Managing the Reliability of an Industrial or Commercial Electrical Power System / E 02

by **Chuck Baker**

Cast

Andy ..... Reliability Manager of Electrical Power System (recently hired by Brian, the Plant RVP)

Brian ..... Regional Vice President (head person for this plant)

Jill ..... Director of Operations

Kevin ..... Director of Reliability

Tim ..... Electrical Engineer (who reports to Andy)

Tina ..... Maintenance Manager (who reports to Brian also)

Chuck Baker is the President of PowerPro 360, a company offering power system reliability assessment and reliability maintenance programs for Industrial and commercial organizations. Chuck entered the world of Substation and Power System Maintenance 36 years ago and has spent a majority of that career on the operations side of power and distribution system maintenance and the development of power system maintenance programs.

Hello, I am Andy.

I have been recently hired by Brian, the regional VP of Smith Industries, to be the reliability manager of electrical power systems. This plant had been ranked the lowest in terms of reliability by the corporate group, which is why I was hired. The biggest contributor to this shortfall had been the power system.

It was my directive to bring reliability to the power system, specifically. Due to this being a special project, I was to report to Brian for the first year, which made the lines of responsibility with Kevin—the director of reliability—a little awkward.

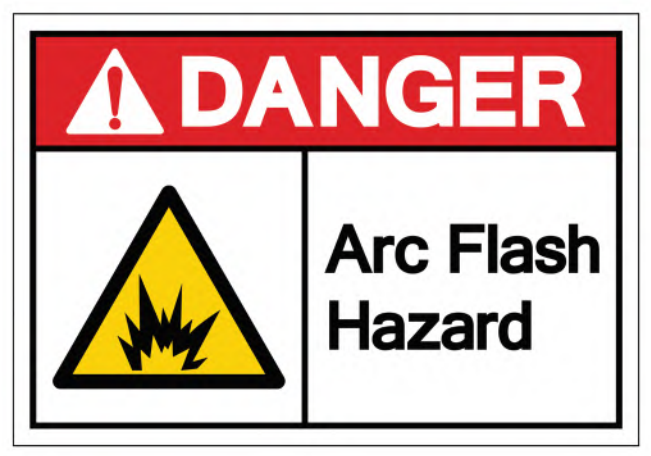
I had just walked out of a meeting with Brian, Jill (director of operations), Kevin, and my EE, Tim when I received an email from Kevin asking for a few minutes of my time to do a meeting recap. I was free, and so was he, so I went to see him right away.

I had done reliability program building before, and the biggest challenge I had faced was changing the way people look at traditional maintenance. It's a different culture. The only way I knew to make it work was to communicate, communicate, communicate.

As I walked into Kevin's office, I figured it was time to practice that communication.

Kevin opened with a question before I sat down.

"Thanks for the update, Andy. Can you let me know a little more about arc flash? The arc flash survey… what is it? And why do we need it? Have we been negligent by not having an update since 2005?"



I saw this as a great opportunity to team with Kevin. Over the course of 45 minutes I walked him through a little of the history and the reality of the situation.

I made these points:

- Arc flashes occur where a flashover of electric current leaves its normal path.
- Temperatures at the arc points can exceed 35,000 degrees – four times the temperature of the sun's surface.
- The sound from an arc flash can reach 140 decibels.
- An arc flash can be caused by dust, moisture, or a tool dropped during inspection.
- When arcs cause equipment to explode, flying metal pieces can travel at a life-threatening 700 mph.
- Anything that produces electric current has the potential to create an arc but can be mitigated through arc flash services.
- Regulations on arc flash standards come from NFPA 70E, which gives instructions on how to comply with OSHA's electrical safety regulations. When an arc flash occurs, it is estimated that should the victim survive, medical costs can run as high as $1M and the resultant OSHA fines have run as high as $500k.
- The real problem with arc flash is what it does to a human. For those who survive, recovery can be a torturous medical process.
- It is estimated that the number of arc flash incidents per year run from 2,000 to 3,000. Bottom line—arc flash is a real risk.

Photo: Shutterstock

As I was explaining this to Kevin, he listened intently and took notes in silence. His next question answered why he was listening and not asking questions.

"Why haven't we been doing this?" he asked. "And what do we need to do to make it happen?"

I asked Kevin if he would be OK if I got the group together and walked everyone through the answer to this question. He agreed, we shook hands, and I headed back to my office to set up the meeting.

I sat down at my desk and opened Outlook. I brought up a new meeting request. I entered the title of "Arc flash studies background" and thought—who to invite? I knew Tim needed to be there. The EE will play a key role. Obviously, Kevin. I included Jill too, as she owns operations and needed to be aware of the training component, and although Tina reports to Jill, I invited her as well. I looked at everyone's calendars and select a start time of 9:30 the next morning, with the meeting ending by 10:30, and hit launch.

While sitting with a cup of coffee the next morning, I thought through what I should say. I had previously talked to Brian several times about this, but I needed to make sure they really understood this well. I picked up my coffee and binder and headed down the hall to conference room H. Almost everyone was already seated. Jill arrived the same time I did.

I was quite pleased when Kevin opened the meeting by stating how serious the subject was. I was really surprised how accurately he reviewed the key points we talked about the day before. As soon as he finished and turned the meeting over to me, the questions started flying:

"When did these arc flash concerns and regulations begin?"
"In 1981 Ralph Lee, a PE and IEEE member, released a whitepaper entitled 'The Other Electrical Hazard: Electric Arc Blast Burns.' It got a lot of attention. In 1995 NFPA 70E got on board by addressing arc flash as a hazard and established arc flash boundaries, introducing the concept of approach limits."

"You said our last one was in 2005. How often should we be doing this?"
"The standard for electrical safety in the workplace—NFPA 70E—states in Article 130.5 that an arc flash study needs to be reviewed every five years or whenever there is a significant change in the electrical system. The five-year interval is straight-forward requirement. The other key area that I want us to make a priority is training. Under the NFPA 70E standard, arc flash training not only needs to be completed every three years, but it must also be documented, and employees must be able to demonstrate that they understand how to safely work on electrical equipment."

Photo: Shutterstock

"Are we in trouble since we haven't done this since 2005?"
"Smith Industries cares and is doing the right thing. We have made this a priority and we are going to keep it one. The bottom line, in my opinion, is that the goal is to keep employees and contractors safe. We are already proceeding with getting the things we need, and we need to work as a team to makes this happen."

"What is required to do an arc flash study"
I didn't want to overcomplicate it, so I gave them just the highlights.

"The reason I won't go into too much detail now is that the arc flash study will generate a large amount of critical data. The study will require specialty software, a project lead by a professional engineer, and everyone's cooperation. What I think is cool is that not only will we use this data in the arc flash, but this data will also be used to begin to build a reliability centered power maintenance program (RCPMP). That is the fundamental reason Brian created this position. But let me back up and give you the fundamental steps we will be going through."

For the next hour I walked them through the **key steps required for an arc flash study**:

1. Update the one-line diagrams. This is critical information that is required for accuracy and when identifying all key bus and components in the electrical system.
2. Perform a short circuit study. I explained that with an accurate one-line, a professional engineer will determine the potential short circuit current that can be generated at each key spot throughout the circuit. When the PE knows what could be generated, they will go onto the next step.
3. Perform a protective device study. This looks at the locations we identified as having a potential short circuit. We look at the calculated energy that could be present and then we check on the protective device that would be responsible to limit or stop the short circuit.

I also pointed out that there are two phases to this which could be done simultaneously:

a. Identify what the protective device ratings and or settings are at today. This is required for the arc flash study.
b. Recommend what changes should be made in the protection system.

I explained that I was taking both options and would explain why a little later.

From this data, I told them, we would post labels showing the required arc flash protection that is required at each potential area throughout the plant. This would allow employees and contractors to see the potential risk and that they must wear appropriate PPE when in that area servicing equipment.

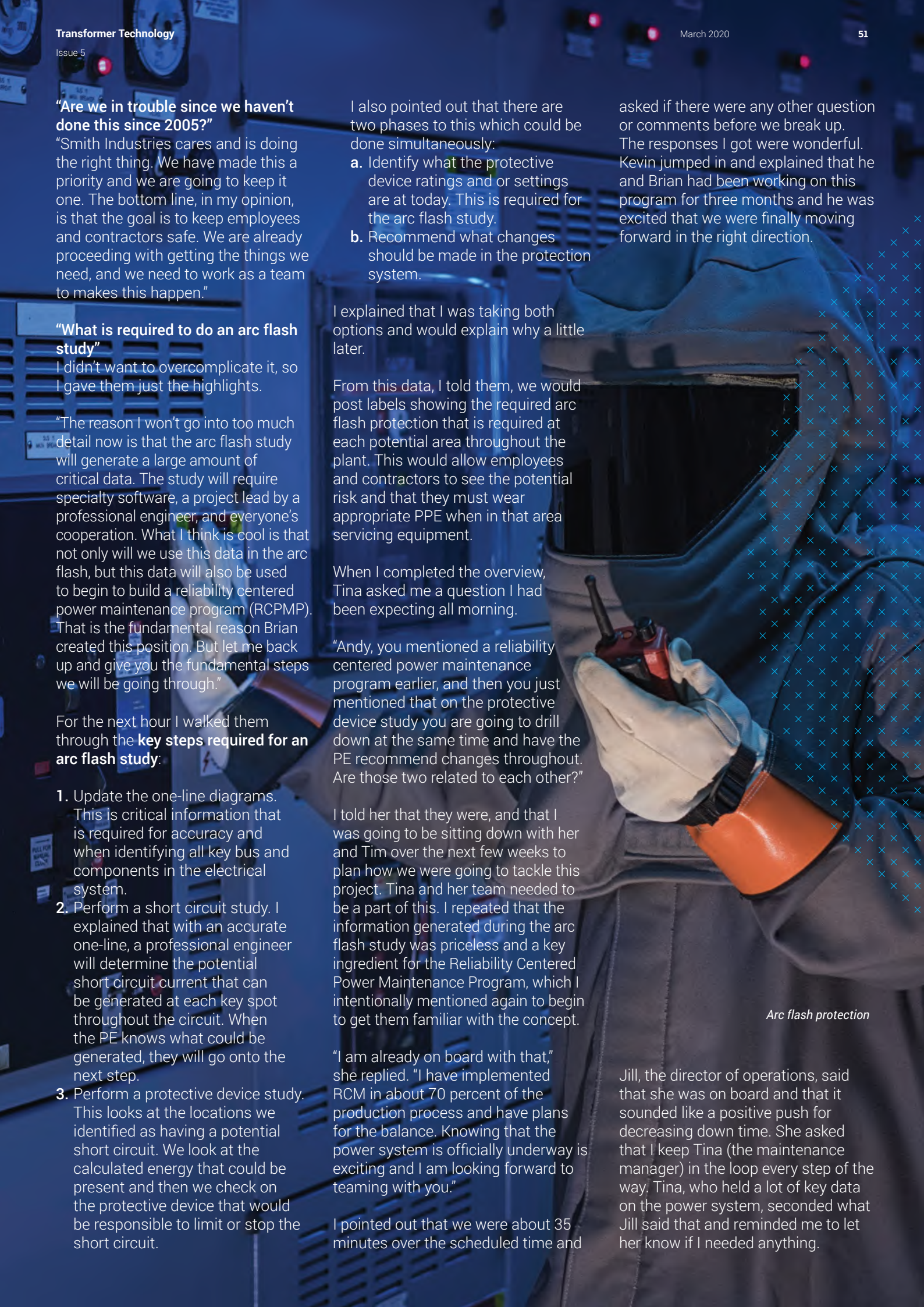
When I completed the overview, Tina asked me a question I had been expecting all morning.

"Andy, you mentioned a reliability centered power maintenance program earlier, and then you just mentioned that on the protective device study you are going to drill down at the same time and have the PE recommend changes throughout. Are those two related to each other?"

I told her that they were, and that I was going to be sitting down with her and Tim over the next few weeks to plan how we were going to tackle this project. Tina and her team needed to be a part of this. I repeated that the information generated during the arc flash study was priceless and a key ingredient for the Reliability Centered Power Maintenance Program, which I intentionally mentioned again to begin to get them familiar with the concept.

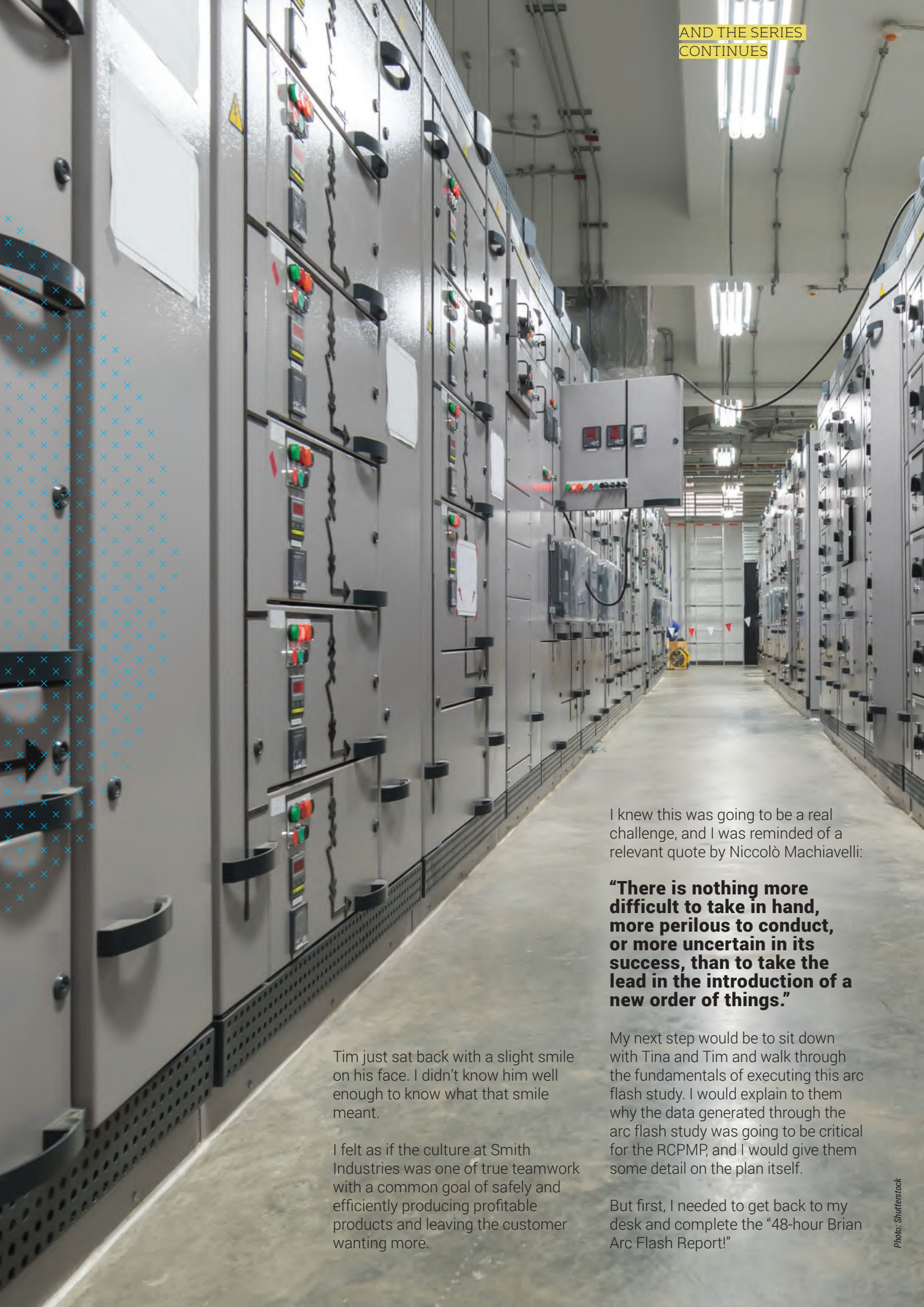
"I am already on board with that," she replied. "I have implemented RCM in about 70 percent of the production process and have plans for the balance. Knowing that the power system is officially underway is exciting and I am looking forward to teaming with you."

I pointed out that we were about 35 minutes over the scheduled time and asked if there were any other question or comments before we break up. The responses I got were wonderful. Kevin jumped in and explained that he and Brian had been working on this program for three months and he was excited that we were finally moving forward in the right direction.



Arc flash protection

Jill, the director of operations, said that she was on board and that it sounded like a positive push for decreasing down time. She asked that I keep Tina (the maintenance manager) in the loop every step of the way. Tina, who held a lot of key data on the power system, seconded what Jill said that and reminded me to let her know if I needed anything.



Tim just sat back with a slight smile on his face. I didn't know him well enough to know what that smile meant.

I felt as if the culture at Smith Industries was one of true teamwork with a common goal of safely and efficiently producing profitable products and leaving the customer wanting more.

I knew this was going to be a real challenge, and I was reminded of a relevant quote by Niccolò Machiavelli:

"There is nothing more difficult to take in hand, more perilous to conduct, or more uncertain in its success, than to take the lead in the introduction of a new order of things."

My next step would be to sit down with Tina and Tim and walk through the fundamentals of executing this arc flash study. I would explain to them why the data generated through the arc flash study was going to be critical for the RCPMP, and I would give them some detail on the plan itself.

But first, I needed to get back to my desk and complete the "48-hour Brian Arc Flash Report!"

Photo: Shutterstock

Authors note:

The next update on the Smith Industries saga will be in the June edition of Transformer Technology. But I want to do something a little different. Transformer Technology has allowed me to provide short articles in April and May that will only be available online. I want to use these two opportunities to walk you through what really happened with Brian's strategy to bring Andy on board, and how he worked with Kevin for several months prior to Andy's arrival. The reality with trying to implement a new and deeper program challenges the current culture and if not done properly will never work. I am looking forward to sharing that with you. Check out www.transformer-technology.com to find out more.

Chuck Baker