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NUCLEAR REGULATORY COMMISSION
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MEMORANDUM: Edson G. Case, Acting Director
Office of Nuclear Reactor Regulation

Robert B. Minogue, Director
Office of Standards Development

Clifford V. Smith, Jr., Director
Office of Nuclear Material Safety
and Safeguards

FROM: Saul Levine, Director
Office of Nuclear Regulatory Research

SUBJECT: RESEARCH INFORMATION LETTER #19 - GO METHODOLOGY ASSESSMENT

This memorandum transmits the results of research on an assessment of GO, methodology for performing reliability evaluations of systems and subsystems, as requested informally by your office. Enclosed please find a copy of a report on the research giving a description of the analysis performed, a description of the GO method and a detailed description of the application of GO to a typical reactor trip system. This research provides for an understanding of this method either to perform reliability prediction or to critique system analyses submitted by applicants. The results of the research were reviewed by the Offices of Nuclear Reactor Regulation, Standards Development, and Inspection and Enforcement.

GO provides a method for system modeling and a computer code to calculate a prediction of system reliability. The study demonstrates that this method provides equivalent results to those obtained from fault tree analysis, the analysis method used in the Reactor Safety Study. A rather unique feature of this method is the capability to calculate with one model the probability of the various states of system condition, e.g., early operation, normal, failed, etc. Other methods, such as fault tree analysis, require a different model for each system condition; however, this feature of GO requires that all system components be included in the model. The model resembles the system schematic or piping diagram which thus reduces the burden of modeling all system components.

Evaluation and Application

An example of how GO can be used to model and calculate system unavailability is extensively described in the enclosed report. The description of the analysis shows how large complex systems can be modeled by using this method. The use of supertypes described in the report, can greatly reduce modeling time and effort when dealing with redundant systems. The method also allows for the inclusion of human errors into the models.

GO has a potential significant use as a means of determining system reliability or as a diverse method for verifying system analysis performed using fault tree or similar modeling techniques; however, it does not provide the qualitative assessment capability that can be obtained from fault trees. The sensitivity results obtained using this method identify the components which have the greatest effect upon a systems unreliability; however, the combinatorial relationship of the sensitive components is probably more easily discerned using fault trees. The choice of using either GO or fault tree analysis may depend upon the analyst's capability and preference. The utilization and application of GO will allow for further evaluation of the practical uses and limitations of this technique.

We currently plan to place the GO program in the computer library at Brookhaven National Laboratory for access by NRC users. If desired, training programs can be arranged by PAS to instruct personnel in the construction and programming of models used in this method.

Saul Levine

Saul Levine, Director
Office of Nuclear Regulatory Research

Enclosure:
"A Comparison of Results from the GO Methodology and Fault Tree Analysis," by D. E. Wood and N. J. Becar, August 31, 1977, Kaman Sciences Corp.