# FREQUENTLY ASKED QUESTIONS

## INTRODUCTION

### What is alkaline hydrolysis?

Alkaline hydrolysis is a process by which animal tissues are broken down into their basic building blocks. The BioLiquidator system creates the ideal environment for this process to occur. The equipment uses a combination of system design, water flow, temperature, and alkalinity to accelerate the breakdown of organic materials.

### What is left after the process?

The end result is a sterile fertilizer, along with the inorganic minerals that composed the bones and teeth (calcium phosphate). The solution is comprised of amino acids, small peptides, sugars, nutrients, and a small amount of biodegradable soap. All of the nutrients that were present in the body can be recycled back to the environment through direct application or alternative methods.

### Are the final remains safe to handle?

Yes. The bone remains are sterile (pathogen and disease free), cooled, and safe to handle immediately after the process.

### What are the different BioLiquidator models available?

The S-units are stationary, installed units. The M-units are mobile, trailered units that are equipped to operate in any location. The model numbers denote the number of pounds the system can process. The S-2500 and M-2500 units can process up to 2500 pounds, and the S-4000 and M-4000 units can process up to 4000 pounds.

### What inputs are required for the BioLiquidator process?

The process requires water, alkali, and energy. A cycle uses 250-700 gallons of water depending on the equipment and volume of mortalities. The alkali is available in liquid or dry form; a blend of sodium and potassium hydroxide is typically used. Stationary systems are hooked directly to electricity and can use propane or natural gas for fuel supply. Mobile systems use an on-board generator to supply electricity (or can be plugged into a 208-240V Single Phase plug when available) and can be ordered in either a propane/natural gas or diesel configuration.

## CAPABILITIES

### What materials can be processed in the BioLiquidator system?

The BioLiquidator process can break down and sterilize animal tissues and protein-based materials. This includes whole and large animal carcasses, fish, sea animals, eggs, blood, SRM (specified risk material), slaughterhouse waste, necropsy mortalities, and anything else that is protein-based. The process can also break down bio-plastics, such as special dissolvable bags.

### Can the system process frozen mortalities?

Yes. Frozen mortalities do not affect the process, but this could impact the volume that can physically fit into the machine.

**What volumes can a system process?**

The S-2500 and M-2500 models are rated for 500 to 2500 lb (227 to 1134 kg) of tissue in a single cycle (minimum and maximum). The S-4000 and M-4000 models are rated for 750 to 4000 lb (334 to 1814 kg) of tissue in a single cycle. Some types of mortalities may allow you to fit significantly higher volumes (1.2-2 times capacity) into the machine, such as avian species, eggs, fish, SRM, and general abattoir waste (from processing facilities).

**Can the machine work with our large variation of volume needs?**

Yes, our systems work well with spikes and lulls in volumes. Please allow us to learn about your operation, so we can determine if we have a system that can meet your needs. We also offer custom systems in smaller and larger sizes.

**How long does the process take?**

With typical installation and use, the process takes 18-20 hours (from start of one cycle to the start of the next). Avian species require significantly shorter cycle times. Please inquire about your specific material.

**Is the cycle time shorter for smaller cycles?**

No. For example, the cycle time is the same whether you have 1,000 lb of mortalities vs 4,000 of mortalities.

**Can cycle times be reduced?**

Yes, with certain setups and situations. Special installation setups can reduce cycle times for some applications where faster treatment is needed, with modifications that include but are not limited to preheated hot water and rapid discharge.

For emergency disease response where rapid sterilization cycles are needed and special inputs are provided (such as preheated water), cycle times can also be reduced.

## BIOSECURITY

**How does the BioLiquidator increase biosecurity for farms?**

The BioLiquidator allows farms to perform routine on-site mortality management, and have a valuable tool for managing, containing, and minimizing the impact of disease events. By having a fully contained treatment system on-site, farms can eliminate the need for third party pick-ups, the liability of transportation of animals off-site, pickups from vehicles that visit other farms, which increase disease exposure risks to the farm's healthy animals. Disease vectors (insects, scavengers) do not have prolonged access to the material, as it can be processed immediately.

Alkaline hydrolysis offers complete sterilization of all material that is placed in the system. Facilities can rest assured that all material processed received full, homogenous treatment. Facilities can verify and document that each cycle reached successful sterilization parameters. The BioLiqudator offers immediate results, and quick sanitary disposal. Cycles are measured and repeatable; there is no operator-variation in the process that is dependent on the type of inputs (carbon material). Farms can be confident that the byproducts that are recycled for beneficial reuse have been thoroughly treated.

**What are the benefits of using mobile BioLiquidator systems for on-site emergency disease response?**

- Mobile systems from various locations can be easily deployed to the site of disease outbreak.
- The units are easily pulled behind a ¾ ton pickup truck, and can be pulled into rugged off-road conditions.
- The inputs for the system are easily attainable at any location. Water and propane (or diesel) are readily available. The process does not rely on the troublesome trucking in of carbon material, or ineffective treatment due to wet or improper bulking agents. Chemical supply is always available locally and can be transported on-site quickly. For disease outbreaks with significant amounts of materials to be processed, chemical needs can be estimated and additional material can be deployed from numerous places throughout the country.
- Cycles are measured, repeatable, and thorough. Treatment is able to be monitored, verified, and documented.
- While not deployed to an emergency event, the equipment can be used for routine mortality disposal and civil service. This ensures the equipment is always in good working order, and provides numerous trained and qualified operators and subject matter experts. This makes sense functionally and economically. Enormous equipment being stored unused in warehouses awaiting for deployment is not practical economically, functionally, and increases occupational health and safety risks due to a lack of operational experience with the equipment.
- One trained operator can manage several machines, allowing a small set of trained operators to take shifts and prevent worker fatigue and excessive personnel costs for emergency situations. This also means that even if only a fraction of the trained operators at regular usage sites are available to respond to an emergency disease situation, the equipment can still be easily transported to the site of outbreak, and one single SME can manage multiple machines.
- The hot, sterile effluent can be used as a hot surface decontaminate for the immediate area.
- Operation is very affordable.
- The process does not aerosolize or spread airborne diseases.
- The process provides immediate results, and does not rely on continued risk to be managed after the SMEs (subject matter experts) have left the premises.

Depending on the pathogen of concern, rapid sterilization cycles can be performed in emergency situations. With proper inputs, the sterilization cycle times can be as follows:

- Poultry (chicken, turkeys): 2 hours turnaround
- Medium (pigs, deer): 6-8 hours turnaround
- Large animal (equine, bovine): 12 hours turnaround

**What diseases are destroyed by the process?**

All diseases are destroyed in the process; the end products are sterile. The process has been thoroughly validated using proper biological indicators (geobacillus stearothermophilus and bacillus thuringiensis), as well as MALDI-TOF analyses showing degree of hydrolysis for prion destruction.

Diseases of common concern are African Swine Fever (ASF), Swine Flu, Classical Swine Fever (CSF), Porcine Epidemic Diarrhea Virus (PED), Laryngotracheitis (LT), Avian Influenza (LPAI and HPAI), Virulent Newcastle Disease (vND), Salmonella, Foot and Mouth Disease (FMD), West Nile Virus, Bovine Tuberculosis (BTB), Cervid Brucellosis, Bovine Spongiform Encephalopathy (BSE), Chronic Wasting Disease (CWD), Scrapie, and vector-borne illnesses. These pathogens and all others are destroyed in the process.

**How is the sterilization cycle verified?**

Proper cycle performance is monitored through parametric monitoring (time and temperature). Bio-Response can assist with efficacy testing procedures if routine validation is desired.

**Can the mobile units be decontaminated? Can equipment be shared between farms?**

Yes. The mobile units can be easily deconned just like any vehicle that travels between farms.

## APPLICATIONS

**Can the BioLiquidator be used to process and effectively treat SRM (specified risk material) and other high-risk materials?**

Yes. Treatment of tissue with hot alkali solution is the most effective and environmentally responsible method of destroying materials that could potentially contain TSEs (transmissible spongiform encephalopathies). TSEs include BSE (Mad Cow Disease), scrapie, chronic wasting disease, etc. TSEs require special treatment, as they are not caused by a virus, fungi, or bacteria. They are caused by malformed proteins that are resistant to most chemical and heat treatments. Because alkaline hydrolysis completely destroys proteins, it is the preferred treatment of prion contaminated material.

USDA FSIS (US Department of Agriculture Food Safety and Inspection Service) has recognized the BioLiquidator system as suitable treatment for high risk potentially prion-contaminated materials called SRM (specified risk materials). These materials include neural tissues where prion disease are found in high concentrations, such as brain and spinal cords from cattle over the age of 30 months (for more information, please visit the FDA Feed Ban Enhancement page https://www.fda.gov/animal-veterinary/bovine-spongiform-encephalopathy/feed-ban-enhancement-implementation-questions-and-answers).

Some state department of natural resources have used the BioLiquidator systems for processing of confirmed CWD infected deer and deer heads that are part of their statewide CWD surveillance programs.

**Is the BioLiquidator system a good fit for zoos?**

Yes. This system provides great benefits for zoo programs. Exotic specie mortalies are extremely costly and cumbersome to manage. Exotics typically require disposal through a solid waste management company, like Stericycle. One issue zoo facilities have to deal with is the container size in which the tissue must be provided to the waste management company – usually 50 lb capacity bags. This creates a distressful work situation for zoo personnel, and requires a great deal of labor. With the BioLiquidator, all mortalities can be handled on-site. The system offers great flexibility for handling extremely large animals, and much smaller cycles with small animals. Small animals can simply be kept in cold storage until the minimum cycle amount can be met. This is a great cost savings to zoos.

**Can the system be used by municipalities?**

Yes, there are numerous uses for civil service. Counties or municipalities can use the equipment as a livestock management service, especially in areas that have management issues for small farms due to rendering plants closing or a desire to eliminate mortality disposal by landfill. This is a good fit for areas that require roadkill management due to disease susceptibility (rabies outbreak) or public needs caused by heavy tourism. Municipalities that have disposal needs for animal control can use this system.

There are many special instances that are a good fit, such as areas managing deer mortalities to stop the spread of CWD or other diseases, or carcass management to limit the carrying capacity of an invasive troublesome wild population that has severe impact to the local economy (i.e. coyotes in Rhode Island).

**Can a private horse cremation be performed in the system?**

Absolutely. Our systems are commonly used for private horse cremations. The final mineral remains (calcium phosphate) can be processed into powdered ash and returned to the family in a horse urn.

**Can the system be used for sea animals?**

Yes, in fact this is a great solution for stranding response organizations and the inherent mortality management. As we continue to develop our shorelines, fast and effective management of sea animal mortalities are necessary in order to address public needs, odor issues, sanitation, etc. The BioLiquidator provides an mobile on-site solution that can be brought directly to the deceased animal for fast response and immediate handling. The body does not need to be transported off-site, nor does a noxious compost solution need to be brought to a very public area. In the event of beached animals that are euthanized by veterinary professionals, the euthanasia chemicals are destroyed in the alkaline hydrolysis process which eliminates this serious environmental concern. Of course, if the animal is diseased, the process destroys any pathogens that could be carried to healthy animals through disease vectors.

**Can the system be used to produce fish emulsion fertilizer?**

Yes, this is a key use of the system. The AAPFCO (Association of American Plant Food Control Officials) considers the fertilizer to be classified as hydrolyzed protein. Bio-Response can assist with production of a fertilizer label and state registration as a commercial fertilizer producer.

**Is the fertilizer from the process considered organic?**

Sodium and potassium hydroxide are permitted for use in organic fertilizer production (USDA Organic, OMRI). The amounts used in the alkaline hydrolysis process does not exceed the amount necessary for nutrient extraction. Additional information may need to be provided to your certification agency to obtain organic certification.

**Will the process work for plant-based food wastes?**

No, alkaline hydrolysis hydrolyzes protein-based materials. Unless the food wastes are all protein-based, the process is not a suitable solution for managing food wastes.

## OPERATION

**How is the system loaded?**

With whatever tools you have available! The unit tilts hydraulically via remote control to accommodate any loading method. Loading methods vary based on application. Agricultural applications typically use a front loader or fork lift. Necropsy and institutional applications sometimes use fork lifts with special attachments for emptying barrels or hippo hoppers. For more delicate applications, like private horse cremation, the unit is ideal for respectful placement of the pet in the system.

**Does the process need to be attended while in operation?**

No. We do recommend that the operator stays at the facility until the system is finished filling (approximately 20-60 minutes). Once the cycle is underway, the operator does not need to remain on-site. The operator can return after the process is complete, and initiate the draining cycle.

**Can a cycle be monitored off-site?**

Yes, all of our systems have the option of remote viewing access and emergency stop capabilities as long as internet access is provided. This allows authorized personnel to view controls and cycle progress from an office, home, or cellular device. This also allows secure access for Bio-Response to provide remote support, diagnostics, and program updates. Systems can be configured for a hard ethernet connection (recommended for stationary installations), wireless, or cellular.

**Does the system produce an odor while in use?**

Yes, but it is managed well. Alkaline hydrolysis itself has an odor, which is an amine-type smell (similar to wet dog food). This is because of the amines that are liberated as proteins are broken down into amino acids. Stationary systems have robust lid seals and a vent line that vents to the roof of the facility, managing the odor during the cycle. Ammonia that is vented to the roof is below regulated levels, and immediately volatilized (destroyed) by UV rays.

Mobile systems produce more odor during operation since they do not vent to a roof. These systems are typically operated in locations where the odor is not a concern. A mobile system can be pulled into a building for operation if the building is outfitted with a quick connect vent line and stack.

**Is the system easy to clean?**

Absolutely. After the process, the system drains. The operator can tilt the unit hydraulically and simply rake the bone remains out into a hopper. The unit can be sprayed out with a hose nozzle if desired, but there is no need to rinse the machine's surface. The grate system that protects the agitators and heat exchange system is easily removed if the operator would like to access those areas for cleaning.

**What can be done with the final byproducts?**

The solid remains (calcium phosphate) are fragile, and easily reduced to small, unrecognizable fragments. This is a very desirable soil amendment (bone meal), and can be used directly in gardens or added to compost. This form of phosphate is bound and will not leach to the water table. When soil pH is in the proper range, microbes and fungi are able to make the phosphate bioavailable to plants.

The liquid byproduct is sterile and full of valuable nutrients and micronutrients. It can be pH adjusted as desired, and directly land applied as fertilizer (top dress or knifing). For acidic soils that are typically limed, the fertilizer can replace the need for liming. The effluent can also be stored in tanks without pH modification for later use, directly released into a manure pit for various benefits (nutrient enrichment, pH manipulation, and odor control), or used to top-dress composts. There are some facilities that drain to the wastewater treatment plant for eventual recycling. Please see our fertilizer guide for more information.

**Does the fertilizer cause odor problems when applied?**

The effluent has an amine-type odor (similar to wet dog food), but this is quickly dissipated within a few hours when land-applied. It is nothing in the realm of manure odors, which are much stronger and long-lasting.

**Can a facility add additional amendments to the tank for specific fertilizer needs?**

Yes. At the end of the process, this is the ideal system to create custom formulations of fertilizer. The additives can be added while the solution is hot, if the heat is needed to dissolve the amendment, or the solution can be cooled. The dual agitators allow gentle and thorough mixing of any custom blends. The pH can also be custom adjusted for the end-user.

## IMPLEMENTATION

**What utilities are required for the BioLiquidator systems?**

For stationary installed systems, an electrician will hook power directly to the control panel. Standard units are 2 20V Single Phase 50/60Hz. The boiler can be propane or natural gas fired. The natural gas connection is a low pressure line. A plumber will need to provide a water connection and connect the 2" vent line to the roof or side wall. The units are equipped with a discharge pump to pump into any type of receiving tank, or the drain line can be connected to the building plumbing for discharge to the municipal wastewater plant.

Mobile systems are fully-contained, trailer-mounted systems made to operate in the field. They include an on-board generator to supply electricity. The units can bypass the generator by being plugged into a 208-240V Single Phase plug when available (this saves energy). Mobile systems can be ordered in either a propane or diesel configuration. Propane versions include a trailer-mounted propane tank. Mobile units can also be connected to an external on-site propane source if available. The system has a standard NPT water hose connection, so water can be pumped into the machine from any water source that is available at the operating site.

For overseas applications, custom power, utilities, and HMI in other languages are available.

**Does the source water have to be potable?**

No, with the mobile systems, water can be pumped from a pond, creek, stream, or tank can be used. The water is of course sterilized in the system during the process.

**Can the systems operate in very cold, freezing weather?**

Yes, the equipment can be used in cold weather. We recommend sheltering the system in areas where high wind chill, snow and freezing rain are present during the winter months. If it is going to be without shelter, we recommend the unit be ordered with a controls heater.

For stationary installed units, the water supply should not be allowed to freeze.

**What is the alkali that is used in the process?**

Our process typically uses a blend of sodium hydroxide and potassium hydroxide, however some fertilizer producers choose to use only potassium hydroxide in order to limit the sodium in the final end product.

**Where can the chemical be purchased?**

Alkali is used in numerous industries on a regular basis; it is a common pH manipulator. There are local suppliers across the globe. Alkali is available in liquid or dry form. Dry alkali comes in 50 or 55 pound bags, which need to be stored in a dry area. The bags are typically delivered in quantities of 20 bags or more, delivered on pallets (a full pallet is 40 bags). Dry alkali has a shelf life of greater than 1 year. Liquid chemical is available in drums, totes, or can be delivered to a permanently installed tank. Bio-Response can assist with the decision of which form to use.

**Is the alkali safe to handle?**

Yes. As with any piece of equipment, the BioLiquidator requires operation by trained personnel only. Bio-Response assists customers with deciding on the proper form of alkali, and provides training on chemical handling and equipment operation. Proper PPE must be worn when handling dry alkali or coming into contact with liquid chemical feed components. Facilities must be equipped with a proper chemical safety shower and eyewash station (ANSI Z38.1), and a compliant portable unit is also available for mobile units. These are the same types of wash stations that are present in every high school chemistry classroom.

**Can the unit be operated by one person?**

Yes. If loading equipment can reasonably be operated by a single person, the unit can be handled by one person. The unit features a handheld remote control so the operator can easily manage the loading and emptying mechanisms.

**How much space is required for installation of a stationary unit?**

Please see our brochure for detailed system specifications. The dimensions of stationary units are about 15.5'L along the front loading edge, 7' depth, and 7' high. The lid opens completely to allow loading of large bodies and use of large loading equipment. When the unit is fully tipped on its side, it extends out the front approximately 5'. The minimum ceiling height in a facility should be 12.5'H. The operator will need ample space in front of the machine to accommodate whatever loading device is planned for use. An overhead ibeam and hoist system would require less space than a fork truck, an agricultural front loader would require more space for maneuverability. Bio-Response looks forward to assisting you with your space planning. We can look at existing building dimensions and help determine if the operator would be happy with the amount of working space, and we can recommend facility design for new builds.

**What kind of ancillary equipment is required for use of the BioLiquidator?**

A method to weigh the mortalities is needed, as the amount of alkali added to the process is based on tissue weight. Stationary systems are available with load cells for automatic weighing at an additional cost. Other methods can include floor scales, or hoist dial scales.

A method for loading mortalities into the machine must be available. This can be an overhead hoist, fork lift with various attachments, front loader, or manual loading for smaller animals.

Proper PPE and a chemical safety shower and eyewash must be in close proximity to the machine.

**What kind of truck do I need to pull a mobile unit?**

We recommend a ¾ ton pickup truck with standard hitch to pull the unit. The mobile units weigh between 8300-8800 pounds. Please see the brochure for more information.

**Can the mobile unit be in use while it is being pulled?**

No. Mortalities can be loaded into the unit and transported, however the unit needs to be parked and readied for operation before the water can be added and process started.

**Is and EPA Air Quality Permit required?**

No. The process does not produce any emissions that are regulated by the EPA.

**Are any other permits required?**

Proper documentation for the recycled use of the fertilizer is necessary. Bio-Response fully assists with this aspect. If the system is discharging to the drain, permission from the municipal wastewater authority is obtained. If the fertilizer is being used as fertilizer, a land application permit or commercial fertilizer producer permit is obtained.

If a facility is processing waste classified as solid or regulated medical waste, you will need to secure the proper permit for processing that type of material regardless of the method you use to manage your mortalities.

## WORKING WITH BIO-RESPONSE

**How do I find out about equipment pricing and operating costs?**

Please contact us for our most recent price list. We handle all sales directly, and we conduct business world-wide. We can be reached by email, phone, or skype. We are happy to provide you with a price list and operating cost breakdown.

**How do you support customers outside of the United States?**

More than half of our sales are to overseas customers. We offer a 24/7 emergency service call line, and all of our systems are equipped for remote support. We are able to use the remote access to make assisting our customers an easy process. We can provide program updates or requested changes through these capabilities.

All of our equipment is designed to be simple, robust, and without proprietary parts that have limited availability. Local service people – plumbers and electricians - can provide any service needed to our equipment.

**Can the equipment be financed?**

Yes. Most of our customers finance their equipment. Any local bank or lender of choice can finance our equipment. We can also provide list of financiers that have come highly recommended by our customers.

**Are there any opportunities for grants or subsidy programs?**

Of course. The environmental benefits could qualify businesses for a number of state or federal grants if the business would like to pursue supplemental funding or incentives. Our equipment could also qualify for subsidy under the Canadian National Farm Stewardship Program, and the Natural Resources Conservation Service.

**How long has the process of alkaline hydrolysis been around?**

The modern technology has been in use by universities and the scientific industries for over 25 years!  Joe Wilson was responsible for commercializing the technology and making it a feasible option for institutions. Most prestigious vet schools and animal disease labs use alkaline hydrolysis for their mortality management in favor of cleanliness and decreased environmental impact. Read more here: (Purdue Article, ranger Joe to CEO). Our team of professionals have more experience with alkaline hydrolysis than anyone else, worldwide. In the early 2000s, Joe and his team set out to develop a safe and affordable version of the technology that could allow its use in other industries.

**How long has the BioLiquidator system been on the market?**

We have offered these systems since 2007! Our reliable systems have been in use for many years in a number of different applications. We have BioLiqudator systems in use by farms, pharmaceutical companies that develop vaccines for large animals, the US Military, state Department of Natural Resource agencies, private cremation companies, animal disease laboratories, universities, and more. line and stack.