

# FIELD HAND BOOK ON CHEMICAL RESTRAINT OF WILD ANIMALS



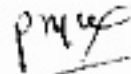
WILDLIFE WING  
DIRECTORATE OF FORESTS  
GOVERNMENT OF WEST BENGAL  
2016-17

## Preface

Restraining animals through chemical immobilization is one of the oft used technique that not only requires high skill but also basic technical knowledge about the equipment and medicines.

In a State like West Bengal, having very high level of Human-Wildlife Conflict, the process of chemical immobilization has been used successfully since long. The art of immobilization technique was pioneered by Late Sri Gopal Tanti, T.A. and has been very successfully taken forward by Sri Subrata Pal Chowdhury, T.A. with a chequered history of tackling all wild animals including tigers, leopards, rhinos, elephants, deer etc. Alongwith them, it has been the endeavor of the Wildlife Wing to have trained manpower in all levels spread over the vast expanse of the State with sufficient technical expertise to combat situations related to wildlife straying and management. To achieve this goal, regular training and practice sessions in chemical immobilization are being organized in different forest and wildlife divisions and now we have a battery of manpower ready to jump for the cause.

This practical handbook has been published with an objective of bringing all updated information within two covers and also to make the officers and staff aware about the nitty gritty of the process. Detailed analysis of the equipment, medicines and target along with some field examples have been incorporated which will refurbish the knowledge of those using it.



(Dr. Pradeep Vyas)

Principal Chief Conservator of Forests  
& Chief Wildlife Warden,  
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## **Restraining Animals**

Restraint practices evolved with the domestication of animals for food, fibre, labour, sport, and companionship. Domestication necessitated special husbandry practices. As people began to minister to animals' needs, they found it necessary to restrict activity by placing them in enclosures. If animals resisted when wounds were treated or medication administered, it was necessary to further restrain them. Trial and error combined with the shared experiences of fellow human beings ultimately produced satisfactory practices. A person who undertakes to restrict an animal's activity or restrain the animal is assuming a responsibility that should not be considered lightly. Each restraint incident has some effect on the behaviour, life, or other activities of an animal. From a humane and moral standpoint, the minimum amount of restraint consistent with accomplishing the task should be used. This should become a dictum for persons who must restrain animals.

1. Each time it is proposed to restrain an animal, the following questions should first be asked: Why must this animal be restrained?
2. What procedure will produce the greatest gain with the least hazard?
3. When will it be most desirable to restrain the animal?
4. Who is the most qualified to accomplish the task in the least amount of time and with the least stress to the animal?
5. What location would be best for the planned restraint procedure?

## **Why Restraint**

Everyone must agree that domestic animals require transporting, medicating, and handling. Some contend that all wild animals should be free ranging, without human interference. This philosophy seems naive in the present time. Wild animals kept in captivity require special husbandry practices. They must be transported, housed, and fed. If they become ill, they must be examined and treated.

Free-ranging animals may have to be translocated, The translocation of free-ranging wild animals has become a common method of wild animal management for reducing overpopulation or building a population in a new location. The reintroduction of captive-bred wild animals to a former native habitat or a revitalized habitat is now a routine wildlife management practice. All of these animals must undergo significant screening, which in turn requires restraint, transport, and eventual release. Diseases in wildlife populations must be monitored, since some have far-reaching consequences for the health of domestic livestock and human beings. Many wild

populations are managed. As far as wild animals are concerned, any captive situation involves some form of restraint.

### **General Concepts**

**Four basic factors should be considered when selecting a restraint technique. Once these four factors are evaluated, a suitable technique can be selected:**

- 1) Will it be safe for the person who must handle the animal?
- 2) Does it provide maximum safety for the animal?
- 3) Will it be possible to accomplish the intended procedure by utilizing the suggested restraint method?
- 4) Can constant observation and attention be given the animal following restraint until it has fully recovered from the physical or chemical effects?

### **Human Safety First**

**Many wild animals can inflict serious, even fatal, injury. The first concern when dealing with wild animals should be the safety of human beings. To think otherwise is foolhardy, and those who grandstand or show off by manipulating dangerous animals without benefit of proper restraint may injure themselves or bystanders. Those who own or have administrative responsibility for wild animals must recognize that the animal, no matter how valuable, cannot be handled in such a way as to jeopardize the safety of those who must work around it. Techniques are known that when properly used can safeguard both animal and operator.**

### **The History of Chemical Capture and Restraint**

Chemical capture is the use of anaesthetic drugs to immobilize an animal for capture. Humans have been using chemical capture for hunting for thousands of years. Indigenous people on several continents have utilized blowpipes made from native plants to fire darts at the animals they hunt. Dipping these wooden darts in naturally-occurring paralytic drugs gave hunters the ability to more effectively hunt their prey.

The first documented modern case of using chemical restraint with wild animals was probably in 1820 when a biologist used an oral mixture of honey and strong spirits to capture bears for study. The first “drug dart” was used for restraining and studying wildlife in 1953. The first modern darts used contained liquid immobilizing agents. The chemicals were

injected into the animal through a hollow needle on the front of the dart and were fired through a modified shotgun-style gun.

### **Chemical Restraint Today**

While chemical restraint is designed to keep animals safe from injury and also to keep them calm during procedures, the early drugs had their drawbacks. In the past, the safety margin to the animals was very narrow and miscalculating the dose could very easily cause the animal's death. In 1960, biologists had a significant breakthrough when a mixture of **morphine**, **hyoscine**, and various **tranquillizers** was pioneered for this use. The new mixture was much safer for the animals.

The most recent major advance in chemical capture and chemical restraint for transporting wildlife has been the adoption of long-acting tranquillizers normally used for humans. These drugs have significantly reduced the numbers of animals that perish during long-distance transportation while in captivity, and following introduction into new habitats. Biologists anticipate that progress will continue in both the drugs and the delivery equipment.

**While most people think of chemical capture as simply “tranquilizing” an animal, it is actually a lot more complex. Capturing and sedating animals with a dart gun involves anesthetizing an animal under the most difficult of circumstances. It requires making a judgment call on the health of the animal and using drugs without knowing the exact weight of the animals and without the benefit of pre-anaesthesia.**

### **Terminology**

**Restraint** - restriction of an animal's movement.

**Physical restraint** - restriction of an animal's movement by physical rather than chemical means.

**Chemical restraint** - restricting the ability an animal to move by the use of drugs; these may be anaesthetics or immobilising agents.

**Anaesthesia** – drug-induced state of unconsciousness that is characterised by depression of the central nervous system and varying degrees of analgesia. Immobilisation – chemical restraint of an animal without anaesthesia or analgesia.

**Neuromuscular blocking agents** – drugs which cause paralysis or paresis of skeletal muscle by their effect on the neuromuscular junction.

**Analgesia** – reduction or the absence of the sensation of pain.

**Sedation** – moderate suppression of the central nervous system inducing a sleep-like state from which the animal can be roused.

**Tranquillisation** – a state of behavioural change, wherein anxiety is relieved, behavioural responses suppressed and the animal is relaxed but aware of its surroundings. Spinal and other reflexes are not affected.

## **Methods of Restraint**

### **Physical**

- Physical restraint is appropriate for simple procedures such as physical examination, injections, venipuncture etc.
- Physical restraint should only be performed by operators who are familiar with the normal behaviour patterns of the species that is to be restrained.
- The duration of the procedure should be kept to a minimum, with prolonged stressful restraint unacceptable.
  - Appropriate restraining devices (eg. bag, rope, restraint board, catch-pole, squeeze cage or crush) may be required to avoid injury to the animal or researcher.
  - Personnel should approach the target animal in a calm and quiet manner. Unnecessary people should keep away from the area to avoid making the animal more agitated.
  - For many species, it is important to cover the animal's head (e.g. with a blindfold, bag, blanket etc.) to impair its view of the environment and reduce stress. Excessive noise and sudden movement should be kept to a minimum.

### **Chemical**

- Chemical restraint may be appropriate in the following situations:
  - ✓ When the period of handling is likely to cause undue stress to the animal;
  - ✓ With aggressive or nervous species that are unable to be physically restrained because they are likely to cause serious injury to the handler and/or themselves (eg. adult feral pigs, wild deer);
  - ✓ When the procedure to be performed is likely to cause significant pain or discomfort. Analgesia should also be used in these cases.
    - Chemical immobilisation of animals can result in significant morbidity and mortality.
    - To ensure that chemical restraint is performed both humanely and effectively, personnel must be experienced with all aspects of drug use and assessment/monitoring of anaesthesia. They must also be familiar with the target species and have knowledge of the best techniques available.

## Drug Delivery Systems

It is important to choose a drug delivery system that will deliver the appropriate volume of drug with the minimum amount of physical trauma to the animal. There are two drug delivery systems available:

- ❖ Hand-held injection This requires the animal to be physically restrained before administration;
- ❖ Remote drug administration system (RDAS)

There are four basic types of Remote drug administration system (RDAS):

- I. Pole syringes are cheap, safe and quiet, but are only useful when the animal is physically restrained or is in a trap. Care must be taken to ensure that needles do not break off (eg. when administering large volumes or using a long needle) and placement of the needle in large muscle masses needs to be accurate as pole syringes may harm the animal if incorrectly placed; a **Pole-syringe/Jab-stick** is used to inject within hands reach- **1m to 2m**.
  - II. Blow pipes are the cheapest and safest system. However they only have a range of 10-15 m experience and practice is required for them to be used effectively; usually **Blow pipe** is used to shoot light weight nylon darts up to **10 m range**.
  - III. Dart pistols are more accurate and have a range of approximately 20 m, but their greater power represents an increase in the risk of danger to the animal; **Pistols** are used for longer distance or in captive conditions for shooting up to **30 – 40 m range**.
  - IV. High-velocity dart rifles have the greatest range and accuracy; however they also present the greatest risk of injury to the animal. **Effective Range** of shooting the target animal varies considerably in different models, though a dart syringe can travel much longer distance may up to 120m – 130m. Usually dart **guns** can shoot **effectively** up to **50 -70 m range**. They are generally much less accurate than conventional firearms and should only be used by experienced operators. Accidental death of the animal can occur from using excessive velocity to propel the dart and/or missing the target area, causing penetration of a vital organ, body cavity, and/or broken bones.
- It is critical to hit a proper injection site, especially when using RDASs. As large skeletal muscle masses are usually the most appropriate sites, regular practice with RDASs and knowledge of the anatomy of the target species is required to ensure consistent hitting of the appropriate injection site.
  - Anaesthetised animals require close monitoring of their cardio-vascular, respiratory and thermo-regulatory systems. Constant monitoring is necessary, with operators

trained to recognise and alleviate potential complications. The depth of anaesthesia should also be closely monitored.

- It is essential to provide a quiet recovery place.
- Where appropriate, reversing agents can be used to facilitate recovery.

### **Equipments & Accessories:**

A **Remote Syringe Projector** commonly known as a **Dart Gun** is used to fire a specially made Syringe filled with desired medicine, called as **Dart**, to the animal from a safe distance; upon penetration the medicine is injected into the muscular tissues of the animal through a needle fitted in front of the dart syringe. An internal mechanism of the dart being activated upon impact with the animal body and injects the medicine out of the syringe. Dart Syringe size depends upon volume of drug and needle varies with thickness of the target animal.

The dart syringe as it is fired by a **Remote Syringe Projector** or '**Dart Gun**'; many people have the misconception about the Dart gun as a weapon similar to a firearm. Practically, the person (darter) firing with the dart gun required to be protected with other firearms in case the animal counter attacks. The dart gun has limitation; its performance to hit the target found good within 30 – 40 meters, so darter has to approach an animal from close distance and there is always a chance of counter attack by the problem animal. **Equipments are very costly and all are required to be imported for use in India. Dart gun, cartridges and other components being declared as 'Fire Arms' in 2009 and require special permission of the MoEF for import. Forest Departments are exempted from 'Arms License' for using these equipments for wildlife management purpose.** Syringes, needles etc. and common drugs are available in India with the authorized distributors.

### **Remote Syringe Projector or Dart Gun:**

Several types of Syringe Projectors are available for use, developed by different foreign manufacturers of the world. Powder charge (Cartridge) or pressurized Gas (CO<sub>2</sub> or Air) is used to propel the dart syringe at a considerable distance for shooting animals.

Barrels of the equipment are smooth bore and available in **13mm or 11mm calibre** for projecting different types of dart syringes. **Strong Steel barrels, Aluminium barrels and Carbon fibre barrels** are available with different models of equipments.

Gun models using powder cartridge charge and fitted with strong steel barrel have been found extremely suitable in tracking animals and shooting through dense Indian forests.

**Dist Inject brand of Syringe projectors and accessories are widely used by the Wildlife Wing, Forest Directorate, Govt. of West Bengal since 1980s due to its light weight, strong barrel and simple using technique.**





**CAP-CHUR PROJECTOR- LONG RANGE – POWDER CHARGED**



**DIST INJECT SYRINGE PROJECTOR MOD.60N – POWDER CHARGED**



**DAN INJECT SYRINGE PROJECTOR MOD. JM.SP & JM.SP.25 – GAS CHARGED**



**TELEDART SYRINGE PROGECTOR MOD. RD406 – GAS CHARGED**



**TELINJECT SYRINGE PROJECTOR G.U.T.50 – GAS CHARGED**

**Different brands of equipments used worldwide are:-**

Brand	Model operating system	Manufacturing country
<b>CAP CHUR</b>	Powder Charged & Gas Charged	USA
<b>DIST- INJECT</b>	Powder Charged & Gas Charged	Switzerland & France
<b>DAN INJECT</b>	Gas Charged	Denmark
<b>TELEDART</b>	Gas Charged	Germany / USA
<b>TELINJECT</b>	Gas Charged	Germany

**Powder Cartridge: Used for Powder charged models of guns and pistols- single use**

Modified .22 blank cartridges of **different strength** are used for projecting different sizes of metal syringes. Cartridges are coded with different colours as per their strength, e.g. Blue, Red, Yellow, Brown, White etc. Lower strength cartridges i.e. blue and red are used in pistols, others are used in guns. A cartridge is put in to the specific Cartridge Holder of the dart gun. Usually metal darts or specially made disposable automatic plastic syringes are fired with cartridge charges. Nylon darts are fired with CO2 gas power.

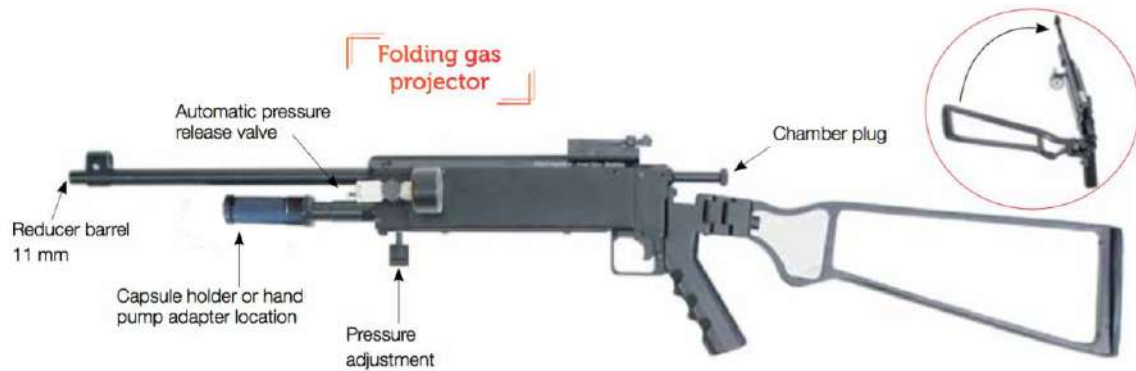


**CO2 Gas Cartridges: Used for gas operated models of guns, pistols and pneumatic blow pipes- multiple use**

Specially manufactured pressurized CO2 gas cylinder which can be attached with the projector is used to project mainly the light weight plastic dart syringes (11mm). Gas Cylinders are manufacturer's model specific; sizes available from 8g, 16g, 28g, 80g etc. are used depending upon number of shots desired.

In few Dist-Inject syringe projector models metal dart syringes (13mm) can also be projected with interchangeable 13mm regular steel barrel; in that way Dist-Inject syringe projector model 35 and newly developed model 72 are more versatile; can be converted into a rifle replacing the short pistol barrel into long steel barrel and able to shoot plastic darts and metal darts both with or without 11mm dia. Aluminium insert respectively.

## DISTINJECT GAS OPERATED SYRINGE PROJECTOR MODEL MOD 72



B

**Dist-Inject**®

### GAS PISTOL mod. 35

A smaller version of the DIST-INJECT rifle mod. 50 with the same technical features, but simpler in detail.

With the optional items, the flexibility of the pistol is increased to that of a rifle.

All types of syringes can be used.



Optional

Art. 4820  
Precision sight

Art. 5324  
Rifle barrel



Art. 5320  
Shoulder stock

Art. 4006  
Length: 530 mm  
Weight: 1200 g  
Range: 30/60 m  
Calibre: 11 + 13 mm



**BLOW PIPE & PLASTIC DARTS**

### DIST-INJECT POLE SYRINGE & EXTENSION HANDLE



### Metal Dart Syringe:

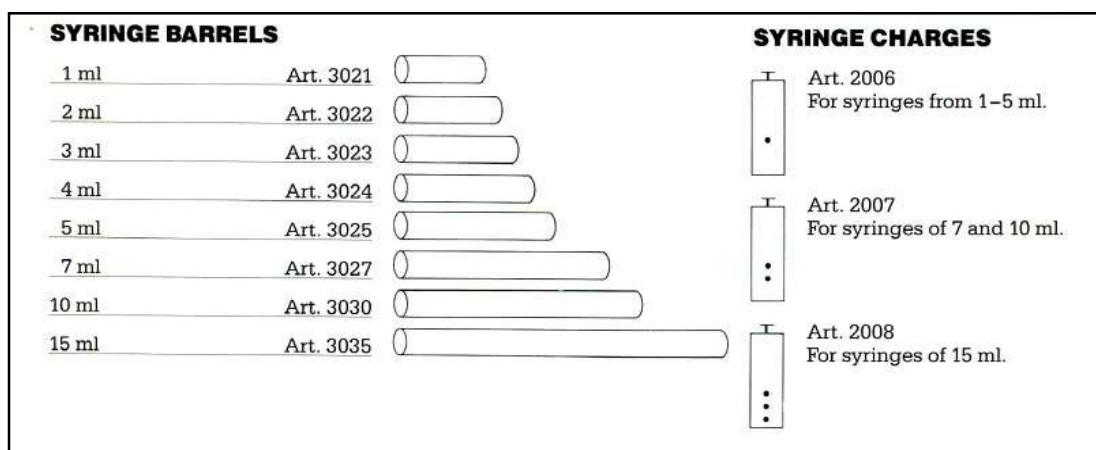
Dart Syringes are the most important part of the drug delivery system. Reusable Aluminium Metal Syringes of **13mm calibre** are widely used darting variety of animals with a powder cartridge charged gun/pistol. Parts of a Metal syringes are assembled by hand to make it a complete dart for remote drug delivery.

There are 5(five) different parts in a Metal Dart – Except the syringe charge other parts of the metal syringes are reusable.

- 1) Feathered Stabilizer
- 2) Syringe Charge Cartridge (different capacities; 1ml - 5ml, 7ml - 10ml & 15ml)
- 3) Rubber Piston / Plunger
- 4) Metal Barrel for Syringe (1ml, 2ml, 3ml, 4ml, 5ml, 7ml, 10ml & 15ml size)
- 5) Needle or Canula (16mm to 63mm - animal specific)



- i) **Feathered Stabilizer:** A metal piece fitted with trimmed natural feathers, it is the balancing end part of the dart. It keeps the gas emitted by the syringe charge sealed behind the piston to push medicine out through the needle as well as balance the dart during its flight.
- ii) **Syringe Charge Cartridge:** A specially made metallic cartridge with a striking pin at one end. The Charge burst and emits gas on impact when the dart hits the body of the animal. The emitted gas pressurise the rubber piston to inject medicine through needle. It is fitted in the tubular hole of the rubber piston. Available in 1ml-5ml, 7ml-10ml and 15ml capacity. To be used for making darts within mentioned capacity for proper function.
- iii) **Rubber Piston / Plunger:** An annulated piece of durable rubber piece, flat at one end and tubular hole on the other end. This reusable rubber piston performs to push the medicine and also to hold the syringe charge on the other end.
- iv) **Metal Barrel for Syringe:** Aluminium metal barrels (13mm dia.) of sizes 1ml, 2ml, 3ml, 4ml, 5ml, 7ml, 10ml & 15ml capacity are available for preparation of darts. It has screw type fitting facility at both ends. Barrel size is selected upon required dosage of medicine.



v) **Needle or Canula:** Stainless steel needles of 1.5mm / 2mm dia. with base screwing facility to attach with the metal barrel. There are types of needles – a) Practice (solid type), b) Smooth (Plain type), c) With Collar (notch or ring) and d) With Barbed (hook). Needles are available from 16mm size to 63mm size and to be used according to the skin thickness and targeted muscle area of the animal.

#### **DIST – INJECT DART NEEDLE SIZE**

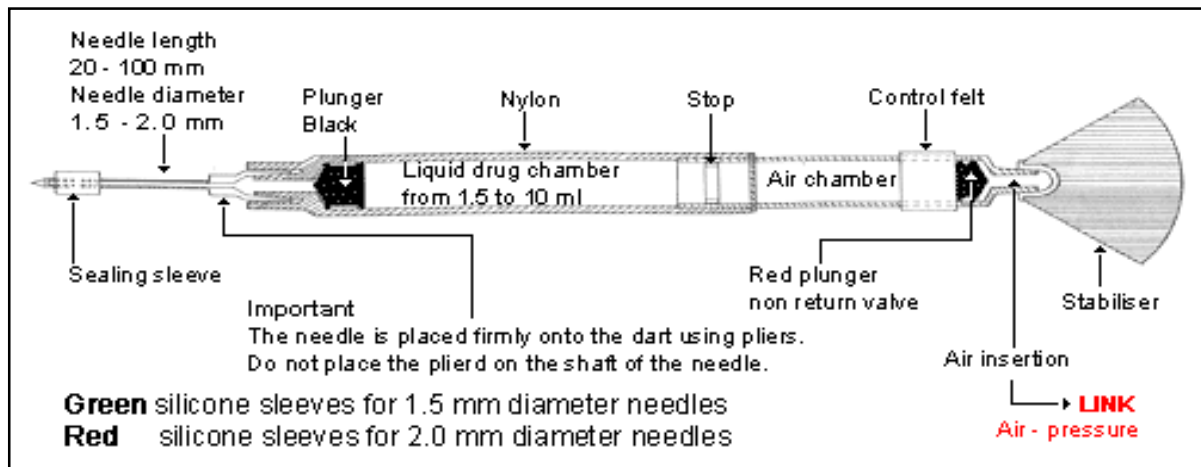
Animal	Size	Type
Monkey	16 mm. / 19 mm.	Collared
Langur	19 mm.	Barbed
Leopard	19 mm.	Barbed
Tiger	28 mm.	Barbed/Collared
Chital	19 mm. 16 mm.	Barbed (Large Male) Collared (Small animal)
Sambar	28 mm.	Collared
Gaur	38 mm.	Collared
Rhino	45 mm. / 51 mm.	Collared
Elephant	51 mm. / 63 mm.	Collared
Wild Boar	45 mm. to 63 mm.	Collared
Smaller Cats & Civets	16 mm.	Collared

#### **Plastic Dart Syringe:**

Plastic dart Syringe is completely different from the metal dart syringe. These are specially made plastic syringes of **11mm Calibre** and compressed air / lighter gas is used to inject drugs into the animal's body. Needle is also special; tip is sealed but has a side port for injection.

Drug is poured into the drug chamber with help of another syringe removing the needle part; then needle is placed securely on the front with its side port covered with a silicone sleeve, so no drug can leak out, then compressed gas / pressurised air is injected at the tail end and the woollen stabiliser is attached at the end. A plastic syringe dart is ready for use. Plastic darts

can only be projected through a gun / pistol using compressed gas. Plastic darts are lighter in weight than metal darts and cause less traumatic injury to animals.



### How to Prepare a DART:

**Other useful accessories for making dart:** There are few other accessories required to assemble a complete dart.

- 1) **Silicone grease** for lubricating the rubber piston and all rubber rings
- 2) A **Plastic Rod** for pushing the grease smeared piston to lubricate the barrel inside.
- 3) **Steel Cartridge Ejector Pin** to push out spent cartridge from the holder.

**Take all 5-parts of a dart and other materials on a tray and clean with alcohol.**






- i. Take a good rubber piston, smear grease on the outside and push the flat side into any opening of a selected size barrel.
- ii. Push the piston out with the Plastic Rod towards the other end of barrel.
- iii. Select a proper Syringe Charge according to barrel size and push the flat end tightly into the hole of the rubber piston, keep pin side out, and again smear grease lightly.
- iv. Then push the piston with the charge into the one end of the barrel. Flat side in – pin side out and gently push it inside just to the rim of the barrel.
- v. Grease the rubber ring of the Stabilizer and screw it tightly with the barrel behind the charger pin.
- vi. Grease the rubber ring of the Needle screw and fit it with the barrel. Pass it through the barrel of the gun with the gun cleaning rod for smooth gliding. Any hard resistance felt then apply grease on the dart rubber rings or change it.
- vii. Take out the required quantity of the medicine from its vial with a disposable syringe, open the needle end of the dart and insert the needle of the disposable syringe and slowly push the medicine inside the barrel cavity. Take out the disposable syringe and








screw the dart needle in place. Apply grease to seal tip of the needle to prevent any leak of medicine.

- viii. Your medicine filled Dart is ready to use. Keep it safely in a long plastic box safely till it is put in to the gun before firing.

### **PREPARATION OF DART SYRINGE IN FIELD SITUATION**

**ASSEMBLING SYRINGE CHARGE, RUBBER PISTON, FEATHERED STABILIZER, NEEDLE AND ALUMINIUM BARRELS FOR PREPARATION OF EMPTY DARTS**

<p><b>Step - 1</b></p>	<p><b>Arrange all the 5 (five) different components of the dart syringe for assembling.</b> <b>Check every part; clean inside of the metal barrel, needle and rubber piston with absolute alcohol.</b></p>	
<p><b>Step - 2</b></p>	<p><b>Smear the rubber piston with silicone grease then push inside the barrel at one end.</b></p>	
<p><b>Step - 3</b></p>	<p><b>Push through the rubber piston inside the barrel with the help of plastic rod and take it out from the other end.</b> <b>If the piston is too loose then change the rubber piston.</b></p>	
<p><b>Step - 4</b></p>	<p><b>Select the Syringe Charge according to Syringe barrel capacity.</b></p>	
<p><b>Step - 5</b></p>	<p><b>Push the flat end of the charge inside the rubber piston hole. Pin end of the charge should always be kept outside.</b></p>	

<p><b>Step - 6</b></p>	<p>Apply silicone push the syringe charge inserted rubber piston at one end of the syringe barrel. Pin end of the syringe charge should be kept out side.</p>	
<p><b>Step - 7</b></p>	<p>Rubber piston and syringe charge should be placed as such that the pin end of the charge is placed parallel to the rim of the barrel.</p>	
<p><b>Step - 8</b></p>	<p>Apply small amount of grease on screw threads of the Feathered Stabilizer and its rubber ring.</p>	
<p><b>Step - 9</b></p>	<p>Take the feathered stabilizer and place it behind the syringe charge at the end of syringe barrel.</p>	
<p><b>Step - 10</b></p>	<p>Now screw the stabilizer tightly with the barrel and smear grease on all rubber rings,</p>	
<p><b>Step - 11</b></p>	<p>Needle selected according to the animal to be attached to the other end of the barrel screwing tightly.</p>	
<p><b>Step - 12</b></p>	<p>A complete Dart syringe is ready for immediate use.</p>	





shooting a dart, **rear-sight** of the syringe projector has be adjusted upwards or downwards according to distance and a shooter has to practice a lot to get a clear idea.



**Adjustable Rear-Sight:**

Dist-inject Syringe Projector Gun is fitted with an

**Adjustable Rear-sight** with graduated slots 1 to 15 and can be fixed at any level in between with help of a push-lever according to the **Target**

**Range – Syringe Size –**

**Cartridge** used. Usually the manufacturer gives a shooting chart with every set of Syringe projector for immediate reference in the field.

		<b>Dist-Inject® Mod. 60N</b>							
		<b>SIGHT ADJUSTMENT</b>							
Shooting distances		0	10	20	30	40	50	60m	
Syringes	2 ml	①	③	⑭	⑧	⑥	⑩	⑤	
	3 ml	①	⑧	⑨	⑦	⑫	⑥		
	5 ml	①	⑩	⑦	⑪	⑦	⑨	⑭	⑧
	7 ml	④	⑨	⑧	⑫	①	⑦	⑫	
	10 ml	⑥	⑩	⑪	④	⑩	⑭		
	speedy	①	⑧	⑫	⑧	⑬	⑨	⑫	
	easy	③	⑧	⑫	⑧	⑫	⑭		

<b>Cartridges</b>				
	Art. 2013	Art. 2019	Art. 2015	Art. 2017

**Dist-Inject Shooting Chart**

**BODY LOCATIONS FOR SHOOTING DART ON WILD ANIMALS**



### Care of equipment

- The barrel of a power charged projector should be cleaned after every shot for smooth delivery of the dart.
- Before storing, the projector's barrel should be cleaned properly twice or thrice and sprayed with gun oil liberally on the metal parts to avoid rusting.
- Used syringe-darts should be thoroughly cleaned in a 1:1000 solution of *Potassium paramagnet*, rinsed in several changes of water and dried in the sun.
- In humid areas or during the rainy season gun-charges should be kept in air –tight container to avoid dampness.
- Damaged needles, syringe barrels and feathered stabilizers should be properly disposed off in an earth -pit.
- Syringes and needles used for morphine drugs should be cleaned in *Potassium paramagnet (KMnO4)* solution, rinsed and thereafter boiled before reuse.
- Cartridge holder should be properly cleaned and lightly greased with silicon grease before storing.
- **All projectors related to capture should be kept under lock and key and be always handle by properly trained persons only.**

Target practise over measured target distances must be performed before planning any capture operation. Test stored Cartridges for stated calibrated distance before each operation.

### Immobilising Drugs :

Immobilising drug is a chemical compound or 'agent' used for restricting animal freedom; controlling its body movement and state of mind at the same time, e.g. walking, running and aggression.

**Drugs can be categorized in Two Broad Categories:**

- 1. Neuromuscular Blocking Agents**
- 2. Central Nervous System Drugs**

### Neuromuscular Blocking Agents:

Before 1960, neuromuscular blocking agents were the chemicals most commonly used. Generally speaking, the neuromuscular blocking agents are potent in many animals but they have less desirable immobilising characteristics than the central nervous system depressants that were developed in the 1960's. These neuromuscular blocking agents act

where motor nerves connect with muscles at the neuro-motor junction or at muscle end plate and prevent the muscles from functioning by blocking transmission between motor nerves and muscles - Immobilise through muscular paralysis :-

- ❖ Drugs are : **Succinylcholine, Gallamine, Nicotine, Tubocurarine etc.**
- ❖ Extremely low safety margin
- ❖ Mortality common with paralysis of respiratory muscles
- ❖ Animals remain awake, fully aware of their environment, subjected to greater stress
- ❖ These drugs have been discontinued as use for immobilizing wild animals due to high mortality rate, low safety margins.

### **Drugs Acting on Central Nervous System (CNS Depressants):**

Act directly on Central Nervous System i.e. brain/spinal cord Site and mode of action of the CNS depressants are extremely complex. The majority of CNS depressants can be more conveniently classified according to chemical class, rather than by mode of action as is true of the neuromuscular blocking agents.

Central nervous system (CNS) depressants can produce effective sedative, analgesic, narcotic, and anaesthetic properties which are highly desirable characteristics for the capture, restraint, and treatment of animals. These chemicals can produce signs and symptoms ranging from "taming" behaviour to psychomotor stimulation and convulsions, sometimes within a single species. A particular effect depends upon the chemical, dose, and species of animal.

- ▶ In general, the CNS depressants are safer to use than the neuromuscular blocking agents because:
  - ❖ they exhibit a greater safety margin,
  - ❖ Many of the CNS depressants have effective antidotes that reverse the immobilized condition within a matter of minutes.

#### ▶ **CNS Drugs are available in 3(three) major types:**

- ❖ **OPIOIDS**
- ❖ **CYCLOHEXAMINES**
- ❖ **NEUROLEPTICS**

#### **Opioids:- “Morphine-like” properties.**

Morphine is a natural chemical obtained from opium, which is the dried juice of the poppy plant, *Papaver somniferum*. The chemical structure of morphine was established in 1925 and since that time many derivatives have been synthesized. By itself, morphine has been

used to only a limited extent. It is more effective when used in conjunction with other chemicals.

The immobilizing characteristics of these chemicals include stupor or insensibility, loss of fear and anxiety, and marked analgesia. Frequently, animals stand with heads drooped, and if they fall to the ground they lie in sternal recumbency. These chemicals have a wide safety margin and severe side effects are minimal. Effective antagonists are available which quickly reverse the immobilization effects. Overdoses produce respiratory depression which is the cause of death.

#### **These drugs are**

- Highly potent
- Effective in small volumes
- Wide margin of safety
- Can be immediately reversed with antagonist / antidote

**These drugs cause loss of consciousness, alleviates perception of pain.** Different sizes of animals can be immobilized with these drugs and commonly used for free-ranging wildlife and zoo species

- Common opioids used in animal immobilization: **CARFENTANIL, ETORPHINE, SUFENTANIL, FENTANYL, BUTORPHANOL**

**Extreme care should be taken in handling these drugs, can be absorbed through mucous membrane, eyes and skin – minute doses are extremely toxic to humans.**

#### **Cyclohexamines :-**

These chemical analogs produce a cataleptoid condition in animals characterized by "waxy rigidity" of the muscles so that animals tend to remain in any position in which they are placed. They also produce marked analgesic and anaesthetic effects without the loss of protective reflexes such as coughing and swallowing. Some side effects of these chemicals include salivation, hyperthermia, excitement, and convulsions. Produce 'altered consciousness' or 'dissociative anesthesia' i.e., dissociate mental state from environmental stimulation. Effects of Cyclohexamines are not reversible. Most often cyclohexamines are used in conjunction with other neuroleptic drugs for achieving desired effects and to reduce convulsions and muscle rigidity.

Commonly used Cyclohexamines are:

- ▶ **Ketamine** (as Hydrochloride) - KETAMIL, VETALAR, KETMIN
- ▶ **Tiletamine** (as Hydrochloride) – TELAZOL (with Zolazepam)
- ▶ **Phencyclidine (PCP )-** SERNYL

### **Neuroleptics:-**

Neuroleptic agents, also known as antipsychotics or tranquilizers, can reduce confusion, delusions, hallucinations, and psychomotor agitation. Neuroleptics are also used as sedatives, tranquilizers, and antiemetic properties. Neuroleptics are used in conjunction with other drugs (Cyclohexamines and Opioids). In different doses these drugs can produce different level of anaesthesia.

- ▶ Produce calmness and relaxation (Tranquilization)
- ▶ Produce depression (Sedation)
- ▶ Cause loss of pain (Analgesia)
- ▶ A trance-like state (hypnosis)
- ▶ Complete loss of consciousness (anaesthesia)

Commonly used neuroleptics:

- ▶ **Diazepam** (VALIUM, CALMPOSE)
- ▶ **Acepromazine** (ACP, ACEPROMAZINE)
- ▶ **Xylazine** (XYLAZIL, ROMPUN, CERVIZINE, ANASED)

**All the drugs used for immobilisation of wild animals are Controlled substances** must be used by licensed veterinarians and available only on prescription. Most of the drugs are not manufactured in India, those are imported by the licensed agencies for wildlife management purposes. Govt. of India has imposed some strict regulations to stop misuse of such drugs.

**Commonly used & easily available Drugs in India are:** Choice of drugs and dosage depends upon the objective of the capture. It is similar to the anaesthetic procedure practiced for humans; the difference is that it being practiced in open field conditions on the wild animals with least available facilities. Most of the drugs used are highly concentrated, essential for quickest induction period required for capture of a free ranging animal, which can be harmful or fatal for human. Except narcotic preparations most of the other drugs require 15 – 20 minutes induction period for an animal to become immobilize completely, within the induction period the animal can run away a considerable distance and unconsciously met with an accident or it may attack and seriously injure the operator. Close observation and precautionary measures should be taken all the time.

#### **1. Ketamine Hydrochloride inj. (100mg/ml):**

This drug is widely used for capturing different species of cats and primates. Readymade preparation of 100mg/ml solution is used for wild animals. It produces dissociative

anaesthesia and on high doses produces unconsciousness. It has a shorter induction period in primates. It has a wide safety margin; the animal can revive even after receiving multiple doses with other supportive measures. Mostly used for capturing tigers, leopards, smaller cats, langurs and monkeys. Also use as human medicine in very low concentration. It was found more effective when used with another drug Xylazine Hydrochloride as an adjunct drug and used to capture wide variety of animals carnivores and herbivores both. **Ketamine HCl does not have any antidote or antagonist.**

## 2. Xylazine Hydrochloride inj. (100mg/ml):

Xylazine HCl was earlier available as dry powder known as **Rompun**. Presently 100mg/ml solution is available for wildlife use. It is an analgesic, muscle relaxant, sedative drug for animal use. Mostly used for sedating herbivores. It has been widely used for immobilizing elephants, gaurs and deer species. It has a greater use when mixed with Ketamine Hydrochloride and use to capture carnivores also. It can produce prolonged unconsciousness in humans if injected or taken internally with meat of a recently treated animal. The drug takes a longer period to work on a stressed or highly excited animals; initial drug requirement may be more than usual dosage and can produce cardio-respiratory problem especially in herbivores. **Yohimbine Hydrochloride or Atipamizole (Both are Restricted Drugs In India)** is the antagonist used for reducing revival time of **Xylazine hydrochloride**.

## 3. Etorphine Hydrochloride : M-99 /Immobilon / Captivon :

It is a narcotic derivative drug **Etorphine Hydrochloride**. **About 10000 times potent than Morphine**. Used for immobilizing large herbivore animals like elephants, rhinos, Gaurs, large deer species etc. The drug is readily absorbed by mucous membrane or skin, **extremely dangerous and Fatal for Human**. **Immobilon** is the trade name of a readymade preparation of Etorphine Hcl (2.45mg/ml) and another sedative drug Acepromazine Hydrochloride (10mg/ml). **Handling and use this drug without Antidote is strictly prohibited**. Narcotic antagonist **M50-50 or Diprenorphine Hydrochloride** trade name is **Revivon** (3mg/ml) is used as its animal antidote and **Nalaxone Hydrochloride (400mcg/ml) is the human antidote** use in case of accidental poisoning. It requires special training and proper knowledge for handling and use.



Procurement, transport, storage and use require special permit from the State Excise Department. Not manufactured in India, import procedure is extremely lengthy involving Drug Controller of India, Central Excise (Narcotic) Department and International Narcotic Bureau, Geneva. Unavailable for last several years in India due to various restrictions. Nandan Kanan Zoological Park, Odisha, used to coordinate procurement and supply to other State Forest Departments. **Production of Immobilon & Revivon has been discontinued** recently by its manufacturer but a much higher concentrated form (4.9mg/ml & 9.8mg/ml) as 'CAPTIVON' is manufactured by a South African company.

### Drug Dosages:-

- ▶ How much drugs do we deliver to an animal?
- ▶ Based on 3 key pieces of information:
  1. How much does the animal weigh (kg)?
  2. What is the recommended drug dosage for the species we are working with?
  3. What is the concentration of the medication we are using?

### **DRUG DOSAGES FOR DIFFERENT ANIMALS**

Animal	Immobilon	Xylazine - 100	Ketamine - 100	Xyl + ket mixture
Elephant	3 ml. – 4 ml.	3 ml.- 5 ml.–10 ml.	x	x
Rhino	1 ml. – 2.5 ml.	x	x	x
Gaur	3 ml. – 4 ml.	5 ml. – 8 ml.	x	Xy 5 ml. + ket 2.5 ml.
Tiger	x	X	10 ml. – 15 ml.	Xy 2.5 ml.+ ket 7.5 ml.
Leopard	x	X	4 ml. – 6 ml.	Xy 1.5 ml.+ ket 2.5 ml. – 3 ml.
Sambar	2 ml. – 3 ml.	5 ml. – 6 ml.	x	Xy 3 ml. + ket 2 ml.
Chital	x	1.5 ml. – 3 ml.	x	Xy 2 ml. + ket 1.5 ml.
Jungle Cat	x	x	1.5 ml. – 2 ml.	Xy 0.5 ml. + ket 1.5 ml.
Fishing Cat	x	x	3 ml. – 4 ml.	Xy 1 ml. + ket 2.5 ml.
Civet	x	x	1 ml. – 1.5 ml.	x
Monkey	x	x	1 ml. – 2 ml.	Xy 0.25 ml. + ket 1 ml.
Langur	x	x	1.5 ml. – 2.5 ml.	Xy 0.5 ml. + ket 2 ml.
Wild Boar	x	x		Xy 0.55 mg./kg. + ket 9 mg. – 11 mg./kg.

Name of Animal	Drug Name	Generic Name	Concentration	Total Content (mg)	Total Volume (ml)
Asian Elephant (Adult)	Immobilon  M-99	Etorphine HCL	2.45 mg /ml	8-8.9	3.25
		+	+	32-35	to
		Acepromazine	10 mg /ml	7.3-8.0	3.50 ml
		-do- mixture	1 mg /ml 10mg /ml	30-32	3.0-3.25
Indian Rhinoceros (Adult)	Immobilon  M-99	Etorphine HCL	2.45 mg/ml	2.45-4.90	1.0-2.0
		+ ACP	+	10- 20	
		Etophine HCL	10 mg /ml 1 mg/ml	1.5-2.5	1.5-2.5
Indian Gaur	Immobilon  M-99	Etophine HCL	2.45 mg/ml	7.35-9.80	3-4 ml
		+	10mg/ml		
		ACP	1 mg/ml	8.0-1.0	
		-do- mixture	10 mg/ml	10.0-25.0	1.0-2.5 ml
Sambar	M-99	Etorphine HCL	1 mg /ml	5-8	5-8
	Rompun	Xylazine HCL	500 mg	3 ml/ml	
Chital (Adult)	HBM	Ketamine	100-150	1.0 -1.5	
		+			
		xylazine	125-187		
Tiger	HBM	Ketamine	300		3 ml
		+			
		Xylazine	375		
Leopard	HBM	Ketamine	200-300		2-3ml
		+			
		Xylazine	250-275	910	9.1 ml
		KCL			

## PLAN OF CHEMICAL CAPTURE OPERATION

### Basic planning and precautions to be followed when undertaking immobilization of any wildlife species

- 1) Select correct darting equipment and drug(s) for the species you plan to capture.
- 2) Even an inexperienced operator would be wise to have a number of practice shots at a target (gunny bag or cardboard box filled with straw ) placed at a similar range to that anticipated in the planned darting operation and using the same size of dart filled with water in place of drug. Solid practice needles are to be used.
- 3) Get idea of the terrain and plan your approach accordingly.
- 4) Consult with Expert in advance and take help if required.
- 5) Select other member of the team including the veterinary doctor for assistance in the field and give particular responsibilities.
- 6) Time of day is an important factor. No capture operation should be undertaken in the middle of the day when the temperature is high. Early morning is the most suitable time for any capture operation.
- 7) Do not use body spray or Perfume before going for Darting.
- 8) Do Not Smoke during tracking the target animal
- 9) A well organized search party should be on hand to assist in finding the darted animal as quickly as possible after the drug is administered.
- 10) Animals should not be darted close to deep water body or near a steep slope / gorge / ridge / jhora / railway tracks.
- 11) The target animal should be approached very cautiously from its back and not chased or otherwise excited prior to darting. Patience may be needed to allow the animal to move into a suitable position for taking the shot. **Never fire unless there is a clear line between you and the target site on the animal. A blade of Grass or Leaves of a bush can deflect the dart and result in a 'miss'.**
- 12) Once the animal is darted remain quite, keeping it in sight as far as possible without disturbing it.
- 13) Induction time (time between darting and the animal going down) varies considerably. Anything between 5 and 20 minutes may be expected with most combinations.
- 14) Do not approach the animal after it goes down but allow a few minutes for it to settle and the drug effect to deepen. When you approach, test reaction of the animal by throwing a stick from the rear. **Do not make noise.**
- 15) Eyes if opened should be covered with cloth, also apply an eye ointment to keep it moist.
- 16) Block ear openings with plugs of soft cotton. **Do not forget to remove ear plugs before complete revival.**
- 17) The dart should be carefully removed and treat the wound with tropical antibiotics (e.g. Betadine lotion & cream).
- 18) Body position is very important: sternal, lateral or standing. Keep watch and change position if necessary.

- 19) Monitor all physical conditions periodically, record on data sheet. Take precaution to a particular problem if necessary.
  - 20) Record all type of body measurements of the animal. Collect blood or other body samples if required.
  - 21) Present with the animal till it is completely revived. Give antagonist drug (if the immobilizing drug has any antagonist) immediately and release the animal as quickly as your purpose of immobilization is served.
  - 22) Always take help of a Veterinary doctor during such operation.
  - 23) Work as quickly as possible.
  - 24) Always remember, **Team Work is the Key of Success.**
  - 25) **Record Drug Dosage & Animal Reaction for future reference**
  - 26) **Take all precautionary safety measures – firearms protection if necessary, in case of an animal known for its fierce nature / attacking behaviour.**
- 

## *"Siddhirbhavati Karmajā"*

*(Success is born of action)*



**DARTED LEOPARD, GAUR AND CAPTURED TIGER**

## LEARNING FROM OUR PAST



DURING CONTROL OF MAN-LEOPARD CONFLICT SITUATION AT SALUGARAH, NEAR SILIGURI IN DARJEELING DISTRICT ON 19<sup>TH</sup> JULY 2011, THE STRAYED LEOPARD POUNCED ON THE STAFF WENT TO IMMOBILISE AND CAPTURE THE ANIMAL, INJURED SIX OF THEM.

**LEOPARDS ARE EXTREMELY AGILE & CUNNING, VERY DIFFICULT TO RESTRAIN**



IMMOBILISATION & CAPTURE OF RHINO ON TEESTA RIVER BED,  
CHUMUKDANGI, MAHANANDA WLS, ON 12.12.2015. FOR  
TRANSLOCATION



**IMMOBILISATION & CAPTURE OF WILD ELEPHANT AT GAZOLE, MALDA  
ON 14.12.2015**



**USE OF JCBs TO MARCH & TRUCK LOADING WILD ELEPHANT AT  
GAZOLE, MALDA ON 14.12.2015**



**Siliguri Feb 10 , 2016 An elephant which had strayed from nearby Baikunthapur forest to Siliguri town went on a rampage here for around seven hours today damaging over 40 houses and some vehicles before it was tranquilised.**

**The elephant was finally captured after seven hours when it was hit by tranquiliser dart for the second time As it got drowsy the jumbo was put on a large 12-wheel truck with the help of two cranes after being tied with ropes and taken to Sukna forest for release.**







**IMMOBILISATION,  
CAPTURE &  
TRANSLOCATION  
OF WILD  
ELEPHANT FROM  
GOLAPBAGH,  
BURDWAN NEAR  
UNIVERSITY  
CAMPUS.**



**TRUCK LOADING  
WITH CRANE AND  
TRANSLOCATION  
BY TRUCK TO  
GORUMARANP  
DURING  
07.06.2016 TO  
10.06.2016**





## **Leopard runs amok & attacks in Raiganj**

***The Telegraph, Jan 3, 2017***

**Reporting by our Raiganj correspondent, pictures by Nantu Dey**

**Raiganj town was in a panic on Monday morning as a leopard darted into homes and attacked at least 35 people before it was somehow confined to a house and darted.**

**RADIO COLLARING & RELEASE OF TIGER IN SUNDARBAN , W.B.  
25.01.2017**



**RADIO COLLAR**



**PREPARATION OF IMMOBILISING DRUGS**



**DRUGGING THE TIGER**



**CHECKING DEPTH OF SEDATION**



**RECORDING BODY WEGHT**



**RECORDING BODY MEASUREMENTS**

**RADIO COLLARING & RELEASE OF TIGER IN SUNDARBAN , W.B.  
25.01.2017**



**RECORDING BODY MEASUREMENT**



**RECORDING CANINE MEASUREMENT**



**MAKING THE COLLAR READY**



**CHECKING THE COLLAR TRANSMITTER**



**PUTTING THE COLLAR ON NECK**



**CARRYING THE TIGER IN CAGE TO BOAT**

**RADIO COLLARING & RELEASE OF TIGER IN SUNDARBAN,  
WEST BENGAL 25.01.2017**



**TAKING THE TIGER IN BOAT FOR RELEASE**



**PREPARATION FOR RELEASE FROM BOAT**



**PLACING BOAT FOR RELEASE OF TIGER**



**COLLARED TIGER JUMPING OUT FROM BOAT**



**LEAP TOWARDS FREEDOM**



**RELEASED TIGER SWIMMING TOWARDS  
SAFETY OF FOREST**