PacifiCorp Energy (PacifiCorp), a division of PacifiCorp, provides 7,750 megawatts of electricity every hour from 12 coal-, gas-, and geothermal-fired generating plants in Utah and Wyoming. MidAmerican Energy Holdings Company acquired PacifiCorp in 2006 and identified coatings maintenance as a priority, both in terms of corrosion protection and aesthetics. In response, PacifiCorp Energy’s Generation Engineering group engaged the services of an independent coatings expert to assess the painted surfaces throughout 10 of PacifiCorp’s 12 facilities to establish painting priorities, painting cost estimates, and specifications for maintenance of the coatings.

This article describes the consultant selection process, the field survey process, results of the field surveys, and the next steps to be taken.
pre-bid meeting in Salt Lake City, Utah, where the scope of work was presented in detail, and questions regarding the project were openly discussed. Once the scope was understood, the firms were given a tour of the Gadsby Plant, one of the ten facilities to be surveyed as part of the contract. The purpose of the tour was to make certain that the entire scope of the project was fully understood by all bidders.

The firms were then required to complete a small, representative survey of two locations within Unit 1 of the plant (Figs. 2 and 3). The surveys had to be comprehensive, with the data entered into each firm’s respective computer program. The surveys allowed PacifiCorp to see examples of each program’s capabilities and overall product, based on familiar surfaces and structures.

The survey results and other technical and financial information were incorporated into proposals submitted a few weeks after the pre-bid meeting. PacifiCorp reviewed the proposals and arranged to visit the two short-listed firms.

The first day with each firm was spent examining the capabilities of the firm and interviewing key personnel who would support the project. The consultants also presented their bid proposals and discussed in detail their maintenance painting management programs.

The second day with each short-listed firm involved a tour of a facility where each consultant’s proposed program was being used. The facility owners and PacifiCorp also held private discussions about the pros and cons of the consultants’ work and their programs. The tour and discussions allowed PacifiCorp to develop an unbiased opinion about the benefits and capabilities of each firm and to deter-

**Goals of the Maintenance Painting Program**

In 2007, after deciding to hire a consultant to help establish a five-year maintenance painting program for ten of PacifiCorp’s facilities, the energy company set several goals for the program (Fig. 1).

The program had to clearly define painting needs for all structures in each facility, from the powerhouse and coal handling areas to warehouses and administrative offices. The only areas excluded from the program at each plant site were the substations and structures related to transmission and distribution. The five-year program had to identify the surfaces to be painted each year, give cost estimates for conducting the work, provide comprehensive specifications for surface preparation and coating application, and address the controls required when disturbing lead-based paint. Painting priorities were based on continued service life of the operating equipment and structures.

One significant challenge was added to the project: work on the surveys, reports, recommendations, and specifications had to begin in June 2007 and be completed by the end of November 2007. Because of the amount of work required, the aggressive schedule, and the tremendous investment being made in money and personnel, PacifiCorp made it clear from the beginning that for the project to succeed, the power company and the consultant had to work together as partners in every aspect of the project to address issues and concerns as soon as they were recognized and to resolve them collectively.

**Consultant Selection Process**

Because of the financial outlay and the need to do the work on a “time and materials” basis—due to a number of unknowns that could affect the completion of the surveys—PacifiCorp developed a unique, multi-phase consultant selection process. The first phase involved identifying firms that PacifiCorp thought would be capable of completing the project. The list was developed by researching information on the Internet. The candidate firms (bidders) were required to attend a
mine whether their proposed programs would completely address PacifiCorp's requirements.

After the proposal presentations and site tours, PacifiCorp's project team collaborated to evaluate each consultant's proposal and sample assessment. From this process, the company selected a consultant and awarded a contract.

**Pilot Study**

The aggressive schedule for completing the surveys and coatings recommendations for the ten plants created several unique challenges. First, there are many ways to subdivide a facility for the collection of coating condition data. Any logical approach can be used to conduct a survey at a single facility. However, because this work involved ten facilities, it was important to develop a plan that was consistent with the manner in which PacifiCorp views the facilities and that would be acceptable fleet wide. Due to the schedule, the plan had to be established before the consultant had the opportunity to visit each facility.

Second, the consultant needed to conduct surveys in as many as four plants simultaneously; therefore, it was not possible to use the same inspection crew at every location. Steps had to be taken to assure that the data collected at each facility was consistent and that the terminology was standardized as much as possible.

Third, it was clear that there would not be time to change the survey process once PacifiCorp reviewed the first report because surveys in other facilities would be underway or even completed before the initial reviews were finished.

Fourth, the support required from PacifiCorp, both its corporate office and the facilities, had to be determined before beginning each survey, as did a means for collecting it. The support included drawings of each facility and available painting histories, piping and structure color codes, information on the prior use of lead paint, and other project-specific information.

Fifth, estimates of the cost and time to complete the entire project, as well as schedules for visiting all ten facilities, had to be established within the first few weeks following the award of the contract.

Because of the challenges above and other concerns, PacifiCorp and the selected consultant agreed that a pilot survey should be conducted at one of the facilities to resolve questions and concerns before starting work in multiple facilities simultaneously. The decision proved to be invaluable to the success of the project.

The Naughton plant (Fig. 1), located south of Kemmerer, Wyoming, was selected for the pilot study. The PacifiCorp project team participating in the pilot included the project management team from corporate (Generation Engineering) and the supervisory staff of the Naughton plant. The consultant team consisted of corporate project management, four consultant survey team leaders, and a data entry supervisor from the consultant's home office. The four consultant team leaders would be in charge of data collection at the other facilities once the pilot program was completed.

The consultant's corporate project management team led the pilot study to assure that a uniform method for subdividing the facilities was developed, to establish appropriate terminology, to develop consistency in data collection, to streamline the data entry process, to identify PacifiCorp support needs, and to work out other project logistics. Based on the time required to complete the pilot survey and on the size of the pilot facility relative to the other nine plants, PacifiCorp worked with the consultant to develop a schedule for conducting the remaining surveys. Two weeks after completion of the pilot, the consultant's project management team met with PacifiCorp to present the pilot results and to reach an agreement on the process that would be used for the remaining surveys, which started immediately thereafter.

**Field Survey Process**

To control the field survey process, the consultant developed a site manual that defined the survey process and contained administrative and technical procedures. The manual assured that the teams followed a standard operating procedure at each facility and that communication and coordination with PacifiCorp were standardized across the fleet.

The field survey required that each specific piece of equipment and associated process systems be identified and assessed together with structural steel, walkways, and other structures (Fig. 4 and box on p. 16). Essentially, all painted surfaces (primarily steel at PacifiCorp's direction) were included (Fig. 5). For each item inventoried, the total painted surface area was estimated (Fig. 6). The consultant had developed a unique rating scale and used it to assess the overall amount of visible deterioration on each item. The scale is
based on SSPC-VIS 2, “Standard Method for Evaluating Rusting on Painted Steel Surfaces.” The percentage of deterioration is typically linked to a maintenance strategy.

Although the consultant developed the unique rating system, the maintenance strategies (no action, localized touchup, full overcoating, or complete removal/replacement of the coating) based on the percentage of deterioration are generally consistent with the recommendations found in SSPC-TU 3, “Overcoating.” The general service environment was categorized; temperatures were measured for high temperature equipment; and accessibility factors were assigned to each component. The accessibility factor is a multiplier assigned to the base square foot price.

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to account for additional costs associated with rigging or complexity. Digital photographs were taken and stored in the computer program with the field data.

The existing coating type was documented when known by the facility, but a laboratory analysis to determine the generic coating type was not included in the initial surveys. The presence or absence of lead-based paint on each component was established, based on the facility’s painting history and random spot checks using field lead detection swabs; however, a laboratory analysis was not included during the initial survey stage. Laboratory analysis for lead will be conducted as necessary before awarding the painting application contracts, and appropriate coating thickness and adhesion tests will be completed. The thickness/adhesion testing will be performed on those surfaces scheduled for overcoating to confirm that the integrity of the existing coating is adequate to receive an overcoat.

Quality Control and Communication

Because of the amount of work being undertaken simultaneously, the consistency and accuracy of data collection, data entry, and data analysis were key factors that had to be controlled throughout the project. The necessary level of control was achieved through multiple steps and checks. First, the pilot survey was performed with the consultant’s project manager and each of the team leaders to develop and ensure a consistent survey format. The surveys at the facilities followed the site manual and were managed by one of the consultant team leaders. A survey technician assisted each team leader. Having team leaders conduct the pilot was a critical step in assuring the consistency of the data collected in the remaining nine facilities.

As a second step, the consultant’s project manager spent a few days with each team at the start up of their first facilities, providing further assurance that consistency would be achieved.

A third check occurred at the time of data entry. Each day, the data was transferred electronically to the data entry supervisor (who had also participated in the pilot) in the consultant’s home office, where the data was reviewed for consistency before being forwarded to data entry personnel. At the same time, the corporate project manager provided a quality control function by examining the data for reasonableness and resolving questions with the field teams. After the data was entered, the data entry supervisor spot checked the entries.

As a further step to address quality and assure a high level of communication, PacifiCorp facilitated weekly project status meetings through conference calls each Monday (Fig. 7). PacifiCorp’s project management team, each of the consultant team leaders, consultant project management, the data entry supervisor, and accounting personnel participated in the conference calls. Informal communication between PacifiCorp and the consultant’s management also occurred daily.

In addition to trips by consultant project management to PacifiCorp headquarters and to various facilities during the project, PacifiCorp project management visited the consultant when the field data was first being refined to establish guidelines for the analysis of the data. For example, the computer program might recommend localized touchup to address corrosion protection. While a spotty appearance is not objectionable in many cases, it is not acceptable in every instance. Accordingly, PacifiCorp established guidelines for overriding the touchup recommendations and reassigning an overcoating maintenance strategy. Likewise, the maintenance recommendations needed to be established with consideration for the remaining life of the asset, the timing of overhauls, and other site-specific issues that had to be conveyed to the consultant.

The communication among all parties was effective throughout the project, enabling the two companies to truly partner and work as a team. All issues and concerns were addressed immediately, assuring that the quality of work, costs, and schedule were not affected. Such teamwork was also instrumental to the success of the project.

Painting Specifications

The contract also required the development of painting specifications to address the aspects of surface preparation and coating application required to achieve long-lasting coating system per-
formance. Master corporate specifications were developed, addressing requirements from cleaning to mixing the coating, application, and film continuity.

Paint system specifications, each three or four pages in length, were attached to the master specification. The paint system specifications provided cleaning and painting requirements that were unique to the system (e.g., degree of surface preparation required, restrictions on ambient conditions, coating thickness, and product brand names). This approach provides PacifiCorp with the flexibility to easily add or delete systems in the future. Separate tables were developed to identify the appropriate system for painted surfaces in each environment.

**Delivering the Data**

The consultant offered to license the computer program to PacifiCorp, which would allow each facility, as well as corporate, to adjust and analyze the data. However, for at least the first year, PacifiCorp decided that such analysis was best left to experienced personnel because no one within PacifiCorp was specifically focusing on protective coatings. Accordingly, rather than delivering the program or hard copies of program-specific documents, the consultant exported the data, after analysis, to a more widely used and accepted spreadsheet. PacifiCorp can use the spreadsheet to examine key data downloaded from the program.

All items identified in each subdivision of each facility were listed. The following data was provided for each item: the condition of the coating on the item, the painted surface area of the item, the type of substrate involved (e.g., steel or concrete), whether or not lead was present in the paint, the maintenance painting strategy recommended over a five-year period (touchup, overcoat, remove/replace, or do nothing), the future cost for painting each

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The spreadsheets were appended to the painting recommendations, which were summarized in a written report together with total cost estimates for the work required each year over a five-year period. Graphics illustrated the comparative condition of various areas within each facility, as well as the composite condition for each facility (Figs. 8 and 9).

The reports and comparative analysis enable PacifiCorp to quickly determine the allocation of maintenance painting funds, both in terms of one facility versus another and specific areas within each facility. In short, the reports and recommendations are used by PacifiCorp to manage overall painting needs fleet-wide for years to come.

Next Steps
Before the five-year maintenance painting program began at the facilities, a series of meetings were held with PacifiCorp's owners and key facility personnel. The meetings outlined the results of the surveys and the maintenance painting recommendations for the next five years. The first meeting was held in March 2008 and was followed by the site-specific reviews of the new maintenance painting programs a few months thereafter. The program recommendations and specifications have been successfully used for a few projects in 2008.

With the assistance of the consultant, PacifiCorp also developed a qualified contractors list. PacifiCorp made a decision that beginning in 2009, contractors doing painting work in PacifiCorp facilities will have to be SSPC QP 1 and QP 2-certified. A long list of contractors was reduced to a short list based on a review of initial submittal packages. Select firms were then invited to participate in interviews. For the interviews, PacifiCorp required the bidding contractors to have a management representative, a project superintendent, and a QC inspector. After an initial presentation by the company, specific questions were presented to each representative, and only that representative was permitted to respond. This means of interviewing proved to be very effective. It showed how key field staff respond to situations, rather than only hearing from corporate management or business development. The list of contractors was reduced further as a result of the interviews, and only the selected group will be invited to bid on PacifiCorp painting projects for the next three years. The first project at a PacifiCorp facility using the qualified contractor list will be performed at the end of 2008.

As painting work at the various facilities is completed, the data in the program will be updated to remain current. At the same time, cost adjust-
ments for more accurate budgets and revisions to the existing data will be made as necessary.

In a few years, the surveys may be repeated to update the accuracy of the projections. Since the initial surveys represent a snapshot in time, it is possible that a surface painted "yesterday" appeared to be in excellent condition at the time of the survey, regardless of the quality of the underlying preparation or integrity of the pre-existing coating. As a result, the program will project that maintenance work is not required for many years. However, by quickly reexamining the surfaces after a few years, such conditions will be revealed, and the data populating the program will become more reliable. Repeating the surveys will take a fraction of the time required for the initial surveys because key data has already been collected.

The second round of surveys also helps to refine the projected rates of coating deterioration for each coating system in each service environment, with the default coating deterioration curves that are an integral part of the computer program, adjusted as required.

The goal is to continue following the recommendations in the program until the coatings throughout all facilities are upgraded to the point at which only minimal routine touchup is required to effectively protect the assets from corrosion and to enhance the aesthetics of the PacifiCorp Thermal Generating fleet.

Conclusions
During 2007, PacifiCorp's owners determined that greater emphasis should be placed on protecting corporate assets and improving aesthetics. Rather than engineer the maintenance painting program through internal resources alone, PacifiCorp solicited independent expertise to project the painting needs in 10 of 12 power gener-
located in the Seattle, Washington area. Following his years of service in the construction and maintenance industry, he "jumped ship" to join the power generation industry, where he has been a part of engineering and project management with PacifiCorp for the past 16 years, both at the power plants and at the corporate level.

Currently, he is the department manager for a project management group that supports PacifiCorp Energy's fleet of thermal generation plants located in Utah and Wyoming.

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Preparation Committee, chairman of the Visual Standards Committee, and chairman of the Task Group on Containment. He is also past chairman of ASTM D1 on Paints and Related Coatings, Materials, and Applications. Mr. Trimber wrote *The Industrial Lead Paint Removal Handbook*, and co-authored Volume 2 of the handbook, *Project Design*. He was named Coatings Specialist of the Decade at the SSPC National Conference in 1990 and is also a past technical editor of the *Journal of Protective Coatings & Linings*. Mr. Trimber is a principal instructor for SSPC’s “Supervisor/Competent Person for Deleading Projects Course (C-3)” and the NHI/FHWA courses, “Bridge Coatings Inspection” and “Hazardous Bridge Coatings: Design and Management of Maintenance and Removal Operations.”

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