Human Factor Analysis Method for Improving Safety Management

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It is thought that there are problems related to the safety system or safety climate of an organization even when an accident is triggered by the result of an individual's work. To solve these problems, an organization needs to make an assessment to determine how to deal with the issues. To prevent accidents caused by human errors, we have to assess what the events (human errors) are that make the accident and what factors (human factors) influence on the occurrence of events. We have therefore developed a technique for on-site level of railway organizations. This is aims to analyze the background factors behind human errors rightly and easy. Three analyzing processes integrate into this (Fig.1).

In the first stage, we clarify what actions (human errors) are the events that lead to accidents. Therefore, we put related elements such as work content (S), the actions of workers and inspectors (L) and machine conditions (H) in time series expressions (Fig. 2) in time series expressions (Fig. 2). The range of investigation includes the contents of instructions and plans to examine whether there are problems that may have caused human errors. Time series is place in order of PDCA cycle (Plan-Do-Check-Action). The PDCA cycle is a management concept to improve the quality of an organization or work performance and to draw continuous improvement. To ensure that the results of the action of a worker (D) are appropriate, the plan and instructions (P) at the preceding stage must be appropriate. Moreover, to ensure that the plan and instructions (P) are appropriate, the check and record (C) and any action taken to deal with trouble (A) at the preceding stage must also be appropriate.

In the second stage of the analysis, we track the cause (background factor) that generates the events (human errors) linked with accidents by means of "why and why analysis." It is thought that, in the background of a problem event, there are multiple reasons which may lead to the event. Further, there may be deeper background factors that lie behind these reasons. When we pursue an accident event to its root cause, we repeat the analysis on "why it has become so" several times to determine a clue for solution. To avoid the repetition of irrelevant questions "why," it is important that "what the problem event is as the object of analysis" is definitely grasped at the first stage. Furthermore, we check whether the viewpoint for analysis has multiple aspects and whether tracking efforts have reached the management factors. To implement multi-viewpoint analysis, it is advisable to deploy multiple analyzers.

After collecting information in depth on the background factors at the first and second stages, we finally discuss accident prevention measures. We select functions out of number of conceivable candidate concepts and combine to achieve maximum effectiveness. Even though the contents of measures may have no faults, those who implement them are human beings. To prevent unexpected problems caused by new measures, therefore, it is more important than the measures contents that the reason why they are being implemented is understood throughout the organization.
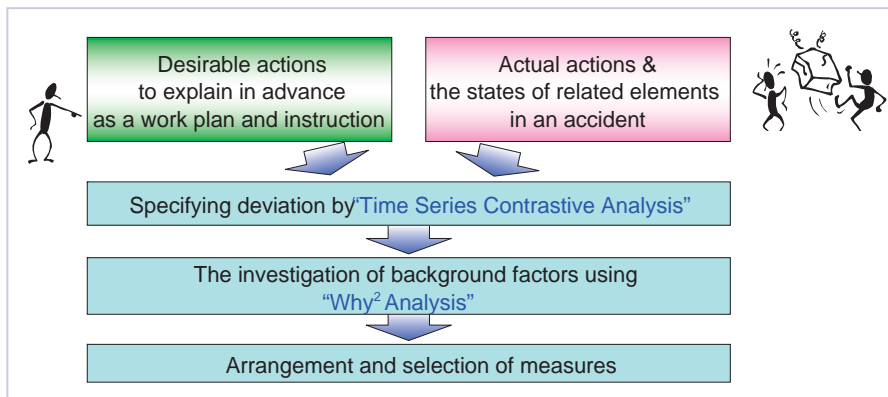

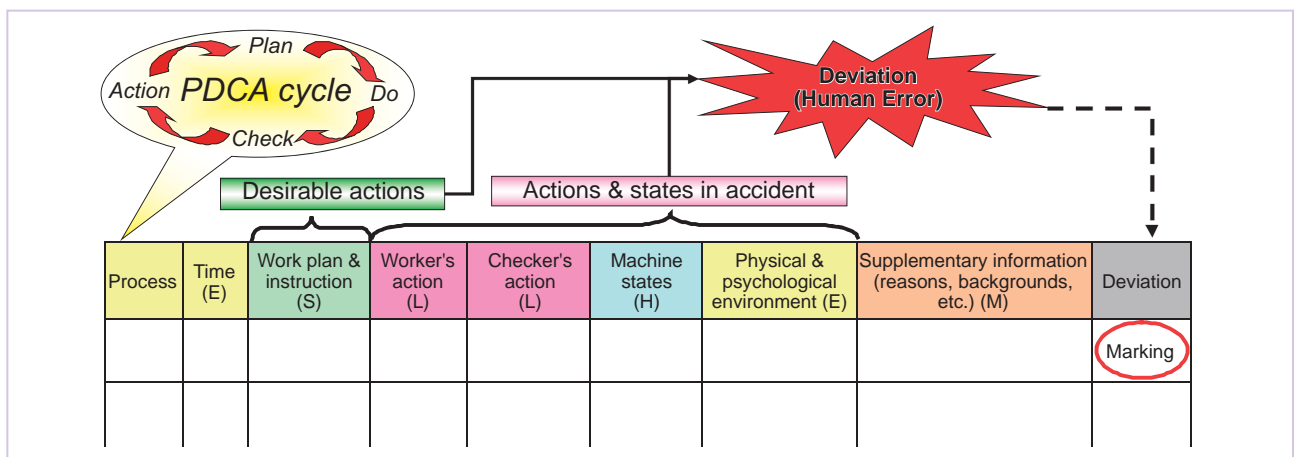**Fig. 1** Three procedural steps in human factor analysis

Fig. 2 How to describe "Time Series Contrastive Analysis"