

MANAGING ENVIRONMENTAL COST

A fundamental business strategy is to reduce the costs of producing your product. This leads to increased profit or a lower cost product which helps ensure a competitive position for continued or increased sales. In the last 10 years, environmental costs have become a significant issue that needs to be managed. How does a business determine which environmental issues need to be managed?

Traditionally, we would look back at our records to identify those issues that are of the highest cost or the items that are increasing in cost the fastest. Millions of dollars were spent in the 1990s on cost models and algorithms. Many additional dollars were spent analyzing and comparing the numerous methodologies. Once the “best” methodology was selected, the yearly expense of maintaining the cost element data in the models would be incurred. Many of the models identified 20-40 individual cost elements, so there was a massive amount of data to assemble and maintain. Often, additional (pareto) analysis demonstrated that only 5-8 of the elements (facilities, labor, medical, material, legal/liability) was significant, so great cost savings could be obtained by only tracking these few items. It was also recognized that business decisions are not solely based on cost models, but need to be combined with risk analysis. Current methodology utilizes algorithms to input risk categories. The accuracy of the algorithms depends a lot on how good of an educated guess is made on the “weighting factors.”

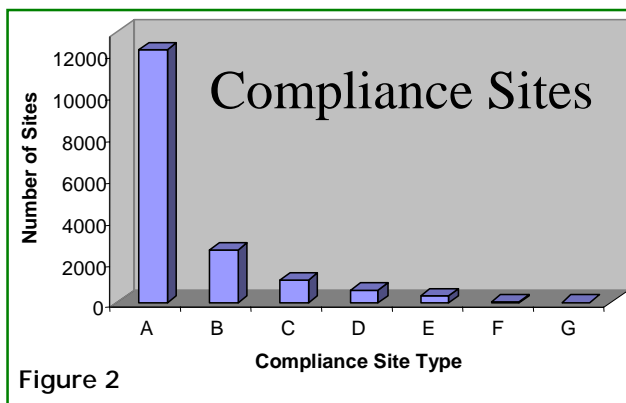
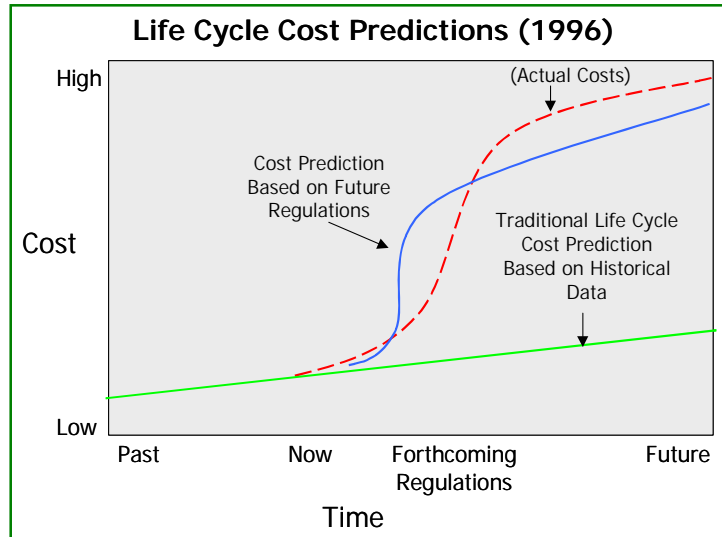


Figure 2

Boeing St Louis has learned much through these numerous processes. The key is to keep the process simple by using only the “pareto significant” items and to look to the future. Working with the C-17 program in 1996, Environmental Assurance used historic data to conduct environmental life cycle cost analyses on five different materials, and then repeated the process with estimated near-term environmental cost increases. Figure 1 shows that very different answers were obtained. We can now see, almost five years later, that looking ahead gave

us a closer prediction of actual costs. The Air Force Material Command has done a good job of assembling a large amount of environmental cost data. One

way of analyzing the data is by looking at the accompanying charts, which are notional representations of the Air Force data. Figure 2 shows the relative number of compliance sites by type groupings. Figure 3 shows the relative cost per compliance site. You can see that even though there are only a few “G” sites, they currently incur the highest costs. It would be easy to say that this is the number one priority for environmental action. A risk analysis may reinforce this as a top priority project or the analysis may show that the “A” type sites are at the greatest risk because of their relatively large number. If any near-term future environmental/OSHA pressures might impact the “A” sites, pollution prevention activities may need to be strongly directed to resolve these issues.

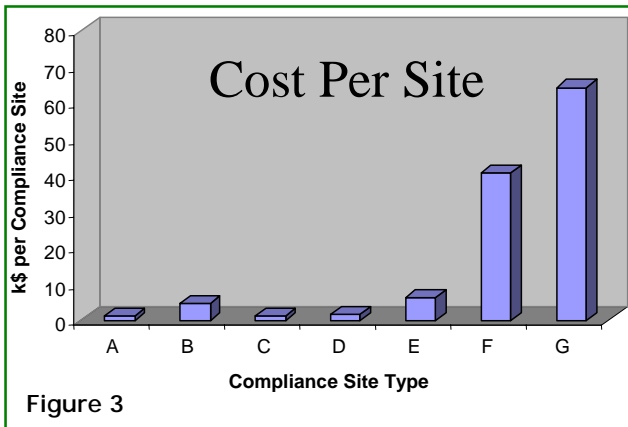
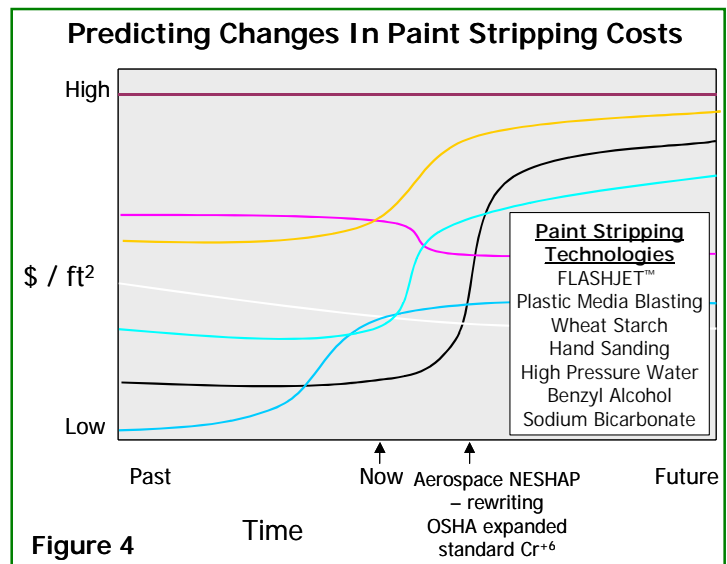


Figure 3 shows the relative cost per compliance site. You can see that even though there are only a few “G” sites, they currently incur the highest costs. It would be easy to say that this is the number one priority for environmental action. A risk analysis may reinforce this as a top priority project or the analysis may show that the “A” type sites are at the greatest risk because of their relatively large number. If any near-term future environmental/OSHA pressures might impact the “A” sites, pollution prevention activities may need to be strongly directed to resolve these issues.

At Boeing St. Louis, we have found that looking ahead at near-term future environmental/OSHA cost impacts is critical to prioritizing pollution prevention projects and making material and process changes in the design/production and support of our products.

Another good study example is paint stripping the exterior surfaces of an aircraft. Tens of millions of dollars have been spent the last few years developing, testing and implementing alternatives to previously-used methylene chloride/phenol chemical strippers. Each of the technologies has its advantages and disadvantages. Mechanical blast methods are the most numerous in production applications. These blast methods put a lot of hexavalent chromium into the air. However, as we look at near-future OSHA pressures, we can see that OSHA intends to improve worker protection by greatly reducing the exposure limits to hexavalent chromium and implementing a number of work practices. EPA is also required to review the Aerospace NESHAP in the next couple of years and base emission limits on health hazards rather than on control techniques currently in practice. Significant cost repercussions are expected from these two forthcoming regulations. After analyzing projected environmental costs, we may need to rethink our paint stripping strategies. Because long lead times are required for capital equipment and facilities changes, budget requests would need to be entered near term to meet the new expected compliance deadlines. Figure 4 illustrates this point. The current most cost-effective paint stripping method may not be so after the forthcoming new regulations are in effect.



Significant cost repercussions are expected from these two forthcoming regulations. After analyzing projected environmental costs, we may need to rethink our paint stripping strategies. Because long lead times are required for capital equipment and facilities changes, budget requests would need to be entered near term to meet the new expected compliance deadlines. Figure 4 illustrates this point. The current most cost-effective paint stripping method may not be so after the forthcoming new regulations are in effect.

In summary, to do the best job of managing environmental costs, it is important to consider near-term future regulatory pressures. It may be more effective to base environmental business judgments on predictable near-term future cost impacts rather than on a massive amount of historic cost data.

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TOUCHUP PAINT COMES OUT OF THE FREEZER

By William Cole

(From Boeing News, 10 November 2000)

Shop floor employees frequently use touch-up paint in 1 to 2 oz. bottles to coat small exposed areas on painted military aircraft skins. But they used to have to work fast and touch up many areas, or pitch the paint. That's because the primers and finish coats, which contain special chemical ingredients, had to be mixed and then frozen at minus 40 degrees Fahrenheit in special freezers in storage areas.

QUICKFACT: Airplane paint is formulated to withstand temperatures of minus 65 to 350 degrees Fahrenheit during aircraft operation. Aircraft also have to be protected against harsh weather and corrosive salt water.

After freezing, the paint must be moved to shop floor freezers and used within two weeks or thrown away. The shop user had to thaw the paint and apply it within two to three hours.

Now, a two-month pilot program has introduced the shop floor to a new kind of touch-up paint that can be stored at room temperature and has a much longer life once the storage bottle has been opened. The two main components of the paint, stored in separate compartments in the bottle, are combined much like homeowners mix store-bought epoxy. The new products have a shelf life of six months and, once combined, are useable for up to three weeks.

"I like it," says sheet metal assembler and riveter Annette Hammett, as she touches up part of the cockpit of an F/A-18E/F. "You don't have to wait for it to unfreeze or throw it away because it has spoiled. It's always there, always ready to use."

The pilot program on the F/A-18E/F has been a great success, says Mark Reighard, manager of Chemical Management Services for A&M in St. Louis. "We went from a 17-step process in the

receiving, mixing, and use of the paint to a five-step process. We've saved time, money and materials. In fact, we saw an 80 percent reduction in the amount of paint being used."



Annette Hammett touches up a Super Hornet cockpit assembly with the new room-temperature paint.

"Now we want to spread the word about this alternative to other parts of A&M and across the company where touch-up painting is done."

Matt Fridley, a Safety, Health and Environmental Affairs operations specialist who coordinated the pilot program on the shop floor, says, "It's a major step forward. Our team members on the shop floor have enthusiastically accepted these paints, which support Lean operations."

Mark Ruesing, senior project engineer in Material Process Engineering and a member of the Surface Finishes Team coordinated with vendors to qualify the material for use.

"We looked at a lot of different room-temperature storage touch-up paint kits, but the low cost and long life of these new products really paid off. It's a great new way of doing business," he says.

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NEW PAINT PROVIDES FINANCIAL FACELIFT

(From Boeing News, 01 September 2000)

Phantom Works has helped develop an extremely durable advanced-performance coating for military aircraft that's projected to save the U.S. Air Force more than \$600 million in life-cycle costs on the C-17 airlifter and KC-135 tanker.

Extended to other aircraft in the military inventory, the new technology could save a large number of dollars. And plans are in the works to develop derivatives for commercial and space applications. "A stable matte finish is critical for aircraft survivability in combat environments," said John DeAntoni, an engineer-scientist with Phantom Works Materials Technology.



A layer of advanced-performance coating developed by Phantom Works is applied to a C-17 Globemaster III.

Unlike the glossy finishes on commercial airplanes, military aircraft use stealthier coatings that scatter light rather than reflect it. But the flattening agents used in these matte finishes add weight and make surfaces hard to clean and costly to maintain. Conventional coatings age quickly, requiring repainting every two to three

years. Frequent repainting became an even greater problem two years ago when the Environmental Protection Agency began requiring the use of specially designed paint hangars.

"This put an increased burden on the Air Force because most air bases do not have such facilities, and it prompted the C-17 System Program Office to fund a pollution-prevention project to solve the problem," said Christopher Hendrix, program manager for the C-17 Pollution Prevention program. A team evaluated nine different coating technologies and 24 different materials. Borrowing paint chemistry used to protect metal outbuildings from harsh Midwest winters, the team developed a fluorine-modified polyurethane paint manufactured by Deft Coatings of Irvine, Calif.

Two dozen C-17s now sport the new paint, and all new C-17s and C-17 repaints will receive it. After a successful field evaluation on two KC-135 tankers, the Air Force has decided to paint all 588 operational KC-135s with the advanced coating.

"The advanced-performance coating meets the survivability requirements of military aircraft and also exhibits high durability under service environments," DeAntoni said. "This avoids frequent repainting and associated maintenance costs. It is estimated that the life-cycle cost savings will be approximately \$500 million on the KC-135 and \$117 million on the C-17."

DeAntoni said the Air Force is thinking about using the new paint on its KC-10 tankers, too. Two F-15 fighters have been coated and are undergoing a field evaluation. Boeing and Deft Coatings are working together to develop glossy versions of the coating for other military aircraft as well as commercial transports, he said.

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