of microbial life including fungi, viruses, and bacteria. (See *Disinfectants and Antiseptics ⟨1072⟩*.)

Specification: The tests, analytical methods, and acceptance criteria to which an API or other ingredient, CNSP, component, container–closure system, equipment, or other material used in compounding CNSPs must conform to be considered acceptable for its intended use.

Stability: The extent to which a CNSP retains physical and chemical properties and characteristics within specified limits until its BUD.

APPENDIX

Acronyms

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API	Active pharmaceutical ingredient
ASHRE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
BUD	Beyond-use date
CETA	Controlled Environment Testing Association
CNSP	Compounded nonsterile preparation
COA	Certificate of Analysis
CVE	Containment ventilated enclosure
FDA	Food and Drug Administration
QA	Quality assurance
QC	Quality control
SDS	Safety Data Sheet
SOP	Standard operating procedures

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