New York State Department of Environmental Conservation
Division of Fish and Wildlife
Bureau of Wildlife
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CHEMICAL IMMOBILIZATION STANDARD OPERATING PROCEDURE

Contents

This document was prepared in 2019 by:

Elizabeth Bunting, *Wildlife Health Program*
Patrick Martin, *Wildlife Health Program*
Jeremy Hurst, *Big Game Team*
Andy MacDuff, *Bureau Management Team*
Matt Merchant, *Big Game Team*

This document was reviewed and updated in 2025:

Jenny Bloodgood, *Wildlife Health Program*
Ernest Borchert, *Region 3*
Jim Stickles, *Region 5*
ECO Ben Tabor, *Region 6*
Tim Pyszczynski, *Region 6*
Jessica Haggerty, *Region 8*
Ryan Rockefeller, *Region 9*
Jeremy Hurst, *Central Office*

Section I – Regulatory Information

Purpose

The purpose of the Chemical Immobilization Standard Operating Procedures (CISOP) is to identify the best management practices, training requirements, safety measures, and legal requirements for employees of the New York State Department of Environmental Conservation (DEC), Division of Fish and Wildlife (DFW), Bureau of Wildlife (BOW) who use controlled substances and other drugs in wildlife management activities. The CISOP is applicable for the routine chemical immobilization of protected and unprotected wildlife in New York, which most commonly will include large and medium-sized mammals. BOW staff should not attempt chemical immobilization of non-native or escaped captive animals without prior consultation with the Wildlife Health Program veterinarian and BOW chief. Appendix 4 contains drug charts for the most common species encountered by BOW staff.

The CISOP is a dynamic document to the extent that federal and state laws governing the possession and use of controlled substances are subject to change, and the chemical immobilization of wild animals in the field is an evolving science. This document includes links to other resources that are integral to the intent and purposes of the CISOP. The CISOP was developed by employees of the BOW and the Cornell Wildlife Health Lab at the Cornell University College of Veterinary Medicine.

Objective: To standardize training and methodologies to maximize staff professionalism, ensure public safety and animal welfare, and improve agency capacity to respond to animal emergencies and conduct research.

Source Documents

United States Department of Justice Drug Enforcement Administration Office of Diversion Control Practitioner's Manual (DEA, 2023)
New York State Moose Response Manual (NYSDEC, 2011)
New York State Black Bear Response Manual (NYSDEC, 2011)
Wildlife Euthanasia Standard Operating Procedures (New York State Wildlife Health Program, 2024)
Division of Fish, Wildlife and Marine Resources Standard Operating Procedures for Collection and Sampling of Wildlife with Firearms (Internal DEC Website, 2008)
The DEC Policy System, Administrative Policy, OAD-16, Firearms and Other Weapons (Internal DEC Website, 1998)
Collection and Sampling of Wildlife with Firearms—SOP 24 (Internal DEC Website)
Chemical Immobilization of Animals: Technical Field Notes (Safe Capture International, Inc. manual)
Kreeger, TJ, JM Arnemo, NA Caulkett, JO Hampton, LCR Meyer. 2023. Handbook of Wildlife Chemical Immobilization, 6th ed. Published by authors, Bovey, Minnesota, USA.

Regulatory Authorities

Federal

Controlled Substances Act (CSA)

The Controlled Substances Act (CSA), Title 21 United States Code (USC), regulates the manufacture and distribution of drugs classified as Controlled Substances (CS). Some drugs used for chemical immobilization in New York are classified as CS. The CSA gives regulatory authority and enforcement of the act to the U.S. Department of Justice Drug Enforcement Administration (DEA). The CSA creates a "closed system" of distribution in which distribution may lawfully occur among registered handlers of CS,

referred to as "registrants." Central to this closed system of distribution is the registration of all persons or entities authorized by the DEA to handle CS.

Drug Enforcement Administration (DEA)

The Office of Diversion Control within the DEA administers the DEA registration process. All registrants are required by the CSA to maintain complete and accurate inventories and records of all regulated transactions involving CS and listed chemicals, as well as provide adequate security controls to prevent their diversion. Therefore, a CS is always under the control of a DEA-registered person until it reaches the patient (free-ranging wildlife of New York) or is destroyed, and the CSA's regulatory requirements ensure that all CS are accounted for from their creation until their dispensing or destruction. The DEA classifies CS by their potential for abuse, with Schedule I being the highest and Schedule V being the lowest.

The DEA has enforcement authority for CS classification, registrations (types), and registrants (requirements and duties), dispensing and distributing CS, transporting CS from registered locations, storing and security requirements of CS, documentation of CS use and record-keeping, drug disposal, theft, and loss reporting.

Food and Drug Administration (FDA)

The Food and Drug Administration (FDA) within the US Department of Health and Human Services ensures the safety of foods and cosmetics and the safety and efficacy of pharmaceuticals, biological products, and medical devices. The FDA regulates drug use in all animals, including wildlife. The FDA establishes withdrawal times for drugs administered to food-producing animals.

The FDA limits the use of drugs to conditions (e.g., species, dose) specified on the label. Most pharmaceutical agents used in the chemical immobilization of wildlife are used in an extra-label manner, meaning they are not listed on the label and have not been extensively tested by the manufacturer for these species. Under the provisions of the Animal Medicinal Drug Use Clarification Act (AMDUCA), as administered by the FDA, these drugs may still be legally used in free-ranging wildlife, provided certain conditions are met. This includes the involvement of a veterinarian in the establishment of protocols, detailed record keeping, and, in animals that may be harvested and consumed, marking/identification of any animals receiving the drugs and determination of drug withdrawal times to prevent accidental consumption of residues by the public.

State

New York State Department of Health (DOH)

New York State Public Health Law (PHL) requires any person acting as a manufacturer, distributor, importer, exporter, institutional dispenser, or conducting research, instructional activities or chemical analysis with CS in New York State to obtain a license from the DOH. The application will document that you have satisfied the licensing requirements as outlined in NYS Public Health Law Article 33 and Title 10 New York Codes, Rules and Regulations (NYCRR) Part 80 Rules and Regulations on Controlled Substances in New York State. More information can be found on the DOH website.

New York State Department of Environmental Conservation (DEC)

DEC's authorities and responsibilities are identified and outlined in the New York State Environmental Conservation Law (ECL).

ECL §11-0303(2): " … the department is directed, in the exercise of the powers conferred upon it, to develop and carry out programs and procedures which will in its judgment, (a) promote natural propagation and maintenance of desirable species in ecological balance, and (b) lead to the observance of sound management practices for such propagation and maintenance on lands and waters of the state, whether owned by the state or by a public corporation of the state or held in private ownership, having regard to (1) ecological factors, including the need for restoration and improvement of natural habitat and the importance of ecological balance in maintaining natural resources; (2) the compatibility of production and harvesting of fish and wildlife crops with other necessary or desirable land uses; (3) the importance of fish and wildlife resources for recreational purposes; (4) requirements for public safety; and (5) the need for adequate protection of private premises and of the persons and property of occupants thereof against abuse of privileges of access to such premises for hunting, fishing or trapping."

ECL §11-0901(3)(f): "No wildlife shall be taken with an arrow with an explosive head or shaft, or with an arrow, dart or any device, propelled by any means, that is used for the purpose of injecting or delivering any type of drug into the blood system of such wildlife. Nothing in this paragraph shall be construed as prohibiting a wildlife biologist or employee of the department or anyone acting under a license from the department from using any method to take wildlife if he is doing so within the scope of his employment for the department, or pursuant to the license issued by the department."

Registration and Licensing

While not all chemical immobilization drugs are CS, the use of CS in New York requires both DEA registration and DOH licensing, and much of this document deals with regulations applying to drugs categorized as CS.

The Regional Wildlife Manager (RWM) will be the person named on both the DEA registration and DOH license. The RWM may, at their discretion, assign a biologist stationed within a secondary office to hold an additional license to provide adequate regional coverage of CS and chemical immobilization equipment. The RWM must designate, in writing, all trained BOW staff that are permitted to handle CS under each license.

This document outlines the general requirements for DEA and DOH licensing. It does not present the requirements in their entirety. It is incumbent upon the applicant to be fully knowledgeable with all applicable Sections of Title 10 NYCRR Part 80.

DEA Registration

The CSA requires an individual to register with the DEA at each address where they will store, dispense, or administer CS.

"A separate registration is required for each principal place of business or professional practice at one general physical location where controlled substances are manufactured, distributed, imported, exported, or dispensed by a person."

DEA registration renewal is required every three years. The DEA license type required is that of a Researcher. The DEA registration holder can designate other agents in their workplace, allowing identified agents access to CS and permission to administer them. This shall be done in writing, and the letter will be kept on file together with the DEA and DOH-required records for the length of the agent's employment. The letter shall define the limits (if any) of their access to drug supplies and use (see Appendix 1 for examples).

The DEA has additional limits for designated agents:

"The registrant shall not employ, as an agent or employee who has access to controlled substances, any person who has been convicted of a felony offense relating to controlled substances or who, at any time, had an application for registration with the DEA denied, had a DEA registration revoked or has surrendered a DEA registration for cause."

While RWMs and biologists who have a DEA registration may be able to procure drugs through a distributor, they are not legally allowed to use them without veterinary supervision. All drugs used for chemical immobilization, whether they are CS or not, are prescription drugs that must be used by or under the order of a licensed veterinarian. The veterinarian does not have to be on-site for the administration of the drug(s) but should be involved in dosage and administration decisions. As such, RWMs and biologists should work directly with the Wildlife Health Program veterinarian when planning research or monitoring efforts that may involve the chemical immobilization of wildlife. Further, this document provides a list of immobilizing drugs (Appendix 2) and dosage charts (Appendix 4) that are ***pre-approved by the Wildlife Health Program veterinarian for use in emergency or unplanned wildlife response situations.***

New York State Department of Health Licensing

The New York State Department of Health, Bureau of Narcotics Enforcement (BNE) requires BOW staff to obtain a license in order to conduct activities with CS. Only one DOH license is required per DEC Region for the use of CS. License renewal is required every two years.

In order to obtain a DOH license, a License Application to Engage in a Controlled Substance Activity (DOH-4330) is submitted to the DOH BNE. The license type required is that of a Class 4 Institutional Researcher (4B). Additional information must be supplied in Appendix B, the Institutional Researcher Statement concerning the specific activities to be conducted (see Appendix 9 for example). Additional (to the RWM) agents are to be identified as "project participants" on the Institutional Researcher Statement, like those designated as agents for DEA. A letter (see Appendix 1) shall accompany the license application to give supporting details about anticipated agency activities.

It also requires 2 attachments (see Appendix 9 for example):

> (i) Controlled Substance Project Approval Committee List: Name, qualifications & competence (e.g., degree & department) of each member of the institution's-controlled substance project approval committee.
>
> (ii) Controlled Substance Project System: Description of the system within the institution for approving, supervising & evaluating controlled substance research projects.

Management Organization

DEC Regional Coordination

Regional Wildlife Managers are responsible for administrative coordination of CS as follows:

- Maintaining DEA registration(s) and DOH license(s) for the respective DEC Region
- Maintaining an up-to-date list of staff in the Region who are agents under the DEA registration, including designating a Regional Chemical Immobilization Coordinator (CIC) who will be responsible for technical coordination of drugs, equipment, and record keeping. This list should be kept in SharePoint.
- Ensuring current Regional registrations, licenses, and agent lists are accessible via a BOW SharePoint site
- Ensuring Regional use of CS is compliant with all DEA and DOH requirements
- Ensuring all Regional staff involved in chemical immobilization are up to date on required training (see Training and Proficiency)
- Ensuring that staff involved in chemical immobilization are proficient in the use of chemical immobilization equipment

Regional BOW CICs will be responsible for:

- Tracking the purchase, inventory, and disposal of immobilization drugs, including CS
- Proper storage of drugs and equipment, including CS
- Inventory, maintenance, and replacement of all chemical immobilization equipment
- Serving as the Regional point of contact with the Wildlife Health Program (WHP) for all chemical immobilization issues
- Ensuring that accurate and up-to-date CS and immobilization records are kept and stored as required (a minimum of 5 years for CSs). See Appendix 7 for examples.

Training and Proficiency

Minimum training standards for BOW staff who will lead a chemical immobilization event are as follows*:

- Read DEC's CISOP and associated documents: Wildlife Euthanasia Standard Operating Procedures, DFW SOP for Collection and Sampling of Wildlife with Firearms, DEC Administrative Policy OAD-16 - Firearms and Other Weapons, and Collection and Sampling of Wildlife with Firearms—SOP 24
- Attend a BOW-approved professional chemical immobilization training once every five (5) years
- Attend a BOW-administered Regional chemical immobilization training annually
- Attend a BOW-administered Regional firearms training annually
- Be current in First Aid and CPR training (note: if the lead is not current on these training courses, at least two other DEC staff who are current must attend a chemical immobilization event).

* At RWM's discretion, new staff having prior experience with chemical immobilization and firearms handling through another agency or organization may be authorized to lead a chemical immobilization event prior to attending BOW-administered training.

Ideally, in addition to the training listed above, the leader of a chemical immobilization event will have directly participated in at least three (3) prior chemical immobilization response events. However, this standard may be waived at the discretion of the RWM.

Regional chemical immobilization training will include the following topics:

- Supplies and equipment
- Drug storage and record keeping
- Drug dosage calculations and selection
- Delivery systems (specific to equipment on-hand in each Region)
- Animal handling and care
- Response to human emergencies
- A live-fire range exercise with all Regional delivery systems

(See Appendix 7 for additional detail on recommended topics for training)

Only the DEA registrant or an agent designated under their registration may handle CS. BOW staff participating in a chemical immobilization event who will be in direct contact with any mammal species must have their rabies pre-exposure vaccination and up-to-date rabies titer (blood test for antibody), which is required every two years and may be recommended annually for some individuals. Other staff who do not meet these training standards may assist with record-keeping, crowd control, or other activities that do not include animal contact or the use or administration of CS.

Record Keeping

Each Region will keep detailed records that track all drugs, including their purchase, inventory, and use, as well as any procedures involving chemical immobilization. To comply with DEA requirements, procedures within a Region must be under the control of the DEA registrant. Record-keeping for CS should be done in accordance with all DEA and DOH requirements. The original copies of all documents should be stored at the DEA registration location and be readily available for inspection by DEA and DOH officers for a period of five (5) years. It is critical that records and inventories be kept up to date and in the format specified by law (see Drug Purchase and Documentation). Standardized record forms for immobilization and inventory are to be used by BOW Regional Wildlife staff. See Appendix 6 for examples.

Responsibilities for Emergency Response

Bureau of Wildlife

- BOW staff will handle chemical immobilization events during hours when staff is available (typically 8:00am to 5:00pm on all normal workdays).
- Both BOW and DLE will be notified of any chemical immobilization training event within the Region.
- BOW response to events occurring outside official office hours will only be done with approval of the RWM, Regional Natural Resources Supervisor or Regional Director.
- Two (2) BOW staff should attend all chemical immobilization events (one must be fully trained).

- If only one (1) appropriately trained BOW staff is available, another DEC staff member or law enforcement professional should be available for safety and support.
- Additional BOW or DLE staff may attend for training purposes.
- BOW staff will not prepare immobilization drugs in the field or begin chemical immobilization procedures until another DEC employee, police officer, firefighter, or EMS practitioner is present and not until the second person has been familiarized with emergency procedures.

Division of Law Enforcement

- DLE staff will respond to events when BOW staff are unavailable, following the same guidelines as BOW staff (at least two staff should be present, and drug preparation should not begin until a second person who is familiar with procedures is present).
- DLE staff will provide on-site crowd control and ensure public safety.

If a non-DEC police or peace officer is on-site, they may be asked by BOW or DLE staff to provide crowd control.

Immobilizing Drugs

Drugs Approved for Chemical Immobilization

The following drugs are approved for use by BOW staff for the chemical immobilization of animals:

- Telazol® (tiletamine, zolazepam), Controlled Substance
- Ketamine, Controlled Substance
- BAM (Butorphanol, Azaperone, Medetomidine), Controlled Substance
- Xylazine and other alpha-2 adrenoceptor agonists, Not Controlled
- Atipamezole, Not Controlled, Reversal Agent
- Tolazoline, Not Controlled, Reversal Agent
- Naltrexone, Not Controlled, Reversal Agent
- Doxapram, Not Controlled, Respiratory Support

More information on individual drugs is available in Appendix 2. Background information concerning the drugs that are being used shall be clearly documented and included in each chemical immobilization field kit. That information shall be in a format that will enable medical personnel to assess the exposure and begin treatment quickly in the event of an accidental exposure. The information must include, at a minimum, the enclosures from the drug packaging and associated Safety Data Sheets. No drugs are to be used if they are past the expiration date listed on the bottle without prior approval by the Regional CIC or WHP Veterinarian.

Drugs other than those listed above must be approved by the BOW Bureau Chief prior to use.

Drug Purchase and Documentation

DEA registrants are responsible for coordinating the purchase of all drugs (controlled and not controlled) for chemical immobilization. The WHP veterinarian can provide necessary prescriptions and purchase

drugs. Both the DEA and DOH require registrants to keep up-to-date inventories of all controlled substances as follows:

"(1) A record of all such controlled substances received shall include date of receipt, name and address of vendor, type and quantity of drug received. A duplicate invoice or separate itemized list furnished by the vendor will be sufficient to meet this record requirement providing it contains all the information required and is maintained in a separate file.

(2) A record of all controlled substances used shall include the name of the person authorized to control and use such drugs, the date, type and quantity of drug and signature of the user.

In addition, such records shall contain the following information for each controlled substance:

(1) Name of substance.
(2) Each finished form (such as 10 mg. tablet, or 10 mg. concentration per fluid ounce or milliliter) and the number of units or volume of finished form in each commercial container.
(3) The number of commercial containers of such finished form received from other persons, including the date of and number of containers in each receipt, and the name, address, and registration number of the person from whom the containers were received.
(4) The amount of such finished form dispensed, including the name and address of the person to whom it was dispensed, the date of dispensing, and the written or typewritten name or initials of the individual who dispensed or administered the substance.
(5) The number of units or volume of the finished form and/or commercial containers disposed of in any other manner by the researcher, including the date and manner of disposal. (DOH)"

At their discretion, staff may follow the same record-keeping for all drugs, controlled or not. Some details, such as a name and address, can't be provided for wildlife, but species and location are to be recorded.

Controlled Drug Storage

Controlled substances have significant requirements for secure storage, specified by the DOH and DEA. Access to areas where CS are stored should be restricted, and only registrants or specified agents should be able to open the secure storage or handle drugs. According to the DEA, to maintain the security of CS, no other drugs should be stored in a safe used for CS unless approved by the DEA agent for the area. Controlled drugs waiting for disposal (expired, etc.) should be kept in the safe. While both DOH and DEA require drugs to be stored in a safe that is fixed to the wall or floor, they may also require additional alarms or security measures. It is best to have the local DEA representative review or inspect the drug storage to make sure that it passes requirements.

To meet the minimum-security standards for non-practitioner handling of Schedule III-V CS schedules under Title 10 NYCRR Part 80, which also satisfies DEA standards, storage should meet one of the following minimum requirements:

(1) Where small quantities permit, in a safe of GSA Class 5 rated or equivalent, if the safe weighs less than 750 pounds, it shall be bolted or cemented to the floor or wall in such a way that it cannot readily be removed.
(2) in a vault which complies with the security requirements of this Part for storage of schedule I and II substances; or

(3) in a building or area located within a building which has walls or perimeter fences of sufficient height and construction to provide security from burglary and has substantial doors which shall be securely locked during non-working hours by a multiple position combination or key lock."

In the field, CS must be under the control of the registrant or designated agent at all times- this includes the drugs and any syringes, darts, and/or sharps. Drugs must be transported in a portable, locking drug container, which will be locked at all times except when preparing drugs for use. After the drugs and darts are prepared, the box will be secured. At no time will the portable drug box be left unattended in an area accessible to the general public.

All disposable darts (i.e., Pneu-darts) that have been loaded with drugs will be disposed of in the red sharps container, whether or not they were used. No attempt should be made to discharge or remove drugs from any unfired disposable dart. All syringes will be disposed of in the red sharps container. The red sharps container should be stored in the drug safe, gun safe, or lock-secured cabinet until disposed of at the WHU.

Drug Disposal

Unused drugs should be disposed of securely and in a way that prevents environmental contamination of any water body. No drugs shall be flushed or rinsed down the drain. This includes CS that are drawn up but not dispensed (extra darts), partial doses of CS that remain behind in a dart, expired drugs, contaminated bottles of drugs, or drugs that are reconstituted but not used. Ketamine, Telazol® and the butorphanol in BAM combinations fall under these rules.

DOH BNE Class 4 licensees are DEA registrants and must comply with all DEA regulations regarding the disposal of controlled substances. DEA-approved disposal options for non-practitioner licensees include:

1. Destruction
    - The method of destruction shall be consistent with the purpose of rendering all controlled substances to a non-retrievable state in order to prevent diversion of any such substance to illicit purposes and to protect the public health and safety.
    - Two employees of the registrant shall handle or observe the handling of any controlled substance until the substance is rendered non-retrievable; and
    - Two employees of the registrant shall personally witness the destruction of the controlled substance until it is rendered non-retrievable.

    Incinerators in New York that meet certain guidelines and have approval from DEC Division of Materials Management may accept CS for destruction. These facilities must be contacted by individual Regional offices to determine a process for disposal. See here for a list of Regional Materials Management Contacts.
2. Reverse distributor mail-in or pick-up
    - The company *UnitedRX Solutions* is a reverse distributor based in New York. They can be contacted at their website www.unitedrxsolutions.com or at (844)741-9718. They will verify the shipment and provide appropriate records that meet DEA and DOH compliance requirements. DOH also maintains a list of all NY-approved reverse distributors here.
3. Some manufacturers and distributors may accept the return of unopened or expired drugs.

Disposal of any CS not administered to an animal must be logged on DEA Form 41 and kept as a record for at least 2 years. At least one witness must be present during the disposal of any controlled drugs, and they must sign the form.

Lost or Stolen Controlled Substances

The contents of any bottle of a CS must be zeroed out when the bottle is empty. If any content is unaccounted for, the DEA and DOH require that the registrant notify them within 24 hours when drugs are discovered missing. Use DEA form 106, Report of Theft or Loss of Controlled Substances. For DOH, call directly.

Section II – Best Practices: Drug, Animal, & Human

Administering Immobilizing Drugs

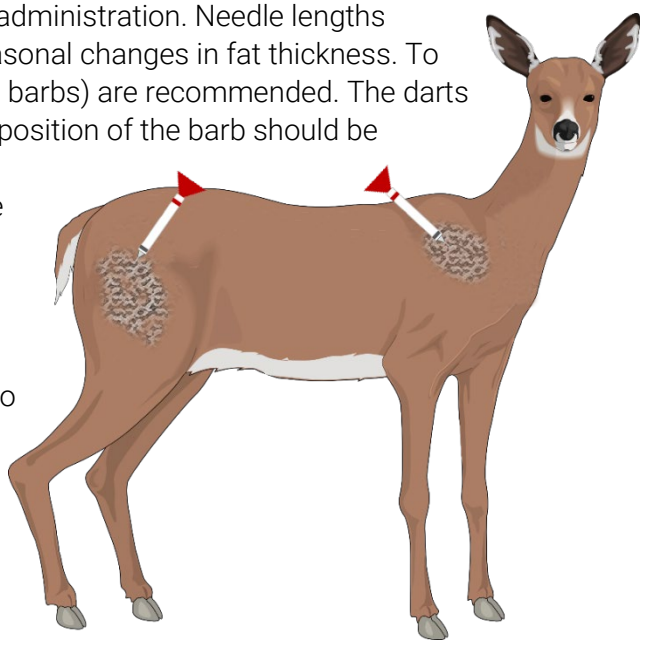
Equipment Maintenance and Use

In all chemical immobilization situations, the event leader should seek to minimize stress and undue harm to the animal, while maintaining staff safety. Basic mechanical drug delivery such as hand injection or pole syringes are often a good choice for caged or restrained animals as they can provide assurance of accurate and complete drug delivery with minimal trauma. However, mechanical drug delivery systems are less ideal for situations where an animal may swat or bite at the delivery device or if the animal can effectively stay out of reach. For animals in large enclosures, free-ranging animals, or animals that may attack when approached too closely, a remote drug delivery system is often a more appropriate choice. When using these systems, it is important to consider the size of the animal, environmental hazards, escape routes, and the hazards associated with using darts. If an animal is in an elevated position (e.g. up a tree), it could jump or fall after dart impact or during induction. If immobilization is not immediately necessary, do not attempt to dart the animal and wait until it has moved to a lower location. If immobilization is necessary, a crash pad/net should always be placed underneath the animal to break its fall

Dart failure can result from inaccurate placement of darts, inadequate force to trigger drug injection, or dart mechanical failure. Excessive force of propelled darts can result in inappropriate animal trauma. The success of remote delivery can be enhanced by a thorough knowledge of the equipment, frequent practice, routine equipment maintenance, cataloging the equipment before each field operation, and post-application evaluation of procedures and outcomes. Staff should develop a technique chart for each dart projector that identifies the appropriate .22 powder load or pneumatic pressure setting for each dart size and distance likely to be needed in the field. Additionally, staff are encouraged to use transmitter darts in situations where a dart may be lost, or the target animal may run out of view after being darted. *Air-powered systems should be used when darting animals weighing <50 lbs. Remote delivery systems using explosive charges are not appropriate for animals this small*.

Dart Choice and Placement

When delivering drugs remotely, the goal is for intramuscular administration. Needle lengths should be chosen accordingly, with consideration given to seasonal changes in fat thickness. To ensure full drug delivery, darts with retention devices (i.e., wire barbs) are recommended. The darts should be surgically removed once the animal is in hand. The position of the barb should be marked on the body of the dart to facilitate surgical removal. Immobilizing drugs are injected into an animal's larger muscle groups, which are usually located in the hindquarters, dorsal part of the neck, and shoulder areas. Injection into the neck provides more rapid drug induction than injection into the hindquarters. However, extreme caution should be used because the target area is smaller, and accidental injection into vital structures near that area can be fatal. Darts should strike an animal perpendicular to the target area. The head, front of the neck, thorax, abdomen, and lower portions of the legs should be avoided to prevent darts from penetrating organs, sensitive tissues, and bones.



Evaluating Effects

The first signs of chemical immobilization are often half-closed eyes and drooping ears or head. Next, the animal may begin to lick its lips and slightly sway its head. As the drug's effects become stronger, the animal's entire body may begin to sway; bears in a tree may start to lose their grip. Free-ranging animals may run for significant distances before succumbing to the drug. Extremely excited animals may not become immobilized enough for handling. Animals should not be handled before they are completely immobilized, except to administer additional drugs as needed. Ketamine/xylazine and Telazol® anesthesia usually last at least 30 minutes, so there is little need to rush in after the drug is administered unless there is a danger to the animal that needs to be addressed (e.g. water hazards).

Tagging for Drug Withdrawal

The Food and Drug Administration maintains standards for the use of pharmaceuticals to prevent drug residues in food for human consumption, although the FDA does not have specific guidance for wildlife species. In general, drugs administered to an animal will be metabolized and excreted at different rates that depend on the species' physiology, age, dosage, means of administration (oral, injectable, topical) and the drug itself. The FDA tests tissues from domestic animals extensively for drug residues in order to calculate withdrawal times (how long after an animal is treated with drugs that it's safe to eat). This information is lacking for wildlife. Consumers of wild game may have an expectation that, unlike domestic animals, wildlife are naturally free of drug residues. Because of the lack of information, it becomes difficult to put a "safe to consume by" tag on any wildlife that is treated with chemical immobilization drugs.

Therefore:

- Any game species that may be consumed by humans that is treated with pharmaceuticals and released must have a tag applied that says "Do not consume" and a WHP or DEC contact number to call for further information.
- BOW staff should state that the animal has been treated with drugs and that BOW can't advise if the animal is clear of drug residues or safe to consume.
- BOW should provide the hunter with a replacement tag if desired.
- The carcass of any animal treated with drugs should be disposed of in an approved municipal landfill, buried >3ft to avoid secondary toxicosis to scavengers, or Regional BOW staff should obtain the carcass for proper disposal or necropsy if needed. If desired, parts (e.g., fur, skull, etc.) may be kept as long as consumption is avoided.

Releasing the Animal

After chemical immobilization, BOW staff will help the animal return to full and normal function as quickly as possible. An animal should not be released in an uncontrolled situation under the strong influence of immobilizing drugs. The effects of some drugs can be reversed with a "reversal" agent that is specific to the anesthetic drug used. There are no reversal agents for ketamine or tiletamine. If ketamine/xylazine is used, the effects of xylazine should only be reversed after a waiting period of at least 40 minutes to ensure that the ketamine has worn off. If Telazol® alone is used and processing is complete, continue to monitor the animal as quietly as possible until the animal appears ambulatory or is otherwise secured in a position and location (e.g., bear in a den) where it can safely recover with low risk to itself or the public.

Before releasing the animal, all equipment and personnel should be moved away from the area as quickly and quietly as possible. BOW staff can then observe the animal from a safe distance to ensure it is recovering safely.

In some rare cases, an animal may not be suitable for release because of prior injury or trauma sustained during handling. Hospitalization or euthanasia may be the best recourse, and staff should be prepared for this possibility by bringing appropriate transportation (when feasible) and euthanasia equipment (e.g., firearm) to every chemical immobilization event. ***The decision for hospitalization or euthanasia is best made by the BOW staff on the scene based on the individual animal's condition, with consideration of the location and extent of the animal's injury and how that injury may compromise the animal's welfare and survival. The WHP veterinarian is available to consult on these cases.***

Animal Standards of Care

Records

After-action reports of each chemical immobilization event will be prepared within three (3) days and include details such as the reason for the immobilization, names of all involved staff, species, sex, approximate weight, drugs used and amounts including reversal agents, tag/collar information, any medical monitoring data, and release location information or disposition of carcass if euthanized. These reports will be filed in the Regions and shared as necessary to further BOW knowledge of chemical immobilization.

Best Practices

Chemical immobilization of wildlife often occurs under difficult and dangerous circumstances. The medical history, health, age, weight, and body condition of the animals are usually unknown. The animals are usually frightened, stressed, and/or exhausted. Adequate training in drug pharmacology, drug delivery systems, and anesthetic monitoring skills are essential to the overall success of the immobilization.

Each BOW staff person administering immobilizing drugs to wildlife is responsible for the animal's well-being and should adhere to the following standards:

- Minimize stimuli via crowd control, talking quietly, and limiting conversation, etc.
- Keep the animal in a body position that maintains an open, uncompromised airway and protects against bloat and regurgitation of stomach contents.
- Use a head/eye cover after applying an eye lube to protect the eyes from light, debris, or other damage.
- Conduct a physical exam as soon as the animal can be safely handled to identify any injuries that may require first aid or, if severe, hospitalization or euthanasia.
- Monitor temperature, pulse, and respiration at least every 5 minutes.
- Conduct procedures that cause the most pain (tooth pulling, tagging, tattooing, etc.) as soon as possible - the height of anesthetic pain relief is about 15 minutes post-administration and consider providing pain relief if the immobilizing drugs do not provide it.
- Watch for hypothermia or hyperthermia and other complications (see Appendix 5), and warm or cool the animal as necessary.
- If an injury is bandaged, remove all bandages before releasing the animal.
- Never leave an immobilized animal unattended.
- Ensure the animal is sufficiently recovered before release.
- If an animal must be euthanized, follow the measures found in the Euthanasia SOP.

Additional details on animal care can be found in the *Handbook of Wildlife Chemical Immobilization,* or *Chemical Immobilization of Animals*: *Technical Field Notes* by Safe Capture International, Inc., or notes from the NYS Wildlife Chemical Immobilization course.

Detailed Animal Standards of Care

Minimize Stimulus

Excitement works against the effectiveness of immobilizing drugs and against animal health and safety. Minimize chase time and the number of people present (crowd control), and choose a drug delivery system that is accurate and quiet.

Once immobilized, external stimuli should continue to be minimized. A sedated animal can awaken without notice. Work quickly and quietly and minimize conversation. Use equipment that can further reduce the influences of external stimuli, including ground cloths and head covers.

Body Position

Maintain an open, uncompromised airway and monitor for signs of bloat and regurgitation. Anesthetized animals are usually laid on either their side or sternum, depending on the species, tasks to be performed, and complications present. It is often most convenient to work with an anesthetized animal on its side, however, deer, elk, and other ruminants should be placed in sternal recumbency (i.e., propped up on their chests and legs folded) to prevent regurgitated stomach contents from going down the airway.

Head/Eye Cover

Covering an immobilized animal's eyes after applying an ophthalmic ointment will protect them from light, debris, and damage and will reduce excitement during recovery. Head/eye covers should be designed to allow for non-restricted breathing.

Patient Examination and Monitoring

A physical exam and evaluation of temperature, pulse, and respiration (TPR) are the most effective methods of documenting an animal's condition during the immobilization process. Immobilizing drugs generally may compromise basic physiologic functions such as thermoregulation, breathing, and blood circulation. Therefore, BOW staff must examine and monitor immobilized animals to reduce the likelihood of adverse complications.

A physical exam should be conducted as soon as the immobilized animal can be safely handled to ascertain its general health and ability to tolerate the immobilization event. The sex, age, and general health of the animal should be recorded. Also, capture-related injuries that may require first aid need to be identified. If a barbed dart was used, it needs to be surgically removed, and the wound cleaned and antiseptic applied. A general physical exam should take only a few minutes. External stimuli need to be minimized as the examination is conducted.

BOW staff should strive to monitor TPR at regular 5-minute intervals. TPR is monitored to determine if values are within normal ranges and to determine if corrective actions are warranted. For example, the animal should be cooled if its body temperature is too high. High body temperatures (hyperthermia) can be life-threatening because the blood's ability to carry oxygen decreases. Low body temperatures (hypothermia) can also be life-threatening and may slow the metabolism of immobilizing drugs as well. Compact digital thermometers work well for fieldwork and signal when the reading is complete.

Certain immobilizing drugs (e.g., xylazine) can slow heart rate to potentially dangerous levels, while others (e.g., ketamine) can dangerously increase rates. Fast heart rates may also be an indication of shock or hyperthermia. The best way to monitor heart rates is with a stethoscope. The heart is easiest to find on the left side of the chest. To determine heart rate, the number of heartbeats heard in 15 seconds should be multiplied by four. Pulse rates also can be determined by lightly placing your fingers around the thoracic cavity at the level of the heart or on a major artery (e.g., the femoral artery) and counting the number of beats that are felt. The number can be noted as beats per minute (BPM).

Respiratory rates also vary widely. Physical activity, capture stress, and hyperthermia will increase respiration. Some immobilizing drugs (e.g., xylazine) will decrease respiratory rates. Respiratory rates are estimated by counting the number of breaths per minute; one way to do this is to count the number of breaths in 15 seconds and multiply by four. The number is noted as respiratory rate or RR.

The chart below gives normal TPR for species commonly immobilized by DEC. These values are for awake animals. Under anesthesia, the temperature may vary +/- 5 degrees and the BPM and RR may vary +/- 50%. Always monitor trends and start correcting before you get outside these ranges.

Animal	*Temperature*	*Pulse (BPM)*	*Respiration (RR)*
White Tailed Deer	100-102°F	70 - 80	16-20
Black Bear*	99.6-101°F	60 - 90	15-30
Moose	101-102°F	60 - 90	8-12
Fisher	100-101°F	159 - 190 (Male - Female)	35-45

*Parameters in hibernating animals are expected to be lower.

Human Safety

Best Practices

Drugs used in the chemical immobilization of animals can have severe and potentially life-threatening effects on humans who are accidentally exposed. Exposures can occur from accidental injection or spray of the drugs into the eyes or mouth. Depending on the drug and quantity, symptoms can range from non-existent to full respiratory and cardiac arrest. It is best practice to have everyone involved in a capture event aware of the nearest emergency facility in case of accidental exposure. At least two chemical immobilization event attendees must be current in First Aid and CPR training.

Basic measures to avoid exposure when handling drugs include:

- Obtain appropriate training in wildlife chemical immobilization, and, specifically, how to safely handle needles, syringes, darts, and drugs.
- Understand what drugs are being used and the signs of human exposure.
- Keep a copy of the SDS and drug insert on hand for each drug being used and bring this with you to the nearest emergency facility if treatment for exposure is needed.
- Never work alone.
- Bring a cell phone and/or have radio contact with other DEC staff when in the field.
- Gloves and eye protection are required when handling drugs and darts. A mask is optional to avoid potential oral exposure.
- Do not eat, drink, or smoke while handling drugs and darts.
- Limit multi-tasking and focus on handling drugs and darts.
- Follow proper firearms safety rules when handling loaded darts, loaded needles, loaded pole syringes, or dart projectors.
- Dispose of waste and sharps properly and clean work surfaces.
- Always locate lost darts, particularly if working in urban areas.

In response to a human exposure:

- Stay calm.
- Tell someone immediately and contact EMS as necessary.
- Monitor patient and keep records of vital signs.
- Flush the exposure site if applicable.
- Provide rescue breathing, O_2 supplementation, and CPR if indicated.
- Transport for emergency treatment, remembering to bring the SDS and drug insert, and fill in the exposure checklist in Appendix 6

See Appendix 8 for specific response instructions.

Appendices – Forms, Drug Charts, & Standards of Care

Appendix 1

Sample Letters

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Division of Fish and Wildlife, Bureau of Wildlife
625 Broadway, 5th Floor, Albany, NY 12233-4754
P: (518) 402-8883 F: (518) 402-8925
www.dec.ny.gov

November 22, 2019

To: Chemical Immobilization Files

From: Name of Permit Holder

Re: Approved staff

The following personnel are trained and authorized to handle and administer controlled substances, may have access to the drug safe and chemical immobilization equipment, and will be responsible for recording drug usage and maintaining drug inventories as per Department SOPs:

John Doe, Wildlife Biologist, Region 5 Warrensburg

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Division of Fish and Wildlife, Bureau of Wildlife
625 Broadway, 5th Floor, Albany, NY 12233-4754
P: (518) 402-8883 F: (518) 402-8925
www.dec.ny.gov

NYS Dept. Of Health
Bureau of Narcotic Enforcement
Riverview Center
150 Broadway
Albany, NY 12204

To whom it may concern:

The following is information relevant to controlled substance renewal application.

The New York State Department of Environmental Conservation (NYSDEC) is required by law to manage wildlife populations at levels that are compatible with the natural habitat and human interests. To accomplish this, the NYSDEC must study the movement and behavior of wild animal populations and respond to situations where wild animals may pose a threat to human safety. Chemical immobilization of wild animals is therefore necessary.

Research and nuisance wildlife response are funded under Federal Aid Project WE-173-G. Although our office conducts research on all wildlife populations statewide, the animals most frequently studied are white-tailed deer, black bear, and moose. Research requires wild animals to be captured and immobilized for the purpose of ID marking and radio telemetry studies of reproductive success, movement and expansion in growing populations, and for easy identification of nuisance animals. Controlled substances may also be used by NYSDEC for the purpose of immobilizing wild animals during handling and relocation when the animals disperse into areas which are unsafe for the animal and/or human population.

The controlled substances to be used by NYSDEC include Telazol and Ketamine, both Schedule III drugs. Drug purchases will be made through _____. These substances will be stored in a locked safe (model/manufacturer). The safe is located (describe where the safe is located, how it is physically mounted, how it is secured from public access).

The records for all controlled substances dispensed are maintained in a _____. Controlled substances will be administered by the following NYSDEC biologists and/or technicians: (list staff).

Please contact me at _____ if additional information is needed.

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

Appendix 2

Drugs Approved for BOW Chemical Immobilization Events

Generally speaking, a small number of immobilization drugs will provide sufficient flexibility and safety margins for use by BOW staff. The following drugs are routinely used by BOW staff for immobilization:

Immobilization Drugs:

Telazol® (tiletamine, zolazepam), Controlled Substance

Telazol® is a mixture of two drugs: tiletamine and zolazepam. Telazol® is classified as a Schedule III drug under the DEA. Tiletamine is a cyclohexane (dissociative anesthetic), and zolazepam is a benzodiazepine agonist (tranquilizer); when used together, the anticonvulsive action of zolazepam reduces the negative effects of tiletamine. Tiletamine is 2.5-5 times more potent than ketamine, and it generally works faster and lasts longer than ketamine. Telazol® is sold in powder form and must be reconstituted before use. One vial of Telazol® contains 286 mg of tiletamine and 286 mg of zolazepam, for a total of 572 mg. When reconstituted, this powder adds ~0.7 mL of volume, such that when mixed with 5 mL of sterile water, the resulting concentration is 100 mg/ml (572 mg/5.7 mL). To increase its effectiveness, Telazol® can be reconstituted with a sedative rather than sterile water (e.g., an alpha-2 adrenoreceptor agonist). Telazol® can also be reconstituted with less volume of solvent to increase the concentration. When reconstituting Telazol®, the drug solution must be completely clear in order for the drugs to work properly. Thus, only clear solutions should be administered. At low temperatures, the powder may precipitate, making the solution cloudy. This is more likely when making concentrated solutions. Keep the drugs warm and minimize the shooting time. Once reconstituted, the shelf life for Telazol® is seven days at room temperature and 56 days if refrigerated, but because Telazol® is a controlled substance, it should only be stored in a secure safe. Therefore, any reconstituted Telazol® should be discarded after 7 days. Telazol® generally results in the most rapid induction (~5-12 mins after IM injection) but the most prolonged recovery of the commonly used drugs (duration of action in cervids 80-90 mins and carnivores 3-6 hrs). Induction and recovery times may be decreased by combining Telazol® with xylazine. There is no reversal agent for Telazol®.

Ketamine, Controlled Substance

Ketamine is possibly the most versatile drug for chemical immobilization and has a wide safety margin. It is a cyclohexane (dissociative anesthetic) that can cause rough inductions and recoveries; thus, it should not be used alone. To minimize side effects and produce a relaxed anesthesia, ketamine is almost always combined with the sedative xylazine or a tranquilizer. Ketamine can be purchased under various brand names in 100 mg/ml concentrations (e.g. Ketaset, Vetalar). Higher concentrations are also available from compounding pharmacies. Ketamine is classified as a Schedule III drug under the DEA. Ketamine can be used to supplement or extend the duration of Telazol® or Telazol®/xylazine immobilizations. Because ketamine wears off quickly, sudden arousals may occur as ketamine is metabolized. There is no reversal agent for ketamine.

BAM, Controlled Substance

BAM is a compounded drug consisting of 27.3 mg/ml butorphanol, 9.1 mg/ml azaperone, and 10.9 mg/ml medetomidine. BAM is a Schedule IV drug under the DEA because of the butorphanol ingredient. Butorphanol is a synthetically derived opioid agonist-antagonist analgesic with a potency of about four to seven times that of morphine. Azaperone is a butyrophenone (tranquilizer). Medetomidine is an alpha-2 adrenoreceptor agonist (sedative). These three components of BAM act synergistically to affect sedation for handling sufficiently. The reversal of two components of the drug mixture can be done. Butorphanol is reversed with naltrexone, and medetomidine is reversed with atipamezole; both of these reversal drugs are included in the commercially available BAM kit. Azaperone is not reversible. BAM and its reversals should be administered according to the BAM Multi-Species Dosing Guide (Appendix 4). Complete induction may take up to 15 minutes.

Xylazine and other alpha-2 adrenoceptor agonists, Not a Controlled Substance

Alpha-2 adrenoceptor agonists (e.g. xylazine, detomidine, medetomidine, dexmedetomidine) are potent sedatives. Detomidine, medetomidine, and dexmedetomidine are used in the same manner but are much more potent than xylazine. All of these drugs alone do NOT produce anesthesia, and sedated animals are usually responsive to stimuli; in other words, they can suddenly arouse when subjected to painful procedures. The possibility of sudden arousal should also be considered when alpha-2 agonists are combined with ketamine; once the ketamine metabolizes, the animal is left only under the influence of the sedative, and chances of spontaneous arousal increase. BOW staff must be attentive to minimizing sight, sound, and touch. Dangerous animals, such as black bears, should not be chemically immobilized solely with xylazine. Brand names for xylazine include Rompun, Cervizine, and AnaSed. Some brands are available in concentrations of either 20 mg/ml for small animals or 100 mg/ml for large animals. Higher concentrations are also available from compounding pharmacies. Xylazine may be used to reconstitute Telazol® or in combination with Telazol® to minimize dart volumes, increase overall effectiveness, and decrease recovery time. The preferred antagonist for all alpha-2 adrenoreceptor agonists is atipamezole. However, yohimbine and tolazoline are still often used. Supplementary oxygen should always be considered in an immobilization protocol using these drugs.

Reversal Drugs:

Atipamezole, Not Controlled, Reversal Agent

Atipamezole is the most potent and selective alpha-2 adrenoreceptor antagonist and effectively reverses the effects of all alpha-2 adrenoreceptor sedatives; for this reason, it is the preferred reversal for alpha-2 adrenoreceptor agonists. Atipamezole is generally administered at a dose of 1 mg of atipamezole for every 10 mg of xylazine administered, or 5 mg of atipamezole for every 1 mg of medetomidine, or 10 mg atipamezole for every 1 mg dexmedetomidine. Atipamezole will effectively reverse alpha-2-associated bloat in ruminants. If ketamine has been used to supplement xylazine anesthesia, atipamezole should not

be administered for at least 40 minutes after the ketamine is injected to allow time for the ketamine to wear off because muscle tension and seizures can occur with ketamine alone.

Tolazoline, Not Controlled, Reversal Agent

Tolazoline hydrochloride reverses the sedation and analgesic effects of xylazine to speed up recovery so that an animal can be released sooner. As with atipamezole, tolazoline should not be administered for at least 40 minutes after ketamine is injected to allow for sufficient metabolism of ketamine. The calculated dose of tolazoline should be administered slowly by intravenous injection at a rate no faster than approximately 1 ml per second until the dose is complete. The onset of arousal is usually apparent within 5 minutes of tolazoline hydrochloride administration, depending on the depth and duration of xylazine-induced sedation. Tolazoline hydrochloride is available in a 100 mg/ml concentration. It can be injected into the muscle if necessary, but it will take longer to work. Like atipamezole, tolazoline will effectively reverse alpha-2 associated bloat in ruminants.

Naltrexone, Not Controlled, Reversal Agent

Naltrexone is the preferred reversal for opioids and is included in the BAM kit for the reversal of the butorphanol component.

Emergency Drugs:

Doxapram, Not Controlled, Respiratory Support

Doxapram (brand name Dopram) is a central nervous system stimulant used to stimulate breathing in an animal with very slow or absent breaths. The duration of action is brief (5-10 min), and thus, it may need to be repeated. Dopram is given at 0.5-2.0 mg/kg and can be repeated every 5 minutes up to a total dose of 2.0 mg/kg. Doxapram is ideally administered intravenously but can also be given sublingually (under the tongue) or intramuscularly.

Appendix 3

Drug Dosage Calculations

Accurate calculations are necessary to administer the proper amount of drug in any situation. You may prepare a chart in advance if you intend to frequently immobilize the same species with the same drugs (See Appendix 4 for examples).

To calculate the proper volume of drug, you must have 3 things:

1) Weight of the animal. You will need to estimate. If expressed in pounds, convert to kilograms by dividing the pounds by 2.2. For example, an animal that weighs 10 lbs weighs 4.5 kg (10 lbs ÷ 2.2 lbs/kg = 4.5 kg).

2) Dosage of drug needed. Usually expressed in milligrams per kilogram (mg/kg). In other words, what quantity (mass) of drug do I need to deliver per kilogram of animal? Common dosages for common species are included in Appendix 4.

Note: The weight of the animal and the dosage must always be expressed in the same units -both must either be in pounds or in kilograms. It is generally easier to convert the weight of the animal from pounds to kilograms.

3) Concentration of drug in the vial. Almost always expressed in milligrams per milliliter (mg/ml). For example, ketamine usually comes in 10 ml vials containing 1000 milligrams total, which is equal to 100 mg/ml.

Once you have these things available, calculating volume is a simple matter of doing the math using the following formula:

$$\frac{\text{Weight (kg)} \times \text{dosage (mg/kg)}}{\text{Concentration of the drug (mg/ml)}} = \text{Drug volume (ml)}$$

For example, the volume of Telazol® needed for a 7 kg raccoon:

1) Weight = 7 kg
2) Dosage of Telazol® for raccoon = 6 mg/kg
3) Telazol® = 100 mg/ml solution

So: $\frac{7 \text{ kg} \times 6 \text{ mg/kg}}{100 \text{ mg/ml}} = 0.42$ ml of Telazol®

Appendix 4

Drug Charts for Common Species

The following charts were made for your convenience and are based on the premise that the user has had significant training in the use of chemical immobilization for handling wildlife.

The charts are made based on the drug concentrations shown, but other concentrations may be available. Be in the habit of checking the label and concentration of the drug you are using EVERY TIME that you prepare to immobilize an animal.

Know the formula for calculating dosages and compare calculated dosages against a chart to see if it makes sense. See below or Appendix 3. Always double-check dosage charts against what you plan to use to make sure that it makes sense and that the dosage that the chart recommends corresponds with the concentration of drugs being used.

Ketamine can be used to supplement other drug protocols when there is a need to extend the time or depth of sedation. A maximum of two (2) doses of ketamine can be given in addition to the initial drug combination.

The effects of xylazine can be reversed, but the reversal agents are only effective for that specific drug and don't work on other drug types. If you use a combination of xylazine and Telazol® or xylazine and ketamine and administer the reversal for xylazine before the Telazol® or ketamine has worn off, the animal will remain under the influence of ketamine or Telazol® alone, which can be dangerous for you as well as harmful to the animal. Always check the recommended minimum waiting times before you reverse an animal.

Many of the smaller carnivore species can be dosed with Ketamine at 5 mg/kg combined with Xylazine at 1 mg/kg. Consult the *Handbook of Wildlife Chemical Immobilization*, Safe Capture manual, or other reference materials for the best immobilizing agents and dosages.

For drug combinations, the volume for each drug is calculated separately, and the drugs are combined into a single dart for delivery. The dart selected should be the smallest volume that fits the entire dose. If the calculated drug volume does not fill the dart completely, the remaining volume should be filled with sterile saline or sterile water.

Black Bear

Black Bear – Telazol®

NOTE: Dosages for Telazol® in black bears range from 4 – 7 mg/kg. The low dose option should be used for calm, captive bears, and the high dose for more fractious or free-ranging animals. For smaller volumes, the drug can be reconstituted at higher concentrations (see Telazol® Alternates 1 and 2).

TELAZOL®			
Reconstitute: 5 ml water mixed in vial with 572 mg Telazol® powder= 5.7 ml of solution; Telazol® concentration: 100 mg/ml			
Weight		Telazol® Volume (mL)	
Lbs.	Kg	**LOW** dose (mL) @ **4** mg/kg	**HIGH** dose (mL) @ **7** mg/kg
50	22.7	**0.9**	**1.6**
100	45.5	**1.8**	**3.2**
150	68.2	**2.7**	**4.8**
200	90.9	**3.6**	**6.4**
250	113.6	**4.5**	**7.9**
300	136.4	**5.5**	**9.5**

Black Bear – Telazol® Alternate 1 (> 38°F)

NOTE: At higher temperatures, Telazol® can be made more concentrated for lower dart volumes.

TELAZOL® ALTERNATIVE 1 (> 38°F)			
Reconstitute: 2.3 ml water mixed in vial with 572 mg Telazol® powder = 3.0 ml of solution; Telazol® concentration: 190.7 mg/ml			
Weight		Telazol® Volume (mL)	
Lbs.	Kg	**LOW** dose (mL) @ **4** mg/kg	**HIGH** dose (mL) @ **7** mg/kg
50	22.7	**0.5**	**0.8**
100	45.5	**1.0**	**1.7**
150	68.2	**1.4**	**2.5**
200	90.9	**1.9**	**3.3**
250	113.6	**2.4**	**4.2**
300	136.4	**2.9**	**5.0**
350	159.1	**3.3**	**5.8**
400	181.8	**3.8**	**6.7**
450	204.5	**4.3**	**7.5**
500	227.3	**4.8**	**8.3**
550	250.0	**5.2**	**9.2**

Black Bear – Telazol® Alternate 2 (> 60°F)

TELAZOL® ALTERNATIVE 2 (> 60°F)			
Reconstitute: 1.8 ml water mixed in vial with 572 mg Telazol® powder = 2.5 ml of solution; Telazol® concentration: 229 mg/ml			
Weight		Telazol® Volume (mL)	
Lbs.	Kg	**LOW** dose (mL) @ **4** mg/kg	**HIGH** dose (mL) @ **7** mg/kg
50	22.7	**0.4**	**0.7**
100	45.5	**0.8**	**1.4**
150	68.2	**1.2**	**2.1**
200	90.9	**1.6**	**2.8**
250	113.6	**2.0**	**3.5**
300	136.4	**2.4**	**4.2**
350	159.1	**2.8**	**4.9**
400	181.8	**3.2**	**5.6**
450	204.5	**3.6**	**6.3**
500	227.3	**4.0**	**6.9**
550	250.0	**4.4**	**7.6**
600	272.7	**4.8**	**8.3**
650	295.5	**5.2**	**9.0**

Black Bear – Telazol® + Xylazine

NOTE: This protocol yields smaller dart volumes by reconstituting the Telazol® with the xylazine. This protocol yields ~3 mg/kg Telazol® and 2 mg/kg xylazine.

TELAZOL® + XYLAZINE		
Reconstitute: 3.8 ml xylazine (@100 mg/ml) mixed in vial with 572 mg Telazol® powder = 4.5 ml of solution; Telazol® concentration 127 mg/ml, xylazine concentration 84 mg/ml		
Weight		Total Volume (mL)
Lbs.	Kg	Telazol® @127mg/ml Xylazine @ 84 mg/ml
50	22.7	**0.6**
100	45.5	**1.1**
150	68.2	**1.6**
200	90.9	**2.2**
250	113.6	**2.7**
300	136.4	**3.2**
350	159.1	**3.8**
400	181.8	**4.3**
450	204.5	**4.8**
500	227.3	**5.4**

Black Bear – Ketamine + Xylazine

NOTE: This chart includes options using standard or high-concentration formulations of both ketamine and xylazine.

KETAMINE + XYLAZINE					
Weight		Ketamine Volume (mL) @5 mg/kg		Xylazine Volume (mL) @1 mg/kg	
Lbs.	Kg	Ketamine @100 mg/ml	Ketamine @200 mg/ml	Xylazine @100 mg/ml	Xylazine @300 mg/ml
50	22.7	**1.1**	**0.6**	**0.23**	**0.08**
100	45.5	**2.3**	**1.1**	**0.45**	**0.15**
150	68.2	**3.4**	**1.7**	**0.68**	**0.23**
200	90.9	**4.5**	**2.3**	**0.91**	**0.30**
250	113.6	**5.7**	**2.8**	**1.1**	**0.38**
300	136.4	**6.8**	**3.4**	**1.4**	**0.45**
350	159.1	**8.0**	**4.0**	**1.6**	**0.53**
400	181.8	**9.1**	**4.5**	**1.8**	**0.61**
450	204.5	**10.2**	**5.1**	**2.0**	**0.68**
500	227.3	**11.4**	**5.7**	**2.3**	**0.76**
550	250.0	**12.5**	**6.3**	**2.5**	**0.83**
600	272.7	**13.6**	**6.8**	**2.7**	**0.91**

Black Bear Xylazine Reversal with Atipamezole

NOTE: Reverses xylazine only; wait 40 minutes after the last administration of ketamine before using. Doses are for 100 mg/ml xylazine.

XYLAZINE REVERSAL WITH ATIPAMEZOLE	
Atipamezole (Antisedan) Standard Concentration: 5 mg/ml	
Xylazine Given (mL)	Atipamezole (mL)
100 mg/ml	**Dosage 1 mg per 10 mg xylazine administered**
0.23	**0.46**
0.45	**0.90**
0.68	**1.4**
0.91	**1.8**
1.1	**2.2**
1.4	**2.8**
1.6	**3.2**
1.8	**3.6**
2.0	**4.0**
2.3	**4.6**
2.5	**5.0**
2.7	**5.4**

White-tailed Deer

White-tailed Deer – Telazol® + Xylazine

NOTE: Dosages for Telazol® in white-tailed deer range from 3.5 to 5 mg/kg. The low dose option below approximates 3.5 mg/kg Telazol® + 2.5 mg/kg xylazine. The high-dose option below approximates 5 mg/kg Telazol® + 2.5 mg/kg xylazine. In these examples, the Telazol® is reconstituted with water, and volumes of Telazol® and xylazine are calculated separately before being combined into one syringe. As with bears, the low dose option should be used for calm, captive deer, and the high dose for more fractious or free-ranging animals. At higher temperatures, Telazol® can be made more concentrated for lower dart volumes, following the same guidelines described above for bears.

TELAZOL® + XYLAZINE							
Reconstitute: 1.8 ml water mixed in vial with 572 mg Telazol® powder; Telazol® concentration: 229 mg/ml, xylazine concentration: 100 mg/ml							
Weight		**LOW** DOSE Telazol® + Xylazine (calm animals)			**HIGH** DOSE Telazol® + Xylazine (fractious or free-ranging animals)		
Lbs.	Kg	Telazol® (mL)	Xylazine (mL)	Total Volume (mL)	Telazol® (mL)	Xylazine (mL)	Total Volume (mL)
		LOW dose @ **3.5** mg/kg	**LOW** dose @ **2.5** mg/kg	**LOW DOSE**	**HIGH** dose @ **5.0** mg/kg	**HIGH** dose @ **2.5** mg/kg	**HIGH DOSE**
75	34.1	0.5	0.9	**1.4**	0.7	0.9	**1.6**
100	45.5	0.7	1.1	**1.8**	1.0	1.1	**2.1**
125	56.8	0.9	1.4	**2.3**	1.2	1.4	**2.6**
150	68.2	1.0	1.7	**2.7**	1.5	1.7	**3.2**
175	79.5	1.2	2.0	**3.2**	1.7	2.0	**3.7**
200	90.9	1.4	2.3	**3.7**	2.0	2.3	**4.3**

White-tailed Deer – Ketamine + Xylazine

NOTE: A combination of ketamine and xylazine can be used to immobilize tame deer. For older animals, 3 mg/kg ketamine plus 2.5 mg/kg xylazine is often sufficient. For younger deer or mildly excited penned deer, 6 mg/kg ketamine plus 2.5 mg/kg xylazine may be used.

Tame deer >1 year old

KETAMINE + XYLAZINE				
Ketamine concentration 100 mg/ml Xylazine concentration 100 mg/ml				
Weight		Ketamine (mL)	Xylazine (mL)	
Lbs.	Kg	@**3** mg/kg	@**2.5** mg/kg	Total Volume (mL)
75	34.1	1.0	0.9	**1.9**
100	45.5	1.4	1.1	**2.5**
125	56.8	1.7	1.4	**3.1**
150	68.2	2.0	1.7	**3.7**
175	79.5	2.4	2.0	**4.4**
200	90.9	2.7	2.3	**5.0**

Tame deer <1 year old or mildly excited penned deer

KETAMINE + XYLAZINE				
Ketamine concentration 100 mg/ml Xylazine concentration 100 mg/ml				
Weight		Ketamine (mL)	Xylazine (mL)	
Lbs.	Kg	@**6** mg/kg	@**2.5** mg/kg	Total Volume (mL)
25*	11.4	0.7	0.3	**1.0**
50*	22.7	1.4	0.6	**2.0**
75	34.1	2.0	0.9	**2.9**
100	45.5	2.7	1.1	**3.8**
125	56.8	3.4	1.4	**4.8**
150	68.2	4.1	1.7	**5.8**
175	79.5	4.8	2.0	**6.8**
200	90.9	5.5	2.3	**7.8**

*Remote delivery systems using explosive charges are not appropriate for animals this small; air-powered systems should be used.

White-tailed Deer – Xylazine Reversal with Tolazoline or Atipamezole

NOTE: Reverses xylazine only. Wait 40 minutes after the last ketamine dose to administer. Yohimbine is not consistently effective in white-tailed deer and moose.

XYLAZINE REVERSAL WITH TOLAZOLINE		
Tolazoline Standard Concentration: 100 mg/ml		
Weight		Tolazoline (mL)
Lbs.	Kg	**3** mg/kg administered IV or IM
25	11.4	**0.3**
50	22.7	**0.7**
75	34.1	**1.0**
100	45.5	**1.4**
125	56.8	**1.7**
150	68.2	**2.0**
175	79.5	**2.4**
200	90.9	**2.7**

XYLAZINE REVERSAL WITH ATIPAMEZOLE	
Atipamezole (Antisedan) Standard Concentration: 5 mg/ml	
Xylazine Given (mL)	Atipamezole (mL)
100 mg/ml	**Dosage 1 mg per 10 mg xylazine administered**
0.3	**0.6**
0.6	**1.2**
0.9	**1.8**
1.1	**2.2**
1.4	**2.8**
1.7	**3.4**
2.0	**4.0**
2.3	**4.6**

Moose

Moose – Telazol® + Xylazine

NOTE: This protocol yields smaller dart volumes by reconstituting the Telazol® with the xylazine. This protocol yields ~3 mg/kg Telazol and 1.5 mg/kg xylazine.

TELAZOL® + XYLAZINE		
Reconstitute: 2.8 ml xylazine (@100 mg/ml) mixed in vial with 572 mg Telazol® powder = 3.5 ml of solution; Telazol® Concentration: 163 mg/ml, xylazine Concentration: 80 mg/ml		
Weight		Total Volume (mL)
Lbs.	Kg	Telazol® @163 mg/ml Xylazine @ 80 mg/ml
300	136.4	**2.5**
400	181.8	**3.4**
500	227.3	**4.2**
600	272.7	**5.0**
700	318.2	**5.8**
800	363.6	**6.7**
900	409.1	**7.5**
1000	454.5	**8.4**
1100	500.0	**9.3**
1200	545.5	**10.0**

Moose – Xylazine Reversal with Tolazoline

NOTE: Reverses xylazine only. Wait 40 minutes after the last ketamine dose to administer. Yohimbine is not consistently effective in white-tailed deer and moose.

®XYLAZINE REVERSAL WITH TOLAZOLINE		
Tolazoline Standard Concentration: 100 mg/ml		
Weight		Tolazoline (mL)
Lbs.	Kg	**3** mg/kg administered IV or IM
300	136.4	**4.1**
400	181.8	**5.5**
500	227.3	**6.8**
600	272.7	**8.2**
700	318.2	**9.5**
800	363.6	**10.9**
900	409.1	**12.2**
1000	454.5	**13.6**
1100	500.0	**15.0**
1200	545.5	**16.4**

Marten

Marten – Telazol®

TELAZOL®	
Reconstitute: 5 ml water mixed in vial with 572 mg Telazol® powder; Telazol® Standard Concentration: 100 mg/ml	
Weight	Telazol® (mL)
Lbs. / Kg	**8** mg/kg administered IM
0.9 / 0.4	**0.03**
1.1 / 0.5	**0.04**
1.3 / 0.6	**0.05**
1.5 / 0.7	**0.06**
1.8 / 0.8	**0.06**
2.0 / 0.9	**0.07**
2.2 / 1.0	**0.08**

Marten – Ketamine + Xylazine

KETAMINE + XYLAZINE				
Ketamine concentration 100 mg/ml Xylazine concentration 100 mg/ml				
Weight		Ketamine (mL)	Xylazine (mL)	
Lbs.	Kg	@**18** mg/kg	@**1.6** mg/kg	Total Volume (mL)
0.9	0.4	0.07	0.01	**0.08**
1.1	0.5	0.09	0.01	**0.10**
1.3	0.6	0.11	0.01	**0.12**
1.5	0.7	0.13	0.01	**0.14**
1.8	0.8	0.14	0.01	**0.15**
2.0	0.9	0.16	0.01	**0.17**
2.2	1.0	0.18	0.02	**0.20**

Marten – Xylazine reversal with Tolazoline

XYLAZINE REVERSAL WITH TOLAZOLINE	
Tolazoline Standard Concentration: 100 mg/ml	
Weight	Tolazoline (mL)
Lbs. / Kg	**3** mg/kg administered IV or IM
0.9 / 0.4	**0.01**
1.1 / 0.5	**0.02**
1.3 / 0.6	**0.02**
1.5 / 0.7	**0.02**
1.8 / 0.8	**0.02**
2.0 / 0.9	**0.03**
2.2 / 1.0	**0.03**

Marten – Xylazine reversal with Atipamezole

XYLAZINE REVERSAL WITH ATIPAMEZOLE	
Atipamezole (Antisedan) Standard Concentration: 5 mg/ml	
Xylazine Given (mL)	Atipamezole (mL)
100 mg/ml	**Dosage 1 mg per 10 mg xylazine administered**
0.01	**0.02**
0.02	**0.04**

Fisher

Fisher – Ketamine + Xylazine

KETAMINE + XYLAZINE				
Ketamine concentration 100 mg/ml Xylazine concentration 100 mg/ml				
Weight		Ketamine (mL)	Xylazine (mL)	
Lbs.	Kg	@**25.7** mg/kg	@**5.35** mg/kg	Total Volume (mL)
5	2.3	0.59	0.12	**0.71**
7	3.2	0.82	0.17	**0.99**
9	4.1	1.05	0.22	**1.27**
11	5.0	1.29	0.27	**1.56**
13	5.9	1.52	0.32	**1.84**
15	6.8	1.75	0.36	**2.11**

Fisher – Xylazine reversal with Atipamezole

NOTE: Reverses xylazine only; wait 40 minutes after last ketamine dose to administer. Calculations using 100 mg/ml xylazine.

XYLAZINE REVERSAL WITH ATIPAMEZOLE	
Atipamezole (Antisedan) Standard Concentration: 5 mg/ml	
Xylazine Given (mL)	Atipamezole (mL)
100 mg/ml	**Dosage 1 mg per 10 mg xylazine administered**
0.12	0.24
0.17	0.34
0.22	0.44
0.27	0.54
0.32	0.64
0.36	0.72

Bobcat, Coyote, and Raccoon

Bobcat/Raccoon – Telazol®

TELAZOL®		
Reconstitute: 5 ml water mixed in vial with 572 mg Telazol® powder; Telazol® Standard Concentration: 100 mg/ml		
Weight		Telazol® (mL)
Lbs.	Kg	**6** mg/kg administered IM
5	2.3	**0.14**
7.5	3.4	**0.20**
10	4.5	**0.27**
12.5	5.7	**0.34**
15	6.8	**0.40**
17.5	8.0	**0.48**
20	9.0	**0.54**
25	11.4	**0.68**
30	13.6	**0.82**
35	16.0	**0.96**
40	18.2	**1.09**
45	20.5	**1.23**
50	22.7	**1.36**

Coyote – Telazol®

TELAZOL®		
Reconstitute: 5 ml water mixed in vial with 572 mg Telazol® powder Telazol® Standard Concentration: 100 mg/ml		
Weight		
Lbs.	Kg	Telazol® **10** mg/kg administered IM
5	2.3	0.2
7.5	3.4	0.3
10	4.5	0.5
12.5	5.7	0.6
15	6.8	0.7
17.5	8.0	0.8
20	9.0	0.9
25	11.4	1.1
30	13.6	1.4
35	16.0	1.6
40	18.2	1.8
45	20.5	2.1
50	22.7	2.3
55	25	2.5
60	27.3	2.7

Bobcat – Ketamine + Xylazine

KETAMINE + XYLAZINE				
Ketamine concentration 100 mg/ml Xylazine concentration 100 mg/ml				
Weight		Ketamine (mL)	Xylazine (mL)	
Lbs.	Kg	@**10** mg/kg	@**1** mg/kg	Total Volume (mL)
5	2.3	0.2	0.02	**0.22**
10	4.5	0.5	0.05	**0.55**
15	6.8	0.7	0.07	**0.77**
20	9.1	0.9	0.09	**0.99**
25	11.4	1.1	0.11	**1.2**
30	13.6	1.4	0.14	**1.5**
35	15.9	1.6	0.16	**1.8**
40	18.2	1.8	0.18	**2.0**
45	20.5	2.1	0.21	**2.3**
50	22.7	2.3	0.23	**2.5**

Bobcat – Xylazine reversal with Atipamezole

NOTE: Reverses xylazine only; wait 40 minutes after last ketamine dose to administer. Calculations using 100 mg/ml xylazine.

XYLAZINE REVERSAL WITH ATIPAMEZOLE	
Atipamezole (Antisedan) Standard Concentration: 5 mg/ml	
Xylazine Given (mL)	Atipamezole (mL)
100 mg/ml	**Dosage 1 mg per 10 mg xylazine administered**
0.02	0.04
0.05	0.10
0.07	0.14
0.09	0.18
0.11	0.22
0.14	0.28
0.16	0.32
0.18	0.36
0.21	0.42
0.23	0.46

Raccoon – Ketamine + Xylazine

KETAMINE + XYLAZINE				
Ketamine concentration 100 mg/ml Xylazine concentration 100 mg/ml				
Weight		Ketamine (mL)	Xylazine (mL)	
Lbs.	Kg	@**20** mg/kg	@**4** mg/kg	Total Volume (mL)
5	2.3	0.5	0.1	**0.6**
7.5	3.4	0.7	0.1	**0.8**
10	4.5	0.9	0.2	**1.1**
12.5	5.7	1.1	0.2	**1.3**
15	6.8	1.4	0.3	**1.7**
17.5	8.0	1.6	0.3	**1.9**
20	9.1	1.8	0.4	**2.2**
25	11.4	2.3	0.5	**2.8**
30	13.6	2.7	0.5	**3.2**

Raccoon – Xylazine reversal with Atipamezole

NOTE: Reverses xylazine only; wait 40 minutes after last ketamine dose to administer. Calculations using 100 mg/ml xylazine.

XYLAZINE REVERSAL WITH ATIPAMEZOLE	
Atipamezole (Antisedan) Standard Concentration: 5 mg/ml	
Xylazine Given (mL)	Atipamezole (mL)
100 mg/ml	**Dosage 1 mg per 10 mg xylazine administered**
0.1	**0.2**
0.2	**0.4**
0.3	**0.6**
0.4	**0.5**
0.5	**1.0**

Coyote – Ketamine + Xylazine

KETAMINE + XYLAZINE				
Ketamine concentration 100 mg/ml Xylazine concentration 100 mg/ml				
Weight		Ketamine (mL)	Xylazine (mL)	
Lbs.	Kg	@**4** mg/kg	@**2** mg/kg	Total Volume (mL)
5	2.3	0.1	0.05	**0.15**
10	4.5	0.2	0.1	**0.3**
15	6.8	0.3	0.1	**0.4**
20	9.1	0.4	0.2	**0.6**
25	11.4	0.5	0.2	**0.7**
30	13.6	0.5	0.3	**0.8**
35	15.9	0.6	0.3	**0.9**
40	18.2	0.7	0.4	**1.1**
45	20.5	0.8	0.4	**1.2**
50	22.7	0.9	0.5	**1.4**
55	25.0	1.0	0.5	**1.5**
60	27.3	1.1	0.6	**1.7**

Coyote – Xylazine reversal with Atipamezole

NOTE: Reverses xylazine only; wait 40 minutes after last ketamine dose to administer. Calculations using 100 mg/ml xylazine.

XYLAZINE REVERSAL WITH ATIPAMEZOLE	
Atipamezole (Antisedan) Standard Concentration: 5 mg/ml	
Xylazine Given (mL)	Atipamezole (mL)
100 mg/ml	**Dosage 1 mg per 10 mg xylazine administered**
0.05	**0.1**
0.1	**0.2**
0.2	**0.4**
0.3	**0.6**
0.4	**0.8**
0.5	**1.0**
0.6	**1.2**

BAM Supplemental

Multi-Species

Species	To IMMOBILIZE	To REVERSE	
	mL of BAM	mL of 25 mg/ml Atipamezole	mL of 50 mg/ml Naltrexone
Black Bear (~250lbs)	1.0 - 2.0	2.0 - 4.0	0.5
Bobcat	0.2 - 0.3	0.4 - 0.6	0.5
Coyote	0.2	0.4	0.5
Fisher	0.1	0.2	0.5
Red Fox	0.1	0.2	0.5
Moose (mature bull)	2.0	4.0	0.5
Moose (mature cow)	1.7	3.4	0.5
Raccoon	0.2	0.4	0.5
White-tailed Deer (buck)	1.5 - 2.5	3.0 - 5.0	0.5
White-tailed Deer (doe)	1.0 – 1.5	2.0 - 3.0	0.5
White-tailed Deer (fawn)	0.3 - 0.5	0.6 - 1.0	0.25

Ketamine Supplemental

NOTE: Ketamine can be used up to **twice** to extend the duration of the anesthetic effect from Telazol®. Given IM or IV.

Small mammals (2.0 mg/kg)

KETAMINE SUPPLEMENTAL		
Ketamine Standard Concentration: 100 mg/ml		
Weight		Ketamine (mL)
Lbs.	Kg	**2.0** mg/kg
1.1	0.5	**0.01**
2.2	1.0	**0.02**
5	2.3	**0.05**
7	3.2	**0.06**
9	4.1	**0.08**
11	5.0	**0.10**
13	5.9	**0.12**
15	6.8	**0.14**

Large mammals (2.2 mg/kg)

KETAMINE SUPPLEMENTAL				***KETAMINE SUPPLEMENTAL***		
Ketamine Standard Concentration: 100 mg/ml				Ketamine Standard Concentration: 100 mg/ml		
Weight		Ketamine (mL)		Weight		Ketamine (mL)
Lbs.	Kg	**2.2** mg/kg		Lbs.	Kg	**2.2** mg/kg
50	22.7	**0.5**		550	250.0	**5.5**
100	45.5	**1.0**		600	272.7	**6.0**
150	68.2	**1.5**		650	295.5	**6.5**
200	90.9	**2.0**		700	318.2	**7.0**
250	113.6	**2.5**		800	363.6	**8.0**
300	136.4	**3.0**		900	409.1	**9.0**
350	159.1	**3.5**		1000	454.5	**10.0**
400	181.8	**4.0**		1100	500.0	**11.0**
450	204.5	**4.5**		1200	545.5	**12.0**
500	227.3	**5.0**				

Doxapram

**For respiratory system assistance, not for immobilization*

NOTE: Doxapram is ideally administered intravenously but can also be given sublingual (under the tongue) or intramuscularly.

Small mammal (5.5 – 11 mg/kg); can be repeated once after 15 minutes.

DOXAPRAM		
Doxapram Standard Concentration: 20 mg/ml		
Weight		Doxapram (mL)
Lbs.	Kg	**5.5** mg/kg
1.1	0.5	**0.14**
2.2	1.0	**0.28**
5	2.3	**0.63**
7	3.2	**0.88**
9	4.1	**1.13**
11	5.0	**1.38**
13	5.9	**1.62**
15	6.8	**1.87**

Large mammal (0.5-1.0 mg/kg); can be repeated in 5-minute intervals for a maximum dose of 2 mg/kg.

DOXAPRAM				***DOXAPRAM***		
Doxapram Standard Concentration: 20 mg/ml				Doxapram Standard Concentration: 20 mg/ml		
Weight		Doxapram (mL)		Weight		Doxapram (mL)
Lbs.	Kg	**1** mg/kg		Lbs.	Kg	**1** mg/kg
50	22.7	**1.1**		500	227.3	**11.4**
100	45.5	**2.3**		600	272.7	**13.6**
150	68.2	**3.4**		700	318.2	**15.9**
200	90.9	**4.5**		800	363.6	**18.2**
250	113.6	**5.7**		900	409.1	**20.5**
300	136.4	**6.8**		1000	454.5	**22.7**
350	159.1	**8.0**		1100	500.0	**25.0**
400	181.8	**9.1**		1200	545.5	**27.3**

Appendix 5

Complications and Treatments

Respiratory Depression or Arrest

Once sedated, animals may have a reduced breathing rate, and respiratory depression/arrest are some of the most common complications of chemical immobilization. It is important to monitor the respiratory rate, respiratory quality, and color of the gums (blue or purple color may indicate a lack of oxygen) at least every 5 minutes. Ensure the airway is open and the animal is positioned so that it can breathe with ease. Monitor for bloat, which can cause respiratory depression.

Prevention/Treatment:

- Ensure patent airway (neck is not kinked, no foreign objects or vomitus blocking the airway)
- Administer oxygen
- Treat with Doxapram injectable (See Appendix 4 for chart). Doxapram is ideally administered intravenously but can also be given sublingual (under the tongue) or intramuscularly.
- If an animal stops breathing completely, the anesthetic should be immediately reversed, and artificial ventilation (chest compressions, endotracheal tube if experienced) should be performed.
- Acupuncture can stimulate breathing in anesthetized animals. Insert a needle between and just below the nostrils on the nose.
- Physically stimulating an animal (moving the legs, turning it over, inserting a needle tip into the nose surface) may also help improve respiratory rate.

Hypothermia (Low temperature)

Hypothermia refers to a low body temperature. For practical purposes, hypothermia should be considered and addressed when body temperatures are >2◦C (3.6◦F) below normal for that species. A rectal thermometer should be used to monitor the trend in the temperature; if the temperature starts falling steadily, start corrective measures before the temperature is below the safe range. Chemically immobilized animals can easily become hypothermic in wet and cold weather because immobilizing drugs, such as xylazine, impair thermoregulation and enhance heat loss. In addition, a sedated animal is usually incapable of shivering for heat production. Strive to keep chemically immobilized animals warm and dry in cold conditions. Prolonged heat loss can result in shock, leading to death. Low body temperatures will also slow the metabolism of immobilizing drugs, contributing to longer immobilization.

Prevention/Treatment:

- Increase insulation between the animal and the ground.
- Be proactive in cold weather and cover the animal with blankets or old sleeping bags. Small animals can be worked up inside a pop-up tent.
- Warm small and medium-sized species with hot water bottles, chemical heat packs, or heaters.
- Administer the reversal agent if one is available and end the procedure if the body temperature is not responding to treatment.

Hyperthermia (High temperature)

Hyperthermia refers to a high body temperature. It is one of the most common veterinary emergencies and is a significant cause of mortality in captured wildlife, particularly large, dark-haired animals. Hyperthermia can occur even in cool or cold weather conditions. For practical purposes, hyperthermia should be considered and addressed when body temperatures are >2°C (3.6°F) above normal for that species. A rectal thermometer should be used to monitor the trend in the temperature; if the temperature starts climbing steadily, start corrective measures before the temperature is above the safe range. With extreme hyperthermia (above 106° F in most mammals), oxygen demand is higher than the body can provide, leading to brain, liver, and kidney damage. Hyperthermia is associated with a rapid heart rate, an irregular pulse, and rapid, shallow breathing.

High body temperatures can be caused by internal and external heat sources. Internal heat sources include physical exertion during capture and muscle tension produced by ketamine or tiletamine. External heat sources include warm weather, sunlight, and human contact. Immobilizing drugs frequently increase the potential of hyperthermia by impairing thermoregulation.

Minimize risk of hyperthermia by minimizing the animal's physical activity during capture and drug delivery.

Prevention/Treatment:

- Provide shade for the animal.
- Cool the animal:
  - Position a warm animal on its chest directly on the cool ground, exposing armpits and groin to cool soil.
  - Apply ice packs, cold water, or isopropyl alcohol to the armpits, groin, and/or foot pads.
  - Wet the animal down thoroughly with water, making sure the water reaches the skin.
  - Administer a cold-water enema.
- Administer the reversal agent if one is available and end the procedure if the temperature cannot be controlled.

Monitor the body temperature closely, and do not over-cool the animal. Stop treatment when the body temperature decreases to the high end of the species' optimal temperature zone.

Bloat

Bloat can occur in ruminants such as deer and, to a lesser degree, in other mammals. It is an accumulation of gas in the rumen or stomach that can rapidly become life-threatening. Bloat is associated with an inability to belch due to poor body position or xylazine sedation. The most obvious sign of bloat is a distended abdomen. This is visible on the animal's left side behind the last rib. Respiration is shallow and rapid, and the pulse is weak or irregular. Bloat is often life-threatening and must be treated as soon as it is observed.

Prevention/Treatment:

- Keep the animal sternal with the neck straight and chin extended.
- Pull the tongue forward and off to the side, preventing obstruction of the esophagus.
- Pass a stomach tube (if experienced).
- Administer the reversal agent if one is available if not resolving.

Vomiting/Aspiration

Vomiting and the subsequent inhalation of stomach contents (aspiration) is a serious veterinary emergency that must be addressed immediately. Xylazine immobilization, physical exertion and excitement, or poor body position can cause regurgitation. When an animal regurgitates, personnel must quickly clear the mouth to prevent the stomach contents from being inhaled. If the animal inhales its stomach contents, a likely consequence is pneumonia, which can be life-threatening.

Reduce the risk of vomiting or aspiration by minimizing the animal's excitement and stress during capture and drug delivery.

Prevention/Treatment:

- Monitor the animal closely for regurgitation, especially if xylazine is used.
- Listen to the animal's breathing for gurgling sounds indicating fluid or partial obstruction of the trachea.
- If vomiting occurs, position animal on its stomach with its head and neck down, allowing stomach contents and saliva to flow away from the larynx.
- Examine the mouth thoroughly and clear all debris.

Shock

Shock is a circulatory compromise or failure. It is safe to assume that all captured animals are in some degree of shock. Shock is most pronounced in animals that have undergone a stressful or strenuous capture. Physical exertion, physiological and psychological stress, hypothermia, chemical immobilization, and blood loss can cause shock. Signs of shock include a rapid heart rate, hyperventilation (which may be masked by immobilizing drugs), and low blood pressure (as indicated by a weak, irregular pulse and slow capillary refill time).

Even though effective treatment of shock is difficult without veterinary assistance, identifying shock is important, so BOW staff can learn how to better prevent it in subsequent field operations.

Prevention/Treatment:

- Minimize additional stress of immobilized animal. Remember that stressful stimuli can be in the form of sight, sound, and touch.
- Monitor TPR and attempt to keep these within healthy ranges.
- Do not use any additional immobilizing drugs.
- Administer the antagonist if it is available.
- Revive and release the animal as soon as possible.

Injuries

- The basic treatment for a wound is to clean it, then treat it with a topical antibiotic. All wounds should be flushed with either dilute povidone-iodine (Betadine®) solution (1:10 dilution), dilute chlorhexidine (Nolvasan®) solution (1:40 dilution), or sterile saline. Wounds should be flushed repeatedly to remove as much dirt or debris as possible. A topical antibiotic may then be applied.
- Bleeding can be controlled with direct pressure, following human first aid procedures.
- The hair around the wound should be trimmed to prevent the hair from matting over the wound. Wounds should be left open to some extent so they can drain.

- Injectable antibiotics may be administered but should not be used without previous discussion with the WHP Wildlife Veterinarian.
- Never release an animal with a bandage.

In some situations, injured or compromised animals can be transported to a veterinarian or rehabilitation facility. BOW staff should have a list of rehabilitators in the Region who can accept certain species.

Seizures

Seizures may occur during chemical immobilization, most commonly as a result of ketamine administration. Seizures are typically a single, short (<2 mins) episode that will not harm the animal. Repetitive or long-lasting seizures may result in hyperthermia if left untreated. The temperature of the animal should be closely monitored, and the area around the animal should be kept quiet and dark.

Treatment

- If available, administer 2.5 – 5 mg midazolam. Midazolam should be given IV if possible, but may also be given intramuscularly at the same dose or intranasally at 0.2 mg/kg.
- If the seizures are due to ketamine and are recurring, a sedative like an alpha-2 adrenoceptor agonist can be added to the protocol.

Capture Myopathy

Capture myopathy is a metabolic condition that results from intense muscular exertion/damage and prolonged stress. Clinical signs of capture myopathy can occur during the capture or hours or even days later. Signs include shivering, rapid breathing, hyperthermia, weakness, incoordination, recumbence, and sudden death. Treatment of capture myopathy is rarely successful, and prevention is key (limit chase and handling intensity and duration, limit stress).

Appendix 6

Standardized Inventory and Medical Record Forms

Drug Inventory Sheet

Region ______ Bureau of Wildlife
Immobilization Drug Running Inventory

Inventory Location: ______________________

Substance: *Ketamine, measured in milligrams (mg)*   In Stock (# vials/volume): _________________

Serial #	Lot/Exp	Use Date	mg Add	mg Sub.	Disposition	Signature	Total mg

Serial #	Lot/Exp	Use Date	mg Add	mg Sub.	Disposition	Signature	Total mg

Serial #	Lot/Exp	Use Date	mg Add	mg Sub.	Disposition	Signature	Total mg

Serial #	Lot/Exp	Use Date	mg Add	mg Sub.	Disposition	Signature	Total mg

Region ______ Bureau of Wildlife
Immobilization Drug Running Inventory

Inventory Location: ______________________

Substance: *Telazol, measured in milligrams (mg)*   In Stock (# vials/volume): _________________

Serial #	Lot/Exp	Use Date	mg Add	mg Sub.	Disposition	Signature	Total mg

Serial #	Lot/Exp	Use Date	mg Add	mg Sub.	Disposition	Signature	Total mg

Serial #	Lot/Exp	Use Date	mg Add	mg Sub.	Disposition	Signature	Total mg

Serial #	Lot/Exp	Use Date	mg Add	mg Sub.	Disposition	Signature	Total mg

BLACK BEAR IMMOBILIZATION FIELD RECORDS

Date:_____ Processed By:_____

Capture Method: □ Den □ Trap □ Snare □ Free Dart New Capture: Yes No

County:_____ Town:_____

Specific Location: _____

_____

GPS Location: Latitude:_____ Longitude:_____

Release Location:_____

Release GPS Latitude:_____ Release GPS Longitude:_____

1st Dose ☐	2nd Dose ☐	3rd Dose ☐	Reversal ☐
Drug used	Drug used	Drug used	Drug used
Mg/Ml	Mg/Ml	Mg/Ml	Mg/Ml
Dose	Dose	Dose	Dose
Injection Time	Injection Time	Injection Time	Injection Time
Down Time	Down Time	Down Time	
#Vials Used	#Vials Used	#Vials Used	Release Time

Vital Signs: Pulse:(14-23b/15sec)_____ Temp:(100F/37.8C)_____ Respiration:(5-8breaths/15sec)_____

Sex: Male Female

Age: Adult Cub

Total Length

Girth

Weight

Cubs present ☐

# of cubs

Lactating ☐

Description of cubs:

_____
_____
_____
_____
_____

Tooth sample: Yes No

Tag #

Hair sample: Yes No

Tattoo #

Collar Frequency

VHF ☐ Satellite ☐

Notes:

_____
_____
_____
_____
_____

General Immobilization Record

Date:_____ **Crew:**_____

County:_____ **Town:**_____

Location Details:_____

GPS Coordinates:_____

Situation: ☐ Nuisance ☐ Relocation ☐ Euthanasia ☐Study

☐ Injured / Sick ☐ Rehab ☐ Other_____

Species: ☐ Bear ☐ Deer ☐ Moose ☐ Other:_____

Weather	
Ambient Temperature	
Cloud Cover (%)	
Precipitation	

Age: ☐ Adult (≥2 years) ☐ Yearling (1-2 years) ☐ Young of year (<1 year) **Sex:** ☐Male ☐Female (Lactating Y / N)

Drug Dosage Information							
Injection	*Method	Time	Drug Name	Volume (ml)	Type	Location Given	Est. Dist. Darted (m)
1	D SP HI				IV IM		
2	D SP HI				IV IM		
3	D SP HI				IV IM		
4	D SP HI				IV IM		
5	D SP HI				IV IM		
6	D SP HI				IV IM		
7	D SP HI				IV IM		
8	D SP HI				IV IM		

*Method: D = Dart; SP = Syringe Pole; HI = Hand Inject

Dart Recovered: ☐ Yes **Eye Salve:** ☐ Yes **Face Mask:** ☐ Yes **Supplemental O_2:** ☐ Yes

Vitals (Every 10-15 min.)					
Interval	Time	Temp.	Pulse (beats/min)	Resp (breaths/min)	*C.R.T. (seconds)
1					
2					
3					
4					
5					
6					
7					
8					

*C.R.T: Capillary Refill Time

Measurements (cm)	
Est. Weight	
Actual Weight	
Girth (behind front legs)	
*Total Length	

*Bear-Nose tip to tail base, Moose-Top lip edge to tail base

Normal Vital Ranges				
Species	Temp. (F)	Pulse (beats/min)	Resp. (breaths/min)	C.R.T. (sec.)
Bear	99.6 – 101	60-90	15-30	0-1
Deer	100-102	70-80	16-20	0-1
Moose	101-102	60-90	8-12	1-2

Tags				
Tag	Type (circle one)	Color	Number	Ear (circle one)
1	Metal Plastic			Left Right
2	Metal Plastic			Left Right
3	Metal Plastic			Left Right
4	Metal Plastic			Left Right

Telemetry Information

Manufacturer:_____

Serial #: _____

Frequency:_____

Magnet removed: ☐ Yes

Device working before release: ☐ Yes

Tattoo Number:_____

Samples Collected		
Sample Type	Location of sample	Notes
Tooth		
Blood		
Skin		
Hair		
Parasites		Type:
Feces	N\A	
Other		

Other Capture Notes (i.e body condition, injuries, unique markings, abnormal behavior, etc.)

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Release Information

Date:_____ **Time:**_____ **County:**_____

Town:_____ **GPS Coordinates:**_____

Location Details:_____

Release Notes:_____

_____

_____

_____

_____

Checklist for Accidental Human Exposure of Animal Immobilization Drugs

For use by responding personnel, on-scene personnel, and NYSDEC dispatch

Name of Individual Exposed: _____ (DO NOT RELAY OVER RADIO)

Age: _____ Sex: _____ Weight: _____

Time of Exposure: _____ Date of Exposure: _____

Location of Incident: _____

Exposed to (mark all that apply, and indicate approximate amount exposed to):

Drug exposed to: _____

Volume Exposed to: ____ ml Concentration: ____ mg/ml Amount Exposed to: ____ mg

Where on the Body was Individual Exposed? _____

How was the Individual Exposed? (Circle One)

SPLASH SYRINGE & NEEDLE DART POLE SYRINGE

Notes on Individual's Reactions to Drugs:

_____

_____

_____

_____

_____

_____

_____

_____

Appendix 7

Recommended Training

Annual Chemical Immobilization Refresher Training Outline

Time	*Topic*	*Presenter*
30 minutes	Record keeping and drug storage • What we have • Where it's stored and the legal requirements • What you must record and when	RWM or CIC
30 minutes	Supplies and equipment • Overview of what's on hand including drugs and their schedule	RWM or CIC
60 minutes	Delivery systems (Region specific) • Go over each type of delivery system including how they operate, care, and maintenance	RWM or CIC
30 minutes	Animal handling and care • What to monitor • Typical vital signs • Body positioning • Common concerns (hypo/hyperthermia, etc.) • Tagging	RWM or CIC
30 minutes	Drug selection and recommended dosages • Drug descriptions • Review charts of recommended dosages • Practice calculating dosages (estimate weight, pick dose, calculate volumes)	RWM or CIC and group
30 minutes	Hands-on dart/syringe loading exercise • Proper PPE	RWM or CIC and group
120 minutes	Live fire range exercise • Need for technique charts • Range estimation • Range time with all projectors	Group
30 minutes	Response to human emergencies • What to do in case of accidental exposure	RWM or CIC

RWM = Regional Wildlife Manager CIC = Chemical Immobilization Coordinator

Appendix 8

Human Safety

General Response and Treatments

- Immediately contact 911 and NYSDEC dispatch to alert them of the situation.
- Keep the exposed individual calm and relaxed.
- Do not leave a patient unattended unless it is critically necessary to rescue efforts (e.g. getting cell service or radio signal in a remote setting).
- Reduce stimuli of any kind to the individual.
- Be prepared to warm up or cool down the individual exposed – some drugs can interfere with thermoregulation.
- If possible, transport the individual to the nearest medical center as soon as possible.
- Loosen or remove any restrictive clothing or objects.
- Monitor vitals (heart rate, respiration, temperature).
- Locate your first aid kit and equipment for artificial resuscitation.
- Do not remove the dart if it is stuck in the person; this will prevent exposure of others and minimize blood loss.
- Airway control – make sure that the individual is comfortable and can breathe with ease. Loosen or remove restrictive clothing, if necessary.
- Flush exposed area with lots of cool water, especially if the area contains a mucous membrane (mouth, nose, or eye) or wound.
- Fill out the accidental exposure checklist (Appendix 6). Make sure to note the time of exposure.
- If the individual has to be transported to a hospital or other medical center, make sure that the drug information packet and SDS from the drug kit both accompany the individual.

Instructions for On-Scene Personnel

- Notify 911 and DEC Dispatch at (518) 408-5850 immediately. Dispatch will notify EMS. Make sure to notify them which medical centers in the area have been contacted that will accept and know how to treat accidental exposure.
- Treatments for specific drugs can be found within the SDS.
- Wildlife personnel are instructed to note the type and quantity of drugs prior to loading any syringes or darts. If you are on-scene and the person that has been exposed is unable to tell you the type and quantity of drug(s) involved, check the datasheet on the clipboard.
- Make sure that the drug information packet from the drug kit accompanies the individual to the hospital.

Appendix 9

New York State Department of Health Renewal

Example Appendix B

Class 4 & 7 Institutional Researcher Protocol

Please complete and submit the following information along with the *License Application to Engage in a Controlled Substance Activity* (DOH-4330) for Class 4 & 7 Researcher (Institutional) applications.

Applicant/Institution:

(i) Name, qualifications & competence (e.g., degree, department, etc.) of each member of the committee within the institution which will approve controlled substance research projects. (Attach committee list) See attached.

(ii) Description of the system within the institution for approving, supervising & evaluating controlled substance research projects. (Attach system description)

Research Project(s): See attached

(i) Description (Title) of the project(s). (Attach additional sheets as necessary)
(ii) Name, schedule & amount of the controlled substance(s) involved.
(iii) Name(s) & qualifications (e.g., degree, position) of the individual(s) working on the project and of the individual(s) designated to supervise the project:
(iv) Name, DEA registration & NYS controlled substance license of the distributor or manufacturer providing the controlled substance(s).

Controlled Substance Research Project Description (Title)	Controlled Substance: Name & Schedule	Project Participant: Name & Qualifications (degree/position)	Project Supervisor: Name & Qualifications (degree/position)	Distributor or Manufacturer	DEA Registration / NYS C.S. License
See attached →					

If controlled substances are to be obtained by any means other than via a DEA registered distributor or manufacturer, explain (Note: Identify the specific project and method of obtaining):

(v) Will controlled substances be administered or dispensed to humans? ☐ Yes ☒ No

If administering or dispensing controlled substances to humans, attach the corresponding Institutional Review Board (IRB) approval & a detailed protocol setting forth:

- Provisions for the safe administration or dispensing of controlled substances to humans
- The proposed method of selecting humans.

Example Appendix B

Addendum to Appendix B, Class 4 & 7 Institutional Researcher Statement

1. Applicant/Institution:

(i) Controlled Substance Project Approval Committee List:

NYSDEC does not have a project approval committee for use of controlled substances. However, the following staff participate in work involving controlled substances as required in NYSDEC Region 6:

Andrew MacDuff	Natural Resources Supervisor
Steven Heerkens	Regional Ecosystem Health Manager
Timothy Pyszczynski	Wildlife Biologist 1
Elizabeth Simons	Wildlife Biologist 1
Cristina Macklem	Wildlife Biologist 1
Erik Latremore	Wildlife Biologist 1
Jeffrey Eller	Fish & Wildlife Technician 2
Joseph Lydon	Fish & Wildlife Technician 2
Derek Steenburgh	Fish & Wildlife Technician 2
Ann Wilcox-Swanson	Fish & Wildlife Technician 2
Adam Bleau	Fish & Wildlife Technician 1
Bridget McCormick	Fish & Wildlife Technician 1
David Selner	Fish & Wildlife Technician 1
Louis Hallstrom	Fish & Wildlife Technician 1
Andrew Preston	Fish & Wildlife Operations Assistant
Benjamin Tabor	Environmental Conservation Officer
Evan McFee	Environmental Conservation Officer

All the above participants have participated in one or more professional chemical immobilization training courses offered by Safe-Capture International as well as frequent in-house trainings. In addition, Andrew MacDuff was one of the co-authors of the NYSDECs *CHEMICAL IMMOBILIZATION STANDARD OPERATING PROCEDURE*, September 2019.

(ii) Controlled Substance Project System:

NYSDEC staff use controlled substances per the agency's *CHEMICAL IMMOBILIZATION STANDARD OPERATING PROCEDURE*, September 2019.

2. Research Projects

Controlled substance research project description (Title)	Controlled substance: Name & Schedule	Project Participant: Name & Qualifications (degree/position)	Project Supervisor: Name & Qualifications (degree/position)	Controlled Substance Provider(s)	DEA Registration/NYS C.S. License
Removal or relocation of nuisance wildlife including but not limited to black bear, whitetail deer & moose	Ketamine, III Telazol, III Xylazine, NA	All staff listed above in Section 1(i).	Andrew MacDuff, Natural Resources Supervisor, MPS Fish & Wildlife Biology & Management	Covetrus	RB0394940
Various wildlife research projects	Ketamine, III Telazol, III Xylazine, NA	All staff listed above in Section 1(i).	Andrew MacDuff, Natural Resources Supervisor, MPS Fish & Wildlife Biology & Management	Covetrus	RB0394940

Photo by Art Kirsch

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