FIELD ISSUES THAT DRAW ATTENTION FROM STATE OR FEDERAL AUTHORITIES (and it can get expensive)

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Abstract

The purpose of this paper is to identify many common installation errors and negligent practices that could put a company in poor standing with the Occupational Safety and Health Administration (OSHA) and various state or local Authorities Having Jurisdiction (AHJs). Bear in mind that codes carry the force of law and then there could be criminal penalties in addition to fines.

Interestingly, even near-miss accidents where there was no injury have sometimes come to the attention (and scrutiny) of OSHA and their investigations can wreak havoc with your operation. When investigators arrive at a facility, their mission is a very painstaking view of your workplace with regards to all applicable regulations and not just the incident that brought them there. Based on their findings, AHJ representatives may demand the facility shutdown until all safety discrepancies have been corrected to their satisfaction.

Although there are more recent examples from this facility, none was so glaring as a Lockout / Tagout lapse at the United States Mint in Philadelphia. Fortunately, no one was injured in the incident, however the investigators discovered non-compliances that resulted in a five (5) week shutdown of that 650-employee facility while nineteen (19) serious deficiencies were corrected. A later inspection[i] at that same facility turned up another forty-seven (47) health and safety deficiencies.

While OSHA cannot levy fines against other federal agencies, the rest of us are fair game.

Because the BATTCON conference primarily covers batteries as used in the telecommunications, data center and electric utility industries, referred to herein as “the industry,” this paper will focus on the kinds of OSHA-targeted infractions frequently observed in facilities common to these industries. Some of the more egregious incidents known to this consultant will be featured herein.

Learning Objectives

The objectives of this paper include but are not limited to:

- The history and objectives of OSHA
- OSHA scope: who is and isn’t covered by OSHA regulations
- Frequently observed noncompliant issues regarding stationary battery systems
- Frequently observed noncompliant issues regarding ladders, fall protection, Personal Protective Equipment (PPE) and Lockout / Tagout in telecommunications and electric utility facilities
- Creating a culture of professionalism to drive safety compliance
- Effective ways to reduce fines
- Ways that OSHA compliance can reduce overall operational costs

OSHA

OSHA was formed in 1970 to combat workplace issues involving an annual tally of 14,000 deaths, 2.5 million disabilities and 300,000 cases of occupational disease. Their goals were to:

- Develop and enforce job safety & health standards
- Establish procedures for employer reporting and records of injuries and illness
- Encourage employers & employees to reduce workplace hazards
- Research occupational safety & health
- Establish training programs
- Establish separate but dependent rights & responsibilities for employers and employees
- Provide state level programs where desired

Who is exempt from OSHA?

- Self-employed persons
- Family farms
- Businesses where other federal agencies regulate health and working conditions
    - (such as) Mining and railroad operations

The telecom and utility industries come under the General Industry and Agriculture clause and General Duty clause and are **not** exempt from OSHA codes and standards.

Regarding ergonomic matters, under the General Duty clause OSHA provides interpretations where no published ergonomic standard exists based upon:

- Would the hazard cause serious physical harm?
- Is the hazard recognized?
- Do feasible abatement methods exist?

Frequently Observed Noncompliant Issues Regarding Stationary Battery Systems

Almost routinely, technicians disregard the requirement for appropriate PPE when performing installation and maintenance on battery systems. While some (but not all) technicians use appropriate eye protection, many do not use gloves or aprons. Additionally, many technicians are poorly trained with regards to the hazard of ElectroStatic Discharge (ESD) in the presence of hydrogen outgassed during battery charging as is clearly defined in IEEE Standard 1657[ii].

An OSHA memorandum[iii] in January 2021 offers penalty guidelines for their Regional Administrators and establishes significant increase in the cost of non0compliance. The tables are provided to provide the readers with a scope of the potential cost of OSHA penalties. Per the document:

2021 Annual Adjustments to OSHA Civil Penalties		
Type of Violation	Penalty Minimum	Penalty Maximum
Serious	[$975] per violation	$13,653 per violation
Other than serious	$0 per violation	$13,653 per violation
Willful or Repeated	[$9,753*] per violation	$13,653 per violation
Posting Requirements	$0 per violation	$13,653 per violation
Failure to Abate	N/A	$13,653 per day unabated beyond the abatement date [generally limited to 30 days maximum]
[* For a repeated other-than-serious violation that otherwise would have no initial penalty, a GBP penalty of $390 shall be proposed for the first repeated violation, $975 for the second repeated violation, and $1,950 for a third repetition.]		

The size of the company under OSHA's scrutiny is a significant factor but is a moot point for most of our industries due to size.

Serious Willful Penalty Reductions	
Employees	**Percent Reduction**
10 or fewer	80
11 - 20	60
21 - 30	50
31 - 40	40
51 - 100	20
101 - 200	10
251 or more	0

Incidents known to this author / consultant that easily could have resulted in OSHA intervention:

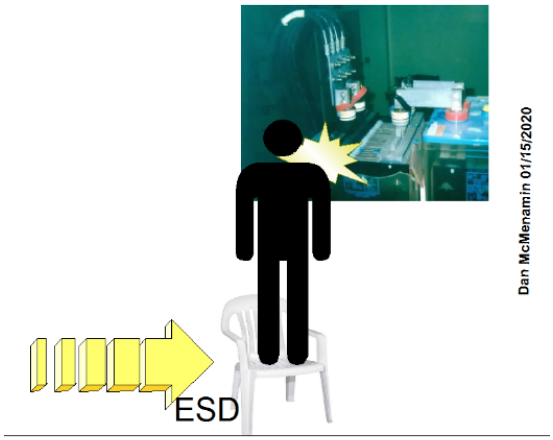

Figure 1 (Left) Rather than use a ladder for battery maintenance, a technician dragged a cast-resin chair across the floor generating a large triboelectric (ESD) charge and resulted in a cell explosion. Chairs are not ladders, and there was a lack of PPE as a factor that could have been further punitive action. Similarly, in the photo to the right, a technician approached a cell under refresh charge in a warehouse. His body accumulated an ESD charge which he failed to discharge safely, thus causing an explosion in the head-space of the cell. Fortunately, in both accidents there were only minor injuries, but the potential existed for serious injury or death from shards of plastic violently leaving the cell(s).

Fire Safety Issues

At one time, technicians were expected to deal with small equipment fires. Over time, the property characteristics of materials changed from metals to plastics and training often has not kept pace. Stated simply, unqualified persons should vacate areas of burning equipment and summon first responders to deal with fires of **any** size. The plastics found most commonly in the telecommunications and electric utility industries are Polyvinyl Chloride (PVC), Styrene Acrylonitrile (SAN), Polyethylene (LDPE) and others. Burning plastics are extremely dangerous due to the toxic chemicals generated and airborne within the smoke they release.

Within the industry there have been several incidents where technicians moved burning equipment outdoors or entered equipment shelters to suppress a fire. Doing so has a high potential for lethal exposure to toxic gasses. Due to injuries and fatalities, professional first responders are trained to use Self Contained Breathing Apparatus (SCBA)[iv] when dealing with burning plastics. Employee safety policies and training should stress that fire extinguishers are placed to facilitate escape if fire blocks safe egress. These devices are not there for persons to combat fires unnecessarily.

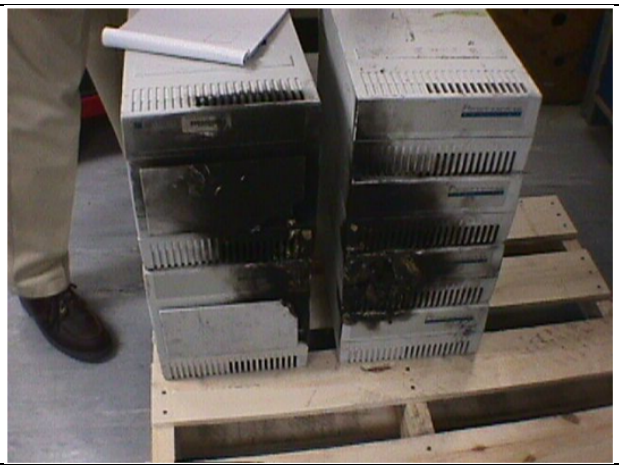

Figure 2 is of a small Uninterruptable Power Supply (UPS) with modular battery units with an internal design defect that resulted in a fire. A technician at the facility placed the burning equipment on a cart and wheeled it outdoors. While his actions were indeed heroic, he placed himself at a risk of death from inhailing toxins.

PPE and Electrical Issues

There is a myriad of instances in the industry where employees and contractors fail to use proper PPE when working in electrical equipment and supply panelboards. If the lapse comes during construction, the OSHA General Duty Clause is the governing Code. If the lapse occurs during maintenance activities, NFPA 70E is the governing document.

Shown below Left: working barehanded in a 220V panel in violation of NFPA 70E, an electrician caused a fault to a grounded lug (inset) while adding circuit breakers for additional rectifiers. The arc burned his hands and while rushing off the stepladder, he slipped and struck his chin atop the ladder, causing an impact laceration needing sutures.

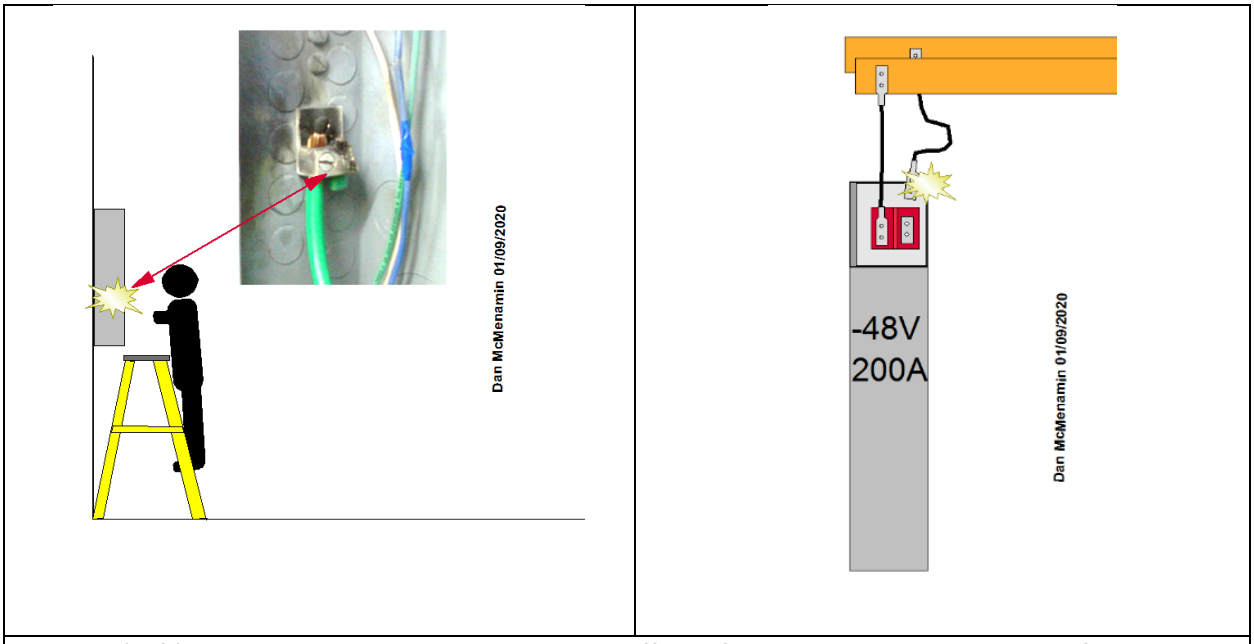

Figure 3 (Left) A barehanded electrical contractor suffered flash burns to his hands and a facial laceration from a slip and fall from the ladder. (Right) A barehanded contractor suffered burns to his hands and amputation of part of a finger while replacing cabling in a battery charger in a battery plant.

Shown Figure 3 right: A contractor replacing undersized output leads between a -48V 200A rectifier (charger) and the dc plant Charge Bus was working barehanded and amputated part of a finger when he accidentally caused an arcing incident. Specifically, he threaded a flexible 3/0 wire terminated in a two-hole lug through a hole in the top of the steel cabinet. He failed to insulate the lug from the cabinet or deenergize the wire. When the arcing began, the installer yanked back his hand with so much force that he bumped an edge on the cabinet door, thus amputating part of his finger. This accident was a failure of all participants in the NFPA 70E Live Work Process (called Method Of Procedure (MOP) in telecom). The MOP should have included PPE requirements and instructions either to disconnect the bus end first or to insulate the lug prior to pulling it through the cabling opening at the top of the cabinet.

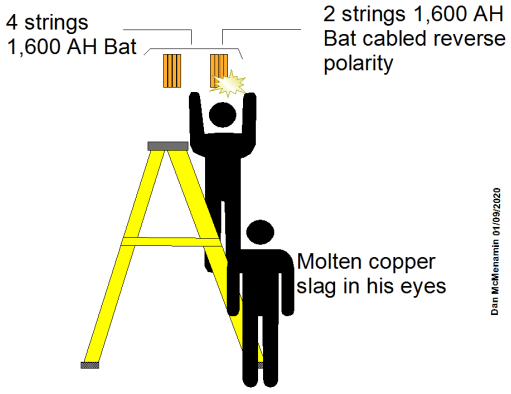

Figure 4: A battery installer suffered minor flash burns while connecting batteries to a bus incorrectly (Reversed polarity). His helper suffered corneal burns because he failed to wear safety glasses.

Protection From Falls - Ladders and Scaffolds

The misuse of ladders is very common in the industry. 29 CFR 1926.1050-1060 is a codified OSHA document that specifies requirements for stairways, ladders and scaffolds. This is an area where OSHA is particularly dogmatic about compliances. Yet, it is commonplace to see employees and contractors taking unsafe liberties with this code.

29 CFR § 1926.451[v] covers requirements for scaffolds and scissors lifts. The kinds of lift noncompliance often seen include overloading, overreaching and literally climbing the railings (see below).

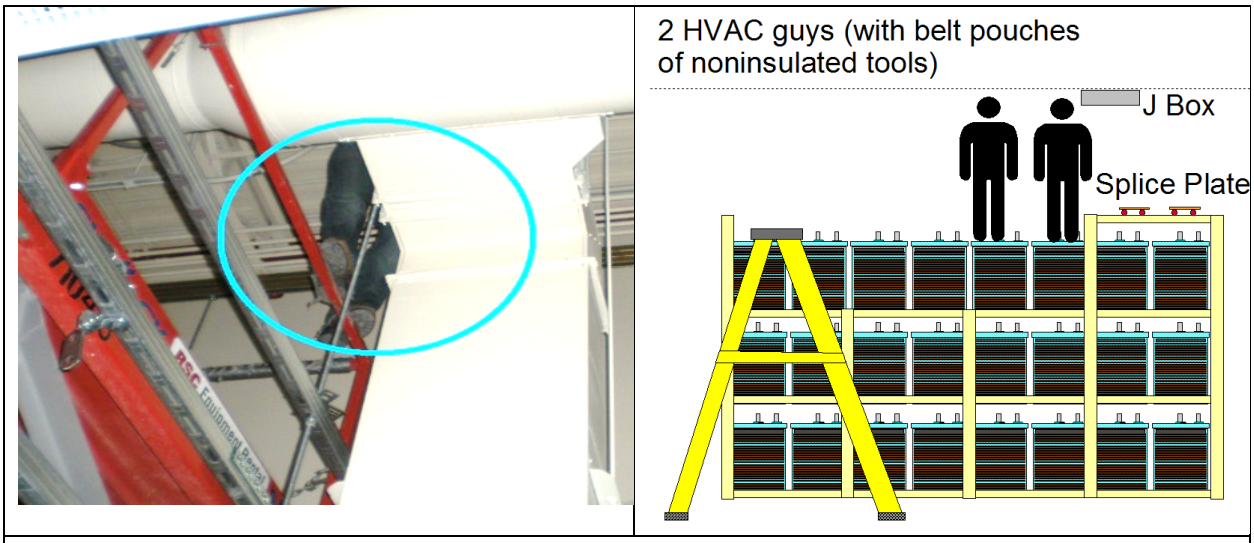

Figure 5 (Left) Contractor (circled) is standing on the railing of a scissors lift in a telecommunications facility. (Right) Batteries are not a scaffold.

Figure 6: One installer not wearing a hard hat and neither is wearing safety glasses.

It is sadly commonplace to witness a lack of PPE in both construction and maintenance activities in the industry. The most common include not wearing hard hats where required and not wearing gloves or eye protection.

With the issuance of NFPA 70E, the PPE requirements covering protection from arc flash and arc blast have changed markedly.

Heavy Metal Contamination

Under most circumstances, heavy metal exposures – primarily Pb (lead) in this industry – boil down to negligence in the workplace that take the forms of not wearing the appropriate PPE and often poor personal hygiene. Workers often eat, smoke and the like while they still have the toxins on their hands or clothing. Potential Pb exposures usually involve lead-acid batteries, older type intercell straps, older type solders. Further, lead and other toxic compounds often found in our industries can be transdermal and enter the body right through skin.

Battery manufacturers generally have a solid grasp on the safe handling of lead within the plant. Out in the field, however, it is disturbingly commonplace for installers or maintenance people to avoid the appropriate PPE while performing their work operations. Given the facts that gloves are cheap and the risks high, the practice of working barehanded needs to be weeded out of the workplace culture as grossly unprofessional behavior.

The pervasive attitude that PPE is for sissies persists and workers in various industries, including ours, all too frequently neglect it. Sometimes they do so because they're taking shortcuts or neglected to bring their PPE to work and sometimes citing discomfort. Another factor is group dynamics. If one employee skips the PPE, others soon follow suit.

Companies can ill afford employees with a "Rambo" mindset.

RoHS

The Restriction of Hazardous Substances (RoHS) directive is a European policy first adopted in 2003, also adopted in some of the United States. Often referred to as the "lead-free directive," the policy restricts the use of ten substances:

- **Lead (Pb)**
- **Mercury (Hg)**
- Cadmium (Cd)
- Hexavalent chromium (Cr^{6+})
- Polybrominated biphenyls (PBB)
- Polybrominated diphenyl ether (PBDE)
- Bis(2-ethylhexyl) phthalate (DEHP)
- Butyl benzyl phthalate (BBP)
- Dibutyl phthalate (DBP)
- Diisobutyl phthalate (DIBP)

Most of the restricted substances have to do with manufacturing processes. However, lead and mercury, are common in the field environment of the industry. As a result of the RoHS directive most – but not all - equipment manufacturers have switched to tin-based solders. Certain circuit board manufacturers have obtained an exemption to use lead solders because tin soldered connections tend

to be brittle and fracture in the presence of vibration. Without knowing which solders are lead versus tin, all circuit boards should be handled and stored carefully. These conditions should not create many problems in the field because the same procedures that protect sensitive electronic components from triboelectric charges (AKA ESD) such as handling by the edges and storing in ESD dissipative sleeves also prevent skin exposures to whatever solders might be present on a given product. Likewise, tin-plated lugs, intercell connectors and the like should be treated as if leaf was present because some of the tin-plating processes included lead in the alloy. Appropriate PPE should always be used when working on batteries. Older type terminal blocks utilized soldered connections and so proper precautions should be used when working with lead solders.

Eyewash Stations

Many battery rooms are equipped with plumbed eyewash stations and deluge showers. Rarely are these units flushed and high levels of dangerous bacteria often grow in the pipes that supply water to these fixtures. Per ANSI Z358.1-2014 Plumbed eyewash stations "shall be activated weekly for a period long enough to verify operation." Weekly testing helps flush the supply lines of sediment and bacteria build-up that is caused by stagnant water. Further, the ANSI Z358.1-2014 standard also requires portable and self-contained equipment "be visually checked to determine if flushing fluid needs to be changed or supplemented." In this consultant's opinion, bottled eyewash is a reliable addition to plumbed in stations. Bottles need no maintenance other than periodic replacement and can be used while someone is being transported to medical attention, thus getting a victim into treatment that much sooner.

Figure 13 (Left) Note that flushing the plumbed eyewash station could spill water on the floor so people tend to neglect the requirement. Hence, this type of fixture rarely if ever gets flushed. (Right) Non-plumbed eyewash stations and bottles are easier to maintain.

When Does OSHA Levy Fines?

OSHA tends to react most aggressively when its investigators determine that an entity is taking a casual attitude or blind eye towards safety. And while self-employed persons are exempt from OSHA, the companies that hire them are not, and are subject to penalties if they tolerate unsafe work practices by their contractors. OSHA requires that progressive discipline measures ranging in steps from a warning increasing through termination. Monetary penalties for nonconforming employees through unpaid safety meetings or classes might be a prudent interim step in policing our contractors.

The most severe penalties occur if the proximate[1] cause of a death or serious injury is the result of failing to meet code requirements or other severely neglectful actions.

Professionalism

In this consultant's opinion, a prudent approach to safety as well as overall job performance is to assert that companies in this industry are respected *professionals* and will act as such every hour of every day. Further, we expect any companies to whom we entrust work also shall perform their duties and meet or exceed the norms of professional behavior. There is no place in this industry for someone with a "wild west handyman" or "Rambo" approach. Professionals don't need to be nagged or coerced to wear safety glasses or other necessary PPE. It's simply part of the job and how professionals approach their work. People who often act unprofessionally need to find another line of work.

A positive methodology such as recognition / reward efforts paired with negative consequences when appropriate is valid and effective. Fostering a team approach provides impetus for good employees to lead by example and influence their coworkers to comply with safety rather than drag down their team's reputation. A long time ago, the United States Air Force realized that it wasn't just pilots who liked photos taken with their aircraft. The trivial cost of a few photographs that included support personnel as important members of the mission reaped rewards in improved quality and safety.

Saving Money (Because money talks!)

It is prudent to retain copies of training completion certificates for safety related courses. Generally, OSHA will allow discounted fines when proof of a "Good Faith" attitude toward safety can be demonstrated.

Insurance premiums are a significant cost for most companies in our industries. Many companies enjoy deep premium discounts by affiliating with the Voluntary Protection Programs Participants' Association, Inc[vi]. (VPPPA). VPPA is a membership-based organization dedicated to cooperative occupational safety, health and environmental management systems. As of this writing, they are a network of more than 2,300 companies and worksites who have achieved or are striving for occupational safety and health excellence, including the Occupational Safety and Health Administration's (OSHA) or the Department of Energy's (DOE) Voluntary Protection Programs (VPP). It would be prudent for companies to assess the financial benefit of membership with respect to their bottom line.

Conclusions

The workplace needs to be managed with good science and professional codes of conduct. Macho attitudes towards safety and a blind eye towards infractions simply have no place in this century. When people are working as a team of professionals – and looking out for each other – workplaces tend to improve. Compliance with relevant safety codes should be a part of the employer's Code of Conduct manual and employment contracts.

[1] Proximate: (Causal event), immediately preceding or following (as in a chain of events, causes, or effects)

References / Bibliography

[i] https://www.govexec.com/federal-news/2002/02/safety-and-health-violations-found-at-us-mint-plant-in-philadelphia/11114/

[ii] 1657-2018 - IEEE Recommended Practice for Personnel Qualifications for Installation and Maintenance of Stationary Batteries, Institute for Electrical and Electronic Engineers, NY, NY 2018, PP 11

[iii] DOL-OSHA-DEP-2021-001 2021 Annual Adjustments to OSHA Civil Penalties Department of Labor January 8, 2021

[iv] NFPA 1404 Standard for Fire Service Respiratory Protection Training, National Fire Protection Association, Quincy Mass

[v] 29 CFR § 1926.451 SAFETY AND HEALTH REGULATIONS FOR CONSTRUCTION Subpart L. Scaffolds, OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION, DEPARTMENT OF LABOR, 2019

[vi] https://www.vpppa.org/