

### **1. What is Aquamation?**

Aquamation is a method of final disposition that is available for both our human and pet loved ones. The scientific name for this water-based process is alkaline hydrolysis. It is the same process that occurs as part of nature's course when a body is laid to rest in the soil. A combination of gentle water flow, temperature, and alkalinity are used to accelerate the breakdown of organic materials.

### **2. Does the family receive an urn?**

Yes, with 20-30% more ashes than one would receive from a flame cremation. At the end of the process, the inorganic remains of the body (the calcium phosphate of the bones) resemble skeletal remains. In North America and other parts of the world, it's customary to process the minerals into a powder for placement in an urn. This is the same processing step that is performed for the remains that result from flame cremation. Some cultures wish to keep the mineral remains as whole as possible for ceremonial burial, and because Aquamation is so gentle to the remains, it is the ideal process for this purpose.

### **3. Can the family still have a viewing?**

Of course, and in fact many families choose to have a full service visitation for family and friends prior to the Aquamation process. There are funeral professionals who can perform a visitation service with or without traditional embalming, as the family chooses.

### **4. Can the body be embalmed?**

Yes, this is a choice that is in the hands of the individual or family. All embalming fluids are completely broken down in the process.

### **5. Is a casket required for this process?**

No. Unlike flame cremation, a box or casket is not used in the process. These materials will not break down in the Aquamation process, nor will clothing unless it is protein-based (silk, wool, or leather). In states that require an alternative container, the body will be placed in a respectful bio-bag, made of a special material that safely biodegrades in the process. There are also beautiful silk and or wool shrouds the family can choose for this process that are similar in appearance to those used for natural burial.

## **6. How long does the process take?**

The process takes 6-8 hours, or 18-20 hours depending on the operating temperature of the equipment. The 6-8 hour process takes place at 300°F, and the 18-20 hour process takes place at 200°F. A flame cremation, for comparison, takes 1-3 hours and takes place at 1600-1800°F.

## **7. What actually happens?**

The Aquamation process is performed after any viewing or visitation services the family wishes to have. When it's time for the process, the individual body is respectfully placed in a stainless steel vessel. Alkali is added to the process based on individual characteristics (weight, sex, embalming status), and the vessel fills with water. The solution of 95% water and 5% alkali is heated to 200-300°F, and gently circulated for the entire length of the process.

At the end of the process, all material is broken down to the smallest building blocks; there is no DNA or RNA remaining. The sterile process water is released for recycling (our bodies are approximately 65% water to begin with), and the vessel performs a fresh water rinse for the equipment and remains. When the operator opens the door, only the inorganic bone minerals remain. These minerals are processed into powder and returned to the family in an urn. This final processing step is the same process that is followed with flame cremation. Many families hold a celebration of life or gathering when the loved one's remains are returned to the family's care.

## **8. Can the family still have a memorial service after the process?**

Yes. Many families choose to have a memorial service or celebration of life to honor the life of their loved one and gather with friends and family.

## **9. Are the remains safe to handle?**

Yes, the ash remains are 100% safe to handle, pathogen and disease free. Alkaline hydrolysis is a proven sterilization process.

## **10. What can be done with the ashes?**

Absolutely anything that can be done with flame cremation ashes. Some families bury the urn in a cemetery, or permanently inter the urn in a columbarium. There are numerous memorial products that can be made with the ashes – hand blown glass memorials, ceramic art pieces, man-made diamonds, memorial plantings for your garden, and many more. Many families choose to scatter some or all of the remains in a special place.

## **11. Are there any special considerations that should be taken for spreading ashes?**

Please check local regulations to make sure the scattering location is okay prior to scattering, and speak with your funeral professional about the best way to scatter the ashes so your experience



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can be as meaningful as possible. Funeral professionals have great tips for making the scattering experience go as expected. Some special care must be taken when spreading the ashes in wind or water, as the ash is quite fine. Your Aquamation provide will provide you with guidance.

## 12. Are the ashes different than those from flame cremation?

The ashes from a flame cremation are primarily the mineral remains from the bone, along with some ash from the cremation box or casket, clothing, and anything else that may have been placed in the process with the body. The ashes from Aquamation are only the mineral remains from the bone, as there are no other materials in the ash.

The color of ash from a flame process is typically gray in color, from the carbon discoloration from burning. The color of ash from Aquamation is anywhere from white to a tan color. With both processes, there can be slight variations in color from individual to individual. The consistency of the ash is also different.

The ash from flame cremation can be described as “chippy” bone fragments. The ash from Aquamation is a homogenous (consistent) powder. With Aquamation, there is 20-30% more ash remains returned to the family.



## 13. Why do you receive more ashes than with flame cremation?

The flame cremation process occurs at 1600-1800°F with the remains in contact with direct flame. Some of the inorganic mineral remains are lost to the air through the stack. The Aquamation process occurs at 200-300°F without any fire at all, and the water circulation in the system is a similar flow to that of a creek or stream. It is very gentle to the final mineral remains, which allows more to be present at the end of the process.



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## Ash Remains: Cremation vs Aquamation

*The difference between 1600-1800°F and 200-300 °F*



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### 14. Will I need a larger urn?

Yes, sometimes a larger urn is needed due to the increased volume of ashes, but this varies for each individual case. Because the ashes are a fine powder versus the larger fragments from flame cremation, the ashes do fit more efficiently into the urns. If a family chooses an urn that will not fit the entire volume of ash remains of their loved one, the funeral professional will call the family and provide options. Some families need to keep the remains together in one urn for interment or cultural/religious purposes, while other families opt to have the excess remains placed in additional keepsake urns (for example, so each sibling can have an urn to bring home).

We highly recommend [Memento Memorials](#) for specially handmade Aquamation urns. The artist behind this company was the first to assist Aquamation families in need of larger urns.

### 15. Are the ashes toxic to the environment or plants?

Absolutely not. As with anything, toxicity of a substance is a function of concentration. Miracle grow is a fertilizer, but if over-applied, it can kill a plant. A daily multivitamin is not toxic when taken as directed, but it would be toxic (and likely deadly) if the whole bottle were to be taken. When spreading or scattering ashes, we need to pay mind to where we are scattering them. A cremation garden that allows the scattering of ashes from hundreds of individuals can be a tough environment for growing plants. In extreme cases, poor practices could result in contamination of the water table. For families wanting to use the ashes from Aquamation or flame cremation as part



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of a potting soil, allowing their loved one to live on through the plant, the ashes are certainly not toxic if the soil is properly prepared. Significantly diluting the calcium phosphate ashes with potting soil and a pH balancer to match your region and specific plant type makes the ashes beneficial to the plant instead of potentially toxic. Your Aquamation provider can provide you with guidance for creating your living memorial.

## 16. How much does Aquamation cost?

The cost of services and what is included in the price varies greatly by area and provider. Aquamation is comparable in price to flame cremation. It is significantly less costly than burial.

## 17. Why do families choose this option?

Families have expressed:

- They are grateful to have a choice.
- They prefer a process that does not use fire or flame.
- They prefer receiving 20-30% more of their loved ones' ashes returned to the family.
- They believe this to be a more gentle option than flame-based cremation.
- They value the decreased environmental impact of the process.



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## 18. Why is this considered an environmentally friendly choice?

With Aquamation, there are no direct emissions of harmful greenhouse gases or mercury to the atmosphere. This process does not burn any fossil fuels. It is very energy efficient - greater than 90% energy savings compared to flame cremation, with 1/10<sup>th</sup> of the carbon footprint.



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#### 19. What is the impact of the water usage?

Very low. The Aquamation process uses less water than a single household uses in one day (source: [water.usgs.gov](http://water.usgs.gov)). This includes all of the water used for the process, along with the clean water rinsing of the final remains and vessel.

#### 20. What happens to the water?

The water is returned to the ecosystem via the normal wastewater treatment facility, just as all funeral homes in the United States, Canada, and many other parts of the world do during the embalming process. The Aquamation process produces a completely sterile solution of amino acids, sugars, nutrients, salts, and soap in a water solution. These are the byproducts of natural decomposition.

#### 21. Do pacemakers need to be removed from the body?

No. This is one of the greatest benefits of this process. Pacemakers and any other battery operated medical implants do have to be removed prior to flame cremation because the batteries explode at the temperatures used in the flame process. With Aquamation, the process is performed at a much lower temperature that does not react with the batteries. This means that the family does not have to incur the cost of pacemaker removal, nor does the loved one have to go through the surgical process of having the device removed. Operating staff are not at risk of injury. The pacemaker is recovered and recycled at the end of the process.



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## 22. Does the process emit mercury to the air?

No. With flame cremation, which operates at 1600-1800°F, mercury contained in the amalgam of teeth becomes vaporized and released to the air. A 2015 study by a collaboration of researchers from University of Minnesota Dental School and Minnesota Pollution Control Agency was the first to quantify how much mercury we actually have in our teeth. Their study yielded a result of 2.3 grams per subject. According to a podcast with Dr. Sandra Myers, at the US's current cremation rate of 50%, baby boomers alone will contribute 190,148.7 pounds of mercury to the atmosphere.

Mercury vaporizes at 674.1°F, and alkaline hydrolysis uses much lower temperatures of 200-300°F. The mercury remains intact, bound in the teeth, and these teeth are recycled through an EPA-approved dental amalgam handler. Release of mercury from fillings to the environment is completely prevented.

## 23. What happens to the metal implants?

Medical implants are not destroyed in this process. The metals are clean, sterilize, and look brand new after the process. These metals are recycled through a metal refiner to be made into new materials. The metal refineries are amazed at the pristine condition of metals from alkaline hydrolysis versus flame cremation.

### Medical Implants: Cremation vs Aquamation

*The difference between 1600-1800°F and 200-300 °F*



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The ability to recycle metals provides an enormous environmental benefit. In fact, a 2011 study on the impact of funeral practices (Keijzer 1, 2) found that alkaline hydrolysis is more environmentally friendly than even natural burial. This is true even when natural burial was considered at its optimal scenario, known as green burial. Green burial was defined as no body bag, no embalming, the most ecologically friendly biodegradable body covering (which happened to be cardboard), no



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use of an elevator, graves dug by hand, no monument – only natural markers, only biologically degradable clothing, no jewels, no maintenance of burial grounds, and more people buried per graveyard. Even though green burial directly uses the least amount of energy, the reclamation of metals from bodies that undergo alkaline hydrolysis more than offsets this energy gap.

We can look to the types of metals used for implants and how they are made to understand the environmental credit of the recycling. Most medical implants are made of titanium. While titanium is the ninth most abundant element on Earth, its acquisition comes with a steep environmental cost. The cost to obtain and transport the materials used to make titanium – often from other countries - is one aspect, while the actual process to turn it into usable products is another (extraction, purification, reactor, alloy creation, and byproduct management). According to the [United States Geological Survey](#), the US has become highly dependent on the import of materials used to make titanium.

A 2017 Italian study ([De Angelis, et al.](#)) found that people average one half pound of metal per individual. Metal implants are even more common in the United States and Canada. [It was estimated in 2014](#) by a study conducted at Mayo Clinic that greater than 7 million Americans have artificial hips and knees, with more than 600,000 knees and 400,000 hips replaced each year. A knee replacement weighs 1-2 pounds, and a hip implant weighs 3-5 pounds. According to the [CDC's most recent death statistics](#), there are greater than 2,744,248 deaths per year in the US alone. This equates to *at least* 1,262,354 pounds of precious metals that could be recycled each year, or enough precious metals to construct 4 Statue of Liberty sized-structures out of titanium *each year*. Aquamation allows a new life for these metals and prevents the environmental impact of creating new.

#### **24. How long has this process been around?**

The modern technology has been in use by universities and the scientific industries for over 25 years! It has been used for the final disposition of human bodies donated to medical science since 1995. The first pet facility was opened in 2007, and the first funeral home to use the technology was in 2011.

#### **25. What is the science behind the process?**

A commonly misunderstood fact is that it is actually the water that performs the breakdown during the Aquamation process, not the alkali.

A hydrolysis reaction is any type of reaction where bonds are cleaved by the insertion of water molecules. With alkaline hydrolysis, a base is added to water to create an alkaline environment. This changes the behavior of the water molecules, causing them to dissociate into hydrogen and hydroxide ions. The solution is only 5% alkali; 95% is water. Equally important to the process are



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the physical characteristics of the system (design), the continuous flow of the solution, and the heat. This all relates to collision theory and the rate and completeness of a reaction.

What happens in the process is Our bodies are 65% water to being with, along with fat, protein, minerals, and carbohydrates. During the process, fats are reduced to salts, protein to amino acids and small peptides (which are groups of a few amino acids), and carbs are reduced to sugars. The process breaks all organic materials into their most basic building blocks, so small that no trace of protein or nucleic acids (DNA/RNA) remain. The organics are dissolved into the water, which consists of 96% water and 4% amino acids, sugars, and salts by weight.



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