Problem Solving Revisited

Much of this article was first published in the October 2007 issue of JCT CoatingsTech. However, since many paint problems reappear again and again, I thought that this was a good time to revisit problem solving. I also see and hear about people jumping to conclusions and wasting time trying solutions when they do not really know what the problem is. It is critical to define a problem and establish its cause before beginning to work on solutions. That may sound obvious, but it is often forgotten or ignored. Although this article may seem aimed primarily at surface defects and failures, the process presented applies to nearly all coatings problems.

The keys to problem solving are using your eyes and your mind. Look and think! Careful observations of the problem by the investigator are critical. Be sure to see the defect or failure first-hand. Be skeptical of other people's opinions until after you have seen the problem yourself. Advice from other people is useful later in the process, but rarely when you are first trying to define the problem. The observations begin with looking at the defect or failure with your own eyes. However, be careful—you may be fooled. If you are dealing with a surface defect on line or in the field, a hand lens or 40–60X shop microscope allows a better look. The latter device has moved into the 21st Century with the availability of new handheld digital microscopes that are just as portable, but can interface with mini-recorders, computers, and monitors. One supplier is Dino-Lite, which has a line of instruments (www.dinolite.com), at least two of which have been used to examine dirt on automobiles and auto parts. The resultant images can be stored and shared as well as being viewed.

If at all possible, bring an example of the defect back to the lab and examine it with a microscope, first at low power (2–10X), then with greater magnification if necessary. Pick at it, cross section it, do whatever it takes to figure out what the problem is. If you are dealing with a flow problem, besides making viscosity measurements, look at the wet paint at higher powers to see the quality of the pigment dispersion, whether there is flocculation, whether a waterborne resin is showing phase separation, etc. [See my article in JCT CoatingsTech, 3 (2), 36-43 (February 2006) for more details on microscope use and applications.] For many problems, scanning an electron microscope is a very valuable tool for characterization.

Once that you are certain what the problem is, the next step, often a difficult one, is establishing the cause of the problem. How do you begin to look for causes? If the problem is new to you or it is a common problem with many possible causes, time spent looking up papers and articles in the Journal of Coatings Technology, JCTR, and CoatingsTech nearly always is useful. Do not ignore older papers. Much excellent work was published in the 60s, 70s, and 80s, as well as more recently. Look through your own files. Ideally, you should keep a file of problems, causes, and solutions for future reference. The Internet also can be very useful. Search engines such as Google® will turn up much material, but you need to be careful because there is false information out there as well as useful papers and articles. Now is a good time to discuss the problem with colleagues. One of them may have dealt with such a problem and found the cause or know a good way to analyze it. Be wary of people advising jumping from defect to countermeasure without knowing the cause, however.

If the coating is an industrial (OEM) type, then observe operations at the customer—substrate preparation (including the pretreatment line), paint application, work attitudes and practices, cleanliness, and possible sources of contamination such as oil in the compressed air used for spraying. If the paint is applied on site (auto refinish, maintenance, or architectural), then observe everything that you can—defects, substrate preparation, or the lack of it, signs of contamination, whether the correct paint is being applied, etc. You may have to check your own plant for pigment dispersion quality, housekeeping, effectiveness of cleaning of tanks and other equipment, filtration, and sources of contamination. Ask a lot of questions—of people working on the line or at the work site, service people, and formulators. Obtain as much background information as possible. Be a detective!

Do not make assumptions. I still make that mistake after all these years. Do not assume that the paint was formulated correctly and tested properly. Do not assume that the batch with the flow problem really had the same viscosity as the control batch. Measure both their viscosities. Formulation mistakes can happen and testing may have been inadequate. I once worked on a problem with an adhesion problem, do not take the customer's word that the cleaning and pretreatment line is working well. I have been in many customer plants where it was not. Running tests on paints applied to the customer's substrate rather than standard panels often shows why there is a difference between lab results and performance on line or in the field.