



## ***Facts about***

## **Alternatives for Calculating PTE for Batch Operations**

This factsheet provides procedures you can use as alternatives for calculating the potential to emit for your facility's batch process.

If you manufacture more than one type of product, you may need to conduct this analysis for each product. Then you can determine which product is worst-case for each pollutant you emit.

The following example calculates VOC (volatile organic compound) emissions. While the calculation method can be used for other pollutants (for example, particulate matter), the amount of material used may not be equivalent to the amount emitted, as it is for VOCs. You would need to determine and justify how much is emitted per batch, for other pollutants, and take into account transfer efficiency, if applicable.

To calculate the PTE of a batch process, you always need to determine the following:

1) You need the minimum time to process one batch. This includes all processing time, as long as the operation must be performed in order to run the process (considered a "physical limitation").

For example, if a tank must be drained and refilled between each batch to get a marketable product, the time to do that may be included. If it is possible to run several batches before draining and refilling, then draining and filling is not part of the batch process time. Equipment maintenance time is not a process limitation.

Let's say a process involves the following activities and that all of these activities must be completed in a certain order as part of the process.

<b><u>Process Activity</u></b>	<b><u>Time Needed</u></b>
Fill tanks and complete mixing	1.5 hours
Treatment time	4 hours
Drip and cure	3 hours
Drain and filter	<u>1.5 hours</u>
<b>Total Process Time</b>	<b>10 hours</b>

There was an additional step to prepare the product for treatment, but because that can be accomplished at the same time as the tank is filling, it cannot be added as a separate item.

2) You need to know the most VOC-containing material that would be used per batch. In general, for VOCs, if it was used, it is considered to have been emitted.

To use the next alternative method, you need to determine the following:

1) You need the minimum and maximum number of parts processed per batch. Depending on the type of widget, we can process as few as 100 and as many as 150 widgets per batch.

2) You need to know the maximum number of products you can produce in a certain time period. You can look at past production numbers, but if they vary you may need to add a safety factor if you weren't producing at maximum capacity. In your application, you

should state what physical limitations or bottlenecks exist that limit production.

Below is the generally accepted method for calculating hourly PTE from a batch process. You take the VOC usage rate (based on the material with the highest VOC content) and the batch-processing time to get your maximum hourly emission rate.

$$\frac{1 \text{ batch}}{10 \text{ hours}} \times \frac{100 \text{ lbs of VOC used}}{\text{batch}} = \frac{10 \text{ lbs of VOC}}{\text{hour}}$$

## Calculating Your Annual PTE

You may use the number above, multiplied by 8,760 to get an annual PTE. Another option would be to use the VOC usage per batch, multiplied by the maximum number of batches per year.

Another method is based on maximum parts processed or maximum plant capacity. This method allows you to account for limitations in your maximum overall production. There are several ways to approach this calculation; below is one example.

1) If you do not know how many parts you could produce in one year, you can calculate the maximum number of parts that could go through the batch process in one year. To do this, divide the maximum number of parts per batch by the shortest batch time to get a parts-per-hour number. This is multiplied by 8,760 to get parts per year. This may give you a higher number than looking at the plant-wide capacity, because it does not take into account physical limitations at your facility.

$$\frac{150 \text{ widgets}}{\text{batch}} \times \frac{1 \text{ batch}}{100 \text{ widgets}} \times \frac{8,760 \text{ hours}}{\text{year}} = \frac{131,400 \text{ widgets}}{\text{year}}$$

To get an annual PTE, take the maximum possible pounds of VOC used per batch and divide by the minimum number of parts per batch to get the maximum VOC emitted while processing one widget. Then multiply by the number of widgets you could process in one year to get the VOC PTE.

$$\frac{100 \text{ lbs. of VOC used}}{\text{batch}} \times \frac{1 \text{ batch}}{100 \text{ widgets}} \times \frac{131,400 \text{ widgets produced}}{\text{year}} \times \frac{1 \text{ ton}}{2,000 \text{ lbs.}} = \frac{65.7 \text{ tons VOC}}{\text{year}}$$

2) Say you have other bottlenecks that limit your maximum capacity to 50,000 widgets per year. To get an annual PTE, take the maximum pounds of VOC used per batch and divide by the minimum number of parts per batch to get the maximum VOC emitted while processing one widget. Then multiply by the number of widgets you could make in one year to get the VOC PTE.

$$\frac{100 \text{ lbs. of VOC used}}{\text{batch}} \times \frac{1 \text{ batch}}{100 \text{ widgets}} \times \frac{50,000 \text{ widgets produced}}{\text{year}} \times \frac{1 \text{ ton}}{2,000 \text{ lbs.}} = \frac{25 \text{ tons VOC}}{\text{year}}$$

