This discussion was put together as a result of a Paint Spray Booth customer adding additional water flow to their system as they added another booth module (this also meant additional paint loading to the system). This increase in recirculation rate would impact the retention time (RT) by reducing it and the customer wanted to know the potential impact of doing this in their system. RT is simply calculated by dividing the system volume (V) by its recirculation rate – or RT = V/RR, where RT is minutes, V is gallons and RR is gallons per minute.

This discussion is especially pertinent to systems where it is desired to float the paint solids into a central pit or tank, skimming the floating solids, and then sending the concentrated stream to a flotation/dewatering device – such as a Palin, Hydropac or similar device.

Without question, shorter retention times (RT) in the spray booth system will increase the risk of the paint solids dispersing in the system. Shorter RTs will provide less time for the paint particles to separate from the water in the pit. Potentially, the dispersed paint particles would not be picked up by the skimmer to be removed as sludge by the flotation unit.

**What is an ideal retention time?** For a floating system, this value can range somewhere between 5 and 10 minutes – but, the closer it is to the high end of this range, the better. The closer it is to the bottom end of the range or below that, the more likely it is to experience some of the problems listed below.

**The potential outcome of shorter RT is:**

1. Increased potential for foaming with higher suspended solids levels in booth water and higher water velocities throughout the booth system
2. Increased potential for paint solids to recirculate through the system and drop out in lower flow areas
3. Decreased solids removal in the flotation unit - less sludge being pulled out and reduced sludge removal efficiency
4. Increased potential for microbiological growth (in particular, anaerobes) where solids may settle out
5. Increased potential for microbiological-related odors
6. Increased challenge placed on the detackifier as more solids recirculate around the system
Another question that may be asked is - to what degree might these happen? That one is a lot more difficult to answer as we know of no easy way to predict these effects. The booth manufacturer may be able to provide some input on what their system was designed for in terms of RT and what the system can handle.

Another potential area of concern is - the higher recirculation rate in the booths will throw off the booth balance without a commensurate increase in booth air flow. Spray booths are designed with a specific L/G (Liquid/Gas) ratio in mind - simply said, a certain amount of water must meet up with a certain amount of air to optimize the scrubbing efficiency of the booth. More water with the same amount of air will most likely decrease the scrubbing efficiency of the booth and increase the potential for live paint overspray to get past the scrubbing chamber, or have overspray back up in the booth.

Our advice to the paint booth customer is to make sure that the booth design can indeed handle more water flow and the proper adjustments can be made to have the booths operate within spec. If they have variable speed booth air recirculation fans, this may not be a problem.

We know booth balance is critical to having a quality paint job on the vehicle - so the air flow side of this must also be seriously considered.

**Improper booth balance and out of spec air/water flows can impact:**

1. **Paint quality of the job**

2. **Transfer efficiency of the painting operation**

3. **Live paint deposition in scrubber, booth back sections and stacks**

4. **Paint emissions out the stack**

**Are there any chemical response actions that can be taken if the paint booth system is going to experience shorter RTs and higher overspray? Read on:**

1. Higher paint loading/overspray in the booth water is addressed by proportionately increasing the detackifier level and likely higher polymer feed rates to the sludge conditioning equipment.

2. The shorter retention time, however, does increase the challenge placed on the particles to float to the surface and be skimmed at the far end of the pit. In essence, we're asking Mother Nature to speed up the rate at which the particles come to the surface.

3. Some assistance can be provided by satellite feeding additional emulsion polymer (which typically goes to the flotation unit) to the return end of the pit. The emulsion polymer can assist with speeding up solids flotation because it initiates the bridging of the particles and entraps more air with the particles - so they float faster.

Of course, this can't be done perfectly as RT continues to decrease - as the rise rate of the more buoyant particles still have to overcome the velocity of the water passing through the sludge pit.
4. Assuming we have more solids going to the flotation unit, it is likely that the emulsion polymer feed up there may need to be increased as well. Like detackifiers, emulsion polymers react proportionately with the paint solids.

5. Additional foaming potential can be handled by more antifoam - to a point. The best solution to control foam is through mechanical means - lower flows, less splashing, etc. Of course, shorter RTs take this in the opposite direction. We would prefer not to feed any antifoam to paint spray booth systems - but in some cases it's required. Antifoams become less effective as you increase their feed rates and they can begin to have a negative impact on the detackification program where the charge neutralization and flotation you're looking for begins to decrease.

Antifoams reduce the surface tension of the water and break apart bubbles. This is good when it comes to controlling a foam layer in the system. It is bad when they're fed to the point where the small bubbles (in the recirculating water) that enhance flotation are broken and the paint solids no longer float as readily.

6. Chemicals can only handle these types of changes to a point - and that is something unique to each system out there. When system mechanics are optimized (correct RTs and correct L/Gs) and we marry that with an optimized chemical program, the overall system results will fall into place.

**What can be done to measure the impact of changes to RT and/or higher paint solids loading?**

We believe it is important to benchmark certain performance parameters of the systems and to track those parameters as the changes are made. These would include:

1. Booth recirculating water turbidity and/or suspended solids levels
2. Booth water conductivity
3. Average sludge % solids - this will help in tracking Item 4 below
4. Paint sludge collection efficiency - this would be done by matching up theoretical daily/weekly paint overspray solids with the actual amount collected in the bags. Weighing the bags helps if it can be done.

5. In parallel, track paint usage and overspray for the above calculation
6. Develop a foam rating scale - i.e. come up with some measurement on the pit walls (i.e., some plants look at the rungs on a ladder that goes into the pit) and track it
7. Measure sludge depths in pit - not always easy to do - could try "Sludge Judge" used in waste treatment clarifiers/thickeners
8. Track other system parameters that may be important to you

Consult with Galaxy Chemical for all of your paint spray booth chemical and technical needs.