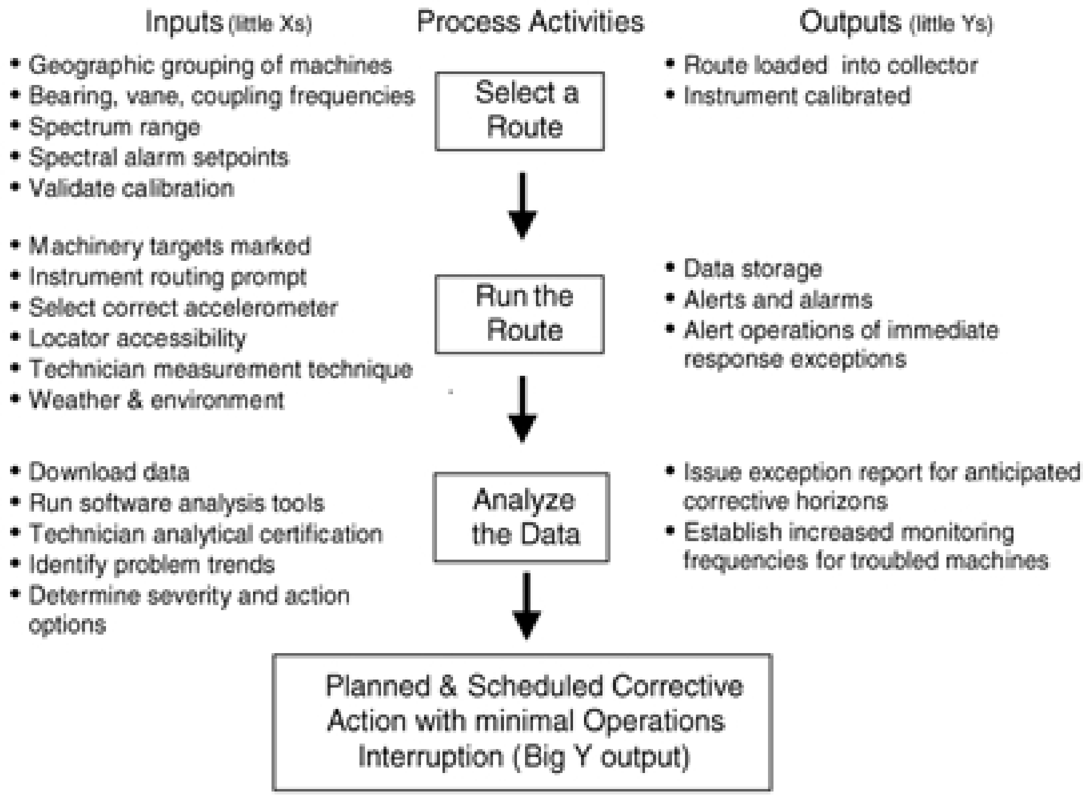

Example of a simplified vibration monitring process map

Most of us in the reliability and maintenance business have either practiced or referred to the discipline of root cause failure analysis. We gather data, evidence, ask why, and use "tools" such as fault trees to understand how to mitigate future similar failure modes. Think of Six Sigma as root cause variation analysis-where a different set of tools is used to identify sources of variation and determine a means to mitigate "bad" variation and control "good" variation to enhance output productivity. The reason we do this highly structured methodology is to reap the business benefits of reducing variation, which results in break-through productivity improvements.

Nearly everything we do in life and in business follows a process, a series of steps. Sometimes these steps are well defined and sometimes they just "happen" and eventually we get an "output" (How consistent is the process to get work done at your site?).

When mapping a process, we need to identify the "inputs" and the "outputs" for each step. Y (output) = function of (inputs X1, X2, X3, &Xn). Simply stated, Six Sigma is aimed at producing key Ys within a specification range (upper and lower control limits) by reducing the variation in the key influential Xs. When Y is centered about the targeted (desired) value and Y's spread of variation is 33 percent of the spread of the upper and lower control limits, we have a Six Sigma process.

The catch is understanding the influence of the many Xs, both planned (controllable) and unplanned (noise). Six Sigma extensively uses statistics, the science of observation. A student of Six Sigma keenly learns the science of observation using many statistical tools to characterize the influence of the Xs on the Ys. It can get sticky when there are interactions occurring among the multiple Xs that influence Y. It gets even stickier when we have an incapable measurement system. (Is the measurement of the Ys and the Xs real? After all, we are observing them through the "lens" of flawed measurement systems.)

This leads us to the stages of Six Sigma variation reduction: measure, analyze, improve, and control.

In my opinion, the measure element carries about 50 percent of the importance in successful variation reduction. So, what should we be measuring to reduce the variation in our assets' performance? The answer is: "it all depends." I'll leave you hanging for a while and then this answer will make sense.

Let's start with the desired output, big Y. What are the principal subprocess steps (activities.); what are the outputs of each of the activities (little Ys); and what are the inputs that influence each activity? In a 10-step process, it's easy to identify 100, 200, or more inputs.

A process map is fundamental to the Six Sigma method. It is the foundation, the starting point, of measure. In manufacturing, a good process map can be facilitated only with a knowledgeable and participative cross-functional team of operators, maintainers, process engineers, supervisors, and environmental and safety engineers.

Why, you might object, do we need to compile a process map when we know the process and run it every day? Because a Six Sigma black belt or green belt can facilitate the mapping process in such a way that we see, perhaps for the first time, the possible influence of these 100 or 200+ inputs, inputs that were never considered nor understood before which may or may not contribute to the variability of big Y, the desired outcome.

I've witnessed many instances where a trainees' Six Sigma project became an overnight business bonanza by merely constructing a process map. Light bulbs went on among the team and "quick hits" could be implemented within a week with big gains. But they didn't stop there.

What is the big Y for asset dependability? Uptime? MTBF? MTTR? Cost? Percent emergency work? It depends on your business drivers. But I would contend that Y (uptime and/or cost) = function of (MTBF, MTTR, percent emergency, etc.). Another layer of mapping would analyze Y (MTBF) = function of (MTBF pump 1, MTBF compressor 2, MTBF control valve 3, MTBF motor 4, etc.).

A little overwhelming maybe? Applying the Six Sigma practice of process mapping is the first step. All Xs need to be identified for the big Y we desire to improve. Six Sigma methodologies enable us to separate the critical Xs from the less critical so we can truly focus on the right things with our limited resources. In the next Viewpoint we will delve into how critical Xs (inputs) are selected. **MT**