

# RESILIENCE ASSESSMENT GRID (RAG) FOR FACILITATING SAFETY CONSCIOUSNESS OF NUCLEAR POWER PLANT PERSONNEL

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## Abstract

Our experience of applying the Resilience Assessment Grid (RAG) method to nuclear power plant personnel is described. Various countermeasures have been introduced in every Japanese nuclear power plant (NPP) in order to meet regulatory requirements issued after the severe accident at Fukushima-Daiichi NPP. These requirements cover diverse hardware installation, human resource enhancement, and managerial improvement. However, although these countermeasures will improve the safety of NPPs in principle, they may also have negative impacts. The most likely negative impact of such strict regulations is loss of operational flexibility, i.e. degradation of resilience potential.

The RAG method has been introduced to avoid degradation of resilience potential. However, in a preliminary stage of applying the method, the plant personnel were reluctant to accept the idea of improving operational resilience. They believed that any anomaly could be handled by following predefined operational procedures, and were reluctant to rely on resilient behavior to handle unexpected situations.

Therefore, the RAG questionnaire was modified to overcome their reluctance. The first modification was to ask interviewees to answer a set of questions related to a class of anomalies that may lead to a severe accident. This version of the modified RAG is called the *restrictive RAG*. In the second modification, the NPP operators were asked to answer mainly questions about the potential to respond and the potential to monitor, while the plant personnel in the safety division, who are responsible for developing procedures, were asked to mainly answer questions concerning the potential to learn and the potential to anticipate. This modified version of RAG was called the *cross-divisional RAG*. Finally, in the third modification, the set of questions focused on envisioning potential difficulties in conducting tasks that the interviewee is assigned to. This version of RAG was called the *brittleness-oriented RAG*. Through attempts over several years, the *brittleness-oriented RAG* was found to be useful as an introductory practice for other RAG surveys. In addition, the *brittleness-oriented RAG* itself was found to be a useful tool for facilitating consciousness concerning possible weak points of the NPP even after implementing various countermeasures. Enhancing safety consciousness seems to be indispensable for developing resilience potential in the organization.

**Keywords:** resilience assessment grid (RAG), safety consciousness, nuclear power plant