Total PFAS Remediation System

Patent Pending Process

There are 4 steps that have to be performed to remove PFAS out of water and wastewater treatment plants.

Step 1: Precipitate or Drop PFAS out of the water or wastewater stream and into the sludge.

Step 2: Dewater the sludge so it can be dried

Step 3: Dry the sludge so it can be baked.

Step 4: Bake the sludge at high temperature to break the chemical bond.

Content

Content

USASludge

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
63/201,179	04/16/2021 11:15:10 AM ET	-

Title of Invention

PFAS in situ Remediation in Water

Application Information

APPLICATION TYPE	Utility - Provisional Application under 35 USC 111(b)	PATENT #	-
CONFIRMATION #	3654	FILED BY	Kenneth Brummett
PATENT CENTER #	60177787	FILING DATE	-
CUSTOMER #	160395	FIRST NAMED INVENTOR	Kenneth Ray Brummett
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	-

Documents

TOTAL DOCUMENTS: 2

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
generatedADS60177787.pdf	6	Application Data Sheet	134 KB
PFAS in situ Remediation in Water Provisional Description.pdf	1	Specification	59 KB

Digest

DOCUMENT	MESSAGE DIGEST (SHA-512)
generatedADS60177787.pdf	1AB451A1107B4C75A84FDC4931C97781462E73D829A74D33C797104A9B9D34E3DCC6254 9C59434CC3AE9794E470C79F43514879D31843E66B05B61848ED706AD
PFAS in situ Remediation in Water Provisional Description.pdf	0B220D5C262C38A263AB4E69EFA76D8D59835A020631A8716E3B184C6ADC87C8F77376C E64217529806BA429788616210334A267BDEA36B5772AACD38F720C8B

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

USASludge

Step 1: Precipitate or Drop PFAS out of the water or wastewater stream

Our PFAS or (Forever Chemicals) remediation process is a simple, continuous, addition of natural mineral compounds (***Bio-Clean and a Rare Earth Lanthanide Solution***) to the aeration basin or mixing chamber of any water and wastewater treatment plant. Combining these two solutions together in an aeration basin or mixing tank will precipitate PFAS/PFOS out of the water or wastewater and into the sludge. Using this method is important because lanthanides are the most powerful "safe" substances available in nature and we have the patent on this technology. Lanthanides are so far down on the periodic element chart that their inherent qualities are more powerful than any other "safe" elements found in nature.

Bio-Clean Technical Composition

Bio-Clean is a complex blend of naturally-occurring elements with extraordinary synergy for remediating wastewater. It affects the environment of wastewater systems, creating a floc so tough that it will floc again and again after shearing, even in recirculation. The complexity of the composition creates attractions we haven't seen in any other chemical or reagent. The composition is so effective that some treatment plants have even eliminated their chemical treatments altogether. Bio-Clean will not "load-up" and comes complete with five catalysts designed to remediate any type of wastewater.

- Improves settling
- Settles scum, filamentous bacteria, algae, grease, and foam.
- Reduces BOD, TSS and SVI
- Improves DO
- Reduces Dewatering costs
- Stabilizes sludge blankets
- Reduces wash-outs
- Increases sludge density without packing
- Natural, safe, and efficient

For over 20 years, Bio-Clean has been a staple in many wastewater operations, used for everything from improved settling to nutrient reduction and heavy metals remediation. Now, with PFAS becoming a serious threat to the human race, we have equipped Bio-Clean to precipitate PFAS compounds out of water, dropping them into the sludge were they can be destroyed at a very low cost.

Bio-Clean Video and Testimonial

Bio-Clean Technical Composition

Bio-Clean is a complex blend of naturally occurring elements. The elements include Alkaline Earth Elements, Alkali Metals, Transition Metals, and Non-Metal Elements, as follows: The primary elements are Magnesium, Calcium, Carbon, Sodium, Potassium, Iron and Oxygen. It also includes Chloride, Sulfite and Fluoride in trace amounts.

H: Hydrogen is the lightest element. It is by far the most abundant element in the universe and makes up about 90% of the universe by weight. Hydrogen as water (H_2O) is absolutely essential to life and it is present in all organic compounds.

C: Carbon is a Group 14 element. Carbon is distributed very widely in nature. It is found in abundance in the sun, stars, comets, and atmospheres of most planets. The atmosphere of Mars contains 96 % CO_2.

Carbon is found free in nature in three allotropic forms: amorphous, graphite, and diamond. Graphite is one of the softest known materials while diamond is one of the hardest. Carbon, as microscopic diamonds, is found in some meteorites. Natural diamonds are found in ancient volcanic "pipes" such as found in South Africa. Diamonds are also recovered from the ocean floor off the Cape of Good Hope.

N: Nitrogen is a Group 15 element. Nitrogen makes up about 78% of the atmosphere by volume but the atmosphere of Mars contains less than 3% nitrogen. The element seemed so inert that Lavoisier named it azote, meaning "without life". However, its compounds are vital components of foods, fertilizers, and explosives. Nitrogen gas is colorless, odorless, and generally inert. As a liquid it is also colorless and odorless.

O: Oxygen is a Group 16 element. While about one fifth of the atmosphere is oxygen gas, the atmosphere of Mars contains only about 0.15% oxygen. Oxygen is the third most abundant element found in the sun, and it plays a part in the carbon-nitrogen cycle, one process responsible for stellar energy production.

Oxygen in excited states is responsible for the bright red and yellow-green colors of the aurora. About two thirds of the human body, and nine tenths of water, is oxygen. The gas is colorless, odorless, and tasteless. Liquid and solid oxygen are pale blue (see picture above) and strongly paramagnetic (contains unpaired electrons).

Na: Sodium is a Group 1 element (or IA in older labeling styles). Group 1 elements are often referred to as the "alkali metals". The chemistry of sodium is dominated by the +1 ion Na^+.

Sodium would not normally be made in the laboratory as it is so readily available commercially. All syntheses require an electrolytic step as it is so difficult to add an electron to the poorly electronegative sodium ion Na^+. Sodium is present as salt (sodium chloride, NaCl) in huge quantities in underground deposits (salt mines) and seawater and other natural waters. It is easily recovered as a solid by drying.

References are available upon request.

USASludge

This is a remediation of PFAS chemicals from a wastewater treatment facility in 2021 using our patent-pending process. This system DOES NOT USE A FILTER

	Before Treatment	After Treatment (PPT)	Percentage Removed
PFPeA	126.70	53.80	58%
PFHxA	2,568.06	60.6	98%
PFHpA	793.95	16.60	98%
PFOA	2,478.90	49.80	98%
PFNA	142.08	1.50	99%
PFDA	107.37	2.06	98%
PFBS	4,016.62	42.30	99%
PFPeS	122.93	1.72	99%
PFHxS	264.96	12.40	95%
PFOS	240.79	14.70	94%
4:2 FTS	125.54	1.11	99%
8:2 FTS	28.11	ND	100%
PFOSA	104.05	ND	100%
N-MeFOSAA	109.93	6.78	58%
N-EtFosaa	123.68	3.49	58%

This Treatment Plant had very high levels of PFAS due to the processing of landfill leachate.

The average removal of PFAS chemicals after treatment was 90%. This was achieved by adding the minimal amount of our Product. Adding more Product will increase the remediation results.

90%

For every 1 Million Gallons a day of influent
Add 30 lbs. of Bio-Clean to Aeration Basin
and
Add 1 gallon of Lanthanide Solution

Reference will be provided upon request

PFAS will forever change the way biosolids and sludge is handled.

Once PFAS is attached to the sludge we can then go ahead and dewater and dry the solids. We can treat digested or undigested sludge but we believe digested sludge or biosolids with PFAS may cause problems downstream in the gas line if the digester gas is not burned on site at a suitable temperature to destroy the PFAS compounds in the moisture stream of the digester gas. Digesting sludge is necessary to stabilize biosolids for land application per the EPA 503 rules but if we are “baking” dried biosolids then digesting only serves the purpose of reducing the volume of solids to be baked.

Dewatering sludge or biosolids with PFAS can be done the same way as treatment plants do now. Centrifuges and belt presses can be used to remove 40% of the water from the sludge without harm to operators because the sludge is not being thermally treated. Almost all sludge or biosolids are land applied or sent to the landfill but that will soon change. The days of taking sludge to a landfill or land application are numbered because it will be assumed that the sludge or biosolids has dangerous PFAS Chemicals...which most treatment plants already have.

Since the (Wet) or dewatered biosolids can not be disposed of via a landfill or land application then the solids will need to be dried. EPA 503 regs specify certain drying criteria for Class A and Class A EQ land application but those criteria will be a thing of the past because of PFAS legislation. Composting, Open Air Drying, and Forced Air Drying using oil or natural gas will not be permitted because of the moisture content of the air leaving the dryer. The only safe way of drying sludge or biosolids will be by dehumidifying a Hot Box full of sludge where no air can escape. This leaves 95% of the dryers on the market unusable.

Our pilot system is designed to treat up to 13 wet tons a day of sludge or biosolids. We have a multi drying system that can treat 75 wet tons a day at 20% solids per machine and be coupled in groups of 8 to dry 600 wet tons a day to 80% solids.

These heat pump dryers are self-contained, insulated, closed loop systems where the air in the dryer is not released out of the drying cabinet making them the most energy efficient dryers in the world. These units dry the sludge using the heat pump cycle instead of burning fuel oil, or natural gas. Solar PV Panels can be installed, and grid tied to generate the electricity needed to operate the heat pump cycle and the moisture released from the organic cell is condensed and sent back to the headworks.

Step 2 and 3 PFAS Sludge Treatment System

Project Entity	Anyone
Project Description	4 MGD PFAS Plant
Project System	PFAS In-situ treatment/sludge dewater/drying.
System Sludge Inlet	50000 Gallons a day at 2% solids
System Outlet Sludge	Approximately 4 Tons of dried solids per 24 hour day.
Project Designer	USA Sludge
Date	7/7/2021

USA Sludge

USA Sludge

USA Sludge is a High-Tech Enterprise devoted to wastewater remediation, dehumidification heat pump sludge drying, and Pyrolysis destruction.

This new line of electric dehumidification heat pump sludge dryers are the most advance sludge drying machines in the world.

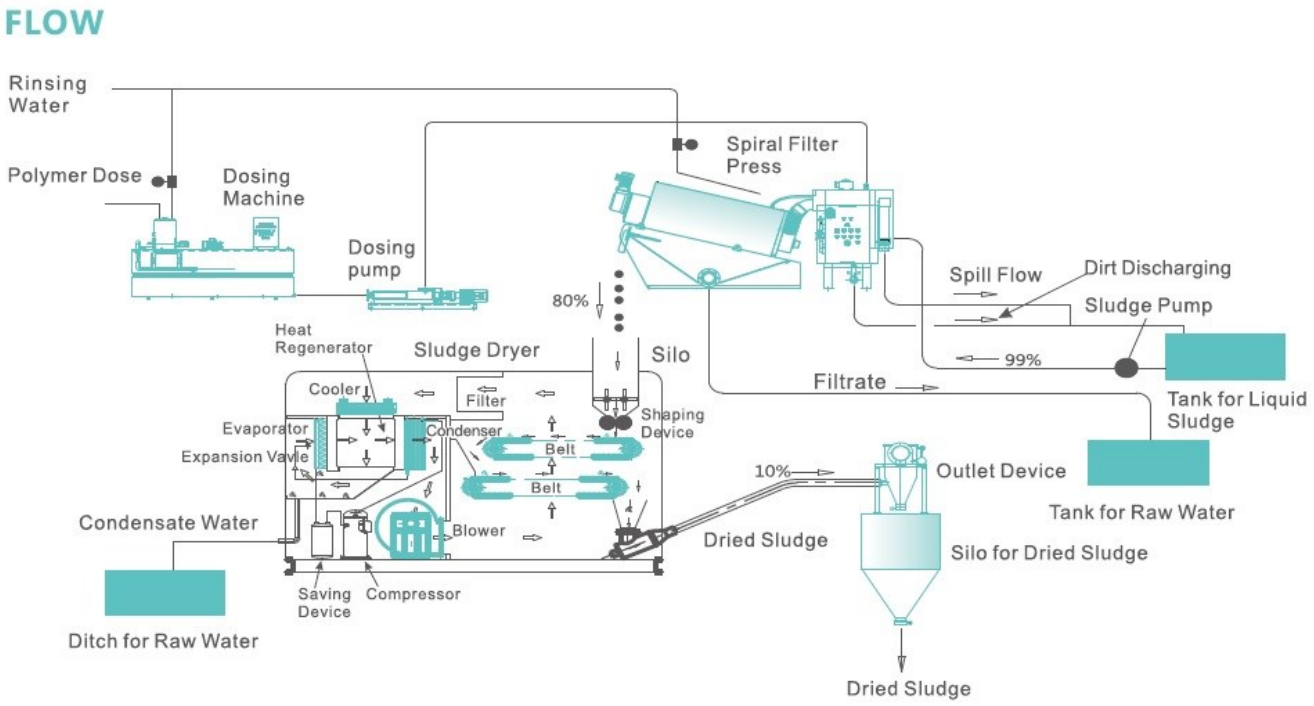
USA Sludge has broken through the difficulties and the high costs associated with traditional gas drying equipment by implementation of a fin-type regenerative cycle with advance slitting, combined with double and triple effect heat pump cycling which dramatically lowers the cost of sludge drying by reusing the heat that would normally be discarded in a traditional sludge drying system.

This high-tech drying system has a small foot print, effectively treats many different kinds of sludge, requires no odor control equipment and doesn't require an fossil fuel emissions permit.

Total Sludge Drying System Overview

The total sludge treatment system consists of two integrated modules that receive inlet sludge from the current sludge processing stream at 1.0 – 5.0 % solids. The treatment system then dewaters and dries the sludge up to 90% solids in a slow moving all-in-one process creating a burnable solid. The system uses a heat pump, powered by electricity, to dry the sludge from 20% solids up to 90% solids.

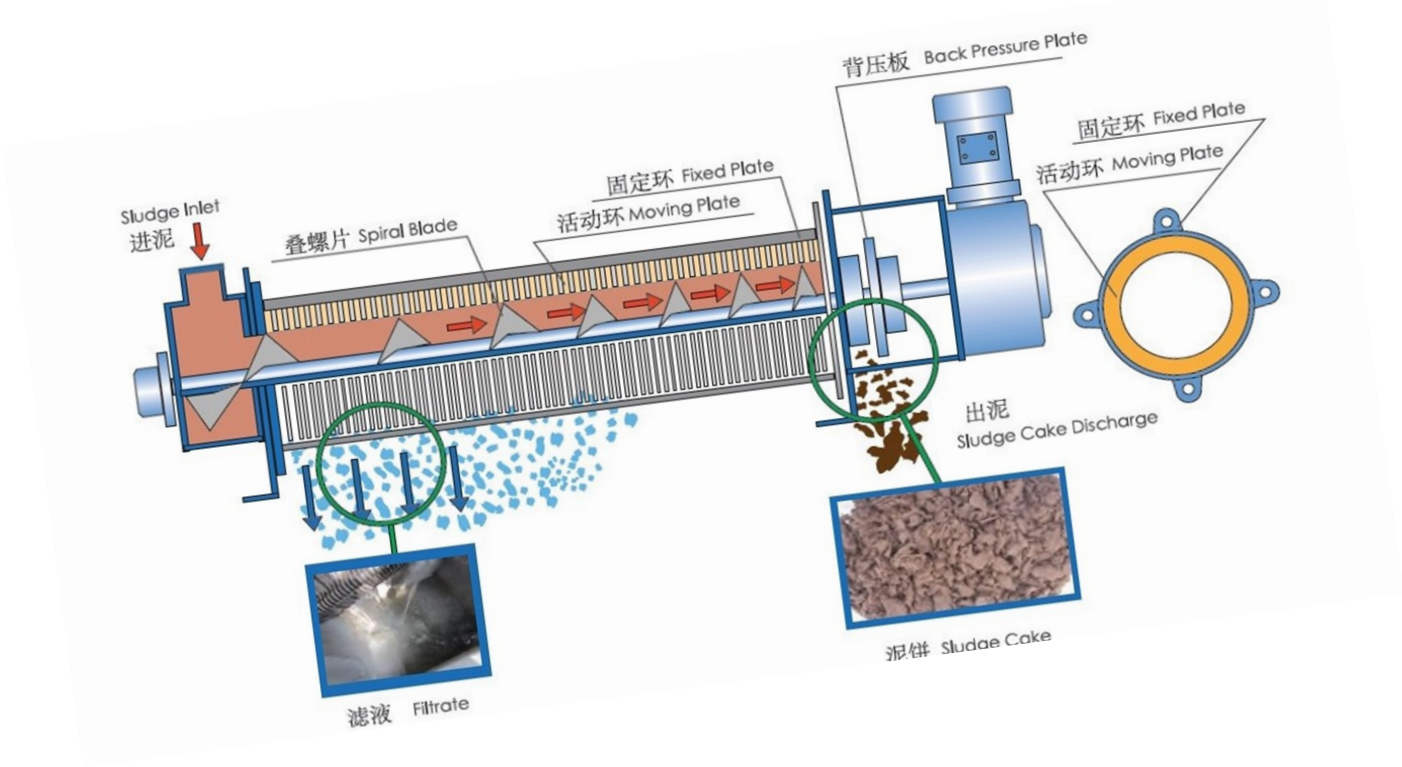
Please see diagram below.



Dewatering Overview

The Spiral Filter Press mounts on top of the Dehumidification unit and excepts sludge with solids as low as 1% and as high as 5%. This slow moving system delivers cake at a consistent 20% solids to the dehumidification unit without the need for adjustment with the filtrate water being sent back to the plant for treatment.

This unit can operate 24 hours a day.



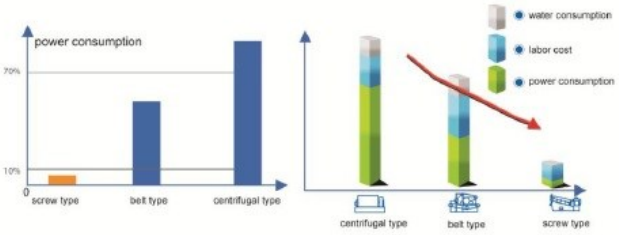
USA Sludge

Filter Press Advantages

Rings substitute filter cloth, self cleaning, no clogging, easy treatment of oily

The traditional dewatering equipments are easily got blocked while the dewatering screw press allows continuous operation with no clogging due to the moving of the fixed rings and moving rings cleaning itself. Therefore, it's especially good at oily sludge with excellent performance. Moreover, it doesn't need additional water for high-pressure cleaning so that no smell or secondary pollution will be produced.

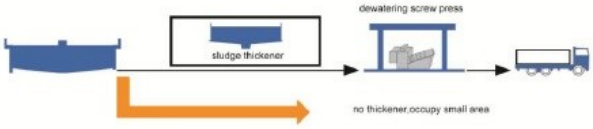
Low speed operation, low noise, low energy consumption, only 1/8 of the belt type, 1/20 of the centrifuge



Reduce the cost of infrastructure investment, improve the results of treatment

The dewatering screw press can directly treat the sludge from the aeration tank and the sedimentation tank so that the sludge thickening tank is not needed any more. Therefore, the construction cost can be greatly reduced and well avoided the phosphorus releasing problem.

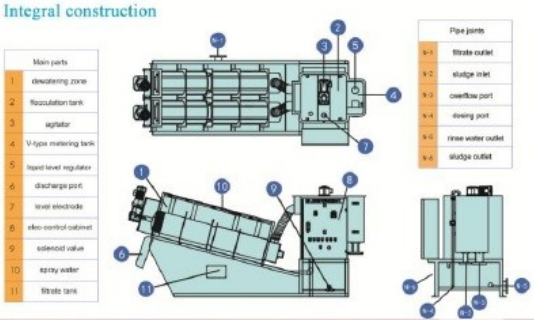
- Saving the cost of sludge thickening tank and other equipments investment.
- Occupy smaller area, reduce construction investment for dewatering.

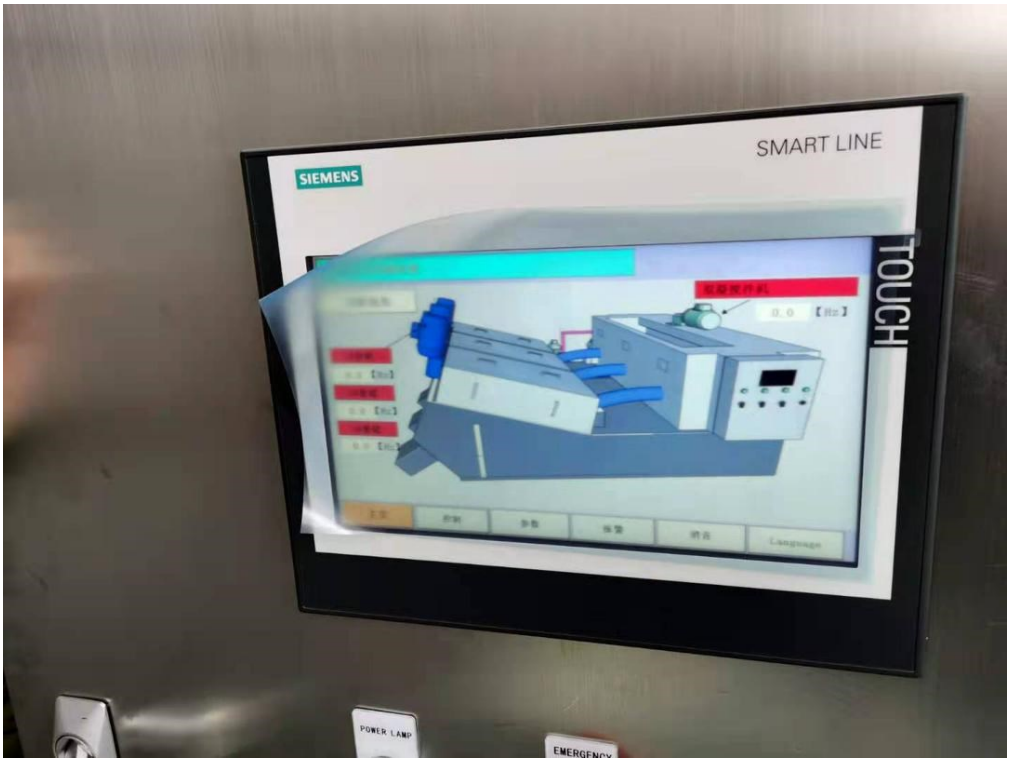


Fully automatic control, easy operation and maintenance

The dewatering screw press has no easy-blocking components like filter cloth or filtration pore inside. Its operation is safe and easy. It also can be set to operate automatically via the elec-control cabinet.

Integral construction





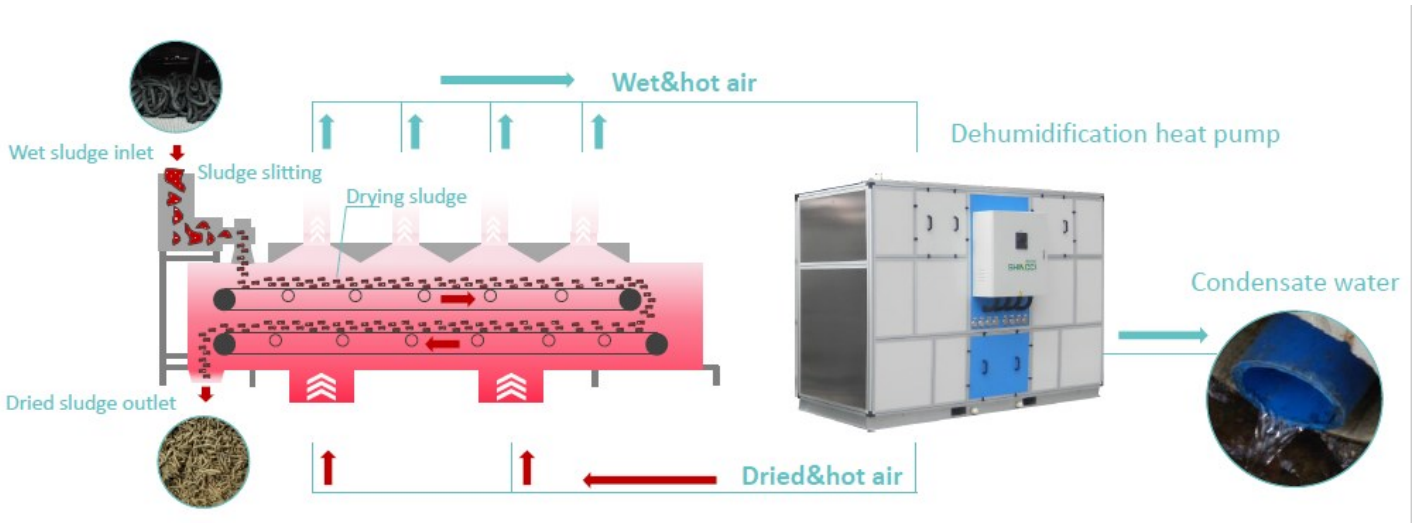
Dryer Overview

Below is a schematic of the USA Sludge Dryer. The dehumidification heat pump dries the wet sludge to dried Class A Fertilizer. The hot air and the condensate water are captured within the system.

There are no odor issues when using this closed cabinet drying system. The heat transferred from the compressor and fan motor is dissipated using a fan coil unit. The condensate water is captured and can be reused or recycled to the headworks of the treatment facility.

The dehumidification heat pump used in the proposed USA Sludge dryer utilizes the refrigeration principal to cool and dehumidify hot wet air. Through the heat pump principal, the heat pump recycles the latent heat released from steam congealing to water liquid. A dehumidification heat pump is equal to the dehumidification process (moisture removal or moisture dehumidifying) plus a heat pump process (energy recycling). A dehumidification heat pump can internally collect all the latent heat and sensible heat during air exhaust, bringing no waste heat to the outside.

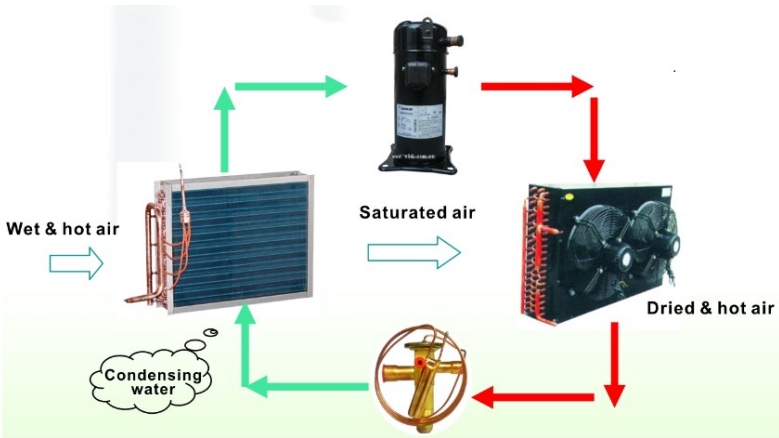
The evaporation of sludge moisture absorbs latent heat; and the condensation of the generated vapor on the heat pump cycle releases latent heat. The evaporation process absorbs the same quantity of latent heat that the condensation process produces, according to the laws of thermodynamics and the law of conservation of energy. As a result, the drying process does not require additional heat capacity, resulting in the reduction of energy costs. The energy consumed during the process is only the electricity needed to operate the compressors and the air handlers.

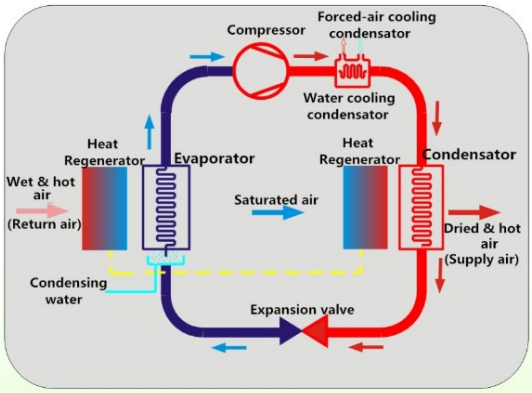


Material used in construction is anti-corrosive 304 stainless steel while the heat exchanger surface is specifically electroplated with an anti-corrosion material which extends the service life. The service life of the dryer is 20 years since there's no mechanical wear and tear during operation.

Triple effect and quadruple effect patented dehumidification technology can effectively maintain the air humidity lower than 10% which enables high drying efficiency and saves electrical consumption. The Independent layered blower system can satisfy the requirement of high-speed dehydration which shortens the period of low temperature drying. Modularized structure design enables high regulating capacity and easy installation. Conveyance motors and outlet conveyor have a frequency converter and infinitely variable speed enables regulated dried sludge moisture of between 10 and 50%

This heat pump system is designed to recycle the heat and reuse it in a closed cabinet dryer. One kilowatt hour is capable of drying 4 kg of H2O. With a quadruple affect heat pump, electricity consumption of the dryer for 1 metric ton of sludge from 80% moisture to 10% moisture is 180 kilowatt hours . Electricity consumption of drying one metric ton of sludge from 80% moisture to 60% moisture is 118 kilowatt hours





USA Sludge

Product Specification

Model USA TSD 400E Sludge Drying System

Model	USA TSD 400E
Dehumidification Capacity Kg/Hr	400
Max Dehumidification Capacity T/24	9.6
Electric Consumed	104 kWh
Length	36feet (Required 46ft) Does Not included Conveyor
Width	8.5 feet (Required 20ft) Does Not include Conveyor
Height	9.1 feet (Required 16ft)
Weight (Full)	24,000 lbs.
Dehumidification Heat Pump Module	2 sets
Number of Compressors	16
Cooling Method	Forced Air
Refrigerant	R-134a
Power Supply	480 Volt 3PH 60Hz
Drying Temperature	118 - 132F (Recycle Air) / 148 - 176F (Supply Air)
Control System	Touch Screen + PLC Programmable Control System
Outlet Sludge	75% Solids

USA Sludge

Operating Cost Heat Pump

Electrical consumption to dry to 75% solids

Energy consumption of low temperature heat pump drying system

(dry from 15% to 75% solids)

1. Per hour electricity consumption: 104 kWhs
2. Daily electricity consumption: 2,496 kWhs
3. Monthly electricity consumption: 74,880 kWhs

Water

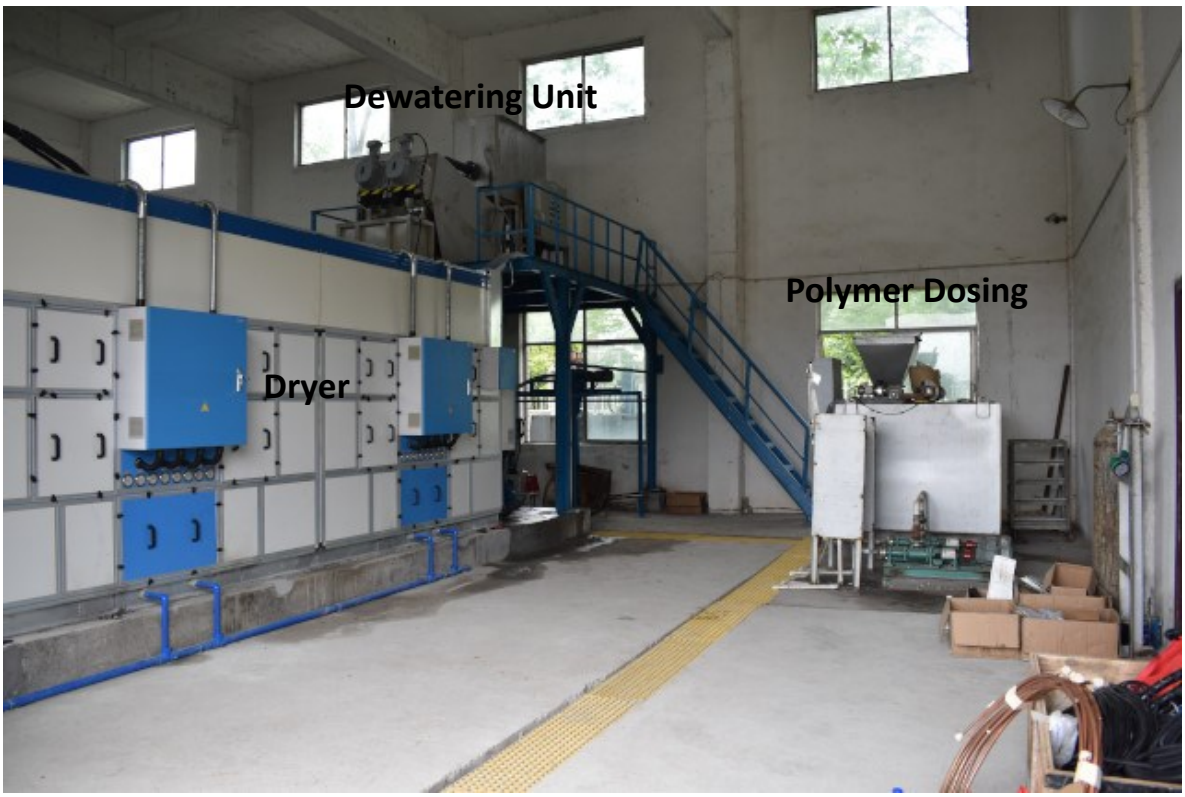
System will condensate 105 gallons of water an hour or 2,520 Gallons a day.

Labor

The machine can operate unattended but pellet storage needs to be managed and the machine should be checked every hour. Filters need to be cleaned once a week and replaced every 90 days. Condensing coils need to be cleaned every 6 months and overall inspection once a year. Slitter combs need to be replaced once a year.

System Cost Heat Pump Dryer	$801,000.
Total Project Cost	**$801,000.**

Click on for Full System Video


Dewatering Unit
Polymer Dosing
Dryer

Belt Conveyor Pulled from Container

Second Forklift placed underneath Belt Conveyor

Truck drives away and Belt Conveyor transferred to forklift

Heat Pump Unit removed from Container

Belt Conveyor placed in Building

Compressors

Evaporators

Belt Section

Touch Screen

Sludge After Drying

Delivery:

The unit will take 140 days from date of order to be delivered to your facility...Hopefully earlier.

Installation:

USA Sludge will have one engineer to help commission the unit. Commissioning will last no longer than 30 days. A Rigging company must be supplied to help install the unit.

Connections:

Plumbing connects 1" from the machine need to be completed by outside plumbing contractor.

Electrical connects to the machine need to be performed by outside electrical contractor.

A 200 Amp 480 3 Phase Disconnect.

A slab will need to be poured for the unit.

Plasma Destruction

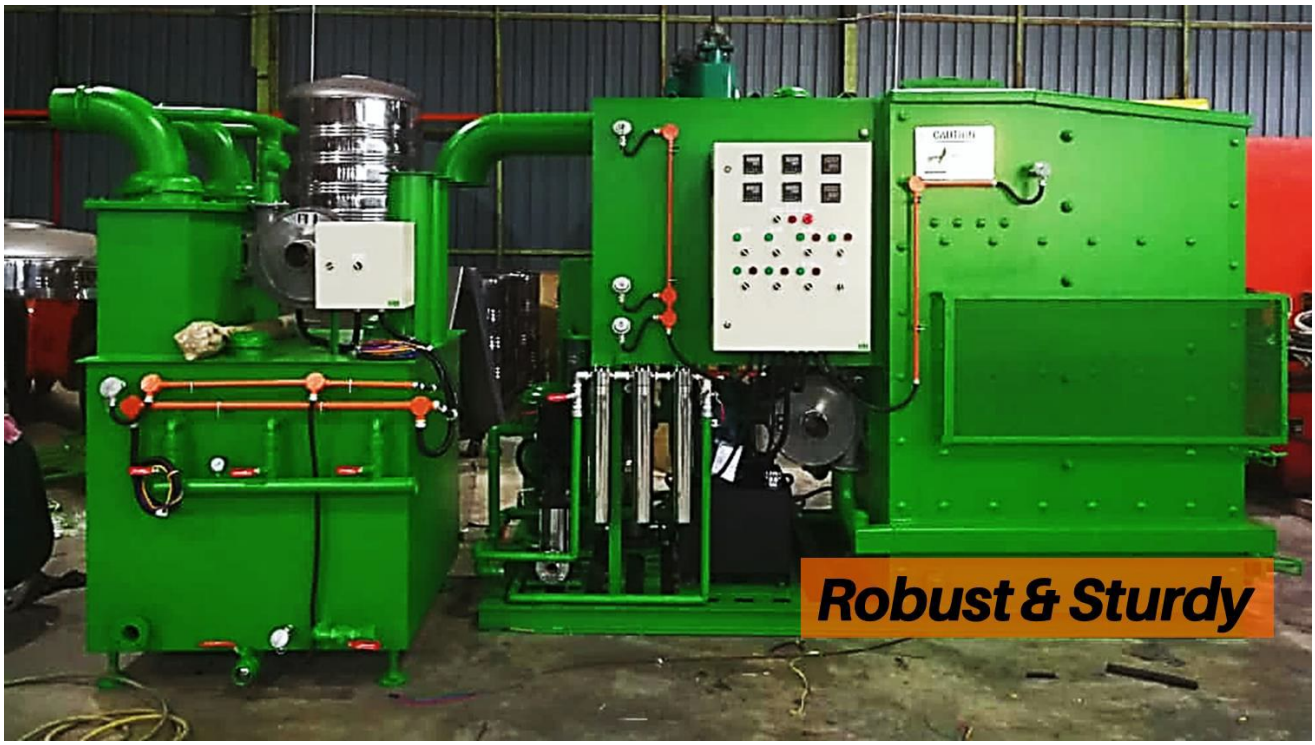
Forever Chemicals Remediation will only be successful if the captured compounds are “broken apart” and the only way we have found to break apart the compounds is by adding heat. Taking resin, granular activated carbon, or dried R/O brine, to a hazardous landfill is not a solution… eventually this compound will leach out of the landfill. A minimum temperature of 500C and maybe more are required to break these compounds apart. Attached is a unit that does not need fuel and uses the heat from the sludge to break the compounds apart.

This unit uses a Plasma Gas to get to the temperatures required…a simple gasifier, or incinerator will not work unless extra carbon and oxygen is added in the burn chamber…most likely natural gas will be the carbon needed to achieve the correct destruction temperature.

This unit can also “Bake” Municipal Solid Waste, Plastics, Tires, Rubber, Carboard and Green Waste. This unit was EPA tested and approved in 2016.

Step 4: PFAS Sludge Destruction System

Project Entity	Anyone
Project Description	Dried Sludge Destruction
Project System	Asher Plasma
System Sludge Inlet (DT)	4 Tons a day at 80% solids.
System Outlet Sludge	340 lbs
Project Designer	USA Sludge
Date	7/5/2021



USA Sludge

Plasma Gasifier Background

USA Sludge is a High-Tech Enterprise devoted to dehumidification heat pump sludge drying and high temperature Plasma Gas Destruction System.

Our Gasification system is simply the most cost effective way of destroying the PFAS/PFOS compounds in bio-solids.

Utilization of *plasma magnetic field to create activated negative-ion that leads to decomposition of inorganic and organic materials through the process of **pyrolysis.

*Plasma: Hot ionized gas consisting approximately equal numbers of positive ions and negative electrons.

**Pyrolysis: A thermal degradation of substance in the absence of oxygen at high temperature up to 1600 degree Celsius. This breakthrough innovation has enabled continuous self-combustion process without the need of external energy sources (diesel, fuel, electricity).

1 Ton of solids converts to 80 lbs. of ash that can be safely used as fertilizer when mixed with dried green waste or sawdust.

Pyrolysis Design (Sludger)

The sludger can handle all types of wastes including Municipal Solid Waste, biosolids, tires, plastics, carboard and green waste. ***<u>We cannot treat, glass, metal and concrete.</u>***

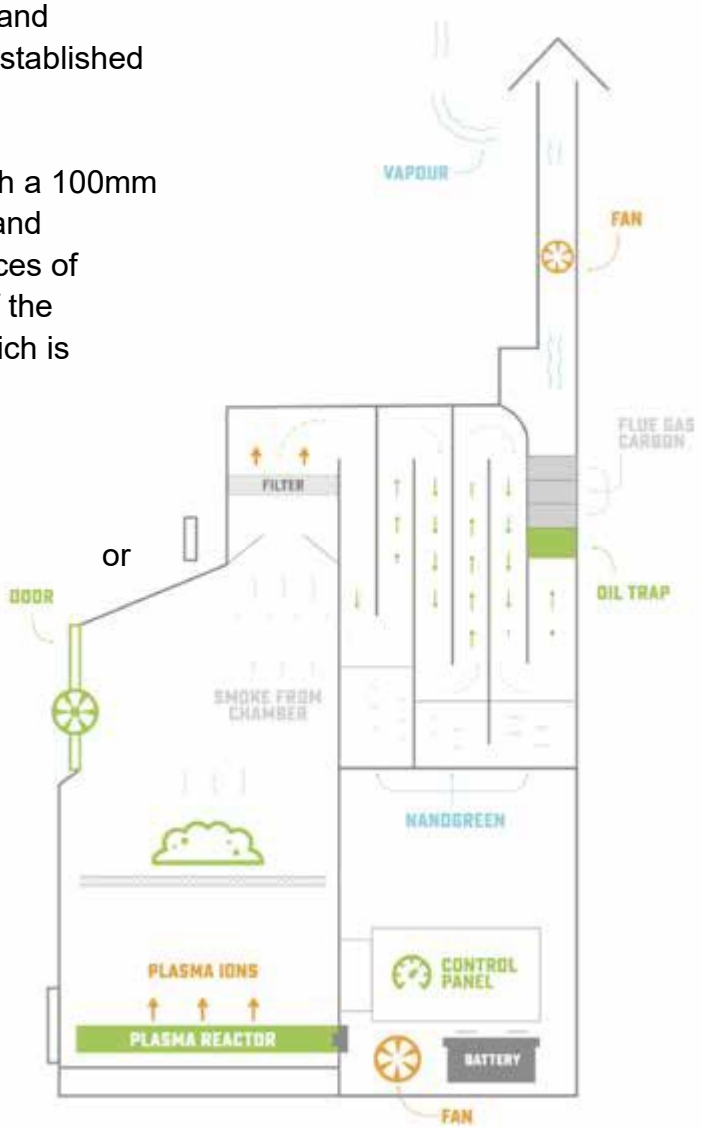
The build structure of the Sludger is guaranteed to last not less than 10 years when it is operated, managed and maintained in accordance to the manufacturer's established protocol.

The outer structure is made of 6mm mild steel with a 100mm refractory of concrete which is designed to withstand temperature up to 1650 °Celsius. There are 4 pieces of 10mm 310L stainless steel after the installation of the refractory in the thermal degradation chamber which is designed typically high and elevated temperature operation to as high as 1200 °Celsius.

The Sludger can function and operate normally even under heavy rain, strong wind, high altitude or cold weather.

The sludger can easily be operated with one person per shift and requires very simple training supervisions for operations and maintenance.

Maintenance and operation protocols are documented and can be easily mastered. Installation and commissioning at sites will take only 4-6 hours per unit. Maintenance cycles are weekly and quarterly.



USA Sludge

Product Specification

Model USA 4T Sludge Destruction System.

Model	USA 4T
Destruction Capacity lbs./hr.	333
Max Destruction Capacity T/24 hr.	4
Electric Consumed	4 kWh
Length	7 ft (Required 12ft) Does Not included Conveyor
Width	5 ft (Required 9ft) Does Not include Conveyor
Height	20 ft
Weight (Full)	14,300 lbs.
Inlet Sludge	80% Solids/20 Moisture
Feed Interval	Hourly
Temperature	400-1600 C
Amps	40
Power Supply	480 Volt 3PH 60Hz
Control System	Touch Screen + PLC Programmable Control System
Outlet Sludge	Ash

USASludge

Sludger Operating Cost

Electrical consumption to operate

Energy consumption Plasma Gas Burner

1. Per hour electricity consumption: 4 kWhs
2. Daily electricity consumption: 48 kWhs
3. Monthly electricity consumption: 1440 kWhs

Emissions

Effluent Gas Filtration System

(high alkaline water scrubber, formulated carbon filers to trap color, odor, heavy metals)

Labor

The Sludger can easily be operated with one person per shift and requires very simple training supervisions for operations and maintenance.

System Cost Sludger **$810,000.**

Payment Terms are 50% deposit on Order and 50% when commissioned...Leasing is also available.

USASludge

Sludger

Sludger

Delivery:

The unit will take 140 days from date of order to be delivered to your facility...Hopefully earlier.

Warranty:

5-year Parts and Labor Warranty.

Installation:

USA Sludge will have one engineer to help commission the unit. Commissioning will last no longer than 30 days. A Rigging company must be supplied to help install the unit.

Electrical connects to the machine need to be performed by outside electrical contractor.

A 480 Volt 40 Amp disconnect will need to be installed.

A slab will need to be poured for the unit.

USASludge

Large Scale Plasma Destruction

This Unit has been permitted in South Coast Air District

Our Partner, Integrated Energy provides its expertise in developing projects utilizing Waste Conversion Technologies with a primary focus on Pyrolytic Conversion systems. The company provides services in every aspect of project development and operations of "Waste Conversion" technologies, to include, but not limited to, Feasibility and Technology Evaluation, Commercial System Design Engineering, Project Engineering, Project Pre-Development, Project Management, Procurement and Operations.

- ✓ Reduces Greenhouse Gas Emissions
- ✓ Reduces Dependence on Fossil Fuels
- ✓ Provides Clean, Renewable Energy
- ✓ Provides Reliable Power (24/7 Operations)
- ✓ Compliments Recycling Ops and Reduces Landfilling
- ✓ Pyrolytic Converter Handles Multiple Types of Waste
- ✓ Permitted in Southern California

INTEGRATED ENERGY®

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