

# THE ANALYSIS OF TRACE/FRAPTRAN IN ULTIMATE RESPONSE GUIDELINE FOR LUNG MEN ABWR NUCLEAR POWER PLANT

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## ABSTRACT

There is more concern for the safety of NPPs in Taiwan after the Fukushima nuclear power plant (NPP) disaster occurred. Therefore, Taiwan Power Company developed an additional ultimate measure category, ultimate response guideline (URG), to prevent and mitigate Taiwan NPPs from encountering core damage for events beyond design basis. The main actions of URG are the depressurization and low pressure water injection of reactor and containment venting. Lungmen NPP is the first ABWR NPP in Taiwan. In this study, we focus on the thermal-hydraulic and fuel rod performance analysis for the URG study of Lungmen NPP. Therefore, TRACE/FRAPTRAN model of Lungmen NPP was developed in order to estimate the URG efficiency under Fukushima-like conditions. TRACE/FRAPTRAN analysis results show that the URG can keep the PCT below the criteria 1088.7 K under Fukushima-like conditions.

## KEYWORDS

TRACE, URG, ABWR, safety analysis, FRAPTRAN.

## 1. INTRODUCTION

There are more concerns for the safety of the NPPs in Taiwan after Fukushima NPP disaster. In general, there are four categories for the NPP operating state, which involve normal operation, abnormal events/transients, accidents and severe accidents. For each operating state, there are corresponding procedures to follow to secure NPPs safety and integrity. Fig. 1 shows the correspondent relationship between NPP operating states and procedures. The first level is operating procedures (OPs) which focus on the NPP operation within an acceptable range. The second level is abnormal operating procedures (AOPs) which aim at restoring the function of NPP systems that could impact the NPP operating margins. The third level is emergency operating procedures (EOPs) which focus on bringing the NPP to a safe and stable state by following a reactor trip or safety injection signal. The fourth level is severe accident management procedures (SAMPs). Uncertainties may exist in both NPP status and in the outcome of actions for severe accidents. Therefore, SAMPs propose a range of possible actions and should allow for additional evaluation and alternative actions. However, EOP or SAMP is generally the symptom-based procedures to mitigate transients/accidents consequence and restore the NPP, depending on the real-time operational parameters of the NPP. For the compound severe accidents, such as Fukushima NPP disaster, its impact to NPP is relatively broad, rather than focus on one system or one area influence. Therefore,



























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