



September 28, 1999

Ms. Annette Vietti-Cook
Secretary of the Commission
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

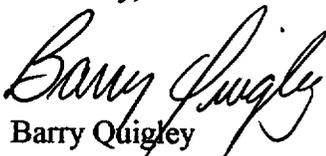
DOCKET NUMBER
PETITION RULE PRM 26-2
(64FR67202)

ATTENTION: Rulemakings and Adjudications Staff

Dear Ms. Vietti-Cook:

Pursuant to 10 CFR 2.802(a), the enclosed Petition for Rulemaking seeks to revise 10 CFR Part 26, *Fitness For Duty Programs* and 10 CFR Part 55, *Operators' Licenses*. The petition calls for clear and enforceable working hour limits to mitigate the effects of fatigue for nuclear power plant personnel performing safety-related work. Changes to the NRC Enforcement Manual, NRC Form-396, "Certification of Medical Examination by Facility Licensee" and the NRC Inspection Manual are also requested.

Sincerely,


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Enclosures

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PETITION FOR RULEMAKING TO CLEARLY ADDRESS FATIGUE

In an increasingly competitive electricity market, the battle cry is 'do more with less'. This means fewer people working more, sometimes many more, hours. Licensees have little incentive to reduce staff working hours. Overtime pay premiums were meant to penalize employers, instead they are now a cost of business. Overtime costs are a business expense to be reduced, but only until production is impacted. Non-union shops and management sometimes work overtime hours without pay performing safety-related work. What possible business reason exists to curb people working for free? Clear and enforceable working hour limits are required to ensure that the impact of personnel fatigue is minimized.

Petitioner requests that the NRC institute a rulemaking to add enforceable working hour limits to 10 CFR 26 and add a criterion to 10 CFR 55.33(a)(1) to require evaluation of known sleeping disorders. Petitioner also requests that NRC revise the Enforcement Policy to include examples of working hour violations warranting various NRC sanctions and revise NRC Form-396 to include self-disclosure of sleeping disorders by licensed operators. Further, changes to NRC Inspection Procedure 81502, Fitness for Duty Program are also requested. The petitioner is licensed by the NRC as a Senior Reactor Operator subject to the provisions of the rules and therefore has standing to request a change.

BACKGROUND

Documents that were readily available to the petitioner were those found on NRC and National Transportation and Safety Board websites as well as some materials from the NRC Public Document Room. Two documents that summarize well the hazards of fatigue are *Overtime and Staffing Problems in the Commercial Nuclear Power Industry*, Union of Concerned Scientists (Attachment A) and *Evaluation of U.S. Department of Transportation Efforts in the 1990s to Address Operator Fatigue*, NTSB (Attachment B)¹.

NRC has stated² that few significant industry events can be attributed to fatigue. Two reasons can explain this: One, NRC is correct. Two, events occur but are either not reported or not properly attributed to fatigue. A review of the NRC's Human Factors Information System (HFIS) database suggests that the second reason is most likely true. NRC Inspection Reports found 87 occurrences of staffing being less than adequate³, while the industry, via LERs, only found 11. Similarly for excessive overtime/acute fatigue, NRC reported 59 occurrences to the industry's 3. For frequent use of overtime/cumulative fatigue, NRC found 28 cases and the industry reported none.

Based on NRC's much higher reporting of fatigue-type events, it is apparent that the industry's accounting and reporting process is non-conservative. This observation is significant and made even more important by the NRC trend of reducing its inspection effort at nuclear power plants.

¹ Appendix C by Dr. Rosekind, a fatigue specialist, formerly of the NASA Ames Research Center is particularly useful.

² Letter from NRC Chairman Jackson to Congressman Markey, May 18, 1999.

³ Less than adequate staffing is a driver for high overtime since more hours must be worked by fewer workers.

Further review of the data shows that like the industry, NRC under reports fatigue issues. Fatigue causes, among other things, inattention to detail, increased risk-taking and poor work practices. Categories in the HFIS database related to these are:

- Work practices or skill of the craft less than adequate - If the skill of the craft activities are not performed consistent with management expectations, safety significance of activity or industry standard. 4913 occurrences (combined NRC and industry)
- Non-conservative decision making or questioning attitude less than adequate - If personnel fail to stop work or establish appropriate controls when presented with unfavorable or uncertain work conditions. 1805 combined occurrences.
- Self checking less than adequate - If a worker fails to adequately self-check before performing task (Stop, Think, Act, Review) 618 combined occurrences.
- Awareness or attention less than adequate - Includes problems due to failing to maintain situational awareness, infrequent or ineffective control board monitoring and problems arising from being distracted or interrupted. 2389 combined occurrences.

These 9725 items account for almost 30% of the HFIS entries for 1996 through 1998. Although there are certainly other causes for these such as distractions and interruptions, fatigue most probably played a role in a respectable percentage. Consider an NTSB report⁴ which found that, depending on the transportation mode, 21% to 33% of consequential events were fatigue related. However, the NRC only attributed 90 items directly to fatigue. It is highly unlikely that less than 1% were due to fatigue. Consider also that the Department of Transportation spent over \$30 million on fatigue research in fiscal years 1990 to 1998. No figures could be found in the NRC budget related to fatigue research. Based on a review of various NTSB and DOT products and comparison to recent NRC products, the NRC may not be qualified to detect fatigue-related events until they grow to the size of Peach Bottom.⁵

Three other factors reduce faith in NRC and industry fatigue reporting:

1. Some fatigue errors are latent. For example, valve mispositionings due to fatigue-driven inattention to detail which have no immediate impact may not be discovered for quite some time. When the mispositioning is found, it is very difficult to trace when it was mispositioned, let alone why. Another example would be procedures with technical errors due to an over-worked and fatigued staff.
2. The HFIS database shows 392 occurrences of root cause analysis being less than adequate. This reduces the faith in the quality of the LERs presented by industry to identify all causes of an event.

⁴ NTSB/SR-99/01 *Evaluation of U.S. Department of Transportation Efforts in the 1990s to Address Operator Fatigue*, May 1999 National Transportation Safety Board

⁵ The NRC ordered the two reactors at the Peach Bottom nuclear plant to be shut down in March 1987 after NRC inspectors discovered licensed operators asleep in the control room.

3. The NRC is not aggressive in looking for fatigue issues. Discussions with NRC staff showed it is very difficult to get overtime issues into Inspection Reports due to concerns that the licensee will object. Consider the NRC Inspection Procedure for labor strikes:

The inspector should look for fatigue from long hours at work which might affect the continued safe operation of the plant. Recognizing that this area is very subjective, the inspector should find clear evidence of an effect on safety before raising this as an issue with plant management.

It appears that the policy of NRC is to wait for something bad to happen and then raise the issue with licensee management.

The petitioner concludes that the impact of fatigue is under-reported by both the NRC and the industry.

The NRC is well aware of the threat to safe nuclear plant operation represented by worker fatigue. On June 15, 1982, the agency issued Generic Letter 82-12 to all plant owners. The NRC directed plant owners as follows:

Licensees of operating plants and applicants for operating licenses shall establish controls to prevent situations where fatigue could reduce the ability of operating personnel to keep the reactor in a safe condition. The controls should focus on shift staffing and the use of overtime. Key job-related factors that influence fatigue.

The objective of the controls would be to assure that, to the extent practicable, personnel are not assigned to shift duties while in a fatigued condition that could significantly reduce their mental alertness or their decision making capability. The controls shall apply to the plant staff who perform safety-related functions (e.g., senior reactor operators, reactor operators, health physicists, auxiliary operators, and key maintenance personnel).

Enough plant operating personnel should be employed to maintain adequate shift coverage without routine heavy use of overtime. The objective is to have operating personnel work a normal 8-hour day, 40-hour week while the plant is operating.

Thus, 17 years ago the NRC knew that worker fatigue posed an undue risk and required plant owners to control working hours. Now – with electricity deregulation forcing plant owners to slash staffing levels and work the survivors longer and longer hours – the NRC has redefined the fatigue risk because few significant events can be precisely attributed to fatigue. But the NRC shut down the Peach Bottom plant without first proving a single significant event at the facility could be attributed to operator inattentiveness (i.e., napping). In the 1980s, the NRC implemented a Fitness For Duty rule that includes both individual and corporate sanctions even though few significant industry events were attributed to drug or alcohol abuse. The petitioner's point is not that the NRC acted inappropriately in these cases. On the contrary, petitioner views these NRC actions as responsible measures taken to reduce the risk of an accident caused by degraded human performance. Petitioner is merely asking the NRC to take comparable steps to prevent degraded human performance resulting from fatigue.

PROPOSED CHANGES

A. Proposed Revision to 10 CFR 26 to address Working Hour Limits:

- 1) The following limits apply for personnel performing safety-related work:
 - a) During non-outage periods:
 - i) 60 hours per week, and
 - ii) 108 hours in two weeks.
 - b) During outage periods⁶:
 - i) 72 hours per week, and
 - ii) 132 hours in two weeks.
 - c) The maximum annual limits⁷ as a percentage over 2080 hours are:

Year ending	Shift Workers		Non-shiftworkers	Roving Crews
	Licensed	Non-licensed		
Dec 31, 2003 ⁸	20	20	30	30
Dec 31, 2002	25	20	35	35
Dec 31, 2001	30	25	40	40

- d) No part of a 16-hour shift shall occur between the hours of 11pm and 7am, except for turnover.
 - e) No more than two 16-hour shifts shall occur in a rolling 7-day period. The first 16-hour shift shall be followed by a 16-hour rest period. The second 16-hour shift shall be preceded by a 24-hour rest period. The rest periods may be combined.
 - f) No more than 24 hours in a 48 hour period.
 - g) The limits apply to an individual regardless of work location or employer.
 - h) Turnovers:
 - i) A turnover time of 1-hour (1-1/2 hours outage) may be allocated in any manner between an individual's oncoming and offgoing turnovers. Any balance of time remaining from turnover shall not be used for other purposes.
 - ii) Exceeding the turnover time limit shall not constitute violation of the working hour limits provided:
 - (1) The condition is entered into the Licensee's Corrective Action program, and
 - (2) No more than one occurrence per individual per week.
 - iii) The turnover time allowance shall only apply to written turnovers conducted face-to-face.
- 2) The following exceptions apply to the work hour limits of paragraph 1) provided the licensee takes action to minimize the effects of fatigue on human performance. Such actions may be demonstrated by compliance with paragraph 3) in addition to increased supervisory oversight.
 - a) Activation of the Emergency Plan under 10 CFR 50.47,

⁶ Outage periods are defined as the 48 hours prior to reactor shutdown, the duration of the shutdown and the 48 hours after synchronizing to the grid.

⁷ Exclusive of turnover time.

⁸ And all subsequent years.

- b) For those plants which shutdown for severe weather, the limits are suspended from the beginning of the power reduction until the severe weather has passed,
 - c) The transition to Daylight Savings time in the Fall. No showing of minimization of fatigue is required for this exemption,
 - d) Plant transients, typically large unplanned power changes or initiation of major Engineered Safety Features. Avoidance of Tech Spec required shutdowns is not a transient covered by this exemption.
 - e) For extended shutdowns the biweekly limit increases to 144 hours per week (weekly remains at 72 hours) provided:
 - i) Prior to restart or fuel load a plan is in place to ensure adequate rest for personnel performing critical tasks. Critical tasks are on a higher tier than safety-related work and are physical and administrative tasks directly related to fuel load and startup of the primary and secondary plant. Critical tasks would typically be those related to fuel load, primary and secondary system fill and vents, safety-related system testing, plant heatup and reactor startup (through the reaching of full power).
 - ii) The role of fatigue is specifically and promptly evaluated for all⁹:
 - (1) Events classified as Significant Conditions Adverse to Quality under 10 CFR 50, Appendix B Criterion XVI,
 - (2) Events classified as Conditions Adverse to Quality under 10 CFR 50, Appendix B Criterion XVI and attributed to personnel error,
 - (3) Reportable events of 10 CFR 50 and 10 CFR 20,
 - (4) OSHA recordable injuries,
 - (5) Traffic accidents involving employees on their way home from work¹⁰.
- 3) Training and monitoring of fatigue.
- a) Licensees shall provide initial and continuing fatigue mitigation training to personnel performing safety-related work, their supervisors and managers. This training shall be developed in accordance with the systems approach to training of 10 CFR 55.4. At a minimum this training will cover:
 - i) Effects of diet, gender and age on fatigue,
 - ii) Importance and ways to maximize rest in off-hours,
 - iii) Symptoms of major sleep disorders,
 - iv) *Other items as determined during the rule comment period*
 - b) Licensees shall provide training to supervisors of personnel performing safety-related work in the monitoring and detection of fatigue.

In addition, 10 CFR 26.20, 'Written policy and Procedures' should be revised to remove the word 'fatigue' from:

"Licensee policy should also address other factors that could affect fitness for duty such as mental stress, fatigue and illness."

This change is necessary to eliminate conflict from the prescriptive working hour limits and inclusion of the word 'fatigue' in a statement that is essentially only a recommendation as indicated by the word 'should'.

⁹ This includes events on other units of multi-unit sites if the personnel are under the extended outage provision.

¹⁰ Letter from D. Lochbaum, Union of Concerned Scientists to Chairman Jackson, NRC March 18, 1999

A definition should also be added to 10 CFR 26. Working Hours - All hours performing safety-related services for the licensee while on property owned or controlled by the licensee. This includes training and meetings. Breaks, paid or unpaid, are also included in the calculation of working hours for fatigue. This is appropriate since fatigue is related to several factors, including time since awakening.

BASES OF PROPOSED CHANGES

Weekly/Biweekly

The weekly and biweekly limits are to prevent cumulative fatigue over the short-term. A 60-hour limit allows 5 twelve-hour shifts or 7 eight-hour shifts. The biweekly limit would limit one of the weeks to 48 hours. The 108 hour total is based on limiting the total hours worked for twelve hour shifts to a reasonable number and ensuring those working eight hour shifts have a least one day off every two weeks.

Annual

The annual limits address longer term cumulative fatigue and are based on NUREG/CR-4248, *Recommendations for NRC Policy on Shift Scheduling and Overtime at Nuclear Power Plants*¹¹ which sought to limit overtime to 2260 hours per year. The maximum allowed by this petition exceeds this amount but is not likely that the limit of 2260 hours could be reached. The table includes a workdown curve for each of the categories to ensure that some amount of immediate relief is provided while allowing a gradual transition period. The shiftworker limits are lower to allow for the impact of rotating shiftwork, constant disruption of circadian rhythms and working during the pre-dawn trough in performance. The licensed operator curve is more gradual to allow more time to increase the number of operators, if the licensee chooses to do so. The roving crew limits are needed to prevent multi-site utilities from almost constantly having people move from site to site using the outage limits on working hours.

16 hour shifts

The 16 hour shift limits address acute fatigue. A substantial amount of first and second-hand experience is available to the petitioner which shows that any 16-hour shift involving a midshift is foolhardy. Consider a 16-hour shift from 3 PM to 7 AM. Assume the worker arises at 8 AM, after a restful sleep, on the day he is to work. A nap prior to 3 PM will be difficult, absent the use of sleeping aids, since sleeping during the day is not natural and the worker should still be rested from the previous night. Near the end of the shift the worker will have been awake for almost 24 hours. Australian researchers¹² show that at 24 hours awake, the performance degradation is equivalent to a Blood Alcohol Content of 0.10%. Additionally, with the increase in online maintenance, midshifts are no longer the quiet times they were a few years ago. Although the increased workload provides increased stimulation, stimulation is no substitute for rest. The increased activities provide more opportunities for mishaps.

¹¹ Battelle Pacific Northwest Labs, Richland WA. July 1985.

¹² *Nature*, Vol. 388, 17 July, 1997 pg. 235.

Next consider a shift from 11pm to 3 PM. Assume again the worker rises at 8 AM on the workday. It is more likely that the worker will be able to nap before work, but the nap will be limited to a few hours at most. At the end of the shift the worker will have been up for 31 hours with a 3-hour nap. Although short naps (30 minutes) may have some restorative ability they must be taken when tired. Additionally, this would qualify as a 'split rest period' under NTSB rules. NTSB is requesting the DOT to abolish split rest periods due to lack of effectiveness.

Individual Basis

Limiting hours worked, regardless of employer or location, is necessary to ensure that contractors or others are not excessively fatigued.

Turnover limits

Turnovers require special consideration. Orderly transfer of information from one shift to the next is essential for plant safety. Equally important is that the work hours are minimized and the turnover allowance is not abused. There is substantial potential for abuse of the turnover allowance since some may see it as a 'free' extra hour. For example, a maintenance worker or engineer (personnel who typically don't have written turnovers) could simply tack on an hour to their workday, absent a specific prohibition. Abuses are also possible for personnel using written turnovers. If a turnover is normally completed in 15 minutes, the extra 45 minutes shall not be used for other administrative duties. This is consistent with the requirement to control working hours to limit the effects of fatigue.

There are times when plant events require extended turnovers. The once a week exception is judged adequate based on the petitioner's experience as an on-shift SRO. The requirement to enter the condition into the Licensee's Corrective Action program is required to provide both visibility and tracking, the assumption being that a high number indicates either an excessive administrative burden or an individual performance issue.

Exemptions

The list of exemptions is considered reasonable based on the petitioner's experience. It is anticipated to grow slightly during the rulemaking phase as more experience is added. The overriding goal of the exemptions is that they be limited both in circumstance and number. The purpose is to avoid, like the plague, the ambiguity of Generic Letter 82-12.

B. Proposed Revision to 10 CFR 55, and NRC Form-396,

A revision should be made to 10 CFR 55 and NRC Form 396 to require self-disclosure and evaluation of known sleep disorders. This would allow for NRC to issue conditional licenses with the appropriate compensatory actions. This is the approach adopted by the Coast Guard in Navigation and Vessel Inspection Circular No. 2-98, *Physical Evaluation Guidelines for Merchant Marine's Documents and Licenses*, which contains guidelines for physical examinations of mariners and includes sleeping disorders as conditions to be evaluated for original and renewal licenses. This was a NTSB recommendation which was closed out in April 1999.

C. Other Changes

A full set of examples ranging from non-cited to Level I violations should be provided in the Enforcement Manual. This would provide clear guidance to NRC staff on the appropriate level of sanctions required, something sorely lacking with Generic Letter 82-12. This change to the Enforcement Manual would be similar to that made for the last major change to the Fitness for Duty rule. Changes to NRC Inspection Procedure 81502, Fitness for Duty Program, are required to provide resident inspectors with guidance in the area of fatigue.