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Agricultural Machinery Operator Safety

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SUMMARY:
Presents an alternative way of looking at Agricultural Safety, that is, by applying Forensic Investigation, forensic Engineering, and Forensic Science techniques to accidents and illnesses specifically involving the operator. No one is saying the way Agricultural Safety incidents have been investigated in the past is wrong, rather, a different approach is suggested for future investigations. The aviation industry has been using these techniques for years and today air travel is the safest mode of transportation.

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No matter who we talk to, as soon as we begin to describe our work on agricultural accidents, people eagerly express their opinions on the causes of accidents. Without a doubt, these causes include carelessness, haste, fatigue, risk-taking, inattention, operator's fault, and inexperience. In this respect, the convictions of experts, such as industrial designers and manufacturers, do not differ much from those of laypeople. A common feature in the spontaneously shared opinions and convictions is that the user or operator is the one who is to blame and technology is without fault.

In this paper, we look at how the reporting of accident information leads to inaccurate reporting of accident details and how using forensic investigation procedures can improve the information we have about an accident so that improvements can be made in Agricultural Safety. We demonstrate that these commonly held opinions of the causes of accidents have limited tenability and regularly turn out to be merely misconceptions. Such misconceptions are to be avoided in agricultural accident investigation because they divert attention away from the focal point: the anticipation and prevention of accidents. Rather than trivializing the analysis of accidents to haphazard so-called satisfactory explanations, we suggest an approach in which the consecutive co-occurrences of a functioning product, user activities, environment, human factors, ergonomics, risk factors, behavior-based safety, role analysis, risk assessment, attention deficit disorder, safety philosophy, measuring safety system effectiveness, human factors, attitude, operator stress, operator development anthropometry, stability factors, and training are taken as the starting point for clarification. This approach emphatically values the perspective of the users.

THE VIEW FROM THE ARMCHAIR

The abundance of misconceptions about agricultural accidents is generated from the lack of detailed accident data and the dissemination of the misconceptions. M.F. Weegels (1998), using mail and phone questionnaires to follow-up research on accidents, found that only general information was known about the accidents. A typical example of an accident description obtained in a questionnaire would be, “While sawing a plank with a circular saw, I hit the blade with my thumb. My thumb was amputated." Such a description provides an excellent breeding ground for "armchair views" on the occurrence of accidents, views that will never be challenged as long as general accident descriptions prevail. Therefore, we recommend using forensic investigation methods for collecting detailed data based on facts from real-life accidents.

WET BEHIND THE EARS

User inexperience is often mentioned as a cause of accidents. To find out more about victim's familiarity with the products involved in their accidents, the victims were asked how frequently they had used the product prior to the accident. Seven percent were using the product for the first time, but the remaining 93% used the product fairly frequently. For those who had frequent experience with the product, the use varied from several times a day to a few times a year. Products with a low frequency of use are generally used for a longer period of time. It is

important to recognize that experience, as opposed to inexperience, is also frequently regarded as a cause in accidents since attention to safety details may decrease when the user is experienced.

What is the message considering the majority of victims are familiar with the products through prior and/or often, frequent use? It is widely recognized that attempts to educate users results in little benefit. Users are not inclined to read operating manuals. When you purchased your last automobile or pick-up, did you read the owner's manual before first driving or operating the vehicle???? Rather than resort to such manuals, agricultural safety specialist should consider the long-standing habits that develop through frequent use or operation of an agricultural product. These habits may completely undermine functionalities of newly designed products.

THE ALLURE OF RISK

Users are often suspected of taking too many risks, or even of deliberately seeking the pleasure of risk. Victims were asked whether they had been aware of running the risk of injuring themselves while working with the product, 74% said they were not aware of running any risks. It never occurred to them that an accident could happen, or they believed themselves to be sufficiently cautious. By their very nature, farmers are risk takers. Twenty-six percent reported they were aware of running the risk of injuring themselves, have had accidents with the product previously, or they knew that the way they were using the product at the time of the accident was a manner in which the product was not meant to be used as they used it. Some people responded explicitly that they realized they were taking risks, but that they took no precaution to avoid injury. For example, it would take too much effort to get or use the proper tool.

The fact that the majority of victims reported no perception of risks during the use of a product maybe related to their familiarity with the product. Regularly used products are best seen to be operated on a skill-rule based level (Rasmussen, 1986), rather than on a knowledge-based level involving conscious decision making, as is widely assumed in risk-taking theories. All of the reams of agricultural safety publications have done very little to raise the risk awareness of farmers and farm workers.

ATTENTION, *** PLEASE ***

Accidents are often seen to be caused by inattention, haste, and fatigue. Victims reported in 64% of the cases that inattention, haste, and fatigue did not apply to them at the time of the accident. However, 36%of the victims reported they were tired, drowsy, irritated, distracted, lazy, careless, or in a hurry at the time of the accident. Approximately, 30% reported their condition, or state of mind may have contributed to the accident or their reactions. These findings raise two important issues:

First — Unless the user is questioned about the influence of internal conditions (being hurried, lazy, worried, tired, etc.) on his or her activities, taking for granted the relevance of the user's state of mind in occurrence of agricultural accidents seems groundless.

Second — Being distracted, drowsy, hurried, or irritated appears to be common in everyday life. Rather than identify these as the users' problem, one can equally well consider it a designer's responsibility to account for these common conditions. A successful example is the shut-off provided on

fuel fill hoses. The safety shut-off accounts for users' preoccupation with other business (service activities on the machinery) at the critical moment when the fuel tank is full and the fuel flow must be stopped.

UNUSUAL PRODUCT USAGE

As a victim of an accident, users are commonly perceived to have done something peculiar or extraordinary with the product, deviating from its intended use. The idea behind this concept is that accidents can be prevented by eliminating deviations. Generally, farmers and farm workers have great freedom as to when, how and where to use a product. There are no explicit agricultural references for deciding what is normal and what deviates, farmers and farm workers determine this.Only24% of the accident victims reported no deviations. Whereas, 76% reported or perceived from 1 to 6 deviations in the use of the product involved in the accident. Investigation revealed that only 26% of the reported variations actually were the cause or contributed to the accident. In other words, 74% of the accidents would have occurred in the absence of the deviating condition. For example: a farmer was hit by a piece of steel flying off a wedge while he was splitting wood. He was splitting the wood in the early afternoon instead in the early morning when he normally split wood. The unusual splitting time cannot be pinpointed as contributing to this accident. The concept of deviations associated in the use ofa product can only be loosely associated with the occurrence of accidents.

THE WRONGDOER -- THE USER

When confronted with videotapes of real-life accidents, the first thing experts involved often say is, "But the product was never intended to be used like that!" An example is a woman who used a children's table as a step to take something from the cupboard. When she did so, the tabletop broke at four of the six screws, and a long screw cut a 20 cm gash down to the bone in her shin. A common reaction to this accident is that tables are not intended to stand on. Is this woman a wrongdoer? Not if we look at her side of the story.

The tabletop consists of chipboard, which is fixed to the frame with six screws. According to the victim, the table gives an impression of firmness because of the thick screws; there is nothing to indicate that the table is fragile. From her point of view, the table could be used as a handy step. In this respect, disqualifiers denoting perceptions, cognitions, and uses as false, improper, or wrong completely miss the point, as if any implicitly designed use is the only correct way to use a product. The product designer's view point may be completely at odds with the user's perspective of what constitutes reasonable use of a product. In addition, it is in contradiction with the designers' legal responsibility to take into account reasonably expected usage.

In reality the question must be, "'What Happened?" rather than "Whodunit?"

Accident reconstructions reveal the importance of people's perceptions in product use. By recording participants' visual field with a helmet-mounted camera, it has been discovered that some victims could not see the position of their hands or fingers in relation to the sharp parts or pinch points of the product. Several victims said they thought the product looked safe - as in the case of the children's table used as a step. Yet, prior to the various accidents, the product did not provide any indications about its condition. If products had revealed their hazards adequately in these cases, users **might have acted differently**. The real question is whether people will act differently if they are aware or are able to act differently. Warnings and pictograms are placed on ladders, yet people still misuse ladders.

The foregoing issues emphasize that it is not at all self-evident users interpret facts, and functional clues when using a product.

THE AGRICULTURAL SAFETY SPECIALIST RESPONSIBILITY

Safety is only one of the many aspects agricultural safety specialists must take into account, and there are limitations to what designers can do. For example, there is little designers can reasonably do when the primary function of a product can cause injuries, such as the sharp parts of a knife or the gathering chains and rolls of a corn head. Clearly, the challenge is to anticipate accidents, of which the causal mechanisms are not clearly, if at all, understood.

WHAT EXPERIENCE INDICATES

In our work as forensic engineers, architects, and scientists we seldom deal with a common incident. We are called upon to investigate the one-off type incident. Our job is to thoroughly investigate the incident, to identify the facts, establish from the facts what can happen without breaking natures' laws, eliminate all natural causes, eliminate all accidental causes, determine if the incident was intentional, analyze the information, and put the results in a form that can be used for negotiation. Over the past 35 years, we have developed methods and procedures that today allow us to develop a "**legally defensible report**."

In each case we develop a body of information about a one-off incident that allows us to understand the case and to be able to explain that information to users, victims, engineers, scientists, lawyers, judges, juries, naive and experienced operators. Many times we find the commonly accepted causes of incidents have nothing to do with the case. Rather we may find that machinery designed to the present accepted safety practices within the industry result in the actual cause of the injury.

The following is an outline of the report form used in putting the case information in a condition so that it can be communicated.

Report Form Online

1. DESCRIPTION:

(The description is a narrative of the case as we were informed at the time we were asked to become involved in the case. This section includes the directions we have been given in the case and describes the work requested by the client.)

2. AVAILABLE INFORMATION:

(The materials and documents that have been provided by the client, along with documentation we have generated, are listed in this section. Some reports may only have one or two items; while others have been known to take as many as eight pages. The information listed here will allow anyone reviewing the report the opportunity to review any and all of the documentation that was in used arriving at our conclusions and in developing the report)

3. DESCRIPTION OF THE INCIDENT:

(A description of the incident is written. This is a restatement of the description given in the introduction along with additional details that were not available at the time we were requested to start work on the case. This is a statement of the situation as we know it to be after we have completed our investigation. No analysis is provided, only the facts as we know them.)

4. ANALYSIS OF THE INCIDENT:

(In this section the various hypothesis are stated and a narrative is presented based on the facts of the case to either eliminate the hypothesis or to support it. Through the process of elimination, all non-supported hypothesis are eliminated leaving only those hypothesis that are supported by the facts of the case, physical laws, natural occurrence, visual inspection, testing, etc. No hypothesis can be accepted that is not based on acceptable technology. Assumptions, 'it sounds right' or an ipse dixit, are not acceptable basis for accepting a hypothesis.)

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