Utilizing PDPC to Forecast Hidden Hazard and their Consequences in order to Promote Products Safety

製品安全向上のためのPDPC手法を用いた製品の潜在危険評価について

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1. Introduction

Around us in current time, there is a variety of consumer products types; variety in purpose of use, size, the way of use, and other features. With the increase of these products number, the issues of safety when using them have become more demanding to be taking in account when designing and selling these products. According to statistical data of NITE in 2009, 2,759 accidents when using consumer products have been recorded, and 1,862 are the accidents caused by the way of usage of them[1].

In order to minimize the possibility of accidents occurrence, ISO/IEC Guide 51 for risk assessment process is usually used in manufactures. This process consists of several steps of defining intended use and reasonably foreseeable misuse, hazard identification, risk estimation, risk evaluation, and risk reduction [2]. To promote this process, hazards list is prepared, however the list contains hazards inherent in the product itself like electric or mechanical hazards. The hazard list also contains ergonomics or human error as hazards which are usually caused by poor human interface design to cause accidents. However, the problem arises when using consumer products that do not have hazards inherent in their design from the hazards list, that accidents still occur when using such products; the hazard is *hidden* in such a case.

Therefore, the aim of this research is to try to address the problem of hidden hazards at consumer products. First step is investigating the meaning of the term of hidden hazard in detail, then proposing a method to find and to cope with hidden hazards. A simple case study with the proposed method will be also conducted and discussed.

2. The Meaning of Hidden Hazard

At some consumer products that do not have obvious hazards like electric, mechanical or ergonomic hazards in themselves, accidents still occur when using them; at products like a bicycle chair for a child or playground equipments such as jungle gyms, accidents like falling of children from them occur. In this study, we name the cause of such accident *hidden hazard*.

3. Proposing the Suitable Solution

The solution is based on adapting PDPC (Process Decision Program Charts) method; it is used to see the flow of the project plan and to anticipate the obstacles that could stop the flow of the plan; it can help in preventing problems occurrence and uncertain events that could occur during the flow of the project plan [3] [4]. To use PDPC, the start point and the end point (the desire goal) of the project plan must be specified at first, then the events of the plan and the desired expectation of each event on the project plan flow is described. To reach to the goal, all desired expectation must be achieved; the unwanted events that could deviate the plan must be discovered for each event, then the countermeasures against each unwanted event must be described in order to return to the right project plan flow. As for safety investigation, there is a trial where PDPC was used to investigate the shipwreck accidents [5]. We have therefore decided to use PDPC to discover the hidden hazards. The reasons for choosing PDPC are;

1. The task flow or the recommended scenario can be described in the same manner of describing project plan in PDPC.
2. Instead of obstacles that could stop the plan flow, the hidden hazards like misuse cases and their consequence can be described.

Fig-2: A part of the results of PDPC chart

4. Designing the Process for Discovering Hidden Hazards

The proposed flow of the process is as follows;

1. Describing the recommended scenario to use the targeted product; the start point is the product before being used, the end point is the product has been used safely. In between, the flow of recommended scenario is described
2. Discovering hidden hazards by taking each event in the recommended scenario and looking for the deviation from it. The deviation corresponds to the hidden hazards. The consequences of each hidden hazard are also described.
3. Describing the countermeasures for hidden hazards to return to the recommended scenario.

5. Case Study

A simple case study was conducted to exam the proposed method. The product is a bicycle chair for a child. It had been checked by OSHA hazards list, and no specific hazard was observed in its design. An image is shown in Fig-1.

Fig-1: The targeted product

6. Results & Discussion

A part of the final PDPC chart is shown in Fig-2. By observing the chart, we have found that the unwanted

events are not only caused by misuse as hidden hazard; they were a mix of misuse like misunderstanding of the right usage, unintended human errors done by the primary or secondary user, or problems in the markets or production process like selling unsuitable size of the product by shop staffs. The market or production process problems that cause accidents by hidden hazards are made by manufactures or merchandisers.

7. Conclusion

We have made an attempt to handle the problem of hidden hazards; PDPC method has been used. It was found that not only misuse but also human errors, market and production process problems could trigger hidden hazards. The expectation is that this method could help in promoting consumer product safety that related to hidden hazards.

References

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