

Guidelines for the Use of Non-Pharmaceutical Grade Compounds in Laboratory Animals

Adapted from NIH OACU: https://oacu.oir.nih.gov/system/files/media/file/2023-05/b14_pharmaceutical_compounds.pdf

Investigators are expected by regulatory authorities to use pharmaceutical-grade compounds (PGC) in animals when they are available. Whenever possible, pharmaceutical grade substances must be used for compounds selected for medical treatment or to prevent or reduce animal pain or distress². The use of non-pharmaceutical grade substances may be necessary to meet the scientific goals of a project or when pharmaceutical grade substances are not available. This is consistent with the regulatory requirements and the expectations of the public that research animals will be provided with *adequate veterinary care*^{1-3, 8}. The Guidelines presented here are intended to help investigators understand their responsibilities and comply with federal law when the use of non-pharmaceutical-grade compounds (non-PGCs) is necessary to complete their research objectives. ***The requirements below also apply to a pharmaceutical-grade product modified by the investigator (i.e., diluted, combined, etc.):***

For all agents administered to animals, the following must be considered in the order presented for pharmaceuticals and reagents of all kinds prior to use⁴:

1. FDA approved veterinary or human pharmaceutical compounds;
2. FDA approved veterinary or human pharmaceutical compounds used to compound a needed dosage form;
3. USP/NF, BP, or other pharmacopeia recognized PGCs used in a needed dosage form;
4. Analytical grade bulk chemical [>95% pure by weight of the active chemical] (USP-NF <797> Pharmaceutical Compounding-sterile preparations) used to compound a needed dosage form (requires justification); and
5. Other grades and sources of compounds (requires justification).

Guidance for Investigators:

It is critical that sufficient information be provided in an Animal Use Protocol (AUP) for all substances administered to an animal for the Institutional Animal Care and Use Committee (IACUC) to effectively evaluate the safety of the agent. Provision of an optional table like the one below often ensures sufficient information for IACUC assessment of administered substances:

Item Number	Pharmaceutical or Chemical Name ^a	Source ^b	Form Obtained ^c	Pharmaceutical Grade (Y/N) ^d If "N" Provide Grade to be Used	Justification for Use of Non-Pharmaceutical Grade Compound ^e	Modifications for Use ^f	pH and Tonicity of Final Product ^g	Precautions to Ensure Sterility ^h	Dose ⁱ	Route, Volume, and Frequency of Administration ^j	Other Significant Considerations ^k	Reference(s) and Prior Experience
1												
2												

- a) Do not provide the brand name of the agent.
- b) DVR Pharmacy, Sigma Chemical, Tocris, Fisher Scientific, Millipore, etc.
- c) Suspension, emulsion, dry powder, liquid, tablet, capsule, etc.
- d) If you are purchasing the substance from a medical supply company, a drug wholesale supply, or directly from the manufacturer and the substance is supplied as a product intended for use in medical or veterinary patients, that substance is likely "pharmaceutical grade". In most cases, bulk reagents purchased from chemical supply companies, or the substance is designated for use in research only, that substance is most likely NOT pharmaceutical grade⁴. If you are unsure, consult your Institute Veterinarian or the DVR pharmacist.

- e) Justification must address why you need to use this compound and why a pharmaceutical grade could not be used. Cost-savings alone is not adequate justification for the use of a non-PGC when a PGC alternative exists and is available³. Examples of acceptable scientific justifications for the use of non-PGCs⁴⁻⁶ include:
- A PGC is not available; this includes new investigational compounds.
 - A PGC is not available in the appropriate concentration or formulation, or the appropriate vehicle control is unavailable.
 - A PGC is available but does not meet the non-toxic vehicle requirements for the specified route of injection.
 - The non-PGC is required to generate data that are part of an ongoing study or to generate data that are comparable to previous work.
- f) Will the compound be altered in any way prior to being given to the animal (diluted, dissolved, mixed with food or flavoring, etc.)? If the compound will be diluted, mixed with another substance, suspended, dissolved, or mixed into the animal's drinking water or food, or otherwise altered, please describe what will take place, the solvent/vehicle to be used and final concentration^{10,11}. If the drug will be administered directly to the animal, as supplied by the manufacturer for that purpose, then nothing needs to be specified. *Diluents, excipients, or vehicles* administered to animals in biomedical research should be pharmaceutical grade, if available⁴. Therefore, when not available they must also be handled as a non-PGC. Products administered orally, which are not pharmaceutical grade, should be food-grade⁴.
- g) Provide the pH and tonicity of the final product to be administered.
- h) Any compounds delivered by parenteral injections, must be sterile⁹. It is not necessary to sterilize medications that will be delivered orally or topically unless required by scientific study design. If the compound cannot be sterilized, scientific justification as to why the material cannot be sterilized and describe what techniques will be used to ensure the final product is free of unwanted pathogens, pyrogens (such as endotoxin) or contaminants that might impact animal welfare. Good aseptic technique in the preparation of all administered compounds is critical. In addition, storage conditions and expiration/use by date are also very important to protecting the integrity, purity, sterility, and stability of the compounds being administered and should be described in the ASP. There are several acceptable methods for sterilization but the two most used are autoclaving and filter sterilization. Aseptic technique is again critical as there are limits to what sterilization can remove⁷.
- Autoclaving uses moist heat and pressure to sterilize components. Care must be taken when autoclaving liquids to ensure that the final concentration is appropriate and that an unacceptable amount of water has not boiled off. The compound must also be heat-stable so that it is not destroyed by autoclaving.
 - Filter sterilization involves passing the final solution through a 0.22-micron pore or smaller filter into a sterile container. Examples of filters for sterilization of solutions include:
 - Positive pressure filter for filtration of large volumes (up to 2 L) [Sterivex™ Filter Units - Sterile Filtration \(emdmillipore.com\)](#)
 - Vacuum Filtration system for volumes up to 500 mL [Stericup Quick Release-GP Sterile Vacuum Filtration System | S2GPU05RE \(emdmillipore.com\)](#)
 - Syringe mounted filter for filtration of small volumes (1-100 mL) https://www.emdmillipore.com/US/en/product/Millex-Syringe-Filter-Units-Sterile-4-13-25mm,MM_NF-C9085?CatalogCategoryID=#ordering-information
 - Centrifuge filters for filtration of very small volumes (0.5 mL) <https://www.emdmillipore.com/US/en/product/Ultrafree-MC-Centrifugal->

Filter,MM NF-UFC30GV0S

- i) Dose (ex: mg/kg body weight, etc.) or dose range.
- j) Route of administration (ex: intraperitoneal injection, intravenous infusion, oral gavage, topically, in the drinking water, etc.), volume to be administered, frequency of administration (ex: daily, twice daily, every hour, once per week, etc.), and for how long will you give the compound (ex: one dose, for 3 days, for one week, for one month, etc.).
- k) Describe any expected outcomes, possible side-effects, toxicities, etc.

Guidance for IACUC:

Where the use of non-PGCs may be essential for the conduct of science, the goal of the IACUC should be to consider the health and well-being of the animals while aiding the researcher in minimizing potentially confounding experimental variables and maximizing reproducibility of the research.² Additional considerations include:

Consider the purpose for which a particular compound is being given:

- When compounds are used for the clinical treatment of animals or to prevent or reduce/eliminate animal pain or distress, PGCs must be used whenever possible.^{1,2}
- When compounds are used to accomplish the scientific aims of the study PGCs are preferred if available and suitable.^{1-4,8}

Consider the justification for any non-pharmaceutical-grade compounds to be used:

- The use of non-PGCs in laboratory animals must be described and justified in the Animal Use Protocol (AUP).
- Examples of acceptable scientific justification for the use of non-PGCs include:
 - No equivalent veterinary or human drug is available for experimental use. The highest-grade equivalent chemical reagent should be used and formulated aseptically, with a non-toxic vehicle, as appropriate for the route of administration.
 - Although an equivalent veterinary or human drug is available for experimental use, the analytical or chemical grade reagent may be required to replicate methods from previous studies.
 - Although an equivalent veterinary or human drug is available, dilution, concentration or change in formulation is required.
 - If the formulation as provided must be diluted, altered by addition, or otherwise changed, there may be no additional advantage to be gained by using the USP formulation.
 - In this situation, use of the highest-grade reagent may have the advantage of single-stage formulation and result in purity that is equal to or higher than the human or veterinary drug.
 - The available human or veterinary drug does not meet the non-toxic vehicle requirements for the specified route of administration.

Additional considerations for the use of drugs/chemicals/reagents in animals:

- Whether the chemical properties of the compound are appropriate for the study and the route of administration (e.g., the purity, grade, sterility, stability in and out of solution, solution vehicle properties, pH, osmolality, pyrogenicity and compatibility of the solvent and other components of final preparation).^{10,11}
- The method of preparation, labeling (preparation and use-by dates), administration and storage of formulations should be appropriately considered with the aim of maintaining their stability and

quality.

- Use must be compliant with applicable national or regional regulatory guidelines and requirements and the requirements of relevant funding agencies.
- The potential for side effects and adverse reactions should also be evaluated along with how animals will be monitored to detect these events and what, if any, treatments may be required.
- Do these considerations apply to non-survival studies? Although the potential animal welfare consequences of complications are less evident in non-survival studies, the scientific issues remain the same as in survival studies and therefore apply to non-survival studies. The use of a non-pharmaceutical-grade euthanasia agent must meet the same standards as for use in any other application.³
- Do these considerations apply to the vehicle/diluent/excipient as well? The guidelines pertain to all components, both active and inactive, contained in the preparation to be administered. Therefore, the vehicle used to facilitate administration of a compound is as important of a consideration as the active compound in the preparation.
- Veterinary and human drugs that are reconstituted in a manner not in accord with the product insert are considered non-PGCs.

References:

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2. AAALAC Frequently Asked Questions: C. Institutional Responsibilities 9. Non-Pharmaceutical-Grade Compounds
3. OLAW FAQ- Non-Pharmaceutical-Grade Substances
4. Transcript of OLAW On-line Seminar broadcast on March 1, 2012 - Use of Non-Pharmaceutical-Grade Chemicals and Other Substances in Research with Animals
5. Transcript of OLAW On-line Seminar broadcast on June 4, 2015 - Regulatory Considerations for Using Pharmaceutical Products in Research Involving Laboratory Animals
6. OLAW Frequently Asked Questions – PHS Policy on Humane Care and Use of Laboratory Animals, F. Animal Use and Management, 4. May investigators use non-pharmaceutical-grade substances in animals?
7. USP-NF Online. General Notices and Requirements. <https://online.uspnf.com> (accessed 03-05-2021).
8. National Research Council, Guide for the care and use of Laboratory Animals. 8th edition. Institute for Laboratory Animal Research, The National Academies Press, Washington, DC, 2011. page 31.
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10. Turner, P., et. al. (2011) Administration of Substances to Laboratory Animals: Routes of Administration and Factors to Consider. *Lab. Animal Sci.* 50:600-613
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12. Turner P.V., Pekow C., Vasbinder M.A., Brabb T. (2011) Administration of Substances to Laboratory Animals: Equipment Considerations, Vehicle Selection, and Solute Preparation. *Journal of the American Association of Laboratory Animal Science*, Vol. 50, No. 5, pages 614–627.

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