In conjunction with a properly implemented paint detackification program, a water recirculating paint booth system will produce chemically conditioned paint particles that are one step closer to actually becoming paint sludge. The selection of the proper equipment to make paint sludge is critical in the sense that it needs to be matched to the design of the system. There is nothing more frustrating than having spent many thousands of dollars on a device to make paint sludge only to find it doesn’t work well with the system you have.

This technical bulletin will provide an overview of some of the most common types of sludge conditioning/processing equipment and what types of system designs for which they are most suited.

**Skimmers** – Skimmers (sometimes called weir boxes) are used in systems that are designed to float the detackified/coagulated paint particles. Skimmers act as collecting devices that will deliver the semi-concentrated paint particles along with some water to a sludge concentrating/dewatering device. Skimmers have a dedicated pump that will facilitate the drawing in and delivery of the paint particles and water to that device.

Skimmer design and placement are critical. Skimmers come in all sizes. Some are fixed in their position and will require very good control of pit water level so the floating paint particles can actually make their way into the skimmer. Others are level adjustable units that will move up or down relative to the water level in the pit – either through automatic level sensors and motors or manually where the skimmer can be moved up or down with motors or hand cranking. In either case, the skimmer needs to see an almost continuous flow of paint particles and water into it to deliver the semi-concentrated paint to the sludge conditioning device.

Placement of the skimmer/weir box is critical in the sense that it has to be in a location where the floating paint particles are moving towards it. In most central pit systems the skimmer will be placed at the end of the pit nearest the booth recirculating pumps. The pumps will naturally produce a water current in that direction. Well-designed pit systems facilitate this movement even further by either having side walls that “V” in towards the skimmer or by installing vertical plates along the sides of the pit that also “V” towards the skimmer.

**Flotation Units** – Flotation units are typically fed by a skimmer/weir box, receiving the floating paint particles that it has gathered. The job of the flotation unit is simple – further concentrate the paint particles into becoming a sludge and separating the paint sludge from the booth water.

Well-designed flotation units have several key elements:
1. Are sized to have enough retention time (volume divided by flow rate) to allow for separation of the floating paint particles from the water.
2. Have the capability to introduce fine air bubbles into the unit to speed up particle flotation.
3. Have a chemical flocculent injection point at the inlet – flocculent greatly assists with pulling paint particles together speeding up flotation and producing a sludge that is readily dewatered. It is a good idea to have alternate injection points further upstream in case additional mixing energy is required.
4. Vertically designed unit to promote good liquid/solids separation with a consolidation zone where the solids concentrate; and a clarification zone where high quality water can return back to the booth system.
5. A well designed scraper assembly to remove the concentrated paint solids from the unit. The scraper can be driven by air or electric motors.
6. Utilize a programmable timer so the scraper can remove the floating sludge blanket on a regular basis.

Flotation units are typically not the final step in producing sludge which is ready for disposal. They are typically followed by a final dewatering step such as dewatering bags, gravity/vacuum filters or potentially a sludge dryer.

**Sludge Dewatering Bags** – Dewatering bags are an inexpensive way to achieve final sludge dryness following an initial sludge consolidation step, such as a flotation unit. Sludge dewatering bags are typically made from a durable, porous fabric that allows a properly conditioned sludge to drain its water; while being strong enough to deal with the weight of the sludge it is holding.

Sludge dewatering bags are placed at the exit point of the initial sludge consolidating device, typically below them, so an easy exit and gravity draining can be accomplished. A well designed sludge processing system will capture the water draining from the filter bag and direct it back to the system.

Dried sludge following sludge dewatering should be dry enough to go to most landfills.

**Centrifuge** – Centrifuges are best utilized in small water recirculating systems and in paint booth systems where the paint solids are being dispersed (See Galaxy Technical Bulletin TB 03, “Paint Booth Sludge Systems – Float, Sink, or Disperse”) for more information on dispersed systems.

Centrifuges use mechanically induced gravity (spinning) to separate the dispersed paint solids from the booth water. Concentrated paint solids are drawn to the sidewalls of the centrifuge and are either continuously or semi-continuously scraped from the side walls. The solids are then
captured in a holding bin/container. If the paint solids are not dry enough, a sludge dewatering bag might be used following the centrifuge. The cleaner water stays towards the center and is drawn off and returned to the booth system, usually by gravity flow. When required, the water can be pumped back from a holding tank.

Centrifuges can receive their supply of dispersed paint solids in a variety of ways. Several possible sources are a side stream off the main booth recirculating header; or pumped separately from a location that is highly active so it sends the most concentrated solids that it can to the centrifuge.

Programmable centrifuges are worth considering as they can 1) reduce the manpower support required and 2) allow for control of the process and cleaning cycle times in semi-continuous units – maximizing sludge dryness and centrifuge efficiency.

At least one flocculent chemical injection point should be installed in front of the centrifuge. Alternate injection points further upstream are also suggested if additional mixing energy is required. Some centrifuge manufacturers will install some serpentine piping near the unit to facilitate this.

**Gravity/Flat Bed Filters** - Gravity/Flat Bed Filters are horizontally oriented sludge concentrating devices that have a roll of traveling filter paper at one end. A mesh screen located underneath the filter paper provides support and usually travels with the paper. Some gravity filters have a curved shape which works well for very wet incoming paint solids. Semi-concentrated paint sludge is delivered to the unit either by gravity or pumping onto the filter paper – and then gravity does its job. A sludge cake begins to form as it accumulates on top of itself. Sludge continues to drain and dry while it travels with the filter paper from one end of the unit to the other - while filtered water passes through the paper and is directed back to the booth system.

Gravity/Flat Bed Filters can work well when there is a high water volume accompanied by low to moderate solids loading.

Sludge conditioning polymers (flocculents) are often used in these devices to promote more rapid dewatering of the sludge on the filter media along with a sludge that is more dry.

**Vacuum Assist Filters** – Vacuum assist filters can come in many sizes and designs, but the common element is that a vacuum is pulled across a surface where the wet fluid or sludge is traveling. The vacuum helps to pull the fluid through the filter media and through the sludge cake as it builds on the surface. Clean fluid is collected as it passes through the filter media; while the drying sludge moves from one end of the unit to the other – and then exits on the far end of the unit.

One of the most common designs of a vacuum assist filter is a horizontal orientation – and looks quite a bit like a horizontal gravity filter with most of the same components – traveling mesh screen and filter paper, etc., but it has the additional help of a vacuum to speed up the removal of moisture from the sludge.
Precoated vacuum assist filters can also be used for drawing moisture out of wet paint sludge. Typically these filters have a rotating drum design that has a filter media, such as diatomaceous earth, that is first drawn to the surface of the filter through a vacuum pulling from the opposite side. Wet sludge is then pumped into a holding vessel where the precoated filter rotates and draws sludge onto it. A scraper blade that slowly scrolls inward peels off a small amount of media along with the dried sludge cake that has built on top. When working well the process looks like a paper towel rolling open.

Although these filters can work well, they require some manpower support to maintain the unit, applying the precoat filter media and switching on the sludge supply.

**Filter Presses/Pressure Filters** – Using a pump and pressure, these types of filters force the solids-laden water against the surface of a filter media (typically a porous fabric). One common design is the plate and frame filter press. These filters are a fixed volume and batch operation. The two major components of the plate and frame filter press are the skeleton and filter pack.

A filter cake builds in between two plates where the porous fabric is positioned on either side. The filtered water passes through the fabric and is returned to the system. The plates are then pulled apart (either manually or automatically) and the dried sludge falls off and drops to a collection chute or bin placed beneath the unit.

There are other pressure filter designs – but they all have the common design feature of pressure being applied against the surface of a porous media/fabric.

One of the key potential issues using this type of filter is the potential for the sludge to stick to the filter media/fabric if the paint is live/sticky.

Galaxy is familiar with all types of sludge conditioning equipment and can assist with optimizing the output and troubleshooting. Galaxy also has contacts with many of the equipment companies who design, build and install this equipment.