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50-414	Catawba Nuclear Station, Unit 2, Duke Power Co.	05000414

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SUBJECT: Forwards interim response to NRC Bulletin 88-004 re potential safety-related pump loss.

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DUKE POWER

August 31, 1988

U.S. Nuclear Regulatory Commission
ATTENTION: Document Control Desk
Washington, DC 20555

Subject: **McGuire Nuclear Station**
Catawba Nuclear Station
Oconee Nuclear Station
Docket Nos. 50-369, 370; 50-413, -414; and 50-269, -270, -287
NRC Bulletin No. 88-04
Potential Safety-Related Pump Loss
Action No. 4 Interim Response

Gentlemen:

NRC Bulletin 88-04 concerning potential safety-related pump loss requested investigation and correction, as applicable, or two miniflow design concerns. One of the bulletin's requested actions (Action No. 4) was the submittal of a report within 60 days of receipt of the bulletin that (a) summarizes the problems and the systems affected, (b) identified the short-term and long-term modifications to plant operating procedures or hardware that have been or are being implemented to ensure safe plant operations, (c) identifies an appropriate schedule for long-term resolution of this and/or other significant problems that are identified as a result of this bulletin, and (d) provides justification for continued operation particularly with regard the General Design Criterion 35 of Appendix A to Title 10 of the Code of Federal Regulations (10 CFR 50), "Emergency Core Cooling" and 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling System for Light Water Nuclear Power Reactors." (Another report describing the actions taken is to be submitted within 30 days of completion of the long-term resolution actions in accordance with bulletin action No. 5).

My letter of July 11, 1988 in initial response to the bulletin for the McGuire, Catawba, and Oconee Nuclear Stations stated that while Duke Power Company's review of the bulletin was well underway, we were not able to provide the requested response on individual pumps at that time (for reasons outlined in that letter), and that Duke would provide a further status of progress on August 31, 1988 including any available final bulletin responses for specific pumps.

Accordingly, please find attached an interim response on the status of Duke's bulletin 88-04 work for the McGuire, Catawba, and Oconee Nuclear Stations. A statement justifying continued operation is provided for each pump based on current information. Also, a list of activities (and associated schedules where possible) are provided that remain to be completed before a final bulletin action No. 4 response can be made for a station(s). Note that activities in addition to those identified to-date may be required after all pump manufacturer information is received. Status on these activities must be provided in future submittals. Another status update will be submitted by December 1, 1988.

IE11

I declare under penalty of perjury that the statements set forth herein are true and correct to the best of my knowledge. Should there be any questions concerning this matter or if additional information is required, please advise.

Very truly yours,

Hal B. Tucker

PBN/110/mmf

Attachment

xc: w/attachment

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DUKE POWER COMPANY
INTERIM RESPONSE TO NRC BULLETIN 88-04

Explanation of Items Under 'Planned Action'

- **Verify (hand calculation or computer model) minimum flow configurations in normal and emergency modes for single and/or multiple pump operation** - Verification involves developing entire system configurations and analyzing all modes of operation (normal and emergency). Multiple pump operation is to be analyzed because test data is not available for this mode. Single pump operation is to be analyzed to provide data requested by manufacturers in order for them to provide updated minimum flow requirements. The following data has been requested by manufacturers:

  Ingersoll-Rand
  . System Operating Mode (all modes)
  . Minimum Flow Line Flow
  . Total Pump Flow
  . Suction Temperature and Pressure
  . Number of Events per Month
  . Duration per Event

  Bingham
  . Current Minimum Flow Capacity
  . Length of Time Pumps Operate at Minimum Flow
  . Original Bingham Minimum Flow Recommendation

  Goulds has provided updated minimum flow requirements.

  Remaining pump manufacturers have not yet requested additional information or provided updated minimum flow requirements. Manufacturers have received multiple utility requests for verification of updated minimum flow requirements and requests are processed in order of receipt.

- **Provide information requested by manufacturer** - The information requested by manufacturers for them to provide updated minimum flow requirements is determined in bullet 1 above or from existing data. Time is needed to retrieve the needed information from the developed data.

- **Determine adequacy of existing minimum flow configuration based on manufacturer's updated recommendations** - Minimum flow capability from bullet 1 above or from existing data will be compared with updated manufacturer recommendations for minimum flow. Decisions will be made on the adequacy of existing minimum flow and any needed changes to ensure proper minimum flow.

- **Issue final report with recommendations** - A final bulletin action response will be issued following completion of the above actions for all pumps on a given station. Any needed changes to ensure proper minimum flow will be identified in the response with a proposed completion schedule.

Oconee Nuclear Station

	Pumps	Manufacturer
Low Pressure Injection (LPI)	1A,1B,2A,2B,3A,3B	Ingersoll-Rand

Configuration:

Each LPI pump has a separate minimum flow recirculation line with an orifice between pump discharge and pump suction.

Continued operation of the LPI pumps is justified on the following basis:

- The LPI pumps do not interact during multiple pump operation because each pump is provided with a separate minimum flow recirculation line and the crossover pipe between discharge headers is isolated.

- The LPI pumps are normally operated above the manufacturer's recommended minimum flow. The pumps are required to operate below the recommended flow only during the following modes of operation:

  1) A single LPI pump is used to lower the level in the reactor vessel during unit outages. During this process, LPI pump flow is reduced to approximately 1/2 the recommended minimum flow for a short period of time. A test was performed 8/25/88 that ran LPI Pump 3C (spare pump) at or below the flow used during this process for 12 hours. There is no evidence in the test data to indicate that this limited mode of operation is detrimental to pump performance.

  2) The LPI pumps are started automatically by Engineered Safeguards (ES) signal on very low Reactor Coolant System (RCS) pressure or high Reactor Building pressure. Each pump has a minimum flow recirculation loop to protect the pumps if RCS pressure is above pump shut off head when pumps receive ES signal. The capacity of the minimum flow recirculation loop is sufficient to prevent cavitation due to pump heat for more than 30 minutes. Plant operators are required to secure the pumps if a flow demand is not established within 30 minutes. Three LPI pumps have each been tested for 28 minutes in the minimum flow recirculation mode. There is no evidence to indicate that this limited mode of operation is detrimental to pump performance.

Planned Action:

1. Verify minimum flow configuration in normal and emergency modes by 5/19/89.

2. Provide information requested by manufacturer by 6/1/89.

3. Determine adequacy of existing minimum flow configuration based on updated manufacturer's recommendations.

4. Issue final report with recommendations.

Oconee Nuclear Station

	Pumps	Manufacturer
High Pressure Injection (HPI)	1A,1B,1C,2A,2B,2C 3A,3B,3C	Ingersoll-Rand

Configuration:

The three HPI pumps per unit have separate minimum flow lines that contain block orifices supplied by the pump manufacturer. The minimum flow lines merge downstream of the orifices into a common line that returns to the Letdown Storage Tank through the Seal Return Coolers.

Continued operation of the HPI pumps is justified on the following basis:

- Flow is limited in each individual minimum flow line upstream of the common minimum flow return line. Therefore, pump interaction is not expected to affect individual pump performance.
- The capacity of each minimum flow line is greater than the manufacturer's recommendation.

Planned Action:

1. Verify minimum flow configurations in normal and emergency modes for single and multiple pump operation by 5/19/89.
2. Provide information requested by manufacturer by 6/1/89.
3. Determine adequacy of existing minimum flow configuration based on updated manufacturer's recommendations.
4. Issue final report with recommendations.

Oconee Nuclear Station

	Pumps	Manufacturer
Reactor Building Spray (RBS)	1A,1B,2A,2B,3A,3B	Ingersoll-Rand

Configuration:

The two RBS pumps per unit do not have minimum flow recirculation lines. They are lined up to discharge through spray nozzles to containment atmosphere.

Continued operation of the RBS pumps is justified on the following basis:

- The RBS pumps do not interact during multiple pump operation because the crossover pipe between discharge headers is isolated.
- The RBS pumps do not have minimum flow lines because they discharge through spray nozzles to containment atmosphere and therefore cannot be dead-headed. These pumps are operated above the manufacturer's recommended minimum flow by procedure.

Planned Action:

1. Provide information requested by manufacturer by 6/1/89.
2. Determine adequacy of existing minimum flow based on updated manufacturer's recommendations.
3. Issue final report with recommendations.

Oconee Nuclear Station

	Pumps	Manufacturer
Motor Driven Emergency Feedwater (MDEFDW)	1A,1B,2A,2B,3A,3B	Bingham

Configuration:

The two MDEFDW pumps per unit are installed in parallel with a single TDEFDW pump. Each pump has a separate minimum flow line that merges into a relatively large common return line to the Upper Surge Tank. An auto-recirculation check valve at the discharge of each MDEFDW pump opens on low flow.

Continued operation of the MDEFDW pumps is justified on the following basis:

- Friction losses in the relatively large common line are small during multiple pump operation because flow is limited in each individual line upstream of the tie-in. Therefore, pump interaction is not expected to affect individual pump performance.

- Each MDEFDW pump is tested individually in the minimum flow recirculation mode. Although Bingham has not yet provided minimum flow information, the test data indicates that the installed capacity is sufficient.

Planned Action:

1. Verify minimum flow configurations in normal and emergency modes for single and multiple pump operation by 5/19/89.

2. Provide information requested by manufacturer by 6/1/89.

3. Determine adequacy of existing minimum flow configuration based on updated manufacturer's recommendations.

4. Issue final report with recommendations.

Oconee Nuclear Station

	Pumps	Manufacturer
Turbine Driven Emergency Feedwater (TDEFDW)	1A,2A,3A	Bingham

Configuration:

The single TDEFDW pump per unit is installed in parallel with two MDEFDW pumps. Each pump has a separate minimum flow line that ties into a relatively large common return line to the Upper Surge Tank. A block orifice limits flow in the TDEFDW minimum flow recirculation line.

Continued operation of the TDEFDW pumps is justified on the following basis:

- Friction losses in the relatively large common line are small during multiple pump operation because flow is limited in each individual line upstream of the tie-in. Therefore, pump interaction is not expected to affect individual pump performance.

- The flow capacity of the minimum flow orifice is expected to be more than required by the manufacturer; a response has not yet been received from Bingham.

Planned Action:

1. Verify minimum flow configurations in normal and emergency modes for single and multiple pump operation by 5/19/89.

2. Provide information requested by manufacturer by 6/1/89.

3. Determine adequacy of existing minimum flow configuration based on updated manufacturer's recommendations.

4. Issue final report with recommendations.

Oconee Nuclear Station

	Pumps	Manufacturer
Auxiliary Service Water (ASW)	1A	Ingersoll-Rand

Configuration:

The ASW pump has a separate minimum flow path that is manually opened before the pump is started.

Continued operation of the ASW pump is justified on the following basis:

- Single pump; no interaction potential.
- Preliminary analysis has shown that the capacity of the ASW pump minimum flow path is greater than the manufacturer's recommended minimum flow. Preliminary analysis also indicates that the pump will operate above the recommended minimum flow during worst case operating scenario.

Planned Action:

1. Verify minimum flow configuration for normal (test) and emergency modes by 5/19/89.
2. Provide information requested by manufacturer by 6/1/89.
3. Determine adequacy of existing minimum flow configuration based on updated manufacturer's recommendations.
4. Issue final report with recommendations.

Oconee Nuclear Station

	Pumps	Manufacturer
Low Pressure Service Water (LPSW)	1A,1B,1C,3A,3B	Ingersoll-Rand

Configuration:

Three LPSW pumps provide cooling water to units 1 & 2 and two LPSW pumps provide cooling water to unit 3. These pumps do not have minimum flow lines.

Continued operation of the LPSW pumps is justified on the following basis:

- Pump interaction is not expected to affect individual pump performance because pumps are not operated in the low flow range on the pump curve.

- The LPSW pumps do not have minimum flow lines because normal and emergency flow demand is greater than manufacturer's minimum flow recommendation when each unit is considered separately. A comprehensive system model is underway to evaluate the worst case operating scenario.

Planned Action:

1. Verify minimum flow configurations in normal and emergency modes for single and multiple pump operation by 5/19/89.

2. Provide information requested by manufacturer by 6/1/89.

3. Determine adequacy of existing minimum flow configuration based on updated manufacturer's recommendations.

4. Issue final report with recommendations.

Oconee Nuclear Station

	Pumps	Manufacturer
SSF Auxiliary Service Water (SSFASW)	1	Bingham

Configuration:

The SSFASW pump has a minimum flow recirculation line with a block orifice between pump discharge and pump suction.

Continued operation of the SSFASW pump is justified on the following basis:

- Single pump; no interaction potential.
- The SSFASW pump has been tested in the minimum flow mode. Tested capacity is greater than manufacturer's original minimum flow recommendation.

Planned Action:

1. Verify minimum flow configuration in normal and emergency modes by 5/19/89.
2. Provide information requested by manufacturer by 6/1/89.
3. Determine adequacy of existing minimum flow configuration based on updated manufacturer's recommendations.
4. Issue final report with recommendations.

Oconee Nuclear Station

	Pumps	Manufacturer
SSF HVAC Cooling Water (SSFHVAC)	1,2	Ingersoll-Rand

Configuration:

The two SSFHVAC pumps provide cooling water to two condensers that have bypass lines. Three-way regulating valves open to bypass the condensers during periods of low demand.

Continued operation of the SSFHVAC pumps is justified on the following basis:

- The SSFHVAC pumps are not operated in the low flow range on the pump curve. Therefore, pump interaction is not expected to affect individual pump performance.

- The SSFHVAC pumps supply condensers which are provided with bypass capacity greater than manufacturer's recommended minimum flow. Plant operating procedures do not allow pump operation below manufacturer's recommendation.

Planned Action:

1. Verify minimum flow configurations in normal and emergency modes for single and multiple pump operation by 5/19/89.

2. Provide information requested by manufacturer by 6/1/89.

3. Determine adequacy of existing minimum flow configuration based on updated manufacturer's recommendations.

4. Issue final report with recommendations.

Oconee Nuclear Station

	Pumps	Manufacturer
SSF Diesel Engine Cooling Water (SSFDECW)	1	Ingersoll-Rand

Configuration:

The SSFDECW does not have a minimum flow line. It is lined up to supply cooling water through two heat exchangers.

Continued operation of the SSFDECW pump is justified on the following basis:

- Single pump; no interaction potential.
- The SSFDECW pump does not have minimum flow protection because it is operated at best efficiency point during its only mode of operation.

Planned Action:

1. Provide information requested by manufacturer by 6/1/89.
2. Determine adequacy of existing minimum flow based on updated manufacturer's recommendations.
3. Issue final report with recommendations.

McGuire Nuclear Station

	Pumps	Manufacturer
Centrifugal Charging (NV)	1A, 1B, 2A, 2B	Pacific

Configuration:

Two pumps per unit have separate miniflow lines. Each miniflow line contains an orifice, supplied by the pump manufacturer to control the minimum flow for the associated pump. Downstream of the orifices, miniflow lines merge into a common miniflow line which returns to Volume Control Tank.

Continued operation of the centrifugal charging pumps is justified on the following basis:

- Miniflow orifices meter miniflow to meet the manufacturer's requirements. Pumps are tested quarterly (IWP program) in miniflow mode. Quarterly tests show acceptable levels of vibration and temperature rise.

- Above mentioned miniflow orifices preclude pump interaction, since the back pressure in the common line portion of the miniflow line downstream of the orifices will be low.

Planned Action:

1. Verify minimum flow configurations in normal and emergency modes for single and multiple pump operation by 5/19/89.

2. Provide information requested by manufacturer (Dependent upon manufacturer's date of response).

3. Determine adequacy of existing miniflow configuration based on the updated manufacturer's recommendations.

4. Issue final report with recommendations.

McGuire Nuclear Station

	Pumps	Manufacturer
Boric Acid Transfer (NV)	**1A, 1B, 2A, 2B**	**Crane-Chempump**

Configuration:

Each pair of pumps has a common miniflow line. Normally, one pump is aligned with Boric Acid Tank and miniflow from this pump flows back to the tank and helps maintain thermal equilibrium. The design miniflow is in accordance with manufacturer's recommendation.

Continued operation of the boric acid transfer pumps is justified on the following basis:

- Pumps are operated one pump at a time and the operation is manual. Miniflow requirements provided by the manufacturer are met for one or both pumps running per unit by flow rates several times higher than miniflow requirements.

- Two pump operation is for recirculating the Boric Acid Tank prior to sampling. Pump curves (characteristics) are similar, therefore the interaction will not be a problem. They will not dead-head each other.

Planned Action:

1. Verify minimum flow configurations in normal and emergency modes for single and multiple pump operation by 5/19/89.

2. Obtain final input from the pump manufacturer.

3. Determine adequacy of existing miniflow configuration based on the updated manufacturer's recommendations.

4. Issue final report with recommendations.

McGuire Nuclear Station

	Pumps	Manufacturer
Residual Heat Removal (ND)	1A, 1B, 2A, 2B	Ingersoll-Rand

Configuration:

Each pump has a separate minimum flow line which provides a path from the pump discharge downstream of the respective heat exchanger to the pump suction. A valve automatically opens on low flow to assure adequate miniflow.

Continued operation of the residual heat removal pumps is justified on the following basis:

- Testing of pumps quarterly (IWP program) shows that available miniflow meets manufacturer's requirements. The tests show acceptable level of vibration and temperature rise. Also, the pumps are used during refueling outages (mid-loop operation) to remove residual heat. The operations have been continued with relatively low flow rates and have shown no pump degradation.

- A preliminary analysis was done to model two pump operation (i.e. during LOCA). At the minimum flowrates anticipated, pump characteristics are such that interaction is not expected to create a risk of pump damage. The pumps will be operating out on their curves such that the stronger pump will not dead-head the weaker.

Planned Action:

1. Verify minimum flow configurations in normal and emergency modes for single and multiple pump operations by 5/19/89.

2. Provide information requested by manufacturer by 6/1/89.

3. Determine adequacy of existing miniflow configuration based on updated manufacturer's recommendations.

4. Issue final report with recommendations.

McGuire Nuclear Station

	Pumps	Manufacturer
Safety Injection (NI)	1A, 1B, 2A, 2B	Pacific

Configuration:

Two Safety Injection pumps per unit have separate miniflow lines. Each miniflow line contains an orifice, supplied by the pump manufacturer to control the minimum flow for the associated pump. Downstream of the orifices, miniflow lines merge into a common miniflow line which returns to Refueling Water Storage Tank.

Continued operation of the safety injection pumps is justified on the following basis:

- Miniflow orifices meter miniflow to meet the manufacturer's requirements. Pumps are tested quarterly (IWP program) in miniflow mode. Quarterly IWP tests show acceptable levels of vibrations and temperature rise.

- Above mentioned miniflow orifices preclude pump interaction, since the back pressure in the common line portion of the miniflow line downstream of the orifices will be low.

Planned Action:

1. Verify minimum flow configurations in normal and emergency modes for single and multiple pump operations by 5/19/89.

2. Provide information requested by manufacturer (Dependent upon manufacturer's date of response).

3. Determine adequacy of existing miniflow configuration based on updated manufacturer's recommendations.

4. Issue final report with recommendations.

McGuire Nuclear Station

	Pumps	Manufacturer
Containment Spray (NS)	1A, 1B, 2A, 2B	Ingersoll-Rand

Configuration:

Two identical pumps per unit are installed in separate flow paths without any interaction.

Continued operation of the containment spray pumps is justified on the following basis:

- Flows exceed miniflow requirements during normal system operations. Minimum flow is tested quarterly (IWP program) while pump is throttled.

- Interaction is not a problem, since pumps discharge on separate paths. During the tests, only one pump is operated, hence pump to pump interaction is not a problem.

Planned Action:

1. Provide information requested by manufacturer by 6/1/89.

2. Determine adequacy of existing miniflow based on updated manufacturer's recommendations.

3. Issue final report with recommendations.

McGuire Nuclear Station

	Pumps	Manufacturer
Motor Driven Aux. Feedwater (CA)	1A, 1B, 2A, 2B	Bingham

Configuration:

The two Motor Driven pumps and the Turbine Driven pump per unit share a recirculation path to the upper surge tank. Flow and pressure at each pump suction are monitored in the control room. Automatic flow control is provided for pump protection during low flow operation. An air operated valve for each pump controls recirculation flow to the Upper Surge Tank. The two Motor Driven pumps feed separate sets of two steam generators. The Turbine Driven pump can feed all four steam generators.

Continued operation of the motor driven auxiliary pumps is justified on the following basis:

- Miniflow requirements are set by Duke Power with manufacturer's recommendations. Monthly IWP testing of the pumps shows acceptable levels of vibration and temperature rise. Travel stops (handwheels) are set on the minimum flow valves to provide the required flow. The handwheels can be adjusted to provide full pump flow during the testing.

- Motor Driven pump discharge flows are isolated from each other. There is no interaction between the two Motor Driven pumps. Automatic actuation signal isolates miniflow valves (and remains close) and pumps start to deliver full flow. If Motor Driven pumps are running, operators will shutdown Turbine Driven pump. Thus, there is no long-term interaction between the Turbine Driven pump and one of the two Motor Driven pumps. High pressure drop across the minimum flow control valves precludes pump interactions through the common recirculation line.

Planned Action:

1. Verify minimum flow configurations in normal and emergency modes for single and multiple pump operation by 5/19/89.

2. Provide information requested by manufacturer by 6/1/89.

3. Determine adequacy of existing miniflow configuration based on updated manufacturer's recommendations.

4. Issue final report with recommendations.

McGuire Nuclear Station

	Pumps	Manufacturer
Turbine Driven Aux. Feedwater (CA)	1, 2	Bingham

Configuration:

The two Motor Driven pumps and the Turbine Driven pump per unit share a recirculation path to the upper surge tank. Flow and pressure at each pump suction are monitored in the control room. Automatic flow control is provided for pump protection during low flow operation. An air operated valve for each pump controls recirculation flow to the Upper Surge Tank. The two Motor Driven pumps feed separate sets of two steam generators. The Turbine Driven pump can feed all four steam generators.

Continued operation of the turbine driven auxiliary pumps is justified on the following basis:

- Miniflow requirements are set by Duke Power with manufacturer's recommendations. Monthly IWP testing of the pumps shows acceptable levels of vibration and temperature rise. Travel stops (handwheels) are set on the minimum flow valves to provide the required flow. The handwheels can be adjusted to provide full pump flow during the testing.

- Motor Driven pump discharge flows are isolated from each other. There is no interaction between the two Motor Driven pumps. Automatic actuation signal isolates miniflow valves (and remains. close) and pumps start to deliver full flow. If Motor Driven pumps are running, operators will shutdown Turbine Driven pump. Thus, there is no long-term interaction between the Turbine Driven pump and one of the two Motor Driven pumps. High pressure drop across the minimum flow control valves precludes pump interactions through the common recirculation line.

Planned Action:

1. Verify minimum flow configurations in normal and emergency modes for single and multiple pump operation by 5/19/89.

2. Provide information requested by manufacturer by 6/1/89.

3. Determine adequacy of existing miniflow configuration based on updated manufacturer's recommendations.

4. Issue final report with recommendations.

McGuire Nuclear Station

	Pumps	Manufacturer
Component Cooling Water (KC)	1A1, 1A2, 1B1, 1B2 2A1, 2A2, 2B1, 2B2	B&W Canada, Ltd.

Configuration:

Two identical pumps share miniflow lines to supply Component Cooling Heat Exchanger. Four identical pumps are supplied per unit.

Continued operation of the component cooling water pumps is justified on the following basis:

- Flow instrumentation open and closes a valve in a common miniflow line in each train of the unit to assure adequate total minimum flow for each pair of pumps. Quarterly tests (IWP program) show acceptable levels of vibration and temperature rise.

- Pump characteristics are almost identical (heads differ by only a maximum of 3%), so that interaction should not be a problem.

Planned Action:

1. Verify minimum flow configurations in normal and emergency modes for single and multiple pump operations by 5/19/89.

2. Obtain final input from the pump manufacturer.

3. Determine adequacy of existing miniflow configurations based on updated manufacturer's recommendations.

4. Issue final report with recommendations.

McGuire Nuclear Station

	Pumps	Manufacturer
Nuclear Service Water (RN)	1A, 1B, 2A, 2B	Bingham

Configuration:

RN pump miniflow path is established by an interlock which opens the corresponding train KC heat exchanger inlet isolation valve based on pump flow. Upon safety injection signal the control valves for the essential heat exchangers open to the valve travel stops. In this alignment, the pumps operate above minimum flow requirements.

Continued operation of the nuclear service water pumps is justified on the following basis:

- Minimum flow interlocks and valve failure positions are in place which provide sufficient flow paths to meet existing miniflow requirements during unfaulted operational modes with a minimum of operator action, and postulated accidents with or without operator action. IWP testing shows acceptable levels of vibration and temperature rise.

- There is no pump to pump interaction during a design base accident. On safety injection signal RN trains and pumps are automatically isolated from each other, along with isolation from all non-safety pumps.

Planned Action:

1. Verify minimum flow configurations in normal and emergency modes for single and multiple pump operations by 5/19/89.

2. Provide information requested by manufacturer by 6/1/89.

3. Determine adequacy of existing miniflow configuration based on updated manufacturer's recommendations.

4. Issue final report with recommendations.

McGuire Nuclear Station

	Pumps	Manufacturer
Control Area Chilled Water (YC)	1, 2	Goulds

Configuration:

Each pump has a separate full-flow path.

Continued operation of controlled area chilled pumps is justified on the following basis:

- Each pump maintains a constant flowrate which is always greater than the required miniflow.
- The pumps are completely separated from each other, therefore interaction is not a problem.

Planned Action:

1. Determine adequacy of existing miniflow based on updated manufacturer's recommendations by 5/19/89.
2. Issue final report with recommendations.

Catawba Nuclear Station

	Pumps	Manufacturer
Centrifugal Charging (NV)	1A, 1B, 2A, 2B	Pacific

Configuration:

Two pumps per unit have separate miniflow lines. Each miniflow line contains an orifice, supplied by the pump manufacturer to control the minimum flow for the associated pump. Downstream of the orifices, miniflow lines merge into a common miniflow line which returns to Volume Control Tank.

Continued operation of the centrifugal charging pumps is justified on the following basis:

- Miniflow orifices meter miniflow to meet the manufacturer's requirements. Pumps are tested quarterly (IWP program) in miniflow mode. Quarterly tests show acceptable levels of vibration and temperature rise.

- Above mentioned miniflow orifices preclude pump interaction, since the back pressure in the common line portion of the miniflow line downstream of the orifices will be low.

Planned Action:

1. Verify minimum flow configurations in normal and emergency modes for single and multiple pump operation by 5/19/89.

2. Provide information requested by manufacturer (Dependent upon manufacturer's date of response).

3. Determine adequacy of existing miniflow configurations based on updated manufacturer's recommendations.

4. Issue final report with recommendations.

Catawba Nuclear Station

	Pumps	Manufacturer
Boric Acid Transfer (NV)	**1A, 1B, 2A, 2B**	**Crane-Chempump**

Configuration:

Each pair of pumps has a common miniflow line and orifice. Normally, one pump is aligned with Boric Acid Tank and miniflow from this pump flows back to the tank and helps maintain thermal equilibrium. The design miniflow is in accordance with manufacturer's recommendation.

Continued operation of the boric acid transfer pumps is justified on the following basis:

- Miniflow requirements provided by the manufacturer are met for one or both pumps running per unit by flow rates several times higher than miniflow requirements.

- Two pump operation is for recirculating the Boric Acid Tank prior to sampling. Pump curves (characteristics) are similar, therefore the interaction will not be a problem. They will not dead-head each other.

Planned Action:

1. Verify minimum flow configurations in normal and emergency modes for single and multiple pump operations by 5/19/89.

2. Obtain final input from the manufacturer.

3. Determine adequacy of existing miniflow configurations based on updated manufacturer's recommendations.

4. Issue final report with recommendations.

Catawba Nuclear Station

	Pumps	Manufacturer
Residual Heat Removal (ND)	1A, 1B, 2A, 2B	Ingersoll-Rand

Configuration:

Each pump has a separate minimum flow line which provides a path from the pump discharge downstream of the respective heat exchanger to the pump suction. A valve automatically opens on low flow to assure adequate miniflow.

Continued operation of the residual heat removal pumps is justified on the following basis:

- Testing of pumps quarterly (IWP program) shows that available miniflow meets manufacturer's requirements. The tests show acceptable level of vibration and temperature rise. Also, the pumps are used during refueling outages (mid-loop operation) to remove residual heat. The operations have been continued with relatively low flow rates and have shown no pump degradation.

- Pumps have separate minimum flow lines. At the minimum flowrates anticipated, pumps' characteristics are such that interaction should not be a problem, i.e. the pumps will be operating sufficiently out on their curves such that the stronger pump will not dead-head the weaker.

Planned Action:

1. Verify minimum flow configuration in normal and emergency modes for single and multiple pump operation by 5/19/89.

2. Provide information requested by manufacturer by 6/1/89.

3. Determine adequacy of existing miniflow configuration based on updated manufacturer's recommendations.

4. Issue final report with recommendations.

Catawba Nuclear Station

	Pumps	Manufacturer
Safety Injection (NI)	1A, 1B, 2A, 2B	Pacific

Configuration:

Two Safety Injection pumps per unit have separate miniflow lines. Each miniflow line contains an orifice, supplied by the pump manufacturer to control the minimum flow for the associated pump. Downstream of the orifices, miniflow lines merge into a common miniflow line which returns to Refueling Water Storage Tank.

Continued operation of the safety injection pumps is justified on the following basis:

- Miniflow orifices meter miniflow to meet the manufacturer's requirements. Pumps are tested quarterly (IWP program) in miniflow mode. Quarterly IWP tests show acceptable levels of vibration and temperature rise.
- Above mentioned miniflow orifices preclude any pump interaction, since the back pressure in the common line portion of the miniflow line downstream of the orifices will be low.

Planned Action:

1. Verify minimum flow configuration in normal and emergency modes for single and multiple pump operation by 5/19/89.
2. Provide information requested by manufacturer (Dependent upon manufacturer's date of response).
3. Determine adequacy of existing miniflow configuration based on updated manufacturer's recommendations.
4. Issue final report with recommendations.

Catawba Nuclear Station

	Pumps	Manufacturer
Containment Spray (NS)	1A, 1B, 2A, 2B	Ingersoll-Rand

Configuration:

Two identical pumps per unit are installed in separate flow paths without any interaction.

Continued operation of the containment spray pumps is justified on the following basis:

- Flows exceed miniflow requirements during normal system operations. Minimum flow is tested quarterly (IWP program) while pump is throttled.

- Interaction is not a problem, since pumps discharge on separate paths. During the tests, only one pump is operated, hence pump to pump interaction is not a problem.

Planned Action:

1. Provide information requested by manufacturer by 6/1/89.

2. Determine adequacy of existing miniflow based on updated manufacturer's recommendations.

3. Issue final report with recommendations.

Catawba Nuclear Station

	Pumps	Manufacturer
Motor Driven Aux. Feedwater (CA)	1A, 1B, 2A, 2B	Bingham

Configuration:

An auto-recirculation check valve at the discharge of each pump opens on low flow to provide a miniflow path.

Continued operation of the motor driven auxiliary pumps is justified on the following basis:

- Minimum flow values for pumps were determined by Duke Power since manufacturer's documentation gives no specific requirements. This minimum flow is provided by auto-recirculation check valves.

- Interaction affecting minimum flow does not occur.

Planned Action:

1. Verify minimum flow configuration in normal and emergency modes for single pump operation by 5/19/89.

2. Provide information requested by manufacturer by 6/1/89.

3. Determine adequacy of existing miniflow configuration based on updated manufacturer's recommendations.

4. Issue final report with recommendations.

Catawba Nuclear Station

	Pumps	Manufacturer
Turbine Driven Aux. Feedwater (CA)	1, 2	Bingham

Configuration:

An auto-recirculation check valve at the discharge of each pump opens on low flow to provide a miniflow path.

Continued operation of the turbine driven auxiliary pumps is justified on the following basis:

- Minimum flow values for pumps were determined by Duke Power since manufacturer's documentation gives no specific requirements. This minimum flow is provided by auto-recirculation check valves.

- Interaction affecting minimum flow does not occur.

Planned Action:

1. Verify minimum flow configuration in normal and emergency modes for single pump operation by 5/19/89.

2. Provide information requested by manufacturer by 6/1/89.

3. Determine adequacy of existing miniflow configuration based on updated manufacturer's recommendations.

4. Issue final report with recommendations.

Catawba Nuclear Station

	Pumps	Manufacturer
Component Cooling Water (KC)	1A1, 1A2, 1B1, 1B2 2A1, 2A2, 2B1, 2B2	Goulds

Configuration:

Each pair of pumps shares a common minimum flow line which has a valve that automatically opens on flow to provide total minimum flow for the two pumps.

Continued operation of the component cooling water pumps is justified on the following basis:

- Flow instrumentation opens and closes a valve in a common miniflow line in each train to assure adequate total minimum flow for each pair of pumps. Worst case mode has been documented by calculation and the miniflow valve set accordingly, with both pumps running.

- At minimum flowrate employed, pump characteristics are such that interaction is not a problem, as discussed above and verified by testing.

Planned Action:

1. Determine adequacy of existing miniflow configuration based on updated manufacturer's recommendations by 5/19/89.

2. Issue final report with recommendations.

Catawba Nuclear Station

	Pumps	Manufacturer
Nuclear Service Water (RN)	1A, 1B, 2A, 2B	Bingham

Configuration:

The minimum flow path for all four pumps is through one or more component cooling heat exchangers. During normal operation a valve on the discharge side of one of the heat exchangers is automatically throttled on flow from each pump to provide a minimum flow path. On receipt of an ESF signal or loss of offsite power, the valves fail open to assure a path.

Continued operation of the nuclear service water pumps is justified on the following basis:

- Minimum flow interlocks and valve failure positions are in place which provide sufficient flow paths to meet existing miniflow requirements during unfaulted operational modes with a minimum of operator action, and postulated accidents with or without operator action.

- At the range of minimum flowrates anticipated, pump characteristics are such that interaction should not be a problem.

Planned Action:

1. Verify minimum flow configurations in normal and emergency modes for single and multiple pump operation by 5/19/89.

2. Provide information requested by manufacturer by 6/1/89.

3. Determine adequacy of existing miniflow configuration based on updated manufacturer's recommendations.

4. Issue final report with recommendations.

	Pumps	Manufacturer
Control Area Chilled Water (YC)	1, 2	Goulds

Configuration:

Each pump has a separate full-flow path.

Continued operation of controlled area chilled pumps is justified on the following basis:

- Each pump maintains a relatively constant flowrate which is always greater than the required miniflow.
- The pumps are completely separated from each other, therefore interaction is not a problem.

Planned Action:

1. Determine adequacy of existing miniflow based on updated manufacturer's recommendations by 5/19/89.
2. Issue final report with recommendations.