May 15, 1989

Docket Nos. 50-369
and 50-370

Mr. H. B. Tucker, Vice President
Nuclear Production Department
Duke Power Company
422 South Church Street
Charlotte, North Carolina 28242

Dear Mr. Tucker:

SUBJECT: FIRE PROTECTION DEVIATIONS, MCGUIRE NUCLEAR STATION, UNITS 1 AND 2 (TACS 55615 and 55616)

By letter of August 3, 1984, you identified and justified four deviations of the McGuire Fire Protection Program from Section III.G of Appendix R to 10 CFR 50. The deviations are in regards to (1) the Auxiliary Building at elevations 716 and 733 feet, (2) wall penetrations for the Reactor Buildings, (3) fire boundary doors with security hardware, and (4) seismic expansion joints for the Auxiliary, Diesel Generator and Reactor Buildings. The NRC, with technical assistance from Franklin Research Center has reviewed these deviations and finds them to be acceptable. Our evaluation for these four items is presented in Enclosure 1.

Similarly, by letter dated May 6, 1983, you identified two deviations from NFPA 72D "Proprietary Protective Signaling Systems" to the extent that it requires the fire alarm systems to be monitored for component failures and to take precedent over all other signals. Our acceptance of this deviation with respect to use of the public address system to provide audible local fire alarms inside containment is given in Enclosure 2.

Should you have questions regarding these evaluations, contact me at (301) 492-1442.

Sincerely,

/S/

Darl S. Hood, Project Manager
Project Directorate II-3
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Enclosures:
As stated

cc w/encl: See next page

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

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ENCLOSURE 1

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REGARDING APPENDIX R DEVIATIONS FOR

MCGUIRE NUCLEAR STATION, UNITS 1 AND 2

DOCKET NOS. 50-369 AND 50-370

1.0 INTRODUCTION

By letter dated August 3, 1984, Duke Power Company (the licensee) identified four deviations from Section III.G of Appendix R to 10 CFR 50. This evaluation is based on the information provided in the licensee's submittal. Additional information, to the extent available from other sources (FSAR and the Fire Hazards Analysis (FHA), has also been used for the preparation of this evaluation.

Section III.G.1 of Appendix R requires fire protection features to be provided for structures, systems, and components important to safe shutdown and capable of limiting fire damage so that:

a. One train of systems necessary to achieve and maintain hot shutdown conditions from either the control room or emergency control station(s) is free of fire damage; and

b. Systems necessary to achieve and maintain cold shutdown from either the control room or emergency control station(s) can be repaired within 72 hours.

Section III.G.2 of Appendix R requires that one train of cables and equipment necessary to achieve and maintain safe shutdown be maintained free of fire damage by one of the following means:

a. Separation of cables and equipment and associated nonsafety circuits of redundant trains by a fire barrier having a 3-hour rating. Structural steel forming a part of or supporting such fire barriers shall be protected to provide fire resistance equivalent to that required of the barrier.

b. Separation of cables and equipment and associated nonsafety circuits of redundant trains by a horizontal distance of more than 20 feet with no intervening combustibles or fire hazards. In addition, fire detectors and an automatic fire suppression system shall be installed in the fire area.

c. Enclosure of cable and equipment and associated nonsafety circuits of one redundant train in a fire barrier having a 1-hour rating. In addition, fire detectors and an automatic fire suppression system shall be installed in the fire area.

If the above conditions are not met, Section III.G.3 requires that there be an alternative shutdown capability independent of the fire area of concern. It also requires that a fixed suppression system be installed in the fire area of concern if it contains a large concentration of cable or other combustibles. These alternative requirements are not deemed to be equivalent; however, they provide equivalent protection for those configurations in which they are accepted.

Because it is not possible to predict the specific conditions under which fires may occur and propagate, the design basis protective features rather than the design basis fire are specified in the rule. Plant-specific features may require protection different from the measures specified in Section III.G. In such a case, the licensee must demonstrate, by means of a detailed fire hazards analysis, that existing protection or existing protection in conjunction with proposed modifications will provide a level of safety equivalent to the technical requirements of Section III.G of Appendix R.

In summary, Section III.G is related to fire protection features for ensuring that systems and associated circuits used to achieve and maintain safe shutdown are free of fire damage. Either fire protection configurations must meet the specific requirements of Section III.G or an alternative fire protection configuration must be justified by a fire hazards analysis. Generally, the staff will accept an alternative fire protection configuration if:

- The alternative ensures that one train of equipment necessary to achieve hot shutdown from either the control room or emergency control stations is free of fire damage.
- The alternative ensures that fire damage to at least one train of equipment necessary to achieve cold shutdown is limited so that it can be repaired within a reasonable time (minor repairs using components stored on the site).
- Fire-retardant coatings are not used as fire barriers.
- Modifications required to meet Section III.G would not enhance fire protection safety levels above that provided by either existing or proposed alternatives.
- Modifications required to meet Section III.G would be detrimental to overall facility safety.

2.0 AUXILIARY BUILDING, ELEVATIONS 716 AND 733 FEET (FIRE AREAS 2, 2A, 3, 3A, 4, AND 14)

2.1 Deviations Identified

Deviations were identified for Section III.G.2.c to the extent that it requires a complete 1-hour fire rated barrier between redundant safe shutdown system components.

2.2 Discussion

The areas affected by the deviation are in the auxiliary building on elevations 716 and 733 feet. Fire areas affected include 2, 2A, 3, 3A, 4, and 14. The walls, floors, and ceilings of these fire areas are of reinforced concrete construction and provide 3-hour fire rated barriers. Mechanical and electrical penetrations in rated barriers are sealed with an approved 3-hour silicone foam seal or have been qualified by a fire test. HVAC ducts are provided with 1-1/2-hour UL fire rated dampers. Access to these fire areas is by 3-hour fire rated doors and/or 3-hour fire rated stairwells.

The above fire areas contain nuclear service water pumps, component cooling water (CCW) pumps, turbine-driven auxiliary feedwater (AFW) pumps, and the motor-driven AFW pumps. Redundant trains of the nuclear service water and CCW pumps, which are required for cold shutdown, are separated by 1-1/2-hour fire rated barriers. Unprotected steel cable tray hangers penetrate these fire rated barriers. The turbine- and motor-driven AFW pumps are separated by 3-hour fire rated barriers. However, unprotected steel pipe supports and restraints penetrate these barriers. Compressed cork is installed in seismic joints and it is the subject of a separate Appendix R deviation, which is evaluated in Section 5.0.

The only combustible material in these fire areas is cable insulation, and the fire load is low. All of the above pumps or pump rooms have automatic fire detection and fire suppression systems. Manual hose stations and fire extinguishers are also available.

Safe shutdown can be accomplished with normal plant components or the dedicated safe shutdown system. The motor- or turbine-driven AFW pumps are adequate for unit shutdown under normal conditions. The turbine-driven AFW pump constitutes a part of the safe shutdown system path for fires in Fire Areas 2, 3, 4, and 14. To ensure safe shutdown system availability, valves 2CA161C and 2CA162C and associated cabling have been 1-hour wrapped in Fire Area 3 and 3-hour wrapped in the pipe chase located in the Unit 1 auxiliary building. For a fire in the other two Fire Areas (2A and 3A) one of the normal safe shutdown trains would be used.

The fire protection in these fire areas does not comply with the technical requirements of Section III.G.2.c of Appendix R because fire rated barriers are penetrated by unprotected steel cable tray hangers and steel pipe supports/ restraints.

The fire protection concern for these areas is that a fire could develop and spread across the intervening fire rated barriers and through the penetrations created by unprotected hangers and supports. However, the fire load is quite low and a fire is expected to develop slowly and not release a significant amount of heat. All of these areas have automatic fire detection and suppression systems. Therefore, there is reasonable assurance that a fire would be quickly detected and the fire brigade summoned. Until the arrival of the fire brigade, the fire suppression systems would control or extinguish the fire.

The nuclear service water and the CCW pumps are both used for cold shutdown. If the redundant divisions of these pumps were damaged by a fire, the dedicated safe shutdown system would be available. The dedicated safe shutdown system equipment, associated cables, and the turbine-driven AFW pumps are located out of these areas. Therefore, the issue of unprotected cable tray hangers penetrating the 1-1/2-hour fire rated barriers between redundant divisions of nuclear service water and CCW pumps is greatly diminished. Because of the light fire load and the presence of automatic fire suppression systems, it is expected that the cable tray hangers would neither fail nor transmit fire through the intervening fire rated barriers.

Another concern was the area which contains the redundant AFW pumps. The turbine- and motor-driven AFW pumps are separated by a masonry block wall with a 3-hour fire rating. Both areas have automatic fire suppression system coverage. These two fire protection features adequately ensure that a fire would not spread across the barriers or degrade the fire rating of the block wall. Should a fire damage one division of AFW pumps (motor- or turbine-driven), the other division would be capable of providing safe shutdown.

The staff has determined that the unprotected steel cable tray and pipe supports/restraints that penetrate fire barriers in the above-mentioned fire areas would not significantly upgrade the level of fire protection if they were provided with a fire rated wrap.

2.4 Conclusion

Based on the evaluation, the staff concludes that existing fire protection features and the availability of a dedicated safe shutdown system provide a level of fire protection equivalent to the technical requirements of Section III.G.2.c of Appendix R. Therefore, the deviation identified is acceptable.

3.0 REACTOR BUILDINGS' WALL PENETRATIONS

3.1 Deviations Requested

Deviations were requested from Section III.G.2.a of Appendix R to the extent that it requires a complete 3-hour fire rated barrier between redundant safe shutdown system components.

3.2 Discussion

The reactor buildings' walls are constructed of 3-foot-thick reinforced concrete and, therefore, have a 3-hour fire rating. These walls have four different types of penetrations:

a. process piping penetrations

b. spare sleeves

c. HVAC duct penetrations

d. personnel access portals.

3.2.1 Process Piping Penetrations

Process piping penetrations are constructed of heavy steel components that are welded together and designed to maintain the integrity of the reactor buildings' pressure boundary. Drawing MC-1676-3.8 illustrates the process piping penetration details. The penetration opening through the concrete wall is lined with a 1-1/4-inch-thick steel sleeve. The process pipe is of stainless steel with a wall thickness of 1-1/4 inches. Full penetration welds structurally connect the pipe to struts, the liner, and the liner ring. These assemblies are typical of those used at other stations where reactor buildings have an annulus area. The annulus area is provided with an automatic fire detection and sprinkler system.

3.2.2 Spare Sleeves

Spare sleeves and those used for instrument tubing penetrations are of steel and are sealed by a 3/8-inch-thick steel plate or a 1/2-inch pipe cap. The sleeves are designed to maintain the integrity of the containment and are similar to other spare sleeves in other nuclear stations.

The sleeves are located in the penetration rooms on elevations 733 and 750 feet of the auxiliary building. Redundant safe shutdown cables are located in these rooms. The penetration room ceilings are about 16 feet high and the rooms are about 140 feet long by 20 to 40 feet wide. Silicone foam is installed in the expansion joints of the reactor and diesel generator buildings. Penetrations through fire barriers are sealed with silicone foam or have been qualified by fire test(s).

Fire protection for the electrical penetration rooms consists of automatic fire detection that annunciates in the control room. Hose stations and fire extinguishers are also available to these rooms.

In the event of fire damage to any of the normal safe shutdown system components, the safe shutdown system is available to independently bring the plant to a hot standby condition.

3.2.3 Reactor Building HVAC Duct Penetrations

HVAC duct penetrations in the reactor buildings' walls are required for the containment purge system and the annulus ventilation system. Each of these systems has four penetrations per unit, and the penetrations are located near each other between elevations 776 and 787 feet.

Two penetrations of the containment purge system are 24 inches by 64 inches and the other two are 10-inch-diameter schedule 20 stainless steel pipes. The rectangular penetrations have sleeves of 3/16-inch-thick stainless steel plate designed to withstand thermal and seismic loading. They are flashed with 1/4-inch-thick stainless steel angles similar to a fire damper sleeve arrangement. A motor-operated damper is provided in each duct, consisting of a 10-gauge steel housing and 16-gauge steel blades. This is considerably heavier than the

18-gauge housing and 22-gauge blades for a typical fire damper. For the 10-inch diameter pipe penetrations, a motor-operated butterfly valve is provided in each duct. The valve has a 10-gauge steel housing and an 11-gauge steel blade. All dampers are normally closed and fail safe in the closed position.

The annulus ventilation system has two penetrations that are 28 inches by 16 inches and two that are 16-inch-diameter schedule 20 stainless steel pipes. Both types of penetrations are designed for thermal and seismic loading. The rectangular penetrations have sleeves of 3/16-inch-thick stainless steel and are flashed with 1/4-inch-thick stainless steel angles similar to a fire damper sleeve arrangement. The annulus ventilation system is an engineered safety feature system and must remain open. In addition, the duct is sealed to maintain the integrity of the secondary containment.

These HVAC duct penetrations are similar to those in other nuclear stations.

3.2.4 Personnel Access Portals

Access to the reactor buildings from the auxiliary building is provided by portals at two elevations. The walls of the reactor buildings were modified to include the personnel access portals. The walls and ceiling of the access portals are of 3/16-inch-thick steel plates on both sides of supporting columns or beams. The space between the steel plate is filled with Dow Corning 3-6548 silicone RTV foam. The entrance doors are of substantial metal construction and are airtight.

Fire protection consists of fire detection and sprinklers in the annulus. Fire hose stations and fire extinguishers are also available on both sides of the access portals.

For safe shutdown, either the normal paths or the safe shutdown system can be used. For a fire in the containment or annulus, the safe shutdown system instrumentation and normal train B safe shutdown equipment are available because equipment and power supplies are located outside of the affected fire areas. Breaker coordination on power supplies and fire suppression in the annulus have also been provided.

3.3 Evaluation

The fire protection for four types of reactor building wall penetrations does not comply with the technical requirements of Section III.G.2.a of Appendix R because a complete 3-hour fire rated barrier seal has not been provided.

Because of the reactor buildings' walls thickness, materials of penetration, seal construction and airtightness, and seal arrangement for all four types of penetrations discussed, it is concluded that the penetrations are equivalent to a 3-hour fire rated seal. This is primarily because the four different penetrations discussed have steel material thicknesses and welds that are much

more substantial than 3-hour fire tested seals for the same application. Also, these penetrations have been previously accepted by the NRC for other nuclear stations.

Both sides of the seals are covered by a fire detection system and sprinklers are provided within the annulus. Therefore, a fire near the seals would be detected early and the fire brigade would be summoned. Because of the low fire loads, a fire is expected to develop slowly, remain small and be readily extinguished by the fire brigade. The dedicated safe shutdown system is available for safe shutdown should a fire damage normal safe shutdown system components near the subject penetration seals.

The staff has concluded that the four types of penetration seals discussed and evaluated above are equivalent to a 3-hour fire rated seal. Requiring a 3-hour fire test would not significantly improve the fire protection level for the affected areas.

3.4 Conclusion

Based on the above evaluation, it is concluded that the existing reactor building penetrations for the process piping, spare sleeves, HVAC ducts, and personnel access portals are equivalent to a 3-hour fire rated penetration seal and/or are sufficient to withstand the expected fire severity with considerable conservatism. Therefore, the omission of standard designed fire tested penetration seals in these areas is an acceptable deviation from Section III.G.2.a of Appendix R.

4.0 FIRE BOUNDARY DOORS WITH SECURITY HARDWARE

4.1 Deviation Identified

The deviation discussed below is associated with Sections III.G.2.a and III.G.2.c of Appendix R.

4.2 Discussion

The licensee stated that certain security doors in fire barriers are identical to those which are UL listed for a 3-hour fire resistance with labels attached. However, these doors have not been tested after security hardware was attached. The licensee further stated that there are no combustibles near either side of these doors.

4.3 Evaluation

By letter dated April 25, 1986, the NRC issued Fire Protection Generic Letter 86-10. The purpose of this letter was to clarify fire protection issues and render NRC positions on Appendix R issues. Enclosure 1 to Generic Letter 86-10 contained six Appendix R interpretations and Enclosure 2 contained Appendix R questions and answers.

Section 3.2.3 of Enclosure 2 contains the following guidance pertaining to security modifications to fire doors.

"Where a door is part of a fire area boundary, and the modification does not affect the fire rating (for example, installation of security "contacts"), no further analysis need be performed. If the modifications could reduce the fire rating (for example, installation a vision panel), the fire rating of the door should be reassessed to ensure that it continues to provide adequate margin considering the fire loading on both sides. Since this reassessment pertains to the establishment of a valid fire area boundary, an exemption is not required."

The licensee has affirmed that the subject doors are in fire area boundaries and that the modifications do not affect the fire rating based on an analysis by the fire protection engineering staff.

4.4 Conclusion

On the basis of the guidance issued in Generic Letter 86-10 written staff approval of the deviation identified with respect to security-modified fire doors is not required.

5.0 AUXILIARY, DIESEL GENERATOR, AND REACTOR BUILDINGS' EXPANSION JOINT

5.1 Deviation Identified

A deviation was identified from the technical requirements of Section III.G.2.a of Appendix R to the extent that 3-hour fire rated seismic expansion joints are not provided in 3-hour fire rated floor and wall assemblies.

5.2 Discussion

A 3-inch seismic gap exists in areas of the reactor and diesel generator buildings, specifically in the electrical penetration rooms. Compressed cork is installed as a filler material within the seismic gap.

The electrical penetration rooms are located on elevations 733 and 750 feet of the auxiliary building. These rooms contain normal safe shutdown cables required for hot shutdown. The walls, floors, and ceiling of the auxiliary building are of 12- to 24-inch-thick reinforced concrete with electrical and mechanical penetrations sealed with a 3-hour fire rated seal.

Cork is obtained from the elastic outer bark of an oak tree. Therefore, it is cellulosic and will support combustion. However, it is also a good insulator and tends to char and glow rather than support a flame [Reference: NFPA Handbook]. For this particular application, the cork is compressed and enclosed on two sides by reinforced concrete, which results in only a small surface being exposed to the rooms. The configuration of the cork has not been tested and approved for use as a 3-hour fire rated seal.

The compressed cork has been removed from the floor, ceiling, and walls of the electrical penetration rooms on elevation 750 feet where they abut the reactor building, and a 3-hour fire rated material has been installed in the gaps.

Also, the gap between the auxiliary and the diesel generator buildings at the 750-foot level has been filled with a 3-hour fire rated material. The cork remains in place at elevation 733 feet.

As discussed in Section 3.2.2 of this report, should a fire spread between the electrical penetration rooms and damage normal safe shutdown cables, the dedicated safe shutdown system would be available to bring the plant to a safe hot shutdown condition.

Fire protection for the electrical penetration rooms consists of automatic fire detection that annunicates in the control room. Fire hose stations and fire extinguishers are also available.

5.3 Evaluation

The fire protection for the seismic gaps between the auxiliary building (on elevation 733 feet) and the reactor/diesel generator buildings does not comply with the technical requirements of Section III.G.2.a of Appendix R because a complete 3-hour fire rated seal has not been provided.

The basic fire protection concern is that a fire could spread through the cork filler and damage normal redundant safe shutdown cables. However, the floors, walls, and ceilings are 12 to 24 inches thick. Further, the cork in the seismic gap is only exposed for a width of 3 inches. Since cork tends to char rather than burn with a flame, it is a good insulator; also, a substantial seal has been provided by the licensee. An exposure fire would have to be quite severe and located close to the seismic gap(s) for a prolonged period of time in order to breach the seal. Since the fire load in the penetration rooms is in the form of cables, which are not installed directly at the seismic gaps, it is not expected that a fire of this magnitude would develop and last prior to fire brigade response. A timely response to this fire is reasonably assured because of the presence of fire detection systems located on both sides of the seismic gaps. Cork filled seismic gaps have been accepted by the NRC for the Farley Nuclear Station, Units 1 and 2.

In the event a fire develops and transmits heat through the gaps and damages safe shutdown cables, the safe shutdown system is available and is independent of the areas involved.

The staff has determined that upgrading the cork-filled seismic gaps to a qualified 3-hour fire rated seal would not significantly upgrade the level of fire protection.

5.4 Conclusion

Based on the evaluation, it is concluded that the cork-filled seismic gaps on elevation 733 feet, coupled with the existing fire protection and physical features of the electrical penetration rooms (including the fire loading), are

sufficient to withstand the expected fire severity. Therefore, the absence of a qualified 3-hour fire rated seal in the seismic gaps is an acceptable deviation from Section III.G.2.a of Appendix R.

6.0 SUMMARY

Based on the evaluation, it is found that the level of fire safety in the areas listed below is equivalent to that achieved by compliance with the technical requirements of Section III.G. of Appendix R; therefore, the deviations identified in the following areas are acceptable:

1. Auxiliary Building, Elevations 716 and 733 Feet (Fire Areas 2, 2A, 3, 3A, 4, and 14) to the extent that a complete 1-hour fire rated barrier between redundant safe shutdown system components is not provided because unprotected steel supports penetrate the barriers affected. See Section 2.0 for additional information.

2. Reactor Buildings' Wall Penetrations to the extent that a complete 3-hour fire rated barrier between redundant safe shutdown system components is not provided because process piping, spare sleeve, HVAC duct, and personnel access portal penetrations have not been qualified by fire tests. See Section 3.0 for additional information.

3. Auxiliary, Diesel Generator, and Reactor Buildings' Seismic Joints, Elevation 733 Feet to the extent that a qualified 3-hour fire rated seal is not provided. See Section 5.0 for additional information.

Based on the evaluation, it is concluded that the licensee's identified deviation relative to modified fire doors does not require NRC approval. Rather, the requirement is satisfied by licensee reassessment of the modified doors in accordance with the guidance of Generic Letter 86-10. See Section 4.0 for additional information.

7.0 PRINCIPAL CONTRIBUTORS

This Safety Evaluation Report was prepared by John Stang, Dennis Kubicki, and Darl Hood, based on a Technical Evaluation Report prepared by Franklin Research Center under a contract with the U.S. Nuclear Regulatory Commission.

ENCLOSURE 2

EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION REGARDING

FIRE ALARM SYSTEM DEVIATIONS

MCGUIRE NUCLEAR STATION, UNITS 1 AND 2

DOCKET NOS. 50-369 AND 50-370

Fire Alarm System Deviations

In Appendix B of Supplement No. 5 to the Safety Evaluation Report related to Operation of McGuire Nuclear Station, Units 1 and 2, the staff indicated that the fire alarm systems meet the requirements of NFPA 72D "Proprietary Protective Signaling Systems." By letter dated May 6, 1983, Duke Power Company (the licensee) requested two deviations from paragraphs 2471 and 2551-C of NFPA 72D to the extent these require the fire alarm systems to be monitored for component failures and to take precedent over all other signals.

Inside containment, the licensee proposes to use the public address system to provide audible local fire alarms.

Paragraph 2471 of NFPA 72D requires the amplifiers and tone generator equipment associated with the fire systems be provided with trouble alarms to indicate component failure. The public address system does not have this capability. However, the public address system is used frequently and any failure of the amplifiers would be readily apparent without component supervision. Failure of the tone generator, however, would not be readily apparent because of its limited use. By letter dated August 1, 1983, the licensee indicated that failure of the tone generator would not affect the operation of the public address system. Therefore, the fire alarm can be announced over the system if the tone generators are not functioning.

Because of the frequent use of the public address system when the containment is accessible, we agree that any equipment failure of the public address system would be detected within a short time. Failure of the tone generators would be detected at the time of the fire and the operators could compensate for this loss by announcing the fire over the public address system. Therefore, the addition of supervisor trouble signals as required by paragraph 2471 of NFPA 72D would provide little increase in safety.

Paragraph 2551-C of NFPA 72D requires that fire alarm signals and trouble signals take precedence over all other signals. The public address is also used for radiation alarms, evacuation alarms and site assembly alarms. These alarms have higher priority than fire alarms, however, the response to any of these four types of alarm would involve the evacuation of the containment. Because of the limited access to the inside of containment and because the responses for radiation, evacuation, site assembly and fire alarms all result in personnel evacuating the containment, we find that the omission of precedence for fire alarms does not decrease fire safety.

Based on the above evaluation, we conclude that the omission of the trouble signals for the public address system and the tone generators and the omission of precedence for fire alarm signals are acceptable deviations from NFPA-72D. Therefore, the use of the public address system for local fire alarms inside containment is acceptable.

This evaluation has been performed by Mr. D. Kubicki of NRR's Chemical Engineering Branch and Mr. D. Hood of NRR's Project Directorate II-3.