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A Duke Energy Company

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March 9, 2001

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

Subject: Duke Energy Corporation
Catawba Nuclear Station, Unit 2
Docket Number 50-414
Proposed License Amendment
Revision of Unit 2 Reactor Coolant System Cold Leg Elbow Tap Flow Coefficients

Pursuant to 10 CFR 50.90, Duke Energy Corporation is requesting an amendment to the Catawba Nuclear Station Unit 2 Facility Operating License. This amendment will allow a revision to the cold leg elbow tap flow coefficients used in the determination of Reactor Coolant System (RCS) flow rate. Note that while this submittal constitutes a formal license amendment request, there are no associated Technical Specification changes required.

On February 17, 1995, the NRC issued Amendments 128 and 122 for Units 1 and 2, respectively. These amendments allowed a change in the method used to measure RCS flow rate from a calorimetric heat balance method to a method based on a normalization of the RCS cold leg elbow tap signals to constants derived from averaged calorimetrics from previous fuel cycles. In the Safety Evaluation for Amendments 128 and 122, the NRC notified Duke Energy that any future changes to the cold leg elbow tap flow coefficients would require prior NRC review and approval. The attachments to this amendment request explain the background associated with Duke Energy's need to revise the Unit 2 cold leg elbow tap flow coefficients and include the technical justification necessary to support this amendment request.

The contents of this amendment request package are as follows:

A001

Attachment 1 provides a description of the proposed changes and technical justification. Pursuant to 10 CFR 50.92, Attachment 2 documents the determination that the amendment contains No Significant Hazards Considerations. Pursuant to 10 CFR 51.22(c)(9), Attachment 3 provides the basis for the categorical exclusion from performing an Environmental Assessment/Impact Statement.

Implementation of this amendment to the Catawba Unit 2 Facility Operating License will not impact the Catawba Updated Final Safety Analysis Report (UFSAR).

Duke Energy is requesting NRC review and approval of this amendment request by September 1, 2001, so that the amendment will be implemented between the Unit 2 shutdown for the Refueling Outage for the End-of-Cycle 11 and the startup for Cycle 12. Duke Energy has determined that sufficient flow margin exists to allow Unit 2 operation for the remainder of Cycle 11; however, approval of this amendment request will be required to support Cycle 12 operation.

In accordance with Duke Energy administrative procedures and the Quality Assurance Program Topical Report, this proposed amendment has been previously reviewed and approved by the Catawba Plant Operations Review Committee and the Duke Energy Corporate Nuclear Safety Review Board.

Pursuant to 10 CFR 50.91, a copy of this proposed amendment request is being sent to the appropriate State of South Carolina official.

Inquiries on this matter should be directed to G.K. Strickland at (803) 831-3585.

Very truly yours,

Gary R. Peterson

GKS/s

Attachments

Gary R. Peterson, being duly sworn, states that he is Site Vice President of Duke Energy Corporation; that he is authorized on the part of said corporation to sign and file with the Nuclear Regulatory Commission this amendment to the Catawba Nuclear Station Facility Operating License Number NPF-52; and that all statements and matters set forth herein are true and correct to the best of his knowledge.

Gary R. Peterson, Site Vice President

Subscribed and sworn to me: 3-9-01
Date

Notary Public

My commission expires: 6-26-02
Date

SEAL

xc (with attachments):

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ATTACHMENT 1

DESCRIPTION OF PROPOSED CHANGES AND TECHNICAL JUSTIFICATION

BACKGROUND INFORMATION

On February 17, 1995, the NRC approved and issued Amendment Numbers 128 and 122 for Catawba Units 1 and 2, respectively, allowing the change in the method for measuring RCS flow rate. The calorimetric heat balance method was revised to a method based on a normalization of the RCS cold leg elbow tap signals to constants derived from averaged calorimetrics from previous cycles. The derived cold leg elbow tap constants currently used and approved under Amendment Number 122 for Catawba Unit 2 are:

	Loop A	**Loop B**	**Loop C**	**Loop D**
Tap I	0.30365	0.30021	0.31370	0.29698
Tap II	0.29183	0.28332	0.29362	0.29685
Tap III	0.30020	0.30258	0.30150	0.29886

The calculated RCS flow rates as determined by the previous method resulted in apparent decreases in the indicated RCS flow rates over the life of the plant prior to the use of the elbow taps to measure flow. These indicated changes were not substantiated by the changes that had occurred in the system hydraulics, and were not confirmed by other indications of loop flow. The previous surveillance method calculated RCS flow based on steam generator thermal output from a calorimetric measurement, divided by the enthalpy difference across the reactor vessel as indicated by the hot and cold leg resistance temperature detectors (RTDs). Process effects in the hot leg temperature indication were identified as the main contributor to calculated decreases in RCS flow. Changes in core reload designs have resulted in core exit temperature distributions that, when combined with incomplete flow mixing and asymmetric flow patterns in the upper plenum, produce varying hot leg temperature indications. The net effect of these phenomena has resulted in what has been referred to as hot leg streaming. The three hot leg RTDs are oriented approximately at 120° angles in the cross section of the hot leg pipe. The RTDs can indicate different temperatures in each loop, between loops, and can change during the fuel cycle as the core power distribution changes. Due to the observed error in the calorimetric method of flow surveillance and the consequences related to core thermal margin and operating space, an alternate method of performing the flow surveillance using the cold leg elbow tap indication of flow was proposed by Duke Energy and approved by the NRC.

The elbow tap indication of flow was implemented to provide more precision and accuracy in the measurement of RCS flow and eliminate the impact of hot leg streaming on future RCS flow measurements. The data gathered since the implementation of the elbow tap method of flow measurement has shown it to be a very reliable and accurate predictor of RCS flow changes. However, it is anticipated that the measured RCS flow on Catawba Unit 2 could approach the minimum measured flow technical specification value (390,000 gpm) within the next one to two cycles. This is evident due to the initial transition to the Westinghouse Robust Fuel Assembly (RFA) fuel design beginning with Cycle 11 in April 2000. The observed RCS flow reduction in Cycle 11 and projections of additional flow decreases in the next two cycles are not compatible with the 390,000 gpm technical specification value.

DESCRIPTION OF PROPOSED CHANGES AND TECHNICAL JUSTIFICATION

It is proposed to revise the Catawba Unit 2 cold leg elbow tap constants to remove some of the excess calorimetric hot leg streaming penalty present in the current elbow tap coefficients. This revision will result in an increase in the indicated RCS flow and provide an increase in the RCS flow margin to the current Technical Specification 3.4.1 minimum measured flow limit.

Technical Specification Surveillance Requirement 3.4.1.3 requires that the RCS total flow rate be verified to be greater than or equal to 390,000 gpm at least once per 12 hours. Recently, the beginning-of-cycle (BOC) 11 Catawba Unit 2 RCS flow rate was determined to be 392,864 gpm, which provides 2,864 gpm or 0.7% flow margin to the technical specification RCS minimum measured flow rate limit. The end-of-cycle (EOC) 10 refueling outage at Catawba Unit 2 introduced 72 Westinghouse RFA fuel assemblies which resulted in a post-refueling outage RCS flow decrease of approximately 1,876 gpm or 0.5% flow. Since the next cycle (Cycle 12) at Catawba Unit 2 will contain the same fuel type and likely the same batch size, the RCS flow rate can be expected to decrease by a similar amount. Estimating an RCS flow rate decrease of an additional 1,876 gpm will leave a flow margin of approximately 988 gpm or 0.25% margin. While this flow rate is still above the technical specification minimum measured flow rate limit, past experience has shown that operating with this little margin is undesirable. The signal noise for these flow channels will most likely result in low flow alarms during the cycle.

The originally approved elbow tap coefficients, as described above, were determined by averaging the elbow tap coefficients calculated each cycle using the calorimetric method of RCS flow determination. This average consisted of the calculated elbow tap coefficients for eleven separate calorimetrics performed between August 1986 and April 1993. As a result of the hot leg streaming phenomena, the flow coefficients calculated each cycle at Catawba Unit 2 resulted in severe flow penalties each cycle even though no significant steam generator tube plugging was occurring. Therefore, when these coefficients were averaged to produce the set of elbow tap coefficients described above, the averaged set of coefficients retained the flow penalties incurred by the calorimetrics up until the time the elbow tap coefficients were set. An analytical model developed to track flow changes due to RCS configuration changes such as fuel ΔP changes and steam generator tube plugging, calculates the Catawba Unit 2 initial flow to be 401,755 gpm and the current flow to be approximately 400,580 gpm. The difference between the current analytical model flow and the current elbow tap measured flow is 7,716 gpm. Catawba Unit 2 currently has a total steam generator tube plugging level of approximately 1.2%. Since both the analytical model and indicated elbow tap flow account for the steam generator tube plugging and other pressure drop related changes, the difference between these flow values is largely the result of the hot leg streaming penalties contained in the calorimetrics used to produce the averaged set of elbow tap coefficients.

It is proposed to calculate a new set of elbow tap coefficients using a subset of the original calorimetrics to produce a new set of elbow tap coefficients with reduced impact from the later calorimetrics with large hot leg streaming penalties. This will produce a set of elbow tap coefficients that will be slightly higher than those currently used. The resulting indicated flow will be higher due to the removal of the excess conservatism in the current coefficient set. The seven most recent calorimetrics, those performed between June 1989 and April 1993, and one early calorimetric performed in August 1986 will be removed from the average to produce the new set of coefficients. The August 1986 calorimetric produced a flow which was slightly higher than that predicted by the analytical flow model and was therefore slightly non- conservative with respect to the analytical model (see Figure 2). This point represented a slight offset to the hot leg streaming penalties in the current coefficients and was removed since the slight non-conservatism would play a bigger role in the new coefficients, which have fewer penalties. The seven most

recent calorimetrics included in the current coefficients were removed since they contain a large fraction of the hot leg streaming penalties contained in the current coefficients. This will leave three calorimetrics performed between September 1986 and March 1988 included in the averaged elbow tap coefficient set. Of the three points used to produce the new coefficients, at least one contains a significant amount of hot leg streaming penalty to ensure these coefficients remain conservative with respect to the analytical flow model. The new set of calculated elbow tap coefficients are:

	Loop A	**Loop B**	**Loop C**	**Loop D**
Tap I	0.30680	0.30313	0.31712	0.29936
Tap II	0.29606	0.28601	0.29659	0.29929
Tap III	0.30382	0.30689	0.30389	0.30137

Using the delta P indications from the last RCS flow surveillance, and the new set of elbow tap coefficients, a new RCS flow rate of 396,907 gpm is calculated for the current cycle (Cycle 11). This represents an increase in the indicated flow rate of approximately 4,043 gpm or 1.0% of the Technical Specification minimum measured flow rate limit. Figure 1 shows the relationship between the current elbow tap indication of flow, the flow indication using the new elbow tap coefficients, and the analytical model prediction of flow. It can be seen that in Figure 1 the RCS flow using the new elbow tap coefficients generally mirrors the elbow tap flow using the current elbow tap coefficients, while providing approximately 1.0% additional flow margin. Figure 2 provides a plot of the Catawba Unit 2 calorimetric-determined RCS flow compared to the analytical flow model prediction of flow. In addition, this figure is annotated to describe the calorimetric-determined elbow tap coefficients used to determine the current averaged set of elbow tap coefficients and the new set of averaged coefficients.

The elbow tap indication of flow was implemented to provide more predictability in the measurement of RCS flow over the previous calorimetric method of measuring RCS flow. The flow data gathered since the implementation of the elbow tap method of flow measurement has shown it to be a stable and accurate indicator of RCS flow changes. The current elbow tap coefficients, however, contain significant excess flow conservatism due to the method in which they were produced. The removal of some of the excess flow margin, which was introduced by the hot leg streaming flow penalties in later

calorimetrics, will allow additional margin between the indicated flow and the Technical Specification minimum measured flow limit. The proposed changes in the elbow tap coefficients will continue to be conservative with respect to the analytical model flow predictions, since the proposed elbow tap coefficients will continue to contain some hot leg streaming penalties from the calorimetric-determined coefficients used in the average. The indicated flow increase will accommodate any future flow decreases resulting from the upcoming core reloads containing Westinghouse RFA fuel, while allowing sufficient operating margin. Once the new elbow tap coefficients are implemented, the current flow margin to the Technical Specification minimum measured flow limit will be approximately 1.77%. The flow margins following the next two refueling outages are projected to be 1.29% RCS flow for the second reload of RFA fuel and 0.95% RCS flow for a full core of Westinghouse RFA fuel.

SUMMARY AND CONCLUSIONS

The RCS flow margin to the Technical Specification minimum measured flow limit at Catawba Unit 2 currently stands at approximately 0.7% flow. The introduction of Westinghouse RFA fuel has resulted in flow decreases following the Catawba Unit 2 Cycle 10 refueling outage to be slightly higher than anticipated. As a result of the higher fuel pressure drop, it is expected that the indicated RCS flow at Catawba Unit 2 will approach the Technical Specification 3.4.1 minimum measured flow limit within the next one or two fuel cycles. Since the current set of elbow tap coefficients contains substantial amounts of RCS flow margin, the removal of some of this margin would allow more operating room between the indicated RCS flow and the Technical Specification limit. The proposed changes in the elbow tap coefficients will continue to be conservative with respect to the analytical model flow predictions, since the proposed elbow tap coefficients will continue to contain some hot leg streaming penalties from the calorimetric-determined coefficients used in the average.

Figure 1

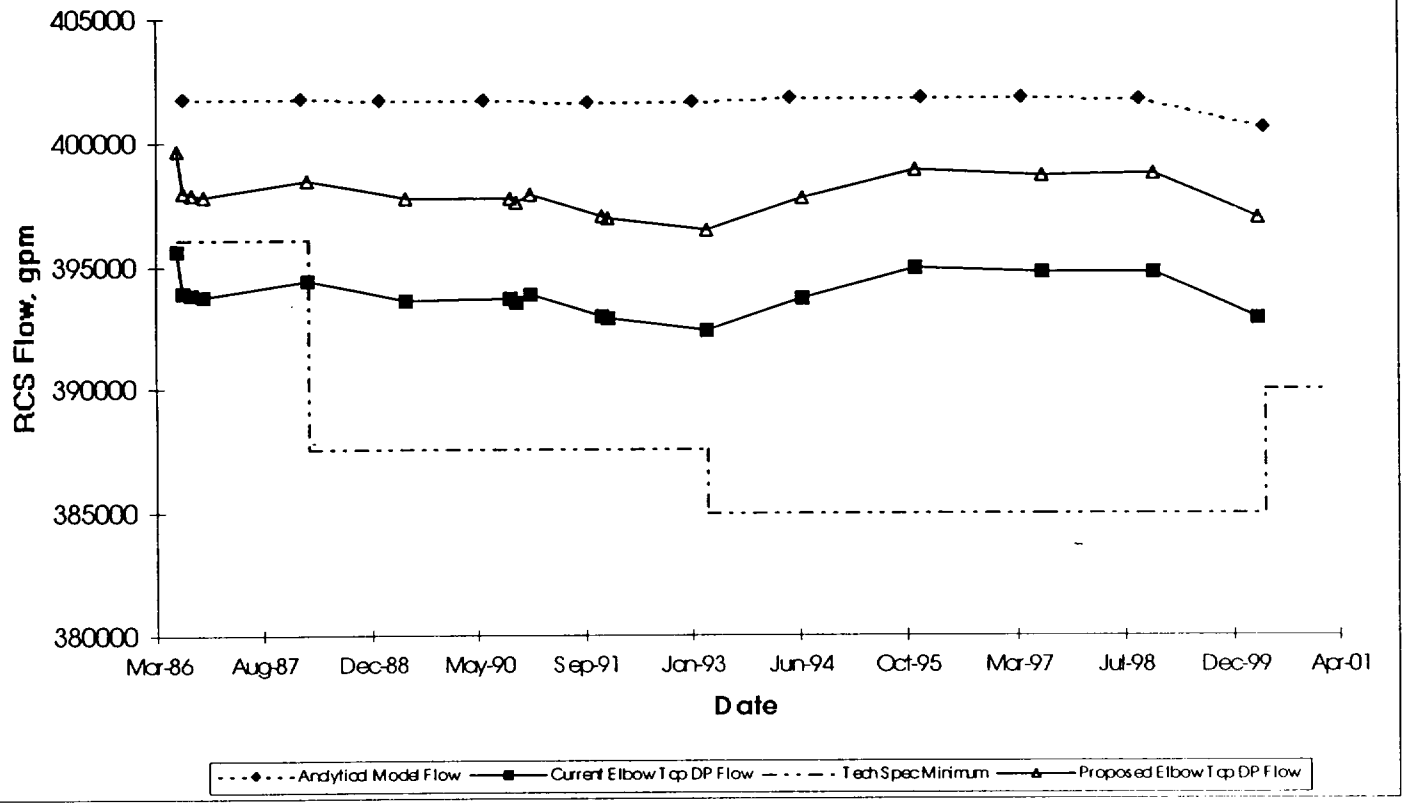
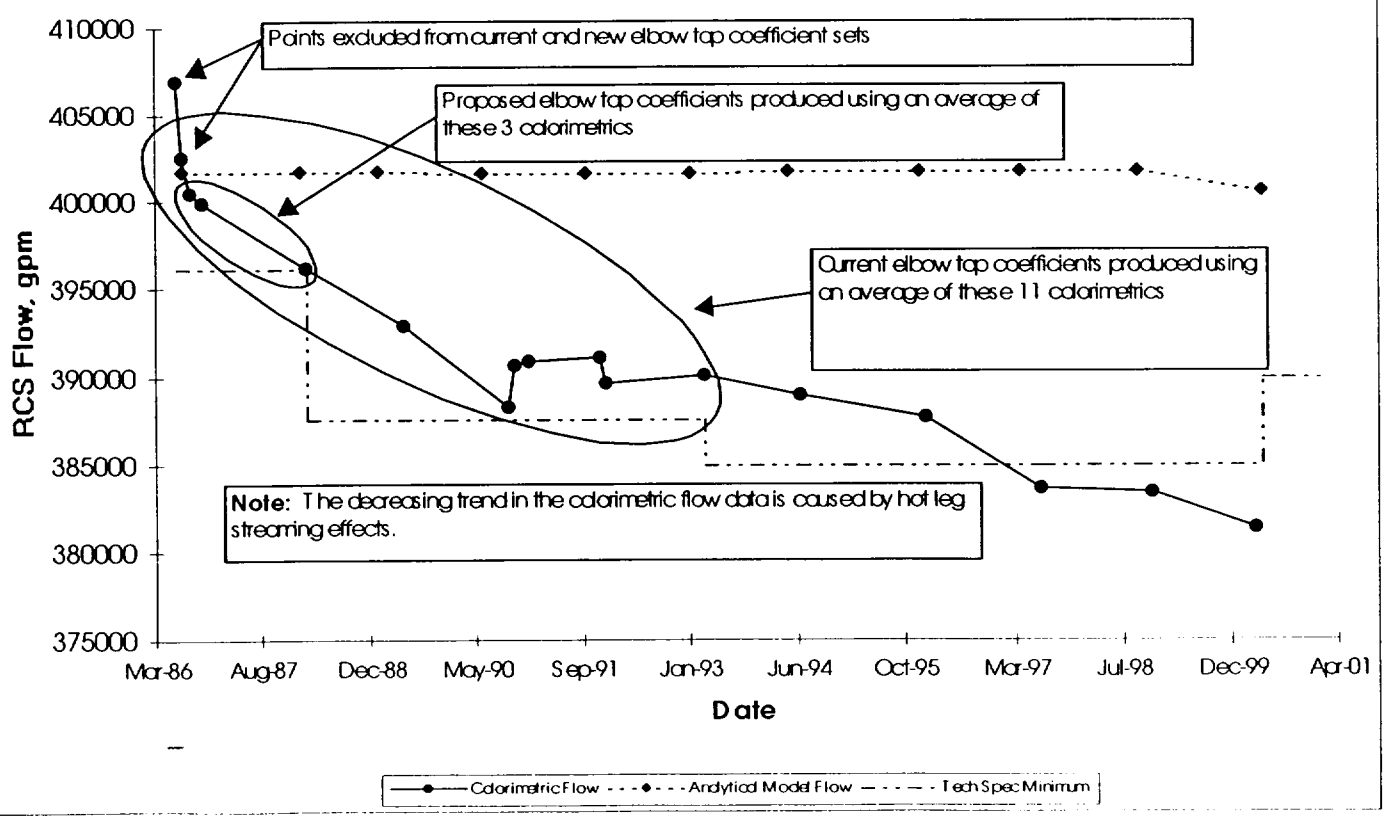


Figure 2



ATTACHMENT 2

NO SIGNIFICANT HAZARDS CONSIDERATION DETERMINATION

The following discussion is a summary of the evaluation of the changes contained in this proposed amendment against the 10 CFR 50.92(c) requirements to demonstrate that all three standards are satisfied. A no significant hazards consideration is indicated if operation of the facility in accordance with the proposed amendment would not:

1. Involve a significant increase in the probability or consequences of an accident previously evaluated, or

2. Create the possibility of a new or different kind of accident from any accident previously evaluated, or

3. Involve a significant reduction in a margin of safety.

First Standard

The proposed amendment will not involve a significant increase in the probability or consequences of an accident previously evaluated. No component modification, system realignment, or change in operating procedure will occur which could affect the probability of any accident or transient. The revised cold leg elbow tap flow coefficients will not change the probability of actuation of any Engineered Safeguards Feature or other device. The actual Unit 2 RCS flow rate will not change. Therefore, the consequences of previously analyzed accidents will not change as a result of the revised flow coefficients.

Second Standard

The proposed amendment will not create the possibility of a new or different kind of accident from any accident previously evaluated. No component modification or system realignment will occur which could create the possibility of a new event not previously considered. No change to any methods of plant operation will be required. The elbow taps are already in place, and are presently being used to monitor flow for Reactor Protection System purposes. They will not initiate any new events.

Third Standard

The proposed amendment will not involve a significant reduction in a margin of safety. The removal of some of the excess flow margin, which was introduced by the hot leg streaming flow penalties in later calorimetrics, will allow additional operating margin between the indicated flow and the Technical Specification minimum measured flow limit. The proposed changes in the cold leg elbow tap flow

coefficients will continue to be conservative with respect to the analytical model flow predictions, since the proposed coefficients will continue to contain some hot leg streaming penalties from the calorimetric determined coefficients used in the average.

An increase in the RCS flow indication of approximately 1.0% will increase the margin to a reactor trip on low flow but will not adversely affect the plant response to low flow transients. Current UFSAR Chapter 15 transients that would be expected to cause a reactor trip on the RCS low flow trip setpoint are Partial Loss of Reactor Coolant Flow, Reactor Coolant Pump Shaft Seizure and Reactor Coolant Pump Shaft break transients. Three reactor trip functions provide protection for these transients, RCS low flow reactor trip, RCP undervoltage reactor trip and RCP underfrequency reactor trip. The transient analyses of these events assume the reactor is tripped on the low flow reactor trip setpoint. This is conservative and produces a more severe transient response since a reactor trip on undervoltage or underfrequency would normally be expected to trip the reactor sooner and therefore reduce the severity of these transients.

The RCS low flow reactor trip is currently set at 91% of the Technical Specification minimum measured flow of 390,000 gpm. The setpoint will not be revised as a result of this change, which means the transients relying on this function will behave in the same manner with the reactor trips occurring at essentially the same conditions as previously analyzed. Therefore, any small increase in the reactor trip margin gained by the small increase in the indicated RCS flow will not adversely affect the plant response during these low flow events.

Based upon the preceding discussion, Duke Energy has concluded that the proposed amendment does not involve a significant hazards consideration.

ATTACHMENT 3

ENVIRONMENTAL ANALYSIS

Pursuant to 10 CFR 51.22(b), an evaluation of this license amendment request has been performed to determine whether or not it meets the criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9) of the regulations.

This amendment to the Catawba Unit 2 Facility Operating License allows for the implementation of revised cold leg elbow tap flow coefficients. Implementation of this amendment will have no adverse impact upon Unit 2; neither will it contribute to any additional quantity or type of effluent being available for adverse environmental impact or personnel exposure.

It has been determined there is:

1. No significant hazards consideration,

2. No significant change in the types, or significant increase in the amounts, of any effluents that may be released offsite, and

3. No significant increase in individual or cumulative occupational radiation exposures involved.

Therefore, this amendment to the Catawba Unit 2 Facility Operating License meets the criteria of 10 CFR 51.22(c)(9) for categorical exclusion from an environmental impact statement.