

# Commentary

## A Lawyer's Guide To Hiring A . . . . Forensic Industrial Engineer

By

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This "how to" article helps you interview and select an Engineering Expert Witness for your industrial cases. An engineer who is an experienced expert is one thing. But one who also has industry experience related to your case is an additional arrow in your quiver to help you prevail. These are the big-ticket cases that do not come along every month.

With these tips, you can determine if the prospective expert has "inside knowledge and experience" with the particular industry(s) involved in your case.

### Overview

First a short overview of "industry." There has been an SIC (Standard Industrial Classification), and now a NAICS (North American Industry Classification System), which list all industries. From a quick review of the list it should be evident that there are differences, albeit commonalities too. There are heavy vs. light industries; process industries with tanks, pumps and pipes; and also solid material handling industries. From one industry to the next, there is the gamut of meanings. For instance, there are varying cleanliness standards for a semi-conduc-

tor plant vs. a meat packing plant vs. a paper mill — and paper mill regulations even depend on the kind of paper!

Some OSHA (Occupational Safety and Health Administration) regulations are specific to an industry, and OSHA has made "interpretations" of those standards by industry. The point is — not all industries are alike, only some. Think of industry as a multi-dimensional continuum as you assess what industrial experience of a potential expert can help you on your industrial case.

As an example, suppose a man got injured while unloading a box from a truck. A 100-pound widget rolled out of the cardboard box onto him. Do you need someone with experience in making cardboard? Or boxes? Or widgets? Or with common carriers? Or with lifting? You will want to question your expert about this. Not that there is one correct answer, but the answers will be revealing.

This article first discusses tip-offs to look for in the CV. For the phone interview, we advise how to use the limited information you already have on the case to help select an expert. We also suggest stumper questions to uncover specific on-target information that only someone familiar with the specific industry would know.

This article assumes you are not familiar with the industry or know what expertise you need. Regardless, you will be able to list specific differences between candidates who can indicate to your client that you

have found an engineer who knows the industry involved in this case.

### Evaluating The CV Of An Engineer Claiming Industrial Qualifications

Dig into the CV looking for the qualifications listed below — before you phone the candidate for an interview.

#### Accreditation

*Did the candidate graduate from an engineering college accredited by **ABET** (Accreditation Board for Engineering and Technology at [www.abet.org](http://www.abet.org))?*

Usually Professional Engineering Registration (PE) is denied those with degrees from non-accredited engineering programs.

#### Specialization

*Here is a primer on engineering academic curricula:*

- **Mechanical Engineers** can major in machine design or in thermodynamics, such as boilers, heating, and air conditioning — things that burn fuel.
- **Electrical Engineers** can major in power or electronics.
- **Chemical Engineers** deal with the process industries, such as pumps, pipe, tanks, and vessels.
- **Civil Engineers** are experts in soils, roads, waterways, and underground pipe.
- **Structural Engineers** deal with foundations, steel beams, concrete, buildings, and bridges.
- **Industrial Engineers** deal with ergonomics, people/machine interfaces, and time studies.

*(In this paper, **industrial engineer**, without caps, denotes any engineer who works in industry.)* The required course work for any discipline of engineering includes cross training in all the above curricula.

In addition to these six major engineering curricula, there are a couple dozen specialty-engineering degrees, such as aeronautics, nuclear, metallurgy, and

computer engineering. Some states address these separately in PE Registration. Also there are engineering-related degrees like computer science, software, pulp and paper, and others, which may not qualify for PE Registration.

*The reality is that **industrial engineers**, (no caps), usually wear several hats, and they become proficient in the basics of several engineering disciplines within a specific industry.*

#### Professional Registration

*What, if any, **Professional Engineering Registration** do they have?*

Registration is issued by state or province. Some states have replaced the word registration with license. If they are registered/licensed in only one state, it may be that they were awarded the PE designation by a “grandfather” process rather than by passing a test. That begs the question whether they have the theoretical depth you require.

Or they may have gotten the PE by passing a test, but have limited experience related only to one state. You can check the state PE web site/s to verify the registrations. Usually the state name followed by .gov gets you to the website, such as [www.Texas.gov](http://www.Texas.gov). There are peculiarities to understanding PE registration for industrial engineers, which will be discussed later in this article.

*Do they have an **NCEES** (National Council of Examiners for Engineering and Surveying at [www.ncees.org](http://www.ncees.org)) certificate?*

This is a relatively new certification whereby an engineer is pre-qualified for PE registration in any state and most provinces. If they have this certification, the above two steps are moot.

*Are they members of **NAFE**, (National Academy of Forensic Engineers at [www.nafe.org](http://www.nafe.org))?*

**NAFE** has high and stringent entrance requirements, and establishes ethical and educational standards for its members. Some similar-sounding associations have less stringent membership requirements, and at least one is nothing more than a mail order certificate mill.

### Work History

*First, a few generalizations, followed by specific types of engineering positions in industry:*

A CV's chronological listing of positions can be confusing, and run together into one blur. Here are tips to interpreting significant work experience.

Some diversity in locations and position levels — in and out of engineering and various industries — prevents stagnation. Continuing education is a good sign. These days, cradle-to-grave employment with one firm, or even one industry, is rare. Good engineers are let go through no fault of their own, and it is often not easy for them to find a new niche right away.

The reality for new engineering grads on their first industrial assignments is that they will be on a steep learning curve — and they are not very productive for the first few years. Seldom will college textbooks be needed as a reference; rather, the technical industrial catalogs must become part of their repertoire. They learn the vocabulary for that industry, recognize the equipment by name, learn the history and status of technology in their industry, develop a “feel” for what works, what is practical, and gain the confidence of their superiors.

A professional pitfall for industrial engineers is to forsake the scientific and theoretical aspects in the day-to-day grind, and become limited in perspective, based mostly on what they learn from the best tradesmen, operators, or sales people. Accordingly, you will want to discern where they are on the continuum, from when they were graduate engineers to whether they gravitated to technicians or rose to fully developed senior engineers.

### Understanding Industrial Engineering Career Paths

Industrial engineer denotes any engineer who works in industry. There are so many different types of jobs engineers do in industry, but the following categories describe over half of the career paths.

#### Design

Many new graduate engineers start in a design office on projects, mentored closely by a senior engineer or even a designer who is not a graduate

engineer. The office might be at corporate headquarters, or in a smaller office at a plant. Often the design projects involve modifying existing production machinery or processes, or product modification. The new grad becomes familiar with the specialized industrial equipment and requirements at a far more detailed level than the generalizations covered in college.

An engineer who stays in design will become specialized because of the complexity and cost/potential profit involved. In the case of a process industry, for example, a Chemical Engineer does the process flow diagram, is involved in equipment selection and general arrangements, then hands it off to the other engineers for the civil, structural, piping, electrical, and process control. After a few years, the employer will evaluate the potential of the engineers, transfer the promising ones to other assignments, and bring in new graduates to develop.

#### Plant Engineering

Industrial plants employ engineers to provide technical support for maintenance and operations. (Maintenance in this case pertains to fixing and improving equipment and plant facilities, not janitorial work.) Frequently, they are assigned to a portion of the plant in a hands-on environment where they work closely with tradesmen, technicians and operators. They must interact with various levels of people, think on their feet, apply theory to practice, and make things happen. They gain insight in understanding industrial organizations, interactions, resources, talents, responsibilities, habits, standards, accidents and underlying causes.

All this augments what they learned in college — provided they do not fall into the pitfall described above of forsaking their formal education.

#### Industrial Management

After some years, the best engineers are promoted to mid-level management in engineering/maintenance or operations, either at a plant or at corporate headquarters. At this level, they will remain attuned to the technology and industrial cutting edges. Their ability to communicate verbally and in writing becomes critical for performance and advancement in management — abilities necessary for Expert Witnessing.

Just as with college rankings, the firm an engineer works for and who mentors him or her has a pronounced influence on their development. However, do not harbor a bias that corporate experience will develop an engineer better for Expert Witnessing than working in a plant.

If you need someone to convince the trier of fact, don't you need someone who has had to provide a safe workplace, who knows how crews work, and has investigated accidents?

### **Engineering Sales**

Engineering sales refers to an outside, not just inside, sales person. It requires technical competence and people skills to sell products or services to numerous locations, to numerous engineers and managers. This broad exposure teaches them to speak and write well, and think on their feet. The products they sell affect their exposure. Some services or products are for only one industry, whereas others are specialized technologies for several industries, such as lubrication or machine drives. Often sales engineers mentor the engineers described above.

### **Consulting Engineering**

For each industry, there is only a handful of consulting engineering firms that have gained the confidence of an industry segment or two to design their industrial facilities. Some of the consultant's staff will have been recruited from the industrial engineers discussed earlier to lead the consultants design projects.

There is a common misconception that the consultant has the superior technical knowledge. A facilities design project becomes a mutually complementary team melding the owner's technical expertise with the consultant's staff and specialists. Most of the consultant's staff is non-degreed designers. Only the lead consulting engineers will be registered PE's. These are the ones you generally look for as effective experts in industrial cases.

However, to avoid conflicts, they will most likely avoid expert witnessing until they retire. And engineers who only have consulting experience generally will lack the industrial operational background, which may be important on your case.

### **Academia**

Engineering professors have formidable academic credentials and some offer their services as industrial expert witnesses. Only some who teach engineering students are professors. And for any industry, only a few have more than spot experience where they were in charge of a design or for troubleshooting problems. It is this hands-on experience that can inspire an academic to suggest a theory that can withstand a Daubert challenge, as well as the vernacular to communicate with the trier of fact, and avoid ipse dixit.

The expertise you usually require will not be found in textbooks.

### **Industrial Careers Summarized**

Industrial experience lends credence to expert opinions about how an accident happened and why a proposed solution will or will not work, because every industry's history is so rich, insightful and convincing. Because effective expert witnessing involves more than reacting to what exists, industrial experience will help an expert identify and opine on what is missing or what standard industrial practices or devices may have prevented the incident.

### **Understanding The Professional Engineer (PE) Registration**

*You should understand why there are so few PE's in the forensic engineering business who have industrial experience, because it can influence your strategy.*

Yes, having a PE indicates something positive about a candidate, and helps withstand a Daubert challenge in some state and federal courts — but the majority of industrial engineers are not registered PE's, even though they are equally competent. Here is why:

#### **State Registration**

*Registration/license is issued by each state or province.* Usually the state requires the applicant to have been graduated from an ABET-accredited engineering college, pass an 8-hour written exam, perform four years of suitable engineering or academic work under another PE, and then pass a second 8-hour exam. There are still some PE's who were "grandfathered" in under much less stringent academic requirements. Grandfathered PE's will usually be licensed in only one state — they are denied reciprocity from other

states. Only those who attain PE status by passing a test can qualify in another state by reciprocity.

Taking the test in each state is not feasible. However, if a PE is certified by NCEES, he or she is pre-qualified for quick PE registration in any state and most U.S. provinces by merely having their records transmitted by NCEES to the desired state.

### **Engineering for the Public**

*The laws say a person who offers to provide engineering services to the public must be a PE.*

That law is interpreted to **exclude those engineers in industry**, and mostly applies to engineers working as a consultant. A consulting firm must have enough PE's to be able to have a PE in responsible charge of the work so the PE can stamp the drawings they provide to the "public." But drawings developed by an industrial firm with its own engineers are not providing the drawings for the "public," and need not be stamped by a PE.

There is neither financial incentive nor encouragement from industrial employers for their engineers to become registered; therefore, they usually never do. Besides, many of the sharpest engineers aspire to career paths outside of engineering for status and money. So getting a PE is often not viewed as important to a young industrial engineer, and as the years pass, it becomes very daunting to sit for the PE exams. So the PE as a qualification has much to do with the state and court requirements as well as what the opposing counsel wants to highlight, rather than the expert's capability.

Nevertheless, there is something to be said for a PE's who passes the stringent requirements and continues his or her education to retain certification.

To put a non-registered expert engineer who failed PE exams on the witness stand is potential trouble for your case.

### **Interviewing A Candidate**

*It is important to ascertain not only a prospective expert witness's experience as an expert, but also his or her specific experience for your industrial case.*

Each industry has its own processes, literature, jargon, and some unique standard practices. Most likely, you will have only fragments of information on the

case — but listed below is information you often do have, and tips on how you can use that information to probe the candidate's industrial competence. Your client can help you make a list of these questions.

You do not need to know the answers to your questions, but your legal training will tell you if their responses are complete and plausible — something that only someone knowledgeable of the industry could know. Do they have an overall perspective of the industry, contacts, and insider knowledge you require? There are subdivisions within industries not apparent to someone unfamiliar with an industry. And realize, for example, that very few engineers who work in the auto industry design cars. A suggested line of probing follows.

#### **Specific Product**

Revealing the specific product should elicit many comments and questions from the expert. With your prodding, they should be able to describe the raw material, the process, the equipment, safety concerns, and methods of shipping.

#### **General Product**

If you only have a general notion of the product, the engineer should be able to list the various types. For example, you only know that the case involves paper. He should be able to tell about brown vs. white paper, linerboard, corrugated medium, bag, newsprint, fine paper, tissue and other products.

#### **Type Of Plant**

If you know the type of plant, he should be able to talk about more specific types. If you say it involves a sawmill, he should ask if it's the wood yard, plywood line, sawmill, kiln, planer, shipping, boiler or another area of the plant. You do not need to know the answer to get an impression from that response.

#### **Plant Location**

If you know the town/city/county where the plant is located, or the name of the plant, an industry insider might very well know about the plant, what is made there, and the equipment and process used. Do not underestimate what a true industry insider knows.

#### **Equipment Names**

Ask the engineer to describe the equipment and companies that manufacture it, and how it operates.

Consider developing a bogus equipment name and see if he tells you he never heard of it. That trips up a fake.

### **Industry Specific Regulations**

Ask them if the federal OSHA or an approved state plan has a section devoted to the industry involved, and if the regulations address this specific equipment. What section of the CFR (Code of Federal Regulations) has that? Or must the case rely on general equipment regulations? Or do national standards such as ASTM (American Society for Testing Materials) or ANSI (American National Standards Institute) cover it, such as ASTM D 4675 for flat strapping materials?

### **Mentors And Peers**

Just as you might ask for client references, ask for their industrial mentors or peers. You might verify those names by asking more about them, such as where they live or whom they work for, and check it out later with an Internet search. Perhaps you ask how to contact them.

### **Industry Publications**

Most every industry has industry-specific technical magazines and books, as well as a magazine for the managers. Ask what magazines they read on the industry, how they keep current with the industry. Ask what industry books are in their libraries.

### **Associations and Conventions**

Likewise, there are industry-specific technical and management associations and conventions that someone familiar with the industry can talk about.

### **Need Suggestions**

Asking what clarifications they need to better respond to your inquiries is a catchall question that gives you insight as to what they know.

Review what information you have, select several topics mentioned above to plan your interview. Maybe ask your client for help. There are only a few experts who fit your needs for an industrial case, and you want a good one.

### **How to Utilize an Industrial Expert**

Hiring a consultant early on allows you to confirm their suitability, and gives you time before you must

name them, or a replacement, as experts on your case.

The oft-attempted cost control method of hiring an expert at the last minute is risky, less effective, and unnecessary. Are you comfortable with last pick of a limited group? Obviously the defense might be encouraged to utilize their client's employees, at least early on.

However, there is a level of competence lacking from someone who is not trained in forensic engineering and in litigation support.

After you have hired a consultant for his expertise, you must manage his work. Brief the consultant on the case, and establish that you want to know — “the good, the bad, and the ugly.” Discuss what case documents you can provide, and what tasks they will undertake.

Follow up soon thereafter about what additional documents exist, if you need them, and where you get them. Probe for what is missing. Elicit possible case theories and parties. Find out what role various parties played in creating the conditions that led up to the incident in this case. Due to variations in sophistication among industries and firms, the usual role played by an owner and his suppliers is unique to the industry. Is additional expertise needed? What are the relevant regulations/ standards, and might there be differing opinions as to which ones apply? Are there industry-specific regulations for this case, and how do they compare to the state-approved plan and to OSHA? What interpretations have they published? Plan the details of the inspection trip to the accident scene.

Discuss who might be deposed, and ask for suggested questions. Consider having the consultant (or Expert if you have already divulged them) assist you at some depositions. If you plan to pursue a settlement, will their presence get the attention of the opposing litigants, to diffuse their egos? Will they realize they cannot razzle-dazzle you with industrial double talk? Can your expert help you make them understand what they are up against if they go to trial?

### **Case Example**

*Following is an example of an industrial case to demonstrate the breadth of knowledge an industrial expert should offer you.*

This case did not require engineering calculations that you can expect from a competent engineer, but rather emphasizes industrial experience.

The plaintiff was a contract employee sent into Owner Inc.'s manufacturing plant to clean out a plugged widget, but got burned while doing so. The widget was a large piece of equipment that was sold by Widget Manufacturing Inc. and had been in operation by Owner Inc. for several years.

The widget was purchased based on competitive bids in accord with specs developed by Design Engineering LLC. Widget Inc. and Design Engineering LLC also provided installation documents for Construction Inc. to install the complete widget system.

Long after the accident, the plaintiff's Expert, having read several depositions, did a site inspection at Owner Inc.'s to look at the widget, the surroundings, the remote operator control room, and the plant organization. Expert wrote a report that explained the following findings:

1. Owners Inc. records show the widget plugs too often as a result of Widget Inc.'s design and their deficient installation requirements. Expert listed what was wrong and what was missing in the design and installation of the widget.
2. Expert explained the responsibilities of the project participants in acquiring a widget. The bid specifications supplied by Design Engineering LLC included requirements that promote plug-ups, and Widget Inc. complied instead of ensuring a design in accord with industry practices. Expert gave specifics.
3. Owner Inc. continued to operate the equipment for almost two days after the operators in the remote computerized control room and their management knew the widget was plugging up. They knew, or should have known, the large plug was more dangerous than if they had shut down sooner. Expert explained the computerized control system, and quoted from depositions. All the defendants should have been aware of the dangers of plugging, and the history of similar accidents in the industry.
4. When Owner Inc. did shut down the system, it did not do so in accordance with the procedures in the safety manual. They did not adhere to the shutdown plan agreed upon with the cleaning contractor. Expert quoted from the Manual, OSHA, and depositions.
5. Owner Inc. should have understood safe operation, safe unplugging procedures, and associated dangers. Expert quoted from OSHA.

The case settled after the Expert's report was issued and before he was deposed.

### **Checklist For Retaining An Industrial Testifying Expert Witness**

Following is a Checklist for interviewing industrial experts:

1. Probe the specific degree(s) from an ABET College, and specialization.
2. Was PE earned by test?
3. Probe work history involving design, plant engineering, management, sales, consulting, and teaching.
4. Describe the type of plant, raw materials, the process, equipment and/or shipping for this product. Then ask where in the plant this may have happened.
5. Tell where the plant is located, and ask if they are familiar with it?
6. Describe the machinery involved, and ask who makes it, and how might the accident have happened.
7. What standards or regulations do you think may apply to this accident? Does OSHA or a state OSHA have a specific section for this industry?
8. Who was your mentor in this area of expertise?
9. What industry magazines or books are published for this industry? Which ones do you have?
10. What are the associations for this industry, and do you belong to any of them?

11. What is it about the information that is lacking for you to know if you have the requisite expertise?

**Summary**

This paper gives you guidance on how to interpret a CV and interview someone who claims to have the engineering qualifications you need for an industrial

case. It is not difficult because you use bits of information you commonly know about a case, or general stumper inquiries provided herein, to distinguish a specific industry expert from a generalist. With the checklist you can be specific in evaluating and recommending consulting or expert candidates for an industrial case. ■