Ground ULV and Equipment Calibrations

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History of Thermal Fogging

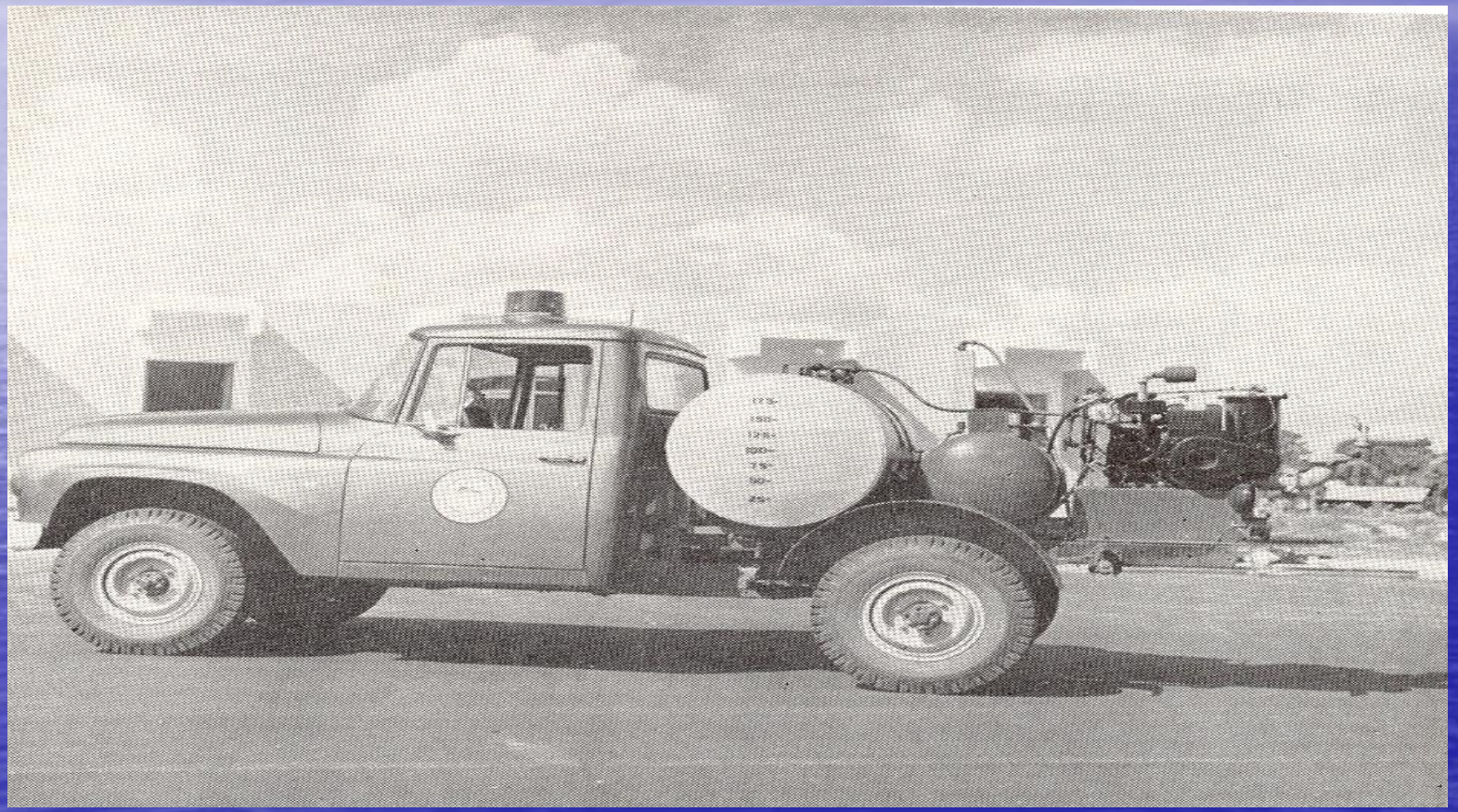
- WWII Technology (Smoke Screen Generators)
- First tests by Latta and LaMer, ca 1945
- Mix of Insecticide and Carrying Agent (usually diesel or kerosene)
- Good Control in Heavy Vegetation
- Creates Traffic Hazards
- Environmental Considerations: 42 gal/hr of oil/diesel

1946

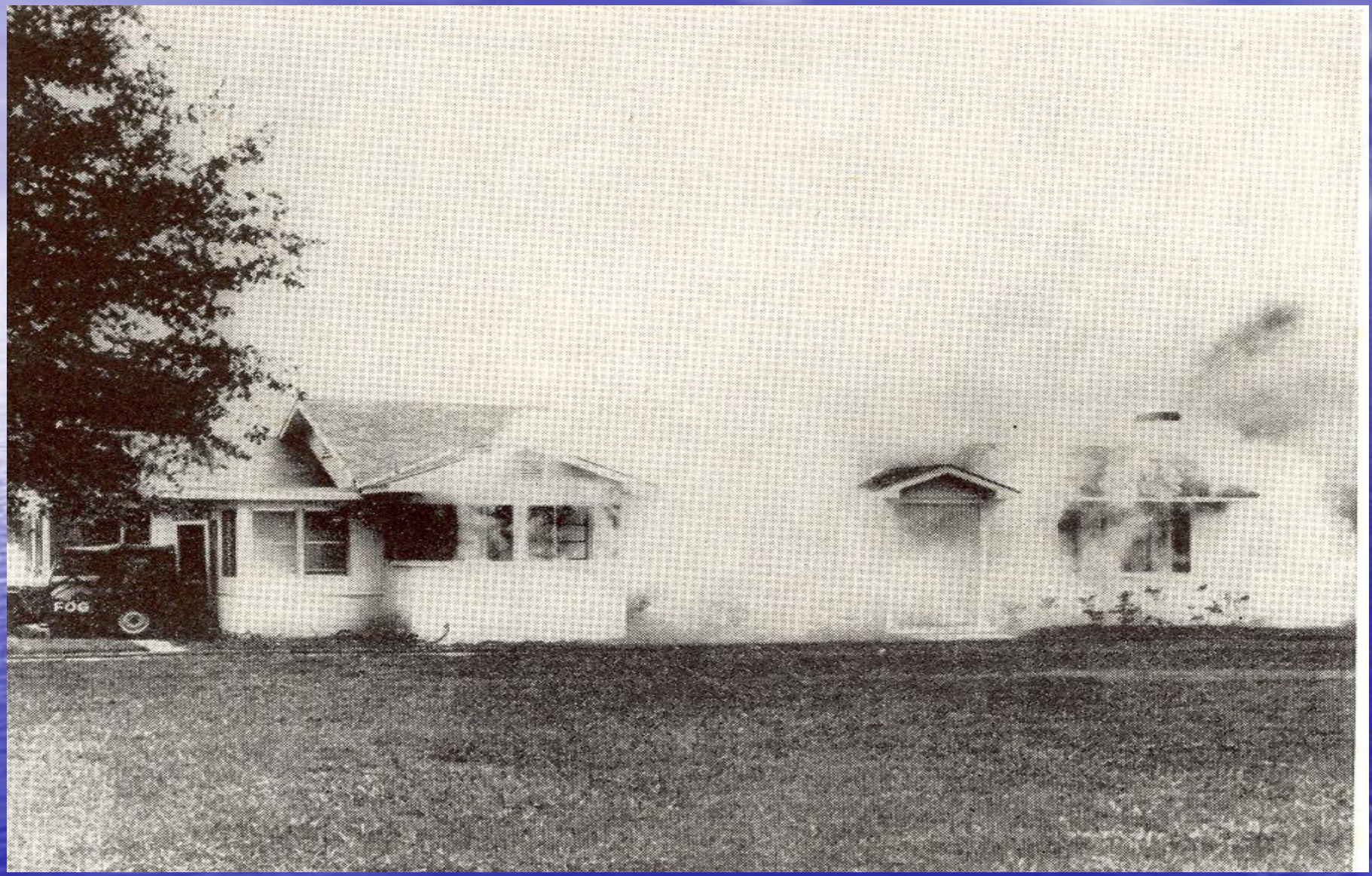
Todd Shipyard made the first thermal mosquito fogger by down sizing a smoke generator that the Navy used to hide ships during World War II. DDT was the first adulticide used and was mixed with Kerosene.


SOUTH CAROLINA STATE FORESTRY COMMISSION
3100 Chevrolet

Separately-fired Combustion Chamber Type



120 Thermal Fogger


FOG

Don’t forget to turn off the pilot light!

Thermal Fogging

History of ULV Aerosols

- Developed during the 1960's
- During 1970's, ULV Papers presented by Dr. Gary Mount at state and national meetings
- Comparable Efficacy with Thermal Fogging
- Use approximately 1-4 gal/hr

1966

The first ULV machine was developed as a joint project between the U.S. Navy Jacksonville, Florida and the U.S. Department of Agriculture.

Thermal vs. ULV

- Comparable Efficacy
- Thermal can provide good penetration
- ULV is Less Offensive and Less hazardous
- Most products and application methods used today were developed using ULV
- ULV uses much less total volume

Adulticiding Basics

- insecticide is moved by air currents
- Droplets must impinge on adult mosquitoes
- Droplets must be small enough to provide adequate drift
- Droplets must contain enough active to kill an adult mosquito

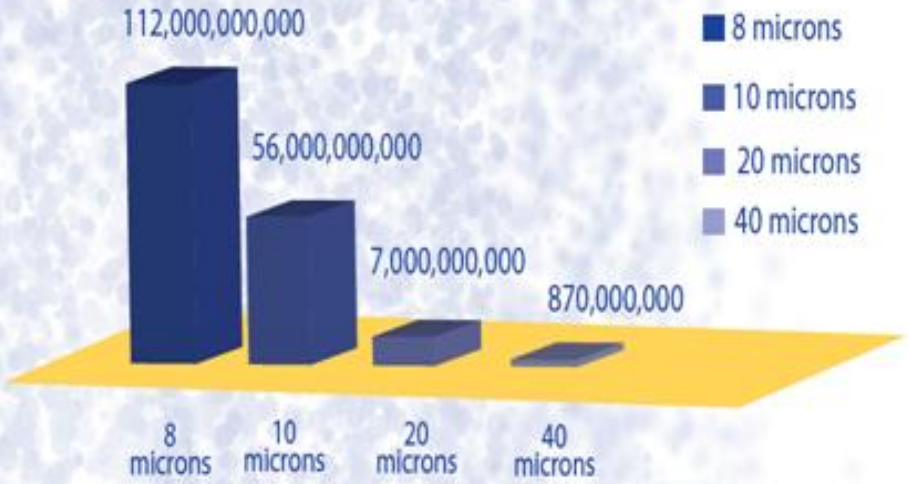
Droplet Sizing

- Maintain maximum level of efficacy
- Meet label/legal requirements
- Recent labeling of mosquito control products requires a specified range of droplet sizes in microns

for proper dilution rates and the recommended VMD.

There have been a number of ground ULV studies on a wide range of active ingredients. The general conclusion is that drops in the range of 5 to 25 are effective for adult mosquito control and a Volume Median Diameter (VMD) of 8 to 17 has been shown to give superior results. These numbers along with the label specifications can be used for a good rule of thumb.

1 oz ULV insecticide contains the following # of drops:



The chart to the left shows some basic droplet dynamics, giving us a clearer understanding of the magnitude of droplets we are producing in a ULV application, as well as some basic idea of droplet drift and droplet settling rates.

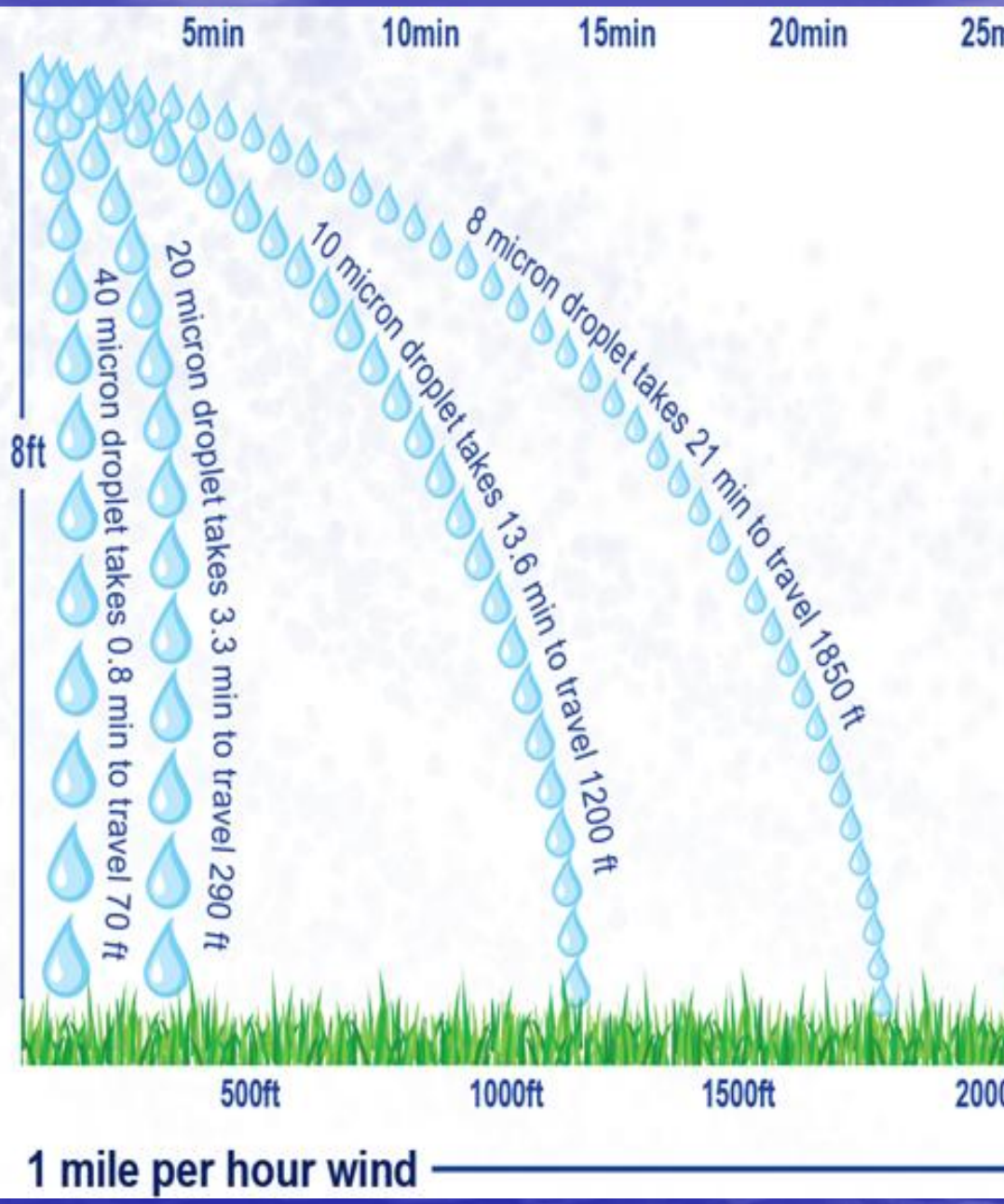
To put droplet size in perspective, keep in mind that the droplet size of an average raindrop during a light rain storm is 500 microns, which has roughly 125,000 times more volume than a 10 micron water drop.

Very large droplets reduce the probability of coming into contact with a flying mosquito. They also fall to the ground more rapidly and thus are less likely to come in contact with an adult mosquito. Smaller droplets may not contain

For maximized mosquito mortality, the adulticide needs to stay in the air and let the wind slowly push it through the target mosquito control zone. The industry standard goal is that effective control can be achieved 300 feet down wind in most open field or low vegetation habitats. Increased vegetation and urban areas reduce the effective swath width because the cloud thickness is decreased as drops are deposited on vegetation and structures.

In calm wind situations, such as 1 mph winds, a 20 micron droplet released at 8 feet above the ground will travel about 290 feet before it settles to the ground. It will drift for approximately 3.3 minutes before reaching the ground, so the higher the wind speed the further it will travel. Likewise, a 40 micron droplet will only stay airborne for approximately 48 seconds and will travel only 70 feet in a 1 mph wind.

Although meteorological conditions and numerous uncontrollable factors play a critical role in droplet cloud behavior, it is still crucial to make



Label Droplet Statement

- *"Spray equipment must be adjusted so the volume median diameter or mass median diameter is less than 30 microns (Dv0.5<30µm) and that 90% of the spray is contained in droplets smaller than 48 microns (Dv0.9<48µm)."*
- The best way to check this is with a DCIII !!!!

Dv0.1

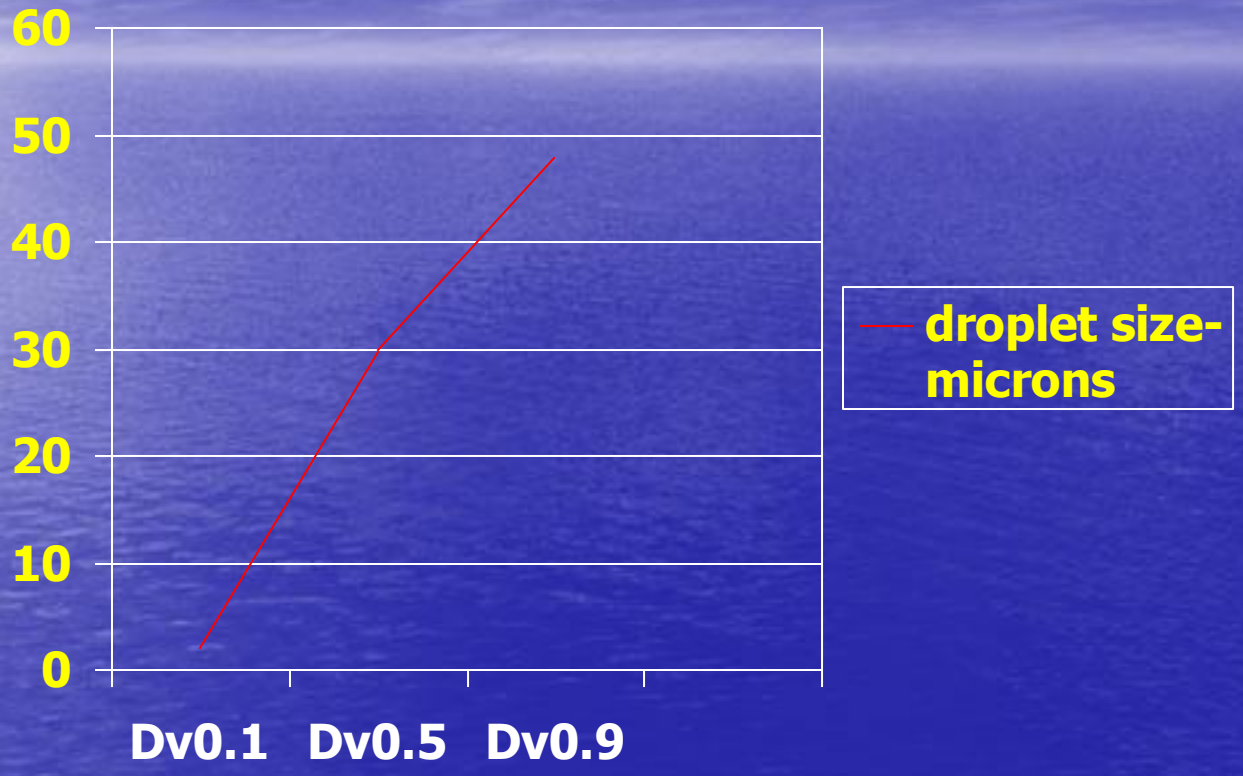
A calculated droplet size in microns that represents a droplet diameter where 10% of the total volume or mass of droplets are smaller

Dv0.5

A calculated droplet size in microns that represents a droplet diameter where 50% of the total volume or mass of droplets are smaller

Dv0.9

A calculated droplet size in microns that represents a droplet diameter where 90% of the total volume or mass of droplets are smaller


60
50
40
30
20
10
0
Dv0.1
Dv0.5
Dv0.9
droplet size-microns

Droplet Sizing: "Hotwire" DCIII

- Very easy to use
- Can be done very quickly
- Best suited for performing multiple tests
- Moderately expensive
- Probes are very delicate and can be broken easily
- Most accurate way of "in the field" sizing


PROBE CALIBRATION CERTIFICATE
DC-IV
PORTABLE DROPLET COUNTER
KLDLABS
INCORPORATED
CALIBRATED

Droplet Sizing: Waved Teflon-coated Slides

- Still used for aerial applications
- Least expensive method
- Very time consuming
- Complex calculations
- Not very accurate!
- Accuracy depends on person reading slide

Rotated Slides

Droplet Sizing: Laser

- Most Accurate
- Very, Very Expensive
- Not Practical for drop sizing vehicle mounted ULV sprayers
- Lasers are normally set up in a laboratory
- Newer ones are more portable, i.e. those used for Agricultural tests

Droplet Sizing: Laser

Why Calibrate?

- You must meet legal requirements for application of any pesticide
- Verify actual amount of chemical applied to comply with product labeling
- Get best results from chemical applied

Components of a Calibration

1. Determine desired chemical application rate from product label
2. Verify correct chemical flow rate and calibrate equipment
3. Verify droplet size (VMD or MMD) and range

label information

- Labels usually provide lbs of active per gallon
- Provide rates of application
- Provide types of applications that may be done, i.e. ULV, thermal, barrier

Label information

- Provide max application limits, i.e. pyrethroids are usually 0.007 per acre
- Aerial directions may contain some limitations
- Labels MUST be applicable for ULV applications, specific directions
- CANNOT use products designed for misting systems or other uses

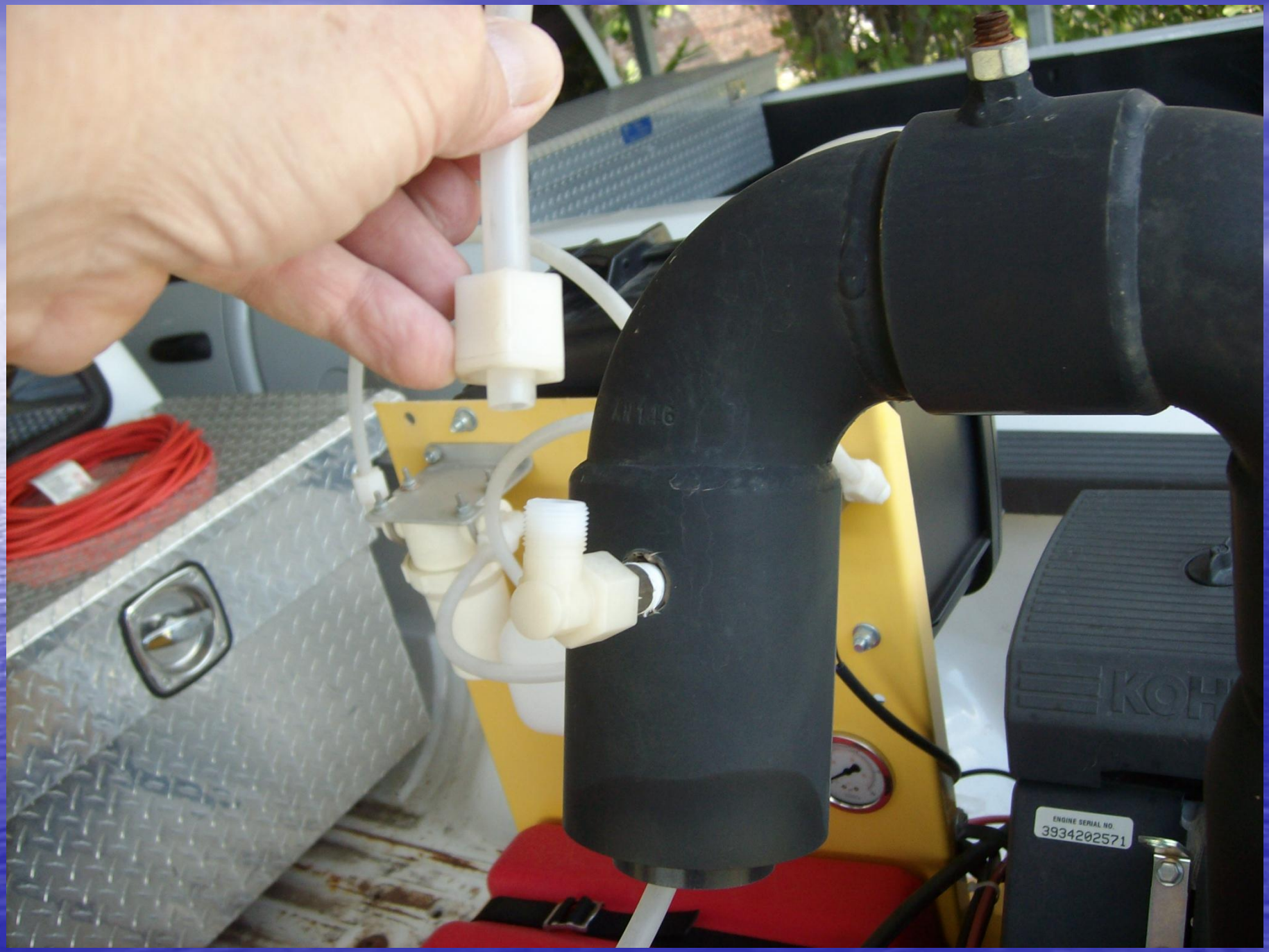
Verifying Flow Rate: Materials

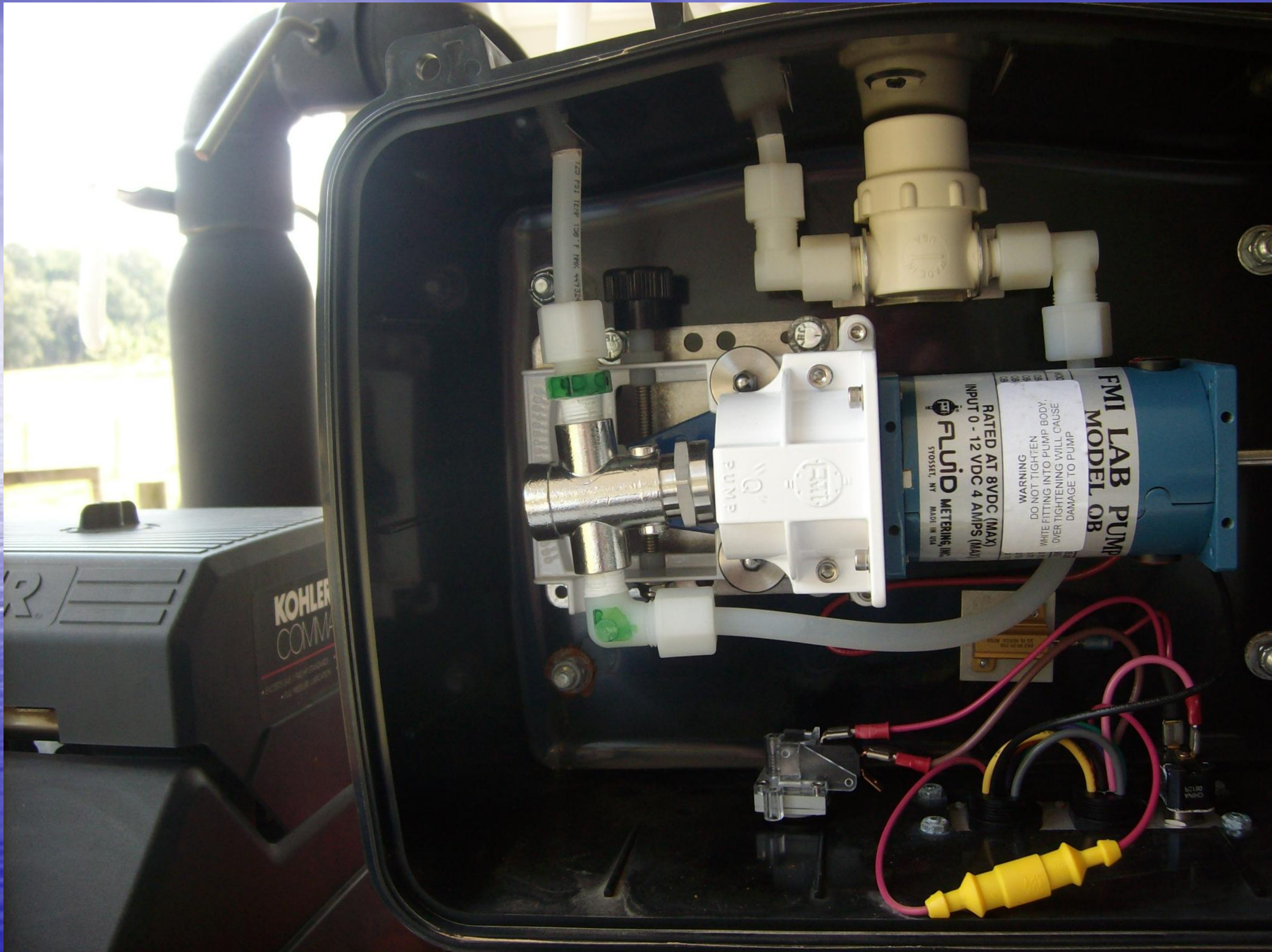
- Personal Protective Equipment: gloves and goggles
- Graduated cylinder (preferably in ml)
- Extra collection container
- Stopwatch
- Any special tools required: i.e. screwdriver, wrench, allen wrench, etc.

Verifying Flow Rate: Chemical Measurement Method

- Push vs. Pull systems: does your flow control system have a pump or does it rely on orifices?

- This determines whether you can measure the output at the nozzle (amount collected) or you must measure the intake (amount used).


ENGINE SERIAL NO.
3934202571


FMI LAB PUMP
MODEL QB
RATED AT 8VDC (MAX)
INPUT 0 - 12 VDC 4 AMPS (MAX)
FLUID METERING, INC.
SYOSSET, NY
MADE IN USA
WARNING
DO NOT TIGHTEN
WHITE FITTING INTO PUMP BODY,
OVER TIGHTENING WILL CAUSE
DAMAGE TO PUMP
"Q" PUMP
KOHLER


WARNING
DO NOT TIGHTEN
WHITE FITTING INTO PUMP BODY.
OVER TIGHTENING WILL CAUSE
DAMAGE TO PUMP
RATED AT 8VDC (MAX)
INPUT 0 - 12 VDC 4 AMPS
FLUID METERING
SYOSSET, NY
PUMP

Verifying Flow Rate: General Rules

- When possible, always take the final measurement with the engine running, as system voltage may affect pump output. Calibration of orifice systems *must* be done with the engine running.
- Measure output for at least 1 minute.
- Make sure all air is removed from the lines and filters before you start.

Pumping Systems

- Flow Meters
- SCAMP
- Leco VF and CV
- ELF
- Monitors 1,2, 3, and 4 Accuflow, GeoFlow
- SmartFlow
- Sentinel GIS

It is now possible to:

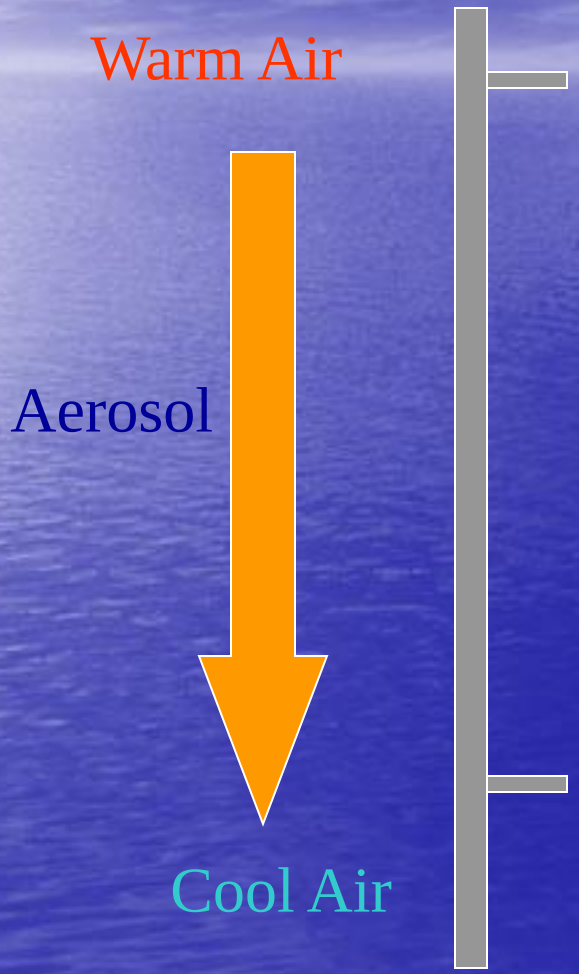
- Generate reports of spraying operations
- Can track vehicles using GPS
- regulate chemical applications, using GPS
- Have download capability
- Real-time tracking of vehicles
- Can now use mobile devices, PDA's to collect data from chemical applications, Sentinel GIS

The Weather

What type of weather do we want?

An inversion with low wind speed!

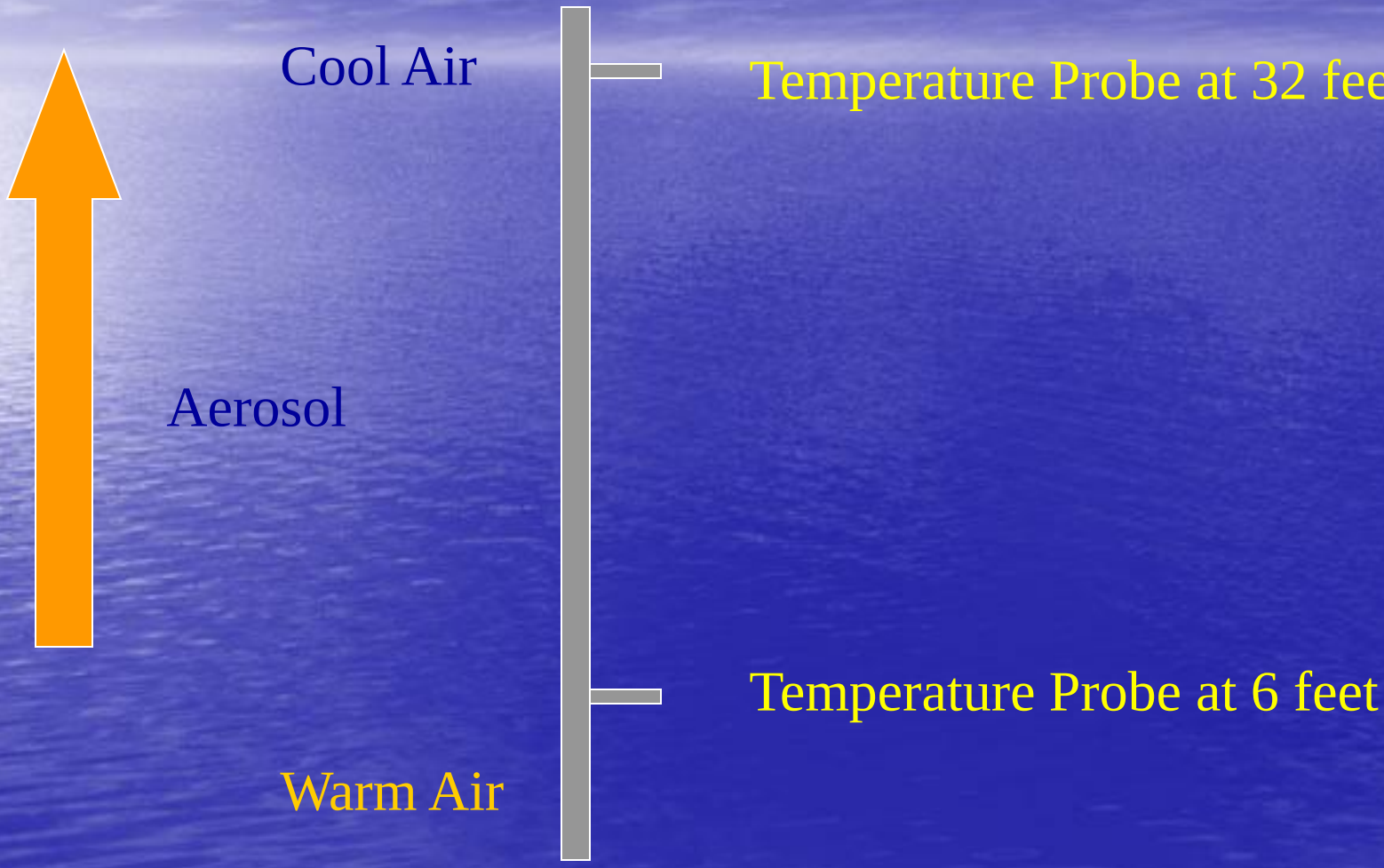
Inversion Conditions



Temperature Probe at 32 feet

Temperature Probe at 6 feet

Lapse Conditions



Adulticiding: Factors to Consider

Timing

- Peak Activity Period of Mosquitoes (consider Ae. ab.)
- Consider Thermal Updrafts

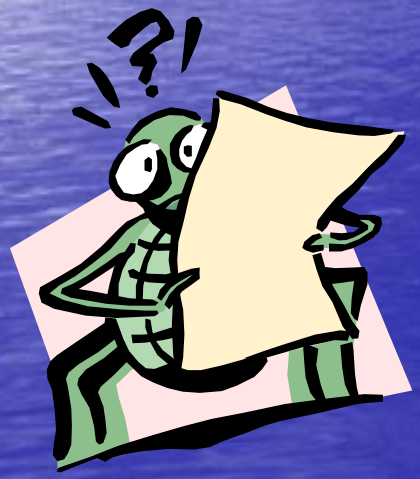
Environmental Factors

- Rain/Wind are limiting factors
- Barriers to treatment

Areas/Maps/Record Keeping

Evaluation

- Outcome of the Application
- Efficacy of the Material



- Did the Material get there?
- Did the Material kill the bugs?

ULV: Truck-Mounted

Basic ULV Types: Low Pressure

ULV: Truck-Mounted

Basic ULV Types: High Pressure

ULV: Multi-Purpose Sprayers

Basic ULV Types: Rotary Atomizers

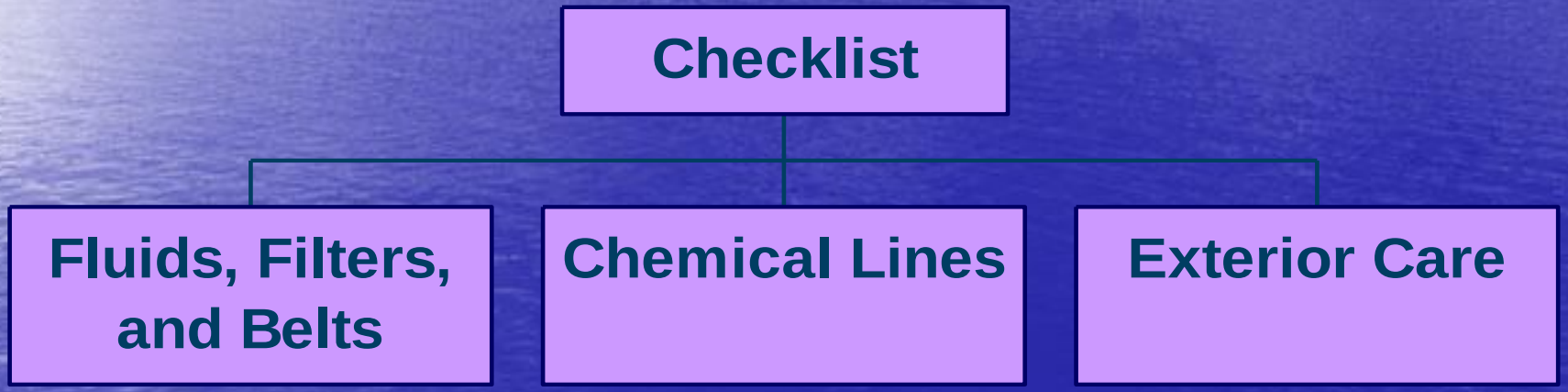
ULV: Gas Handheld

ULV: Backpack

ULV: Electric Foggers

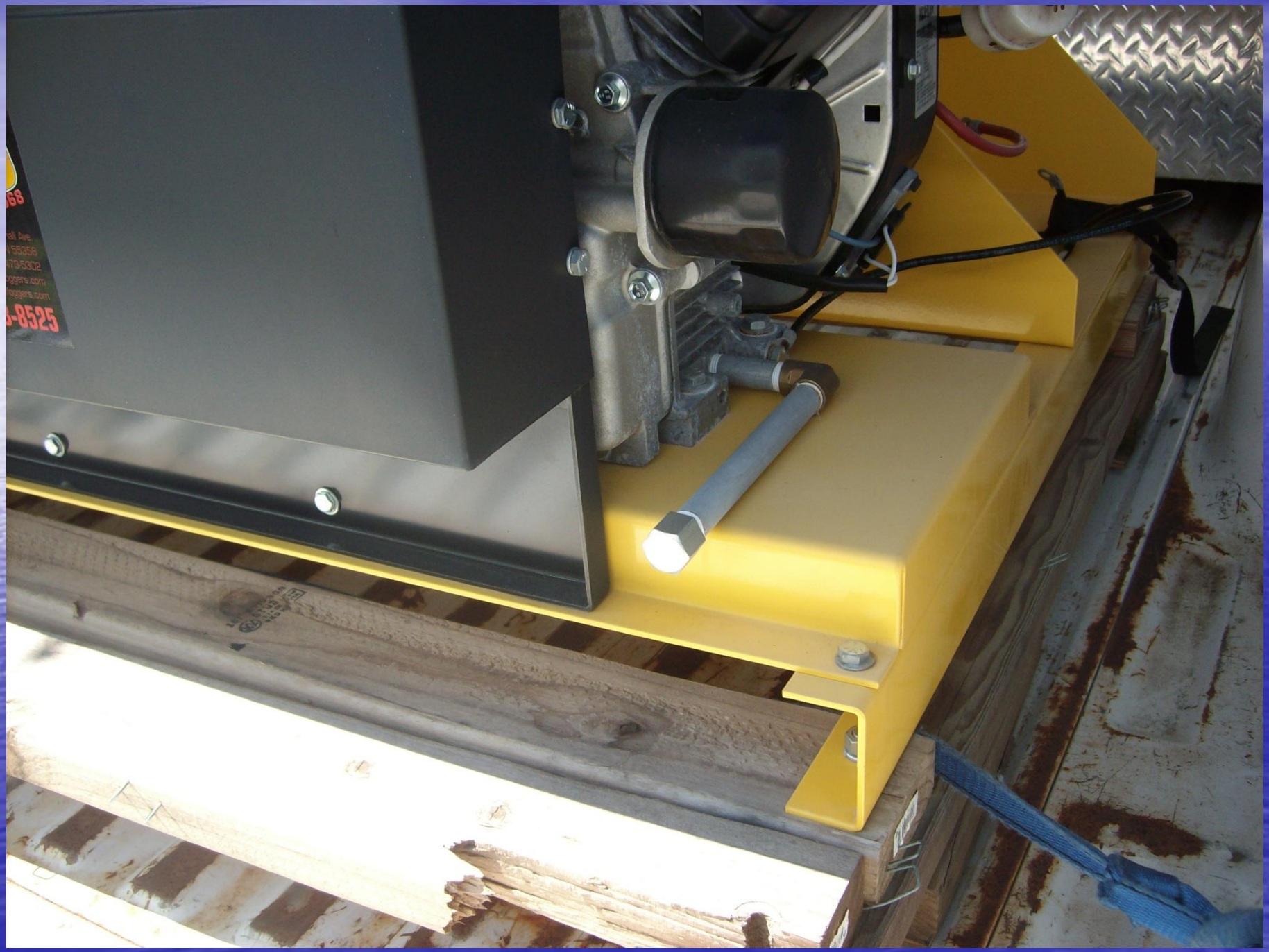
ULV: Aerial

Ground Units, Maintenance



Fluids, Filters, and Belts

- Fluids: engine oil, blower oil, grease fittings
- Filters: oil filter, chemical filter, air filter
- Belts: check tension and wear



Chemical Lines

- Check all lines and fittings regularly for leaks
- Watch for dry or brittle lines
- Replace lines as needed

Exterior Care

- Wash and degrease occasionally
- Repaint surfaces as necessary
- Replace worn or damaged parts

Adulticiding: Why is it Necessary?

- Part of an IPM Approach
- Complements Source Reduction and Larviciding
- Large Scale Larviciding May Not Always be Possible
- Presence of Disease and/or Vectors requires an immediate response

Questions?