

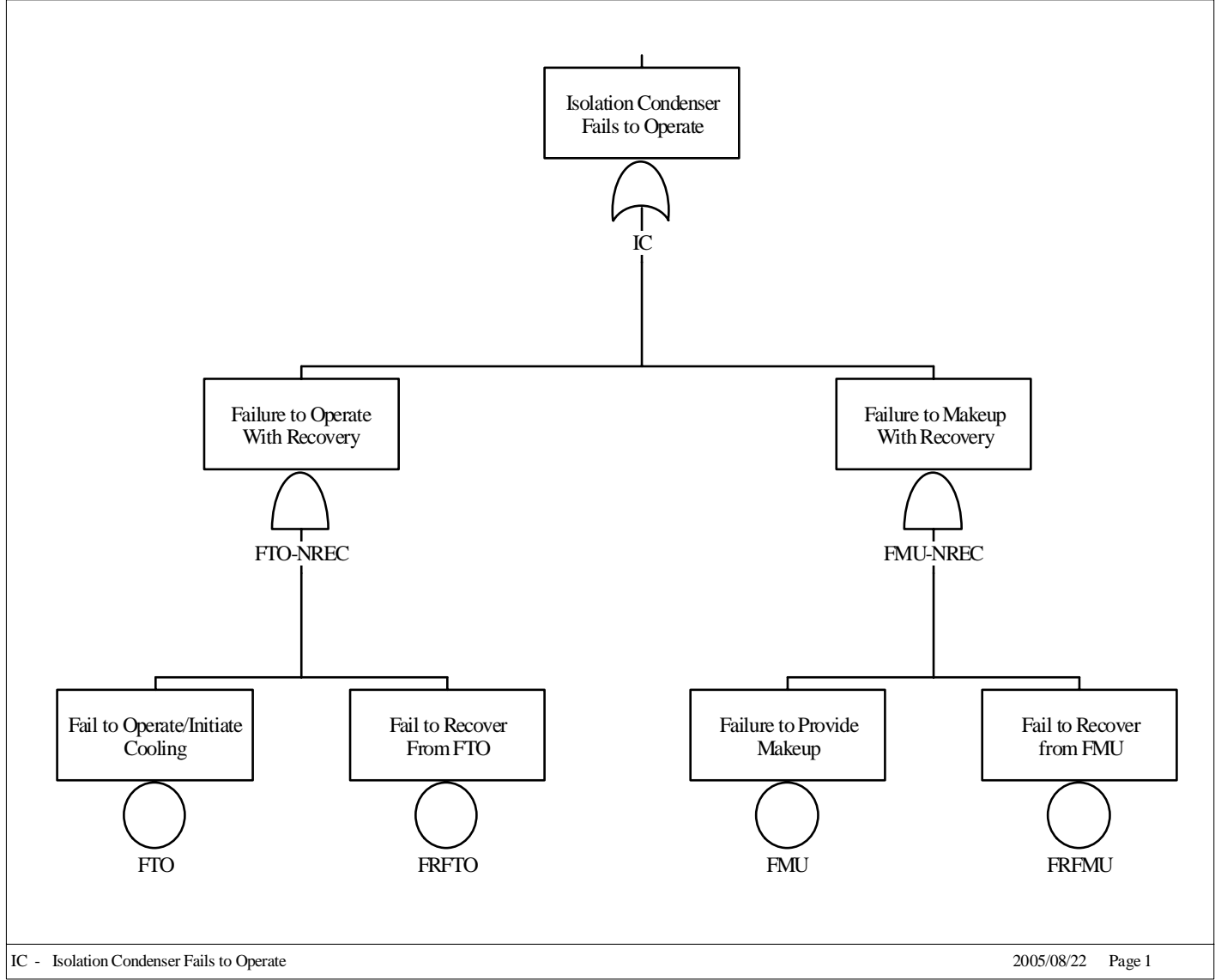
# Isolation Condenser Reliability Study

## 1 IC FAULT TREE

IC train unreliabilities were estimated using a fault tree model, [Figure 1](#), to combine broadly defined failure modes such as failure to operate or failure to provide makeup into an overall IC train unreliability model. The failure probabilities for the individual failure modes were calculated by reviewing the failure information, categorizing each failure event by failure mode and then estimating the corresponding number of demands (both success and failures).

For the purposes of this study, failure modes that can occur in response to an actual IC system demand are defined below:

- Maintenance out of service (MOOS) occurs if, due to maintenance, the IC system is prevented from starting automatically or manually. (Based on the operational data, MOOS was not considered as an explicit failure mode in the calculation of IC system unreliability.)
- Failure to operate (FTO) occurs if the system is in service but fails to operate, either automatically or manually, by opening of the condensate return valve and achieving stable reactor steam flow to the IC system condenser and condensate return flow back to the reactor.
- Failure to provide makeup (FMU) occurs if, at any time during the operation of the system, the capability to provide makeup water to the shell side of the condenser is lost when makeup is required.



**Figure 1. Fault tree model of isolation condenser train utilized for estimating train unreliability.**