

Personal Protective Equipment

An Antecedent to Safe Behavior?

By Jason Dean

It's a morning ritual at the job site. As starting time approaches, workers, some of whom were gathered in small groups talking casually in the dim light of the fast-approaching sunrise, and others who were sitting in their vehicles catching a few extra moments of quiet, begin to file into the site meeting trailer. Following a job and safety briefing on the day's planned activities, personnel don their basic site-required PPE and exit the trailer to perform designated work assignments. Does the PPE they wear play a role in their safety consciousness as they begin the work day?

That question led to the present study. To meet legal mandates and protect workers, companies worldwide are projected to spend \$33.3 billion on PPE annually by the year 2015 (Global Industry Analysts Inc., 2012). With such a significant investment in safety, are employers and organizations receiving only the practical functionality of the equipment they purchase or are other benefits realized as well?

Antecedents serve as triggers to specific observable behaviors (Reynolds, 1998). Krause (2001) defines *antecedents* as "events that precede and trigger behaviors; antecedents have both direct and indirect influence on behaviors" (p. 15). Some antecedents are controlled by management; examples of antecedents that employers have traditionally focused on as primary mechanisms for ensuring safety include machine safe-

guards, safety rules and procedures, displaying signs and posters, training, creating memos and displaying safety records in public areas (Reynolds, 1998).

This qualitative study aimed to explore the perceptions, attitudes and lived experiences of union laborers, equipment operators and professional staff regarding the effect of wearing PPE in an occupational setting and its role as an antecedent to safe behavior.

Most references to PPE by manufacturers and users in literature focus on the equipment's functional purpose, comfort and effectiveness. PPE also plays a wider, but less studied role in a company's overall safety program when taken in the context of behavioral antecedents. Workers take cues from their environment on acceptable behaviors.

Results of this study provide information for companies with workers who are required to wear PPE on the job. In particular, information was derived about workers' response to wearing PPE and their feelings about its effects on their safety awareness and behavior. The study also obtained information about what effect PPE has on the work environment.

IN BRIEF

•This qualitative study examined the perceptions, attitudes and lived experiences of union laborers, equipment operators and professional staff regarding the effect of wearing PPE in an occupational setting and its role as an antecedent in safe behavior.

•Most participants reported that the effects of donning and wearing PPE heightened their awareness, focused their attention and provided a cue to appropriate behavior. They also inferred information about work hazards and made assumptions regarding other workers and their employer from the presence of PPE.

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Assumptions, Limitations & Delimitations

Research assumptions are defined as self-evident truths by Leedy and Ormrod (2005). This study's validity was predicated on the following assumptions:

- 1) Participants will answer truthfully and accurately to the interview questions based on their personal experience (Bruyn, 1966, p. 91).
- 2) Participants' lived experiences could positively contribute to the revelation of the effects of wearing such PPE on their occupational cognition.
- 3) The researcher will be unbiased.
- 4) Audio recordings of the interviews will be a consistent and accurate representation of each participant's point of view.

Recognized limitations identify a study's potential weaknesses (Creswell, Hanson, Plano, et al., 2007). This study's limitations included the following:

- 1) Data may not be representative of other personal experiences.
- 2) Researcher biases and perceptual misrepresentations are also potential limitations in a qualitative study (Yin, 2003).
- 3) How the researcher reacts during the interview may affect the participants' responses (Yin, 2003).
- 4) Data resulting from the interviews will be analyzed using qualitative methods that may be subject to other interpretations.

Delimitations are limitations the researcher imposes deliberately on the research design (Creswell, et al., 2007). This study's delimitations were as follows:

- 1) All interviews were conducted face-to-face.
- 2) All interviews were audio recorded.
- 3) The target purposeful sample was 20 union laborers, equipment operators and professional staff at a hazardous waste remedial action site.

Methodology

Because the research goal was to explore the perceptions and lived experiences of workers regarding their responses to wearing PPE, the researcher used a qualitative design approach. This approach allows a researcher to identify, study and describe shared meanings of individuals (Moustakas, 1994). It involves the collection and analysis of data that are not easily quantifiable, and enables a detailed exploration of the subject with a flexible and responsive approach (Ritchie & Lewis, 2003).

Because the samples were not randomly selected, a nonprobability sampling method was utilized. Purposeful sampling (also known as purposive sampling) is a method in which the researcher knows that specific characteristics exist in a segment of the population and that those characteristics are critical to the investigation's results. The researcher then purposely selects participants who display the desired characteristics (Baumgartner, 2006). The purposeful sample population for this research study was union laborers, equipment operators and professional staff at a hazardous waste remedial action site who wear PPE as part of their daily job activities.

Research Ethics

Institutional Review Board approval was received for the use of human subjects. Written informed consent with permission to record the interviews was obtained from each participant.

Participants

Suzuki, Ahluwalia, Arora, et al. (2007), assert that the decision regarding the number of study participants is a reflection the study's purpose. Creswell, et al. (2007), suggest that 10 to 12 participants may prove sufficient in qualitative inquiries to understand participants' experiences and perceptions. The detailed and intensive work required for qualitative research necessitates a small sample size (Anderson, 2010).

Thus, a target sample size of 20 was solicited for participation from a group of approximately 40 employees on site based on these criteria: job assignment, experience on the job and history utilizing PPE. An invitation delivered to the purposeful sample generated 16 positive responses to participate.

Interview Process & Data Analysis

The approximately 20-minute semistructured interview sessions were audiorecorded, transcribed, coded, tabulated and triangulated. Participants were interviewed on the project site during regular work hours. The interviews began with a



The interviews began with a photo-elicitation segment during which two images (Photos 1 and 2) were shown separately. Participants were asked their opinions or associations regarding safety after viewing the activities portrayed in each photo.

Interview Questions

- Can you draw any conclusions about the safety of the activity depicted in the photograph? (Ask for each photograph.)
- When you observe someone wearing PPE, do you make any judgments or have any expectations about their safety behavior?
- Do you feel that PPE has a symbolic meaning?
- When you arrive at work, when do you first think of PPE?
- Does the experience of donning PPE impact your perceptions about the work you are about to perform?
- Can you describe your thought process when you select and don PPE?
- Does your view of safety change when you are wearing PPE?
- In your opinion, what are the main reasons why you wear PPE?
- Have you ever had an experience where PPE prevented or contributed to an injury? If so, did that event have an impact your attitude toward PPE?
- Can you describe an experience where you performed an activity without an article of PPE when it was required?
- What role, if any, do you feel PPE plays in preparing you mentally for the work day?
- Does the experience of wearing PPE give you a more secure feeling while working?
- When you are wearing PPE, are you consciously aware of the PPE when you are working?
- Do you feel that wearing PPE impacts your safety behavior?

photo-elicitation segment during which two images (Photos 1 and 2) were shown separately, and participants were asked their opinions or associations regarding safety after viewing the activities portrayed in each photo. The researcher selected the photographs based on the presence or absence of PPE on the photo's subject(s). To minimize any priming effect, no reference was made to PPE during the initial questioning. The interview then continued with a question-and-answer session focusing on each subject's own experiences not relating to the photographs.

Worker experiences reveal what is significant to each individual's understanding of PPE (Patton, 2002). A phenomenon may be described as an experience or occurrence that is observable (Babbie, 2003). Using individual interviews was the preferred research method because the study showed the subjects' perceptions regarding the why, how and what is occurring in their natural settings (Creswell, et al., 2007).

A qualitative theme analysis of the transcribed interview data was performed to identify themes among statements made by participants during the interviews. According to Moustakas (1994), statements made by participants relevant to the subject under investigation are essential to their experience and perceptions. Responses and/or statements were coded and grouped according to content

(Merriam, 2009). A process of axial coding, in which the codes are related to each other via a process of both inductive and deductive reasoning, was employed to identify similar occurrences in the data.

These common constituents (responses) were then used to generate themes that represented the perceptions of the group, achieved by first grouping the common constituents into thematic categories.

The thematic categories identified are presented, and verbatim excerpts from the participant interviews are shared to clarify and highlight key concepts. Stemming from the identified thematic categories and the constant comparing of elements and categories throughout the analysis, overarching themes were developed (Merriam, 2009). These themes described the perceptions of the group as a whole and, as such, represent the conclusions of the analysis.

Methodological triangulation and data triangulation were utilized to increase the study's validity. Triangulation involves using two or more methods to study the same phenomenon, while validity refers to the extent to which the findings accurately reflect the phenomena under examination. Photo-elicitation was combined with in-depth interviews for methodological triangulation (see "Using Photo-Elicitation" sidebar on p. 45).

Data triangulation was achieved by interviewing three groups of stakeholders involved in the job site's field activities (operators, laborers, professional support staff) and allowing the participants to perform checks for accuracy and to validate that the content of their individual interview transcripts correctly captured the intent of their responses. An interview protocol was used to ensure consistency across all interviews conducted. Questions were pilot tested for clarity, then revised as needed based on feedback.

Results

Data from 12 of the 16 interviews (designated in the study as Record with a corresponding number, e.g., R_2) from the three primary sample groups (Table 1, p. 44) were included in the analysis. Three interviews were used as pilot tests and not included in the study, and one interview was eliminated due to a recording failure. Interviews were conducted over 2 weeks in March 2013. Data saturation occurred after 12 interviews, when no new information was emerging. Characteristically, 75% of the

participants had worked more than 10 years while wearing PPE and 66% had worked on hazardous waste remediation projects for 10 or more years. No women were employed in the crafts on this site.

Interview Data

The photo-elicitation portion of the interviews resulted in 92% of the subjects noting the presence of PPE in the first image they were shown (Photo 1, p. 42) while they were evaluating the photograph for “safety,” while 100% of the subjects noted the absence of PPE on the individual in the second image they were shown (Photo 2, p. 42). The term *safety* was defined as the condition of being safe; freedom from danger, risk or injury.

The process by which participants arrived at the responses tabulated in Table 2 was the focus of the data analysis in the photo-elicitation portion of the interviews. Subjects verbalized the cues they were using to infer information from the photo; the responses ranged from environmental conditions, ergonomics, rigging practices and body positioning to tool usage. PPE was the only common element mentioned by all study participants and it was the

first cue utilized by 66% of the subjects. A representative comment regarding Photo 1 is as follows:

There’s an elementary understanding of safety in the form of PPE based on the picture. Guys are wearing gloves. Guys are wearing boot covers. They’re taped. Areas of potential wear and tear on the boot covers are taped in advance, so there’s some knowledge and instruction that’s occurred. (R_2)

The link between PPE and safety was more evident when participants viewed Photo 2. The individual wearing casual attire with no PPE invoked comments such as:

[T]he one guy giving the hand signal has no hard hat, no steel toes [and] nothing. I mean, he definitely is going to get hurt. (R_14)

[T]his guy should not even be in the area because there are four guys in the area; three of them have hard hats, safety vests and steel-toe boots, and one guy has no PPE at all. Three guys do. He is unprotected therefore he should not even be in the area. (R_7)

During the analysis, two major themes were identified: nonverbal communication and cognitive effects of wearing PPE. To probe positive or negative biases toward PPE, participants were asked about their personal experiences with PPE and whether it had ever prevented or contributed to an injury, and if so, had that event affected attitudes toward PPE. Forty-one percent said that PPE had protected them against an injury. They held a positive view of PPE as reflected in this excerpt from one response:

Yeah, I definitely thought, “Wow I was lucky I had those on.” Definitely. (R_9)

Also, the effect of witnessing an incident in which the lack of PPE played a role produced the same favorable effect on attitude as those in the study sample who had personally experienced an event:

It helps you realize that PPE is a necessity. It’s not a burden. It’s a necessity. (R_20)

No participants in this study reported that PPE had contributed to an injury.

Nonverbal Communication

In the course of the interviews, 83% of the participants referred to nonverbal information that PPE transmitted to

Table 1
Participant Characteristics

Characteristics	n	%
Age range		
25-35	3	25
36-45	6	50
46-55	3	25
Craft		
Laborer	4	33
Operator	3	25
Support staff	5	41
Years of experience in craft		
3-5	1	8
6-10	2	16
11-15	3	25
16-20	3	25
21+	3	25
Years of experience on hazardous waste projects		
1-3	1	8
3-5	1	8
5-7	2	16
10+	8	66
Years of experience working in PPE		
3-5	1	8
6-10	2	16
11-15	3	25
16-20	3	25
21+	3	25
Gender		
Male	12	100

The purposeful sample population for this research study was union laborers, equipment operators and professional staff at a hazardous waste remedial action site who wear PPE as part of their daily job activities.

them when they observed it being worn by others. These subjects reported that they inferred information about hazards in the immediate work environment and made assumptions about the individual wearer and his/her employer from the presence of PPE.

The following comment reflects how PPE provided information about the type of environmental or physical hazards present:

It would help me understand what I'm getting into if I go onto that job site. (R_20)

The wearing of PPE also transmitted information about the safety attitude, competence and training/education of the individual wearing the PPE:

They're a little bit more educated since they're wearing PPE . . . a little more safety conscious. I guess it shows that they've at least been—somebody's showed them the right [way] . . . [and they] have the right attitude toward safety. (R_11)

The presence or absence of PPE was not the only factor participants considered. Using PPE inappropriately (e.g., wearing it upside down) or mismatching PPE with a particular hazard could be perceived as a sign of inadequate training and/or incompetence. Participants also reported that they made inferences about employers:

In the sense that if you see somebody that's in PPE, I have a kind of a base expectation that they have been prepared for the job or should have been. But that suggests that there is some sort of professional involvement in them having been trained or prepared for the work that they're doing. So, if I looked at two groups of people that were charged with doing the same job and "Company A" over here has all the proper PPE (what I would consider proper) and "Company B" has a mix of people dressed in a variety of PPE, I would probably assume that Company A is more prepared from a safety standpoint. (R_2)

Three participants noted that the presence of PPE on an individual would indicate to them that they are part of a safety program, but these subjects refrained from making judgments about the individual until they observed behaviors:

Behaviors, you have to watch their behaviors to understand their interest or dedication to the safety program. They look the part, but watch and determine if they act the part. (R_3)

Cognitive Effects of Donning & Wearing PPE

Questions about participants' experiences donning and wearing PPE revealed the effects on their

Table 2

Photo-Elicitation Responses

Participant's opinion	Photo 1	Photo 2
Safe	6	1
Unsafe	0	8
No opinion/need more information	5	2

Using Photo-Elicitation in Research Interviews

Photo-elicitation originated in anthropology and sociology in the 1950s and is based on the idea of inserting a photograph into a research interview. Harper (2002) explains that the difference between interviews using images and text, and interviews using words alone lies in the ways people respond to these two forms of symbolic representation. Images evoke deeper elements of human consciousness than do words; exchanges based on words alone utilize less of the brain's capacity than do exchanges in which the brain is processing images as well as words, which elicits more information as well as a different kind of information.

cognitive state. The first exposure to PPE in a routine workday typically occurred after arriving on the project site and before entering any work areas. Participants reported that the effects of donning PPE heightened their awareness, focused their attention and provided a cue to appropriate behavior:

Putting on PPE gets me into an attitude of preparing to do the work. It does change my attitude on getting ready to go out in the field. (R_3)

[PPE] makes you think about what you're doing . . . and makes you focus more on it. (R_19)

If I start putting on PPE, it triggers [me] to think of the precautions for what I figure I'll be doing. (R_7)

[PPE is] a trigger. It's triggering appropriate behavior. (R_2)

Ninety-one percent of respondent's reported having a protected feeling as a result of wearing PPE:

It's always in the back of your mind that you are taking precautions to be protected. (R_10)

The cognitive effects of donning and wearing PPE were reported to fade as participants acclimated to wearing the PPE, depending on its intrusiveness on the wearer's awareness [for example, safety vest (low) vs. respirator (high) or in OSHA HazWOPER standard terms, Level D vs. Level A]. However, new or unfamiliar PPE could refresh the experience for the wearer. One participant's response to being asked if he was aware of his PPE while working provides an illustration of acclimation:

No. [It's] just like second nature. (R_17)

This individual had more than 10 years' experience in the hazardous waste industry.

Finally, 83% of the participants felt that PPE affected their safety behavior in a positive manner.

The following statement represents a common theme in response to the question: “Do you feel that wearing PPE impacts your safety behavior?”

[I]t probably makes me more safe just for the whole fact of putting on PPE, the [safety] vest, everything, makes me more aware, I guess [it] makes me think about things a little bit more instead of just doing them. (R_11)

Two participants felt PPE did not affect their safety behavior.

Discussion & Conclusion

This qualitative study aimed to explore the perceptions, attitudes and lived experiences of union laborers, equipment operators and professional staff at a hazardous waste site who wear PPE as part of their job assignments, as well as their occupational cognition of wearing PPE and its role as an antecedent to safe behavior. Two research questions drove the methodology:

•RQ1: What is the symbolic meaning of PPE to the workers?

•RQ2: What are the perceptions, attitudes and lived experiences of staff who wear PPE about the effect of wearing such personal safety equipment on their occupational cognition and its role as an antecedent to safe behavior?

As noted, this analysis produced two distinct themes: nonverbal communication and cognitive effects. Each theme consisted of subthemes as well (sidebar at left; Table 3). The results highlight PPE’s multifaceted role when viewed in terms of an antecedent to safe behavior. Based on the photo-elicitation interview responses, most participants associated PPE with the concept of safety and viewed PPE as a tangible indicator or symbol of safety. To study participants, PPE had a literal function as protective equipment and also served as a source of information about

hazards and provided clues about the individual wearer and/or employer’s safety attributes.

Krause (2001) defines antecedents as “events that precede and trigger behaviors; antecedents have both direct and indirect influence on behaviors” (p. 15). Donning and wearing PPE played a prominent role as a behavioral trigger for most participants in this study. By observing PPE in the work environment, they inferred clues about hazards in the environment that helped them select appropriate safe behaviors. In addition, the cognitive effects that the PPE induced in participants as they donned and wore it served as direct influence on their immediate behavior. **PS**

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Major Themes

Nonverbal Communication

Subthemes

- Hazards
- Assumptions

Cognitive Effects

Subthemes

- Awareness
- Focused attention
- Behavioral trigger

Table 3

Summary of Themes by Participant

Participant ID	Nonverbal communication		Cognitive effects			
	Hazards	Made assumptions	Awareness	Focused attention	Trigger	No effect
R_2	X	X	X	X	X	
R_3	X	X	X	X	X	
R_7	X	X	X		X	
R_8	X		X	X	X	
R_9		X	X			
R_10		X			X	
R_11	X	X	X	X	X	
R_14						X
R_15	X		X		X	
R_17	X					X
R_19	X		X	X	X	
R_20	X		X			