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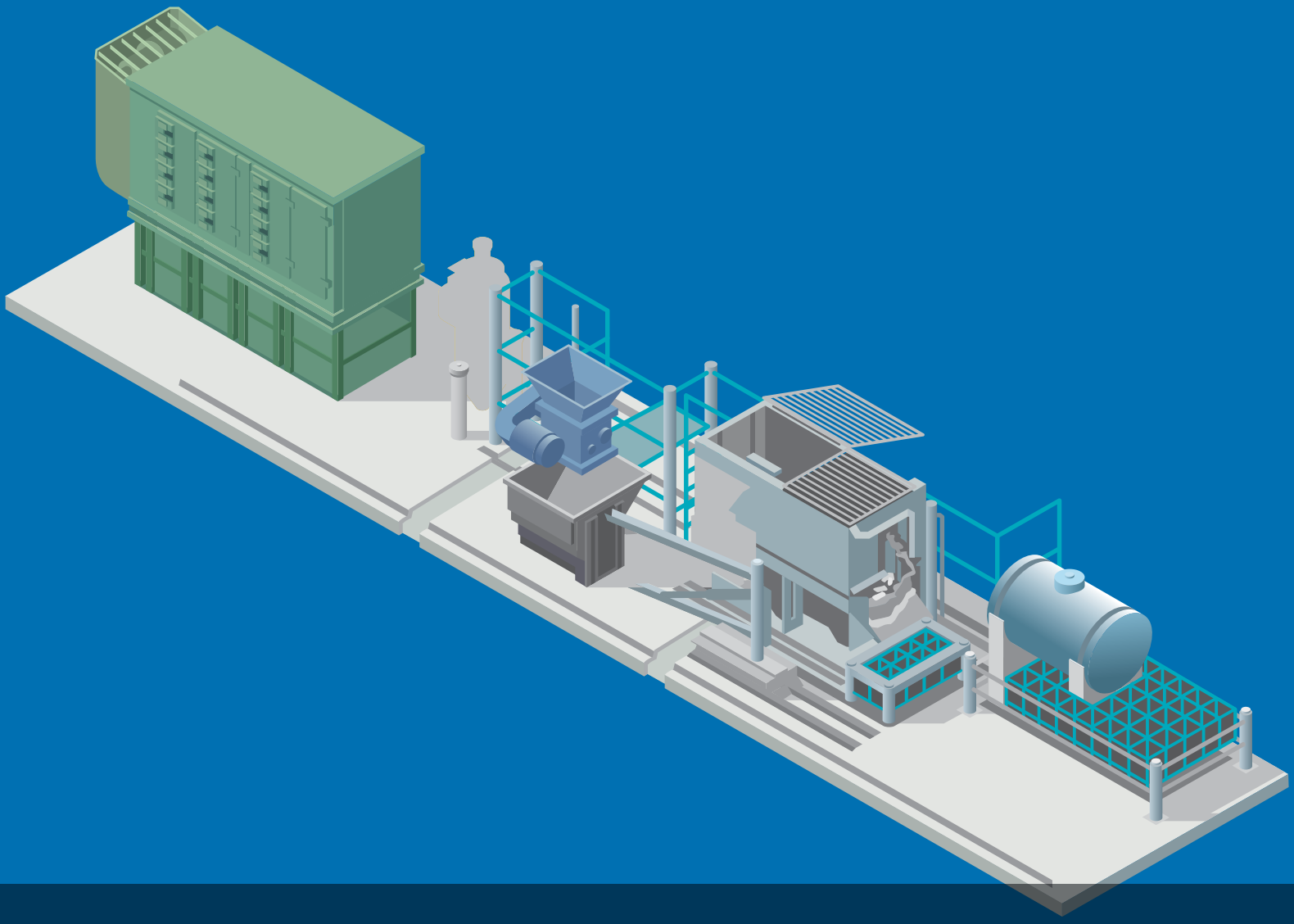

Standard operating procedures for pharmaceutical waste processing

using a cement-based solidification/stabilization system

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For more information, contact pfscm@pfscm.org.

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Glossary

Accelerant or set accelerator: A chemical additive or admixture used in making concrete or mortar to reduce the time needed for proper curing and for enhancing strength development.

Additives: Aggregates, such as sand and rock, water and admixtures, such as accelerants, that are added and mixed with cement to make concrete.

Aggregate: Inert granular materials, such as sand, gravel or crushed stone, that are intermixed with water and cement to make concrete. Aggregates serve to strengthen concrete by acting as a type of reinforcement.

Cement: A powdery substance most often comprised of calcined lime and clay that is mixed with water to form mortar or mixed with aggregates and water to make concrete. This is usually understood to mean Portland cement which is the most common type of cement in general use throughout the world.

Concrete: A mixture of cement, water and aggregates. Aggregates typically comprise 60 to75 percent of the mixture and cement and water make up the rest. Chemical admixtures, such as set accelerators, may be added to modify properties of the concrete or to effect curing for particular applications.

Curing: The process during which ingredients used in making concrete including cement, water, aggregates, and additives chemically react thereby allowing the concrete to form properly and achieve desired properties such as strength and permeability.

Form or concrete form: A solid barrier or enclosure that holds concrete in place and forces it to assume a certain shape upon curing and drying.

Granulator: A device or equipment used to reduce the size of pharmaceutical waste, such as UPP and/or other types of waste to a small, granular size typically about 40 mesh (0.016-in or about 0.42-mm) or smaller.

Residue(s): The end product or materials discharged from a waste treatment process. This includes the concrete-like material or product discharged or removed from cement-based solidification/stabilization processes as covered in the SOPs herein.

Waste processing: The use of physical, chemical, mechanical, thermal or other processes or combinations of processes to change the characteristics, composition, or nature of a waste or waste streams for a particular purpose. Waste processing is used for such purposes as weight or volume reduction, destruction, detoxification, sterilization, disfigurement, recycling, reuse, and the like. Waste processing systems and equipment vary widely and include

shredders, granulators, compactors, incinerators, sterilizers, dryers, gasifiers, composters, solidification/stabilization units, and the like. The term is considered synonymous and often used interchangeably with the term waste treatment.

Waste treatment: This term is often used interchangeably with the term waste processing but it typically refers to processes that are used to render or convert wastes that are considered or regulated as being hazardous, toxic, infectious waste, radiological, pathological, physically dangerous, and the like to a residue that is considered safe and suitable for general landfill disposal.

Unusable pharmaceutical products (UPP) or pharmaceutical waste: Pharmaceuticals such as drugs and medicines that can no longer be used because of being expired, withdrawn, recalled, damaged, contaminated, or for any other reason. UPP, which is also often termed pharmaceutical waste, ultimately must be disposed in a proper, safe manner, and such disposal almost always requires processing or treatment depending on whether they are considered or regulated as hazardous or potentially hazardous and/or as a means of preventing them from being scavenged and resold or used.

Purpose & scope

The standard operating procedures (SOPs) described herein are recommended for the treatment or processing of pharmaceutical waste, or unusable pharmaceutical products (UPP), using a cement-based solidification/stabilization (S/S) system. These SOPs are applicable or limited to processing certain types and forms of pharmaceutical waste, to the use of a S/S system having certain components and features as described herein, and for attaining process residues having high strength structural properties or qualities. These factors are discussed as follows:

Applicable pharmaceutical waste streams

Pharmaceutical waste generally comprises pharmaceutical products and medicinals that are no longer useable because of being expired, withdrawn, recalled, damaged, or for any other reason. Such waste is typically generated at relatively small dispensaries or clinics in relatively small quantities, but in many parts of the world UPP is collected and consolidated in centralized or regional warehouse type bulk storage facilities and maintained in secured quarantine storage for an indefinite period of time. Many of such quarantine storage areas have large quantities of UPP in storage and some are filled to capacity with no further space available for the UPP that are continually being generated. This is a serious problem because the improper handling and/or disposal of such waste could readily endanger the environment and public health or enable pilferage leading to improper use or resale on the black or grey markets. Additionally, few viable options are available for safely treating and disposing of such waste.

The SOPs described herein are specifically for processing UPP consisting of relatively large bulk quantities of capsules and tablets (which are collectively termed pills) that have been removed from their packaging and collected within heavy-duty corrugated boxes, fiber drums, or similar containers for interim storage and containment.

It is assumed that the volume of each typical box or container for the bulk, unpackaged UPP for processing is no more than about 1.5 cu-ft (about 0.04 cu-m) such that the total weight of UPP within each when filled averages about 50 lb (about 23 kg). Larger containers and those containing larger volumes and weights of UPP are acceptable but additional handling requirements would be needed to proportion the proper weight of each batch load to be processed in the S/S system.

Applicable solidification/stabilization systems

Cement-based S/S systems have been used for the treatment and disposal of many types of waste including a wide range of hazardous wastes over many years. A recent testing program demonstrated that S/S systems are also suitable and effective for processing large quantities of UPP to an unrecognizable end product or residue that is safe for handling and suitable for

disposal in a general or sanitary landfill. The SOPs described herein are primarily based on data obtained during that testing program (refer to the Treatability & demonstration testing cement-based solidification/stabilization technology for UPP technical report) including the use of a system and components that are comparable to those used during the testing program. Details and descriptions of that system and associated components are included below in Section 2.

Applicable process residue qualities

The properties or qualities of residues discharged from a cement-based S/S treatment process are totally dependent on the proportions or the amounts of additives that are intermixed with granulated UPP. For example, if too much water is added, the process residues will be too wet or of a soup-like consistency, they will be difficult to contain and handle, and they will not dry or cure to a solid consistency suitable for landfill disposal. Likewise, if too much sand or rock and/or too little water are added, the process residues will be too dry and difficult to handle, and they may also not dry or cure to a solid consistency suitable for landfill disposal. However, if the UPP and additive amounts or proportions are proper, the process residues should be easy to handle and, after hardening, they should be stable, safe for handling, and suitable for general landfill disposal without endangerment to the environment or public health. In fact, the solidified concrete-like residues should have high structural strength such that they could be formed into block shapes and possibly used in certain types of construction activities.

UPP types, properties & mixtures

As discussed above, the SOPs and recommended proportions and additives to be used during processing as described herein are primarily based on data derived during the aforementioned testing program (refer to the Treatability & demonstration testing cement-based solidification/stabilization technology for UPP technical report) including the particular UPP composition and product mixtures that were used during the program. It is believed that such recommendations are applicable or suitable for processing most UPP types, compositions, and mixtures being generated and in storage. However, bench-scale testing using apparatus provided as part of the S/S system will enable the verification or determination of the process mixtures and additives that would be best for any site-specific UPP waste stream or composition.

Solidification/stabilization system & components

Basic processing steps

Cement-based S/S is a relatively simple process that involves the following steps:

1. The granulation of UPP to very small sizes in a controlled manner,
2. The thorough intermixing of the granulated UPP with specific quantities of water, cement, rock, sand, and a strength accelerator,
3. Containment of the intermixed components, or residues, within special forms,
4. The curing, hardening, or setting up of residues within the forms, and
5. The removal of hardened residues from the forms for eventual landfill disposal or beneficial use.

Specific details for each of these steps are described below in Section 3.

Solidification/stabilization system & components

The S/S system consists of a number of components that have been designed and integrated to function together in a controlled, safe, and reliable manner when operated properly and in accordance with the manufacturer's operating instructions. These components are as follows:

1. Main components
    A. Materials handler unit
    B. Granulator system
    C. Processor unit
2. Other components
    A. Form boxes
    B. Dust collection system
    C. Process water system
    D. Electrical power generator unit

e. Controls & instrumentation

F. Bench scale testing equipment

The main features of these are described below.

Main solidification/stabilization system components

1. Materials handler unit

   This is used for collecting granulated UPP from the bottom of the granulator system and then mechanically transferring and loading it into the processor unit. It is also used for mechanically loading cement, rocks, and sand into the processor unit. The materials handler unit is hydraulically operated via a pendant-mounted control box.

2. Granulator system

   This is used for reducing or breaking down the UPP to very small pieces. The granulator system consists of the following components:

   a. Granulator system loading hopper

      This is the box or enclosure located over the top of the granulator unit into which UPP is manually loaded or fed. It is equipped with a top cover that must be closed before the granulator unit can be operated.

   b. Granulator unit

      This is the device that breaks down or granulates the UPP loaded into it to small pieces by means of a high-speed, rotating cutting shaft. When loaded and operated properly, the UPP should be reduced in size to as small as about 0.125-in (about 0.32-cm).

   c. Granulator system discharge hopper

      This is the box or enclosure underneath the granulator unit into which the finely granulated UPP is collected. it is equipped with a bottom seal gate that must be closed before the granulator unit can be operated. When the bottom seal gate is opened following each granulation cycle, granulated UPP is discharged into the hopper of the materials handler unit for loading into the processor unit.

3. Processor unit

   This is used for thoroughly intermixing the granulated UPP with cement, water, rock, sand, and other additives. The processor unit is equipped with a top loading hopper, an internal mixing mechanism, and a discharge gate for the controlled removal or discharge of processed residues into form boxes for curing and hardening.

Other solidification/stabilization system components

1. Form boxes

   These are grid-like or box-shaped forms that are mounted on a moveable support frame and used for the collection of residues discharged from the processor unit for curing and hardening. Empty form boxes are placed under the discharge gate of the processor unit for residue collection after the completion of each process cycle. Filled form boxes are moved to a designated location for sufficient time to enable the residues to fully harden or cure.

2. Dust collection system

   This is a system used to collect, contain, control, and remove fugitive dusts from the hopper of the granulator unit and from above the processor unit during processing operations and to prevent such dusts from being discharged or emitted into operating areas and thereby becoming a nuisance. The dust collection system consists of ductwork; a blower for collecting and moving air-borne dusts and particles through the ductwork; and a high-efficiency cartridge type filtration unit for removing collected dusts and particles from the exhaust air stream.

3. Process water system

   This is a system that is used for automatically suppling controlled amounts of water to the processor unit during different stages of operation. The process water system consists of a water feed tank; a pump for supplying water to the processor unit during operations at the proper pressure; an automatic valve for water feed control; and a control valve for automatically keeping the water tank filled.

4. Power generator unit

   This is a diesel oil powered engine for generating sufficient electrical power for operating the complete S/S system. It is equipped with diesel oil tank on its underside having sufficient storage capacity for up to 30 days of S/S system operation.

5. Controls & instrumentation

   This consists of a main control panel and associated instrumentation and devices for the proper, safe start-up, operations, monitoring, and shutdown of the complete S/S system.

6. Bench scale testing apparatus

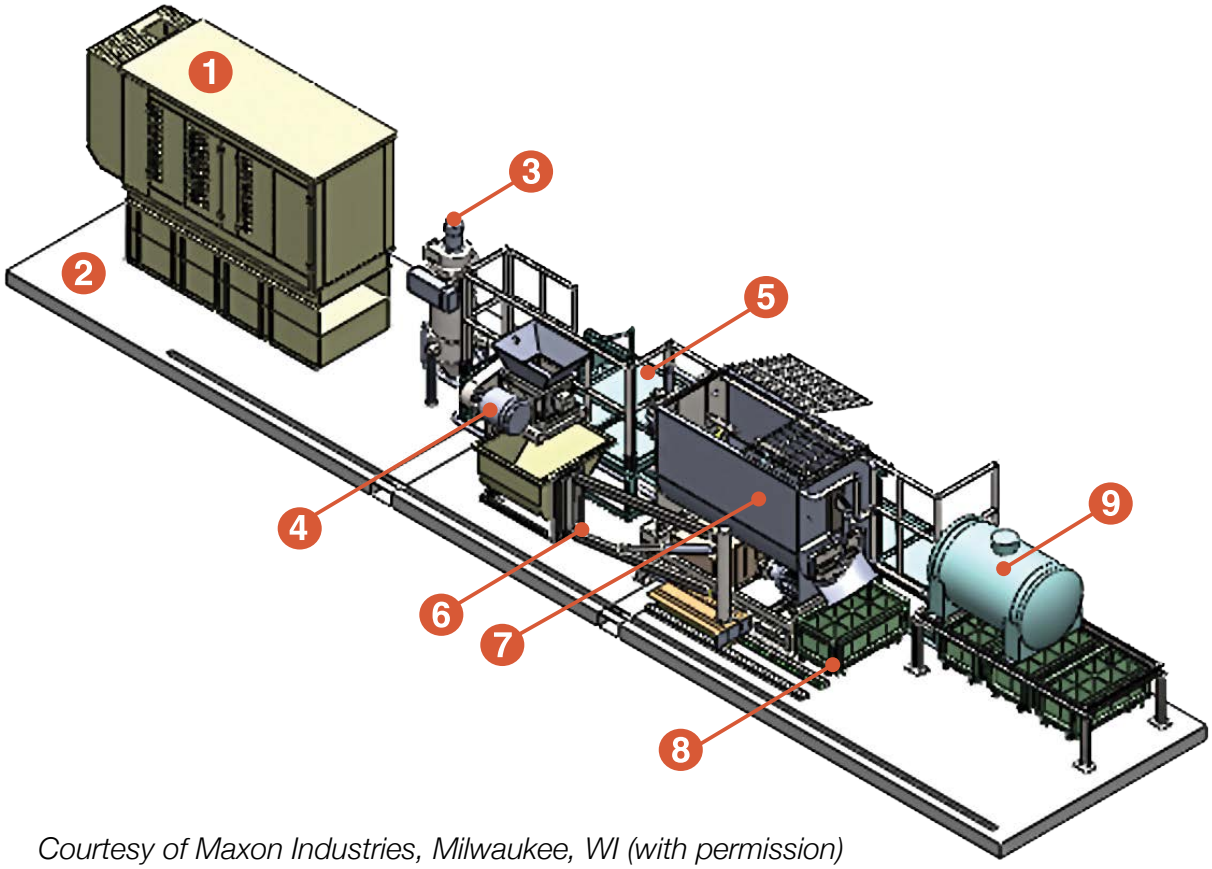
   This consists of a boxed set of various devices and items to enable replicate testing of small representative samples of UPP types and mixtures in order to determine or verify proper or optimum proportions of cement, water, and other additives needed for obtaining process residues having desired qualities.

Solidification/stabilization system schematic

Figure 1 on the right is a schematic showing the main components and their general arrangement for a typical S/S system as described herein.

Figure 1

Typical solidification/stabilization system



Courtesy of Maxon Industries, Milwaukee, WI (with permission)

1. Power generator unit with fuel tank
2. Base configured for ocean container enclosure
3. Dust collection system
4. Granulator system
5. Operator platform
6. Materials handler unit
7. Processor unit
8. Residue form boxes
9. Process water system

Solidification/stabilization system operations

Process capacity & operating times

The S/S system has a capacity suitable for processing about 100 lb (about 45 kg) of UPP per batch cycle of operation for obtaining residues having high structural qualities.

1. Batch cycle processing capabilities

   The time for completing a cycle of operation starting from the time that a batch load of UPP is loaded or placed into the granulator system loading hopper through the time that residues from that batch are completely removed from the processor unit should average about 30 minutes. Therefore, on average, two (2) 100 lb (about 45 kg) batches or about 200 lb (about 90 kg) of UPP can be processed per hour.

2. Daily processing capabilities

   It is estimated that up toabout one hour is needed daily for implementing S/S system start-up procedures inclusive of the time needed for the handling and staging of UPP containers for loading and processing. Also, up to about one hour is needed for implementing S/S system shutdown procedures and associated cleanup operations at the end of each day of processing. As such, UPP can be processed in the system on nearly a continuous basis for about 6 hours during the course of a typical 8-hour work period or during what is considered one-shift of operation.

   Taking into account the time needed for implementing system start-up and shutdown procedures, about 12 batch loads of UPP can be processed during a normal 8-hour shift of operation. Accordingly, at an average processing rate of 200 lb per hour (about 90 kg per hour) with 6 hours of loading per shift, about 1,200 lb (about 540 kg) of UPP can be processed per day of operation.

Required consumables

Consumables and additives needed for processing UPP in the S/S system are described as follows:

1. Portland cement or cement

   Pre-packaged, or bagged, ready-mix type, high-strength, 4,000 psi (about 281 kg/sq-cm) cement. Containerized bulk quantities of such cement could be used if available.

2. Aggregate

   a. Rock

      Size No. 2 coarse aggregate or rocks that are defined as having a nominal size range of 1.5-in to 2.5-in (about 3.8-cm to 6.4-cm).

   b. Sand

      Washed sharp sand, or concrete sand, which is a coarse sand comparable to beach sand, having particles in the range of 0.02 to 0.04-in (about 0.5 to 1.0-mm).

3. Water

   Fresh water or domestic water added during processing via the automatic process water system. Such water need not be potable or drinkable but it should not be brackish or salty.

4. Set accelerator or accelerant solution additive

   A solution added during processing for speeding up or accelerating the time needed for residue curing and hardening as well as for increasing the strength of the hardened residue. The solution is similar or equivalent to “Premium Concrete/Masonry Set Accelerator” as made by Akona Manufacturing, a brochure of which is attached.

5. Form release solution

   A solution that is sprayed to coat the internals of the processor unit and form boxes prior to processing operations to facilitate residue removal and clean-up procedures. The solution is similar or equivalent to “Duogard Form Release Agent” as made by W. R. Meadows, a brochure of which is attached.

Consumable usage rates

Table 1 below shows the quantities of cement, water, aggregates, and other additives that are needed for processing each ton of UPP using the S/S system as described above for obtaining process residues having high strength qualities. To reiterate, the indicated values are representative of the UPP processed during the aforementioned testing program, and as such, they should only be considered as typical or representative of most UPP. Bench scale testing may be needed to verify or determine the proper consumable usage for any particular, site specific UPP or other wastes.

Table 1

Estimated consumable usage rates per ton (tonne) of pharmaceutical waste (UPP) processed

CONSUMABLE & PROCESS ADDITIVES	UNITS	UNITS
Cement	Lb (Kg)	5,800 (2,630)
Rock	Lb (Kg)	15,600 (7,076)
Sand	Lb (Kg)	10,400 (4,717)
Water	Gal (L)	380 (1,438)
Set Accelerant Solution	Gal (L)	30 (114)
Form Release Solution	Gal (L)	1 (3.8)

Table 2 on the right shows the quantities of cement, water, aggregates, and other additives that are needed for processing UPP for each batch of loading, for each hour of operation, and for each 8-hour shift of operation using the S/S system as described above and for obtaining process residues having high strength qualities. It also shows corresponding UPP loading rates and resultant process residues.

Table 2

Solidification/stabilization system process system operating summary & consumable usage rates

	UNITS	USAGE RATES BASED ON S/S SYSTEM OPERATING PERIODS \a		
		SINGLE BATCH LOADINGS	HOURLY LOADINGS	8-HOUR SHIFT OF OPERATION
System Loading Rates				
Number of Filled UPP Containers	No.	1	4	24
UPP Quantity	Lb	100	200	1,200
	Kg	45	90	540
Process Additives				
Cement	Lb	300	600	3,600
	Kg	135	270	1,620
Water	Gal	20	40	240
	L	75.7	151.4	908.5
Rock or Gravel	Lb	780	1,560	9,360
	Kg	355	710	4,260
Sand	Lb	520	1,040	6,240
	Kg	235	470	2,820
Structural Accelerant Solution	Gal	1.5	3.0	18.0
	L	5.5	11.0	66.0
Form Release Solution	Gal	0.05	0.1	0.6
	L	0.20	0.4	2.4
Process Residues				
Quantity	Lb	1,700	3,400	20,400
	Kg	770	1,540	9,240
Number of Blocks for Disposal \b	No.	25	50	300

\a Values are rounded-off and approximate
\b Each block weighing about 65 lb (about 30 kg)

Process & consumable variations - advisory

It must be noted and reiterated that the quantities of cement, water, rock, sand, and additives as shown in Tables 1 and 2, above, as well as described below in Section 4 under operating sequences should NOT be considered precise, exact, or to be used exclusively for any and all UPP types, compositions, or mixtures. The indicated quantities were derived from the testing program involving what were considered typical range of UPP compositions comprising mixtures of unpackaged capsules and tablets, and, therefore, they should only be considered reasonably accurate and applicable for processing most bulk, unpackaged capsules and tablets.

Again, it may be necessary to conduct bench scale testing to determine the proper or optimum quantities of cement, water, rock, sand, and additives to be used for processing UPP of widely differing or unusual types, products, or compositions. Such bench scale testing may also be needed if residues collected from any particular process cycle are found to be either too wet, to dry, or which do not harden within a reasonable time period.

Solidification/stabilization system operational steps

Operating advisory

The following are the basic, minimal steps or procedures required for properly operating the cement-based S/S system from pre-start through system shutdown. However, it is **VERY IMPORTANT that all of the steps and procedures described in the operating instructions, in the O&M manual, and/or in the operator training video as provided by the system manufacturer MUST be followed without exception even if they are different from any of the steps as described below. Any failure to follow the manufacturer's operating instructions could potentially result in operating problems, equipment breakdowns or failures, unsafe conditions, and/or other unacceptable conditions.**

General safety precautions

All safety precautions included in the S/S system manufacturer's operating instructions MUST be followed at all times.

Solidification/stabilization operational steps

1. System pre-start procedures

   The following are the minimum basic steps to be followed PRIOR to start-up and operations of the S/S system and any of its components.

   a. Check the levels of diesel oil, engine oil, and radiator fluid in the electrical generator. Add oil or fluid as needed.

   b. Check the levels of hydraulic oil in the hydraulic power unit serving the processor unit and the materials handler system. Add oil as needed.

   c. Check the level of water in the water feed system tank. If too low, check, adjust, and/or repair the automatic water fill valve and connection.

   d. Check the cartridge filters on the dust collection system to make sure they are in place and that their latch mechanisms are closed tightly and securely.

   e. Check to verify that the gates and covers on granulator system and processor unit operate easily and close tightly.

f. Verify that the interior of the processor unit has been thoroughly cleaned; clean if necessary.

G. Spray form release solution in the interior of the processor unit and inside form boxes to be used for the day.

2. System start-up procedures

The following are the minimum basic steps to be followed for the initial startup and powering of the main components of the S/S system in order to begin processing operations.

a. Start the power generator (or turn on electrical power supply if that is the source of electrical power).

B. Energize dust collection system blower. Note: this blower starts and operates automatically whenever the granulator unit is started and operated.

C. Start the hydraulic motor for the materials handler unit.

D. Start the process water system pump motor and add 5 gallons (about 20 liters) of water to the processor unit .

E. Start the processor unit mixer through the control panel.

3. UPP processing procedures

The following are the typical operational steps to be followed for processing UPP in the S/S system and for obtaining process residues having high strength properties.

a. Granulator system operations

1) Manually load approximately 100 lb (about 45 kg) of UPP into the granulator system loading hopper from the operating platform.

Note: This will typically involve the opening and loading of two (2), full boxes or containers of UPP with each weighing about 50 lb (about 23 kg). If any boxes or containers are larger and hold substantially more than 50 lb (about 23 kg), then it will be necessary to load only a portion of the UPP into the granulator system loading hopper at a time. Overloading the granulator unit with too much UPP at one time could possibly cause it to become temporarily stuck or jammed.

2) Close the granulator unit loading hopper top cover and secure it tightly.

3) Start and run the granulator unit from the control panel and run it for about 5 minutes or until everything inside is fully granulated. Afterward, stop it from operating through the control panel.

b. Materials handler unit operations

1) Operate the materials unit from the pendant-mounted control box to move its loading hopper beneath the granulator discharge hopper opening.

2) Open the bottom gate of the granulator discharge hopper gate until all of the granulated UPP is discharged via gravity into the loading hopper of the materials handler unit.

C. Processor unit operations

1) Open the processor unit cover.

2) Operate the materials handler unit loading hopper from the pendant-mounted control box to move it from underneath the granulator discharge hopper and then lift, tilt, and dump its contents completely into the processor unit. Afterwards, return the hopper to ground level.

3) Manually load cement and sand into the loading hopper and then hydraulically lift and dump them into the top of the processor unit in the following quantities:

a) Sand: Load about 520 lb (about 235 kg) or 4.5 cu-ft (about 0.13 cu-m).

b) Cement: Load about 300 lb (about 135 kg) or 3 sacks (each at 94 lb or about 43 kg).

4) Add 10 gallons (about 45 liters) of water via the process water system pump.

5) Close the processor unit cover.

6) Start and run the processor unit for 5 minutes and then pause it.

7) Manually load rock or gravel and a structural accelerant into the loading hopper and then hydraulically lift and dump them into the top of the processor unit in the following quantities:

a) Structural accelerant: Add 1.5 gallons (about 6.8 liters)

b) Stone, rock, or grave: Load about 780 lb (355 kg) or about 11 cu-ft (about 0.3 cu-m).

8) Add 5 more gallons (about 23 liters) of water via the process water system pump.

9) Start and run the processor unit for 15 minutes.

10) Stop the mixer assembly of the processor unit.

11) Open the processor unit cover and observe the consistency of mixed process residues within. If not fully mixed and uniform in consistency, close the cover and restart the mixer assembly for an additional 5 minutes. If fully mixed and uniform, begin residue discharge procedures.

Note: The quantities of cement, rock, sand, water, and additives to be used for each process batch are shown above in Table 2.

d. Residue removal & handling operations

A. Move and place a form box under the discharge gate of the processor unit

B. Open the residue discharge gate slowly from the control panel.

C. Turn on the processor unit mixer assembly and run it at a low speed in the discharge mode; adjust mixer speed and the discharge gate opening and closing to control residue discharge rates.

D. Completely fill each form box compartment; move or reposition it as needed to ensure each of the forms is filled and to prevent overfilling and spillage.

E. After each form box is filled, close the discharge gate, stop the mixer assembly to temporarily stop residue discharge, and then replace the filled form box with an empty one that has been internally coated with form release solution. Repeat this process as many times as necessary until all residues are removed from the processor unit.

F. Move filled form boxes to a selected area of facility or a designated location for curing, setting, and hardening.

4. End of daily operations – system shutdown

   The following procedures apply after the last load of UPP has been processed and with all residues completely removed from the processor unit.

   a. Using a high-pressure water wand as a component of the process water system, thoroughly wash down the entire processor unit and the loading hopper.

   b. Lubricate and grease components and fittings as per manufacturer's instructions.

   c. Power down the system by stopping the electrical power generator and/or by turning off electrical power supply.

   d. Secure or lock down the system.

   e. Flatten, crush, or breakdown all emptied waste boxes or containers and place them in an area or within a bin for off-site disposal.

Process residues

a. Residue quantities

   The residues from processing each 100 lb (about 45 kg) batch load of UPP should weigh approximately 1,700 lb (about 770 kg) with a volume of approximately 11 cu-ft (about 0.3 cu-m).

   The residues from processing 1,200 lb (about 544 kg) of UPP per 8-hour operating day should weigh approximately 20,400 lb (about 9,250 kg) with a volume of approximately 136 cu-ft (about (4.0 cu-m).

b. Form box requirements

   Each compartment or box-shape on each form box has a volume of about 0.50 cu-ft (about 0.014 cu-m) which was sized for containing approximately 65 lb (about 30 kg) of process residue. As such, approximately 25 blocks of hardened residues should be generated from each 100 lb (about 45 kg) batch of processed UPP. This equates to approximately 50 blocks per hour of operation and about 300 blocks per 8-hour shift of operation.

Note: Residue quantities and form box requirements for each batch of processed waste, for each hour of operation, and for each 8-hour day of operation are shown on page 11 in Table 2.

Appendix

Catalog data sheets for set accelerator solution & form release solution

AKONA MANUFACTURING, LLC
SPEC BLENDED CONSTRUCTION PRODUCTS.

PREMIUM CONCRETE/MASONRY SET ACCELERATOR

Fast Setting Cement / Mortar Additive

Product Description

Akona® Premium Concrete/Masonry Set Accelerator is a ASTM C494, Type C, non-chloride, non-corrosive, liquid that improves workability and initial strength while it reduces the hydration time of cement. The product is recommended for use during cooler weather to accelerate set time and reduce the risk of frozen mortar and concrete mixes. It is also recommended for use when early strength gain is desired to speed up construction. Akona® Premium Concrete/Masonry Set Accelerator provides a reduced curing time, faster set time and increased early strength. The product speeds finishing operations in any weather condition without any corrosive effects.

When/Where to Use

- Interior / exterior
- Concrete & masonry projects
- To accelerate cement set time to decrease project time
- Freeze thaw conditions

Advantages

- Non-Chloride Accelerator
- Non-Corrosive
- Meets ASTM C494 *Standard Specification for Chemical Admixtures for Concrete*
- Increases early compressive strengths of concrete or mortar
- Increases workability of concrete or mortar
- Accelerates initial/final set and curing time for concrete and mortar
- Allows earlier finishing of concrete and removal of concrete forms

Package

1 Quart (32 ounces) / (.946 liters)

Helpful Items:

Mixing

Slowly stir product before use. Do not create bubbles or foaming by shaking the product. In most cases, substitute recommended "water addition" with equal amount of Akona® Premium Concrete/Masonry Set Accelerator or follow packaged product manufacturer instructions for proper ratio.

Application

Stir product before using. Intended for use when temperature is 20°F (-7°C) or higher and a faster set is desired. Follow typical water addition mixing instructions on the applicable cement, concrete or mortar bag. Combine the recommended amount of Akona® Premium Concrete/Masonry Set Accelerator with sufficient water to provide the desired consistency of the mix. Set Accelerator is added directly to the mix water. Reduce the amount of water proportionally to compensate for the liquid addition. This product affects only the portland cement portion of the mix and is not antifreeze for the water portion. Protect set accelerator from freezing.

Table I: Typical Addition Ratio

Product:	Suggested Rate*:
94 lbs. (42.6 kg) Portland Cement	64 ounces (2 quarts)
70-75lbs. (32-34 kg) Masonry Cement	32 ounces (1 quart)
80 lbs. (36.6 kg) Pre-blended Mortar	16 ounces (½ quart)
60 lbs. (27.2 kg) Pre-blended Concrete	8 ounces (¼ quart)

** Typical addition ratio can be adjusted to achieve desired results*

Warranty:

Seller warrants that its product will conform to and perform in accordance with the product specifications. The foregoing warranty is in lieu of all other warranties, express or implied, including, but not limited to, those including merchantability and fitness for a particular purpose. Because of the difficulty in ascertaining and measuring damages hereunder, it is agreed that, seller's liability to the buyer at no point for any particular project shall exceed the total purchase price of said product.

WARNING: PROTECT FROM FREEZING

KEEP OUT OF REACH OF CHILDREN!

Precautions:

Avoid contact with eyes and skin. If contact with eyes occurs, flood eyes repeatedly with clean water and see a physician immediately. Do not rub eyes. Wash hands thoroughly after handling or before eating with warm, soapy water. Do not take internally. Keep out of reach of children.

Table II: Typical Set Time Properties:

Set Time	60 lbs. Concrete Mix		Masonry Mortar—Type S		Masonry Mortar—Type N	
	Control:	Akona Set Accelerator:	Control:	Akona Set Accelerator:	Control:	Akona Set Accelerator:
Initial Set (hr:min)	3:30	2:35	2:50	1:45	3:45	2:10
Final Set (hr:min)	5:10	4:10	5:00	3:20	7:00	5:00

2025 Centre Pointe Blvd, Suite 300, Mendota Heights, MN 55120 | P 651.905.8137 | F 651.688.9164 | www.akonallc.com

PRODUCT DATA

W. R. MEADOWS. SEALTIGHT

DUOGARD®
Form Release Agent

DATA SHEET NO. 3150-112

DESCRIPTION
DUOGARD form release agent is a ready-to-use mixture of organic chemicals, which react with the concrete alkali to prevent bonding of the concrete to the form, and a chemically inert, high-molecular weight non-reactive ingredient, which also facilitates form removal. This combination provides both chemical and physical (DUO) separation for highly effective form release.

USES
DUOGARD is designed for all types of forms - wood, steel, fibreglass, plastic and paper, including pre-treated panels and tubes. DUOGARD may also be used to soften concrete build up on tools and equipment; spray daily for easy clean up and rust prevention.

FEATURES/BENEFITS
- Dual separation properties eliminate bonding between concrete and form.
- Low odour.
- Permits easier stripping of forms, even up to 90 days later.
- Unique formulation allows for superior coverage - lower costs.
- Does not stain or discolour concrete.
- Does not inhibit bond of paint, plaster, and epoxy concrete coatings.
- Increases the life of wood forms by covering and penetrating the wood to prevent water and alkali absorption from the concrete, and eliminates the swelling and delamination of plywood caused by oils.
- Reduces metal form maintenance by forming a rust-resistant film when applied prior to storage.
- VOC-compliant

PACKAGING
18.9 Litre Pails
205 Litre Drums

COVERAGE
Up to 40 m²/L (2000 ft.²/gal.), depending on type and porosity of form.

SHELF LIFE
When stored indoors and in original, unopened containers at temperatures between 4 - 32° C (40 - 90° F), shelf life is a minimum of two years from date of manufacture.

SPECIFICATIONS
- Complies with Canada VOC Concentration Limits for Architectural Coatings Regulations

TECHNICAL DATA

Colour	Amber
Viscosity (Ford No. 4)	10 seconds
Freezing Point	Less than -29° C (-20° F)
Staining	None

APPLICATION
Surface Preparation ... Form surface should be clean and free of hardened concrete and other deleterious materials. Remove rust, scale, or previously used form oil from steel forms in accordance with good concrete practice, especially for architectural or exposed concrete surfaces.

Continued over ....

Application Method ... Apply by low pressure sprayer,

W. R. MEADOWS OF CANADA
70 Hannant Court, Milton, ON L9T 5C1
Phone: (905) 878-4122 • Fax: (905) 878-4125

Montreal Sales: (877) 405-5186

Hampshire, IL / Cartersville, GA / York, PA / Fort Worth, TX
Benicia, CA / Pomona, CA / Goodyear, AZ / Milton, ON /
St. Albert, AB
www.wrmeadows.com

such as a Chapin 1949, equipped with an 80° fan pattern spray tip (such as a Chapin 1-5915), at a rate of 0.4 litres (0.08 gal./13 oz.) per minute in a light, even coat. When employing a brush or roller, take care to apply as thinly and evenly as possible. More is not better; a thin coating provides superior results.

New wood forms (not pre-coated) should receive at least two coats before being used.

All forms should be recoated before each subsequent use.

PRECAUTIONS
Do not use on plaster moulds or in autoclaves. Harmful or fatal if swallowed. Avoid prolonged breathing of vapour or prolonged contact with skin. Use with adequate ventilation. Flammable - keep from open flame and excessive heat.

MASTERFORMAT NUMBER AND TITLE
03 11 00 - Concrete Forming

LEED INFORMATION
May help contribute to LEED credits:
- IEQ Credit 4.2: Low-Emitting Materials – Paints and Coatings
- MR Credit 2: Construction Waste Management
- MR Credit 4: Recycled Content
- MR Credit 5: Regional Materials

For most recent data sheet, further LEED information, and MSDS, visit www.wrmeadows.com.

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SCMS


PEPFAR
U.S. President's Emergency Plan for AIDS Relief


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