

HANDLING, MIXING AND LOADING

section 3



3.1 BASIC PRINCIPLES

All aqueous Btk formulations are suspensions, not solutions. They consist of water plus Btk spores and crystals, fermentation solids, adjuvants, stabilizers and other minor inert ingredients. Therefore, some basic principles can be stated about how these liquids should be handled in order to avoid problems in calibration and application.

Variable Viscosity

In some unique situations, temperature may affect the viscosity of the material.

Typical temperature changes during the day will not be noticeable in spray system flow rates. However, wide temperature ranges that could be experienced between the start and finish of a project, usually experienced at higher elevations, may require the use of different calibration constants in flow meters. Be aware of this and if required, consult with Valent BioSciences personnel about this unique situation.

Suspensions

The suspended solids are small particles; filters finer than 30 (i.e. 50 to 100) mesh may collect these particles and eventually become plugged.

i APPLICATION TIP: DO NOT USE ANY FILTERS FINER THAN 30 MESH, ESPECIALLY WITH UNDILUTED APPLICATIONS.

Detergent Action

Foray formulations act as mild detergents and may loosen up dried-on accumulations of foreign matter

from previous spray operations on the walls of spray tanks, aircraft hoppers, lines, pumps, booms and nozzles. Carefully check all filters in your loading and spray systems after the first few loads; this is when and where such debris will be found.

Stickers

Aqueous formulations of Foray contain additives to enhance sticking. Therefore, regular rinsing, especially of system parts exposed to the air where drying can occur, should be performed before complete drying of the Foray on atomizers and aircraft surfaces occurs.



Operations

Always have back-up pumps available in case of pump failure.

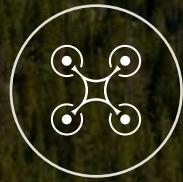
Aeration

Any heavy, viscous liquid can entrap air and hold it for some period of time. When recirculating or transferring these products, it is important to avoid the entrapment of air. Submerging both the inlet and the outlet of the hoses/tubes when recirculating these products will help prevent excessive aeration and producing a product with a milkshake-like consistency. If this situation arises, the pilot will first notice an increase in pressure and an altered flow rate, especially near the end of a load. This will alter the flow rate and ultimately the application rate.

3.2 EQUIPMENT

Pumps

Loading pumps with a 3-inch (7.5 cm) suction inlet is recommended. They should be powerful enough to transfer a minimum of 100 gpm (400 L/min). If 2-inch (5 cm) centrifugal pumps are used with bulk tankers, it is better to use a 3-inch suction hose from the tanker to the pump and then reduce from



Operations:

At the start of the season, calibration of transfer pumps should be checked by pumping material into a previously calibrated container and comparing the pump flow meter readings to the actual volume transferred.

3-inch to 2-inch at the pump. Always have back-up pumps available in case of pump failure.

Hoses

Maximum hose diameters should be used wherever possible to improve the rate of flow of product from tank to tank or aircraft. Suction hoses of less than 2-inch (5 cm) in diameter and loading hoses of less than 1-inch (2.5 cm) diameter will be inefficient and should not be used. Hoses should be in good condition and suction hoses must be airtight and free of holes and leaks. All fittings on the suction side must be airtight. Use the shortest possible suction hoses.

With centrifugal pumps it is much more efficient to extend the hose length required on the pressure (outlet) side of the pump than on the suction (inlet) side of the pump.

Screens/Filters in Transfer/Loading Systems

Screens and filters in transfer and loading systems are designed to prevent damage to pumps and meters and to prevent larger particles from entering the aircraft spray system. Screens of 20-30 mesh size will accomplish this objective. A 20 mesh screen will allow improved flow rates and will not plug as easily. If no inline screens are being used in the aircraft system, then 30 mesh screens should be used in the loading system. See Section 4.2 for a detailed discussion on spray system screens.

Flow-Meters

Meters are used to measure the liquid volume of product being handled. Meter accuracies will vary with the slippage of the liquid past the meter vanes, and by the amount of entrapped air in the product.

Meters should be calibrated for (1) the product being pumped and (2) the system being used. If meters are calibrated with water only, aqueous Foray formulations produce meter readings which

are typically 5-7% less than the actual amount of non-aerated product delivered.

For example, a meter calibrated with water reading 100 gallons (or liters) will have actually only delivered 93-95 gallons (or liters) of Foray. No single standard conversion factor can be provided because of variables such as viscosity of product as it passes through the meter and the extent of aeration. However, if you allow for a 5-7% flow differential, your aircraft will be very close to applying the desired rate.

At the start of the season, the calibration of transfer pumps should be checked by pumping material into a previously calibrated container, such as an aircraft hopper, and comparing the pump flow meter readings to the actual volume transferred. Some jurisdictions require a regular inspection and verification of the flow meter by an external agency certifying the accuracy of the flow meters.

Current aircraft Differential Global Positioning System (DGPS) navigation systems integrate flow rates, flight speed, swath width and area treated to provide accurate flow and application rates across the treatment area. The pilot may ‘tweak’ the control inputs in the first one or two loads to improve the accuracy of the application.

Even with properly calibrated equipment, the pilot and ground crew should always check the volume pumped into the aircraft with the size of the areas treated to help ensure accuracy.

3.3 SPILL MANAGEMENT AND DISPOSAL

Spill Management of Aqueous Foray Formulations

Always assure adherence to federal, state/provincial and local regulations subsequent to disposal. Foray formulations are Category III pesticides



Safety

Always be careful when handling
Foray drums, as they weigh 550 lb
(≈ 220 kg) each.

and are not classified as hazardous materials and are not regulated under DOT (US Department of Transportation) hazardous material regulations (49 CFR 100-199).

Foray degrades naturally in the environment and does not accumulate in the soil. There are no petroleum-based components in the formulation. Therefore, spills on soil surfaces may be handled as follows:

Hose the area down with ample water to disperse into the soil and/or grass. The dilution effect will facilitate the biodegradation of Btk. Cover the spill with a layer of soil to enhance degradation. (This would be the most likely option in remote forested areas).

If a spill occurs on an impervious surface such as concrete or asphalt, rinse the area with clean water if the runoff can be directed to a soil/grass surface.

OR Use an absorbent material such as cat litter, clean sand, or commercially available absorbents (e.g. SorbAll) to soak up spills. The contaminated material may be spread over the soil surface or taken to an approved landfill. While Btk has shown no adverse effects to aquatic organisms, do not rinse spills directly into streams, lakes or rivers.

 Foray is listed with the Chemtrec Spill Notification Network (800) 424-9300.

Most spills occur in and around the aircraft loading area and consequently the spill is accessible and clean-up is a simple procedure.

One or more emergency jettison sites should be identified on the treatment maps and discussed with the pilot in advance of the program. In the case of an in-flight emergency and if it is safe to do so, the pilot may proceed to the designated area(s)

to dispose of the balance of the load. These sites should not be located near any water bodies.

3.4 DISPOSAL OF RINSATE

Foray must be disposed of in accordance with federal, state/provincial and local regulations. For product and container disposal procedures, see label directions.

Rinsates are best disposed of by adding them to the spray mixture during the operation and applying the material on the target area. Rinsate may be added to undiluted materials so long as it constitutes no more than 5% of the total volume at any time; this will not affect the calibration rate. Some program managers prefer to wait until program completion and then direct the pilot to apply the rinsate to the treatment area. Open up all nozzle restrictors and/or uncap the booms to apply the rinsate. Alternatively, the rinsate may be jettisoned over the pre-approved emergency jettison sites.

3.5 FORAY PRODUCT CONTAINER SIZES & HANDLING PROCEDURES

Foray formulations are available in North America in 55-gallon poly drums, 265-gallon (1000 L) mini bulk containers and in bulk quantities of 4000 to 5000 gallons (16,000 - 18,000 L) shipped in tanker trucks.

In the rest of the world (RoW), Foray is available in several package formats including 200 L poly drums, 1000 L mini bulk containers. Smaller package sizes may be available in some countries, depending upon local needs. Each type of packaging may require somewhat different handling procedures; please consult with Valent BioSciences staff regarding specific needs for your program.



Safety

When unloading product, the lid to the mini-bulk container opening must always be open or removed to facilitate flow and prevent the collapse of the container.

Drum Handling

(SEE APPENDIX 2 for drum photo and dimensions.)

Delivery: Drums are normally delivered by truck on pallets (4 drums/pallet). If a forklift is not available, drums may be rolled off the truck tailgate onto two or three old tires (without rims) stacked behind the tailgate where the drum impacts the ground. Be careful when handling drums in this manner and ensure that no one is located immediately behind the stacked tires; drums of Foray weigh 550 lb (≈ 220 kg) each.

Storage: Store drums upright in a dry location. Storage temperatures should be between 32° and 90°F (0° and 32°C). Keep out of direct sunlight at higher temperatures.

During shipping and storage, some normal settling of the formulation will occur. To re-suspend, roll or shake drums prior to dispensing.

Unloading: The drums may be configured with two, 2-inch NPT threaded openings (North America) or a combination of a 2-inch NPT and a (5 cm) metric threaded opening (RoW). Product can be dispensed either by pouring or by use of a transfer pump having a minimum flow capacity of 100 gal/min (400 L/min), e.g. 5 HP gasoline engine - centrifugal pump with a standpipe at least 42 inches (110 cm) in length, not more than 2 inches (5 cm) in diameter, and a non-collapsible hose. All pump and transfer lines should be flushed with plenty of clear water prior to use.



Performance

Container contents should be recirculated prior to use.



Diluted or undiluted Foray left in the lines and pumps will not cause damage or plugging.

APPLICATION TIP: If a meter is unavailable and a partial drum quantity is required, a measuring stick may be used to determine the volume.

The liquid height in a standard drum containing 55 gal is approximately 33 inches.

Therefore, 1 inch on the dipstick is equivalent to approximately 1.67 gallons and 1 cm is approximately equivalent to 2.5 L. You may check this by measuring the level of Foray in a full drum.

The 265 gallon/1000L mini bulk containers

include a measuring gauge on the side of the outer frame. This can be used for estimating the volume of material remaining in the container if it is only partially emptied.

A properly calibrated flow meter is required for more precise measurements.

Mini Bulk Handling

(SEE APPENDIX 2 for photo and dimensions)

Delivery: When full, mini-bulk containers weigh about 2650 lb (~1050 kg) and require a forklift to handle. When empty, the containers weigh 175 lb (80 kg) and can be handled manually.

Storage: Mini-bulk containers are mounted on a 4-way pallet and should not be stacked more than two high.

Store in a dry, preferably enclosed, location that is accessible to a forklift. Container contents should always be recirculated prior to use.

Unloading: A (5 cm) male metric threaded outlet is fitted with a valve and located at the base of the container. Each container also comes with a (5 cm) male metric to 2-inch female NPT adapter. The top of the container has a large 8-inch (20 cm) opening fitted with a screw-on lid, through which a 42-inch (110 cm) standpipe may be inserted.

Prior to use, the contents should be recirculated once by pumping the product from the outlet valve back through the top opening. The hose end should be submerged below the surface of the product.



Safety

External valve controls should always be secured during non-use periods to prohibit unauthorized operation.

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Replace the lid once the unloading operation is complete to prevent airborne contamination by dust, debris, rainfall or other moisture. If the entire mini-bulk is to be pumped into the aircraft or into a larger holding tank, recirculation is not required prior to pump out.

Bulk (Tanker) Handling

(SEE APPENDIX 2 for photo and dimensions)

Delivery: Bulk shipments are made in standard bulk tanker or ISO tanker trucks in North America. They may be off-loaded into the customer's bulk facility or "spotted"/"dropped" for direct use by the customer; the customer should have a large capacity pump to offload the tanker.

Note that all entries, outlets, and vents with removable caps on the tanker are sealed with a tamper evident numbered seal. There may be a dozen or more, depending upon the configuration of the tank. These seals are installed to verify the product has not been accidentally or purposefully tampered with. The numbers are recorded and included with the shipping documents as a Chain of Custody.

Storage: If the entire contents of the tanker are off-loaded into the customer's facility, no recirculation of the contents is required. Standard tank trucks are equipped with 3-inch (7.5 cm) male camlock outlet fittings; the customer may need to assemble a 3-inch/2-inch (7.5 cm/5 cm) adapter fitting to easily connect to the 3-inch male camlock fitting.

If it has been sitting for two days or more, the product should be recirculated at least once

prior to use During recirculation, the return hose should always be submerged under the product surface to avoid entrapment of air and foaming of the product.

Unloading: Equipment recommended for off-loading and/or recirculating bulk tankers includes:

- a 3-inch (7.5 cm) non-collapsible suction hose
- a transfer pump capable of pumping 250 gpm (1,000 L/min)
- 1-inch or 2-inch (5 cm) loading hoses of sufficient length to reach the top manhole and/or one or more aircraft for direct loading.

Most bulk tankers are equipped with two control valves (internal and external) to avoid accidental discharge. Both valves must be open to allow discharge of contents. External valve

controls should always be secured during non-use periods to prohibit unauthorized operation.

APPLICATION TIP: If 2-inch suction pumps are used with bulk tankers, it is better to use a 3-inch suction hose from the tanker to the pump and reduce from 3-inch to 2-inch at the pump. A smaller loading hose provides a slower flow rate.

The contents of the tanker should be completely recirculated once before partial unloading or usage. This can be done by pumping the product from the outlet valve through the open manhole. The hose end at the manhole should be submerged below the surface of the product. Precautions should be taken to prevent the hose end from coming out of the manhole and causing a spill or injury; usually the hose is tied into place at the



Security

Always check the integrity of seals upon arrival of the tanker.

manhole and a ground staff member stays beside the manhole for safety.

The lid of the tanker manhole must always be open when pumping to prevent the collapse of the tanker walls. The lid should be vented prior to opening the tanker to release any pressure that has built up. If the tanker has not been completely emptied, be sure to close the lid in order to prevent rain or debris from contaminating the contents.

If the delivery tanker is being dropped to use as on-site storage, it must be placed on solid ground with the front support dollies on solid planks or timbers between four and six inches thick.

Upon arrival, ensure that the dollies can be easily raised and lowered so that the front of the tanker can be manipulated as it nears empty. The ground should be solid and level (or slightly inclined towards outlet) and the trailer wheels should be locked and chocked. If the tanker unloads from the tail, the rear of the tanker should be lower than the front. If it unloads from the center, it should be level. When unloading a tanker into another tanker or holding tank, the storage tanker or tank must be flushed and cleaned with clean water and

completely drained prior to transferring the product into the empty vessel.

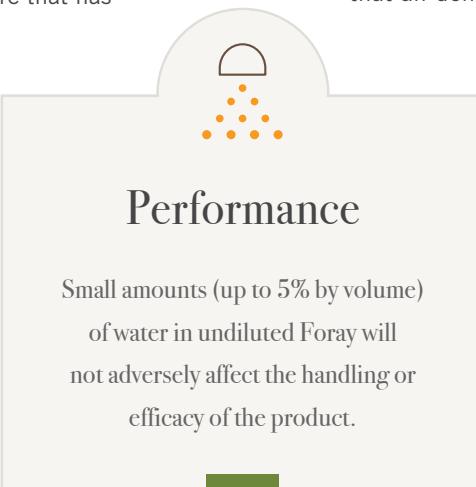
When the container is almost empty (less than 200 L), rinse down the sides of the container with small amounts of water. This will assure that all delivered product is removed as the water will reduce the viscosity of the remaining contents which will then flow readily from the tanker.

Please ensure that the tanker is completely empty, including any rinse water that was used to clean the tanker. Jack up the front dollies to their full extension to drain the tank. The tank haulers return all tankers to a washing facility for an acid

wash decontamination before being put back into service. The customer will be charged a disposal fee by the hauler for any liquid left in the tank that has to be disposed of, including rinse water.

3.6 RECIRCULATION PROTOCOL FOR FORAY FORMULATIONS

Undiluted formulations of Foray are stable suspensions. There is no need to periodically recirculate the contents during storage except prior to use.



Performance

Small amounts (up to 5% by volume) of water in undiluted Foray will not adversely affect the handling or efficacy of the product.