Chromium PEL Issues Dominate the Discourse at the Second SFIC Washington Forum

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The Future of Finishing

Following on the heels of the successful first SFIC Washington Forum in 2005, L'Enfant Plaza Hotel again was the venue for the second Forum on May 15–18, 2006. Because global environmental, economic, regulatory and technology trends have created significant challenges, this meeting offered an important collection of speakers, presentations and networking - rich opportunities for knowledgeable players in the surface finishing industry.

In the memory of many attendees, never had there been so many concerns regarding regulatory issues from so many sources around the globe. Dominating everything was the chromium PEL issue, but several environmental directives from the European Union and other agencies posed challenges as well. Growing in importance were issues regarding that critical metal, nickel. And there was an abundance of other issues including chemical security, trade with China and the impact of globalization on our industry.

Chromium PEL – The Issue Facing the Industry Today

Although there were many issues waiting in the wings and emerging from them, the dominant issue at the Washington Forum was (you guessed it) the chromium PEL regulations recently issued by OSHA. The chromium issue was ably addressed from several points of view.

Joelie Zak, CEF-4, Scientific Control Laboratories (Chicago, IL) addressed the issue of what it would take to test and be in compliance with the regulation. As outlined by Zak, the situation is this:

• The regulations impacts all Cr(VI)-related metal finishing operations, including: hard and decorative chromium plating, chromic acid anodizing, chromate conversion coatings, plating on plastics, passivation, welding and fabricating, polishing and grinding and chemical mixing and blending operations. It's not just chromium plating.

• It will be necessary to evaluate exposures for ALL potential job tasks involving Cr(VI), including operators, supervisors, maintenance personnel, lab people, waste treatment operators and any other tasks that involve handling Cr(VI).

• Facilities with 20 or more employees must comply with the regulatory requirements of the rule by November 27, 2006, except where engineering controls are needed. Engineering controls involved the installation of added ventilation and the like to meet the new PEL. Firms with less than 20 employees have until May 30, 2007 to comply with the regulatory requirements, again excepting engineering controls. All engineering controls needed to meet the new PEL must be implemented by May 31, 2010.

• The permissible exposure limit will be reduced from the existing 52 micrograms per cubic meter ($\mu g/cm^3$) of air to 5.0 $\mu g/cm^3$, as an eight-hour time-weighted average However, this is not the end of it, as an action level of 2.5 $\mu g/cm^3$ was also established. That means that at or above the action level, action is required and monitoring of the air must be done at six-month intervals. Below it, monitoring can be discontinued. At or above the PEL, it must be done every three months. Initial monitoring is required of everyone, in order to determine if exposures are at, above or below the action level, which would determine the course of action.

Zak described the air monitoring technology, based on OSHA Method ID-215, which uses ion chromatography. She noted that initial monitoring could not rely on historical data taken before May 30, 2006, which means that all measurements must be determined anew.

Of particular interest was some data which shows where we stand at present, shown the figure below. The nearly 90% reduction in the PEL value poses challenges in demonstrating compliance.

She went on to discuss what measures might have to be taken in the event that the PEL is

OSHA Method 215 Used:

Hard Chromium Plating Shop (March 2006):

Manual Tank Operator:	11 µg/m³
Manual Line Supervisor:	2.535 µg/m³
Auto Line Supervisor:	2.4 µg/m³

Maintenance: 2.3 µg/m³

Decorative Chromium Plating (2005-2006):

Range:	0.03 - 11 µg/m³

Hexavalent Conversion Coating (2005-2006):

Barrel:	0.45 - 1.45 µg/m³
Manual Rack:	4.8 - 15 µg/m³

Stainless Steel Welding:

Range:	0.27 – 7.0 µg/m³

Current industry data (J. Zak).

exceeded, including respiratory protection (masks), work practices, establishment of regulated areas, protective work clothing, changing and washing facilities, employee monitoring and training, as well as engineering controls such as ventilation, enclosed tanks, elimination of air agitation and the like.

Further details on necessary engineering controls were supplied by Ken Hankinson of KCH Services (Forest City, NC). Of course, the primary question to be asked is, "Can the existing local exhaust ventilation system meet or exceed the 2.5 $\mu g/cm^3$?" If so, the plant operator has fewer headaches to deal with. However, in order to be certain, this is the time to hire a qualified compliance survey company with a high level experience in ventilation practice. It is critically important for the operator to have impeccable data that can pass muster with OSHA inspectors without question. Hankinson reviewed just what should be measured and inspected prior to making the qualifying test.

Plant Exhaust System (K. Hankinson).

If, after the chromium measurement, the test result is not up to standard, all is not lost. It is possible that some existing ventilation equipment can be adjusted to tweak the system below the action level. Further, this might involve adjustments to the hood environment around the tanks. It is such considerations as these that makes it so important to work with a knowledgeable firm to get the level down. Spending a little extra money here could save an enormous amount if PEL compliance measures must be taken.

Another approach is to get rid of the chromium operation entirely and replace it with one of the alternative coatings/processes that are coming to the fore. Bill Saas, of Taskem (Cleveland, OH) reviewed what is available today. Unfortunately, he informed the conference that there was no magic elixir that could provide a universal substitute. Indeed, the viability of a particular substitute is quite dependent on the application involved. Saas is not the first person to tell us that there is no free lunch and he won't be the last. It boils down to choosing the best compromise for each situation.

He noted that hard chromium is the most difficult to replace. There are several substitutes available, including electroless nickel, boron alloys, vapor deposited coatings or high velocity oxygen fuel (HVOF) thermal spray coatings. He discussed the pros and cons of each, and drove the point home that none meet all needs met by hexavalent chromium. For those who wondered, trivalent chromium substitutes have a ways to go here. On the other hand, decorative chromium substitutes offer more viable choices, including trivalent chromium processes, as well as boron and other alloys.

As for applications other than electroplates, Saas discussed the sulfate electrolyte that is available for anodizing. Chromate conversion coatings can be replaced by trivalent passivates, organic and inorganic topcoats and other non-chromium treatments, but again none are universally applicable.

Now all of these considerations result from regulations promulgated by OSHA. To give the attendees background on the history behind the development of the chromium PEL standard, Amanda Edens, Director of Health Standards at OSHA (Washington, DC) presented the story behind the development and reviewed the key provisions of the standard, which was described earlier in this article. Edens was the person primarily responsible for developing the standard and presented the government's point of view. She stressed that OSHA was quite cognizant of the potential effects of the PEL on the small business community and made an effort at taking such factors into account.

She noted that the matter was still in litigation, but groups sponsoring the litigation were endeavouring to lower, as well as raise, the numbers. Clearly, our industry would like to see it raised. However, on the other side, there are labor groups which would like to see the chromium PEL standard reduced further. She informed the audience that oral arguments in these cases would not be presented until the fall. To the credit of both Edens and the audience, the exchange after her talk was civil and constructive.

Edens more or less provided a segue into the next talk, by Chris Buckley, Partner at Gibson, Dunbn and Crutcher, LLP, who discussed Chromium in Court: Toxic Torts and Legal Issues. His main thrust was to convey the enormous expenses that such litigation can engender.

He cited a case involving Lockheed-Martin, whose affectionately-named "skunk works" pioneered in aviation history in the years following World War II. The plant used hexavalent chromium in a variety of places, including plating and as a corrosion inhibitor in cooling towers. A class action was filed involving 600,000 members. Herculean efforts were undertaken to combat this case, including an epidemiological study of 125,000 workers, re-creation of 1940s-designed spray booths to duplicate operations and massive soil sampling to locate particulate contaminants (none found). After 50 years of effort, and $500 million of costs, the case was thrown out of court.

The point was to illustrate the great lengths that are necessary to combat such cases. He stressed that good science – very good science – must be used. Defense witnesses must be first class scientists with impeccable credentials, and not slick operators. Buckeley stressed that if the facts are on your side, you can prevail in these very costly cases. Yet such toxic tort cases can present very high risks - as evidenced by the tragically wasteful costs in the Lockheed-Martin case – but they can be combated.

And in that light, Baruch Fellner, Partner, Gibson, Dunn & Crutcher LLP (Washington, DC) presented an update on the OSHA Chromium PEL litigation situation. Fellner was optimistic about the outcome of the litigation strategy. He explained that the first argument dealt with Cr(VI) as a health hazard, and noted that the linear dose response curve was subject to challenge. The second argument, he noted, has a better chance of success, as it deals with the economic analysis. The standard must be found to be economically and technologically feasible. If an industry is economically threatened, the standard is suspended.

He outlined a three-pronged strategy. First there are grounds for settlement which could result in acceleration of the implementation of engineering controls inn exchange for relief for the respirator requirements. Second, litigation would proceed, and Fellner felt there was "a very

good case." Third, government relations efforts toward obtaining relief through Capitol Hill would continue.

Emerging Concerns with Nickel

Among metal finishing processes in recent years, we have seen regulatory attention given to cadmium and chromium – and waiting in the wings has been nickel. Now it is emerging into the spotlight. As is the case with many of these actions, in this global economy, early action comes from activities within the European Union.

Naturally, nickel air emissions are of interest to the U.S. EPA, David Ferguson, of the U.S. EPA National Risk Management Research Laboratory (Cincinnati, OH), reported on recent findings of their nickel emissions study. These findings shed considerable light on some steps that can be taken to reduce them in certain operations. Interestingly, and not surprisingly, based on the data from the study, barrel plating with the highest solution surface tension gave the highest air emissions.

The use of eductors instead of air agitation reduced nickel air emissions by 40 to 50%. Lowering solution surface tension reduced emissions significantly. The use of mesh pads was also helpful, as was the act of making efforts to avoid splashing. In essence, simple inexpensive moves can reduce nickel air emissions considerably.

As to developments in the European Union, Dr. Hudson Bates, of the Nickel Producers Environmental Research Association (Durham, NC), reviewed the European Union system of classifying and labeling nickel and its compounds, which involves the evaluation of a hazard of a substance and a communication of that hazard via a label. Nickel compounds, including nickel sulfate, chloride, nitrate, carbonate, sulfides, oxides and the metal itself are evaluated for their dermal, respiratory, toxic and carcinogenic risks, among others. In July 2006, a risk assessment document is to be submitted to the Organization for Economic Cooperation and Development (OECD) which could form the basis for regulation of nickel in North America in 2007. This is yet another case of Europe driving events in North America. The United States is not a signatory to these entities and therefore has limited influence.

Comprehensive information on this Risk Assessment is available from the European Nickel Industry Association website at http://www.enia.org/index.cfm/ci_id/12913.htm.

Bruce McKean, of the Nickel Institute (Toronto, ON; Durham, NC) discussed the issues and trends in product stewardship as related to nickel. Perhaps the most surprising revelation from his talk was just how far the consequences of "bad use" of nickel in products can extend. Inappropriate uses of nickel can create damaging assessments from the customers. For example, a cheap and poor quality nickel-plated flute can elicit such comments as, "… my daughter's lips turned scabby and itchy." There is also concern about allergic reactions to nickel-plated components in cell phones. In these and other examples, the reputation of nickel plating is hurt by the bad use of nickel plating. Mr. McKean reviewed efforts by the Nickel Institute to develop a program to address these issues head-on.

Further Regulatory Issues to Consider

Several speakers in the Washington Forum addressed the notable expansion of international law relating to the environment. Since the late 1980s and the signing of the Montréal Protocol, an unprecedented number of regulations and standards have been imposed by a variety of governmental bodies all over the world. In the long term, the chromium PEL issue may turn out to be just one brief chapter in a never-ending story.

Russ LaMotte, of Beveridge & Diamond, P.C. (Washington, DC), reviewed the overall impact international multilateral environmental agreements (MEA) on chemicals and heavy metals on the surface finishing industry. Unfortunately, as a result of the failure of the United States to ratify some of the key accords, the influence of Europe in setting the global environmental agenda has increased greatly, with a concomitant decline in the sway of the United States. Regardless, American industry is undeniably affected. Mr. LaMotte noted that the United States was in essence ceding leadership to Europe by failing to ratify key accords.

These issues do not deal with chemical bans and restrictions alone. Such elements as life cycle assessments, downstream user responsibilities, the "precautionary principle" and other matters may impact our industry profoundly.

As noted earlier, product stewardship legislation aimed at products may become the major issue in the future. There is growing concern about hazardous constituents in products. Materials bans already in play, including the End-of-Life Vehicle Directive (ELV) and RoHS/WEEE are just the beginning. Indeed, these well-known directives are being duplicated in other countries and regions. RoHS regulations will be in play in China by 2007, and all three of the above are to be implemented in South Korea. They are under consideration in several countries, including Russia and Argentina as well as several states in the U.S.

And others are entering our acronym vocabulary every day, a rather far-reaching one being the Stockholm "Persistent Organic Pollutant" (POP) Convention, entered into force in 2004. It establishes an international regimen for the restriction or total elimination of POPs. The Rotterdam "Prior Informed Consent" PIC Convention establishes a legally binding procedure for listed banned or severely restricted chemicals. The United States is not a party to this convention, but 102 countries and the European Union are.

LaMotte left the audience with the following thoughts: (1) robust international legal regimes governing chemicals are now in place and will expand, (2) international agreements will drive national standards world-wide (e.g., production bans, restrictions, management) and (3) U.S. participation is essential to ensuring balanced, science-based decisions under these agreements.

A comprehensive tour of the European Union Directives, WEEE and RoHS was then presented by Holly Evans, Strategic Counsel, LLC (Alexandria, VA). The RoHS Directive stands for "restriction of the use of certain hazardous substances in electrical and electronic equipment" and WEEE signifies "Waste Electrical & Electronic Equipment." To a large extent they go hand-in-hand, addressing environmental issues associated with waste electronics. RoHS deals with design for environment, and WEEE deals with recycling. They place several burdens on the manufacturer, including financing the collection, recovery and recycling of equipment, and restricting the use of lead, mercury, cadmium, chromium (VI) and other substances in new equipment. It covers every type of electronic equipment, from toys to medical devices. And again, these directives follow the developing trend of product regulation, and as noted earlier, other countries are developed their own versions of RoHS. As Evans noted, more is on the way.

Following on, Frank Altmayer, MSF and President of Scientific Control Laboratories (Chicago, IL) discussed the European Union Directives with respective to hexavalent chromium. For automotive hardware, the ELV is the operating entity and there are some extensions. Cr(VI) is still allowed until July 1, 2007 for corrosion-protective coatings only. It is also allowed until July 1, 2008 for nut/bolt applications on auto chassis, where torque tension requirements are critical.

Currently, workable substitutes are not viable, and the dates could be extended if this situation continues.

The auto manufacturers have responded by restricting Cr(VI) in a coating to 1000 ppm in a non-leachable coating and 0.1 $\mu g/cm^2$ in a leachable one. This then isn't just a consideration in leachable chromates. It is also a factor in decorative chromium plating because Cr(VI) can be entrapped in the microcracks and pores in the plated deposit. Indeed, Altmayer showed data with measured values on the order of hundreds of ppm. In black chromium deposits, values were in the thousands.

At the same time, the RoHS specifies only in terms of ppm (1000 ppm), and thus the same coating would require different testing depending on whether it is an automotive of electronic application. This speaks the inevitable question about electronic applications in an automobile. Confusion reigns.

Microcracks in chromium – sites for entrapment of Cr(VI) (F. Altmayer).

Altmayer then reviewed the multitude of coatings containing Cr(VI) and the test procedures now specified by the automobile manufacturers. It was apparent that there are several issues that still require clarification, thought and good science before all of this comes together.

Returning to matters here at home, Dr. Donna Lee Jones, of the Office of Air Quality Planning and Standards, U.S. EPA (Research Triangle Park, NC) presented an update on air regulations for the metal finishing industry. To clarify, these regulations pertain to the general environment, while the OSHA rules deal with workplace health and safety issues.

She discussed the concept of area sources, as contrasted with major sources of the sort that have been discussed here to now. Area sources are facilities with the potential to emit less than 10 tons/yr for a single hazardous air pollutant (HAP) and less than 25 tons/yr for combined HAP. The view is that in sum, the combined amount from area sources represents 50% of stationary source HAP emissions. The EPA strategy is to use flexible regulatory approaches which account for the limitations of small businesses.

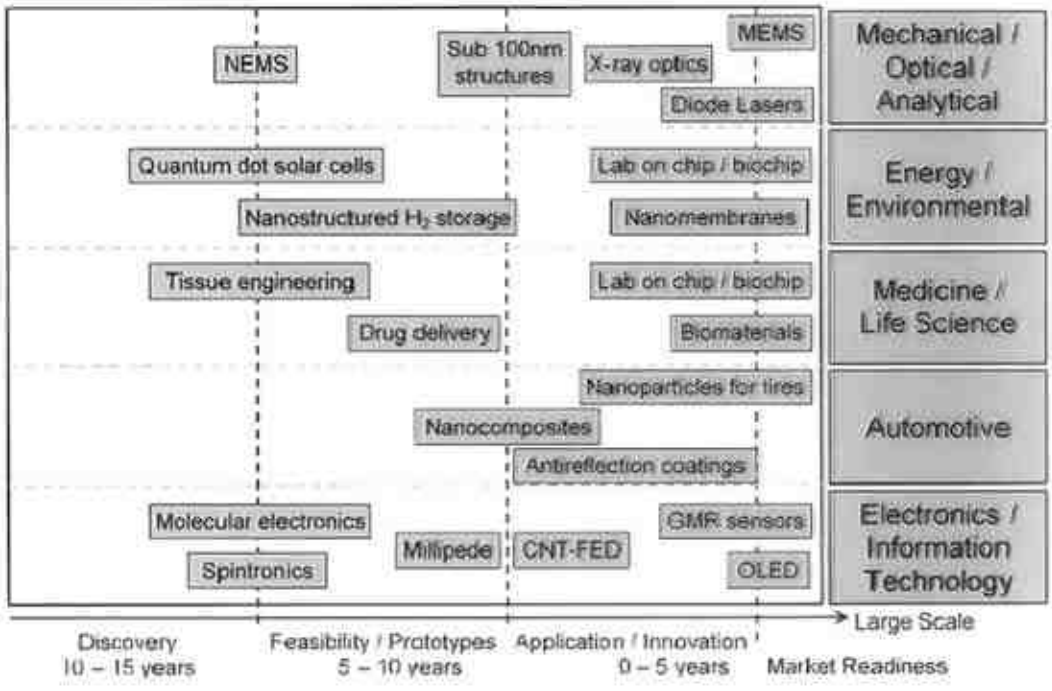
There are 70 area source categories, 16 of which have been promulgated, including plating. There are court-ordered deadlines for all of these categories, stretched out to 2009. Plating and Polishing Rules are targeted for December 2007 or June 2008. The proposed regulations are to be issued one year earlier. The area sources include facilities engaged in all types of plating activities, but the focus is on non-chromium plating and polishing. HAP emissions of concern include nickel, cadmium, lead, cobalt, cyanide and hydrochloric acid.

At this point, the EPA has distributed a survey to approximately 1200 companies engaged in non-chromium process. Its purpose is to determine what each facility can and cannot do with regard to HAP emissions. Dr. Jones noted that the survey allows that facility to be counted and included in what the EPA knows about the industry. It is an opportunity to provide realistic input. Completion of the survey is required by law and must be submitted to EPA by July 15, 2006.

Concurrently, Metal Fabrication and Finishing Area Source Rules are also being developed, targeted for June 2008 promulgation. The EPA is looking at common processes for air pollution control opportunities, including abrasive blasting, machining, grinding, painting, plating and welding. Stay tuned.

Another issue discussed at the Washington Forum dealt with chemical security issues, discussed by Jamie Conrad, of the American Chemistry Council (Arlington, VA). These concerns deal with land transportation security as well as facilities. With warnings that chemical plants could be used as weapons of mass destruction, new legislation may force tighter security. Conrad noted that the issue is not going away and reviewed some of the legislation that is making its way through Congress. His concern is that legislation not drift into areas of chemical substance regulation. This would be akin to banning the use of ammonium nitrate fertilizer from agricultural use because it could be diverted to make clandestine explosives.

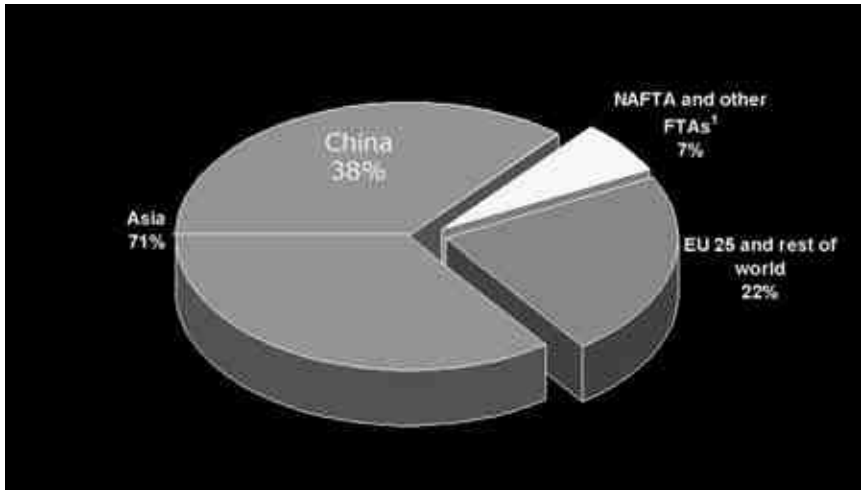
Most of the processes discussed so far have been around for some time. However, emerging technologies, such as nanotechnology and microelectromechanical systems (MEMS). This topic was addressed by two speakers. Bob Samuel, of Integran Corp. (Toronto, Ontario, Canada), discussed the latest technology developments for surface finishing in the field of nanomaterials. Currently, applications are growing in most of the important industrial sectors – automotive, electronics, energy, environmental, mechanical, medical and optical, to name a few – from aerospace to golf clubs. The market for nanotechnology is projected to be $20 trillion annually in 20 years. Samuels noted that electrodeposition offered considerable versatility in achieving nanoscale materials. Simply put,



State-of-the-art in various nanotechnology sectors (B. Samuel).

a large number of materials can be deposited with modest capital investment and at significant production rates in an existing commercial infrastructure.

Yet this new and promising field has not occupational health and safety and environmental concerns. Jo Anne Shatkin, of the Cadmus Group (Watertown, MA) discussed the emerging risk, health & safety concerns for nanotechnology. Already the field of "nanotoxicology" has emerged into the light of day. Some of the concerns of this new field include (1) large surface area of nanomaterials relative to size and the related increase in reactivity, (2) biologic reactivity, (3) unusual and unpredictable behavior and (4) translocation in living organisms by inhalation, ingestion or skin contact. At present, little is known about the risks that may exist and no regulatory standards or guidelines exist – yet.



U.S. Manufacturing Trade Deficit in 2005 (P. Mears – NAM).

Business Issues

The remainder of the program dealt with business issues of global trade and the role of the United States in it. The Keynote speaker at the Forum luncheon, Eric Mittelstadt, CEO of the National Council for Advanced Manufacturing (Washington, DC), discussed the opportunities for U.S. manufacturing in this rapidly changing world. He noted that a major transition was taking place in the U.S. industrial base itself, including (1) consolidation, (2) a migration of manufacturing to lower tier suppliers (a clear trend in the metal finishing industry), (3) outsourcing of low skilled jobs overseas (and some higher skills as well), (4) migration of manufacturing facilities within the U.S. and (5) a changing makeup of the labor force. The second item is particularly noteworthy.

Original equipment manufacturers are continuing to become assemblers of components that are made by suppliers further down the chain. Those suppliers may assemble sub-assemblies, and so on. Somewhere along the way, parts receive surface finishing. Mittelstadt referred to the supply-chain as a "network." Thus we have a chain of smaller manufacturers who face the same challenges as OEMs but without the resources to cover them. Thus more connectivity and collaboration is essential. Mittelstadt noted that our real economic strength is at the supplier-small manufacturer level. In the end, business, labor and government need to work together more than ever before.

The other business issue to be addressed was the matter of U.S.-China trade. Patricia Mears, of the National Association of Manufacturers (Washington, DC), presented a sobering portrait of the situation today. She addressed the large trade deficit that we have with the world, but most notably with China. 71% of the U.S. manufacturing trade deficit in 2005 was with Asia, and more than half of that was with China. Imports from China continue to grow more rapidly than exports to China. Unfortunately, the U.S. share of China's imports worldwide has also been falling, from 12% in 1998 to less than 8% in 2005.

Mears reviewed the trade agenda developed by the National Association of Manufacturers. The agenda includes: (1) the revaluation the Chinese currency to reflect economic fundamentals, (2) enforcement of intellectual property rights, (3) elimination of Chinese regulatory and standards barriers, (4) expansion of exports to China and (5) promotion of fair competition. Nonetheless, she also pointed out that many of the problems lie in the United States. In particular, we have failed to meet the appalling shortage of engineering graduates, which continues to decline. Further, our own structural costs, including corporate taxation, health and pension costs, litigation costs, regulatory compliance costs and soaring energy costs place a 22% penalty for manufacturing in the United States. We have a long way to go, but the alternative is unthinkable.

The Second SFIC Washington Forum did well in providing a well-rounded program that provided information on the total picture that the metal finishing industry faces. There obviously were challenges, but also positive things as well. Those who attended left Washington unquestionably better informed on matters critical to their business. Undoubtedly, regulations and standards are here to stay and growing, and a forum like this one will be very important to attend in the future. ***P&SF***