

December 26, 2001

MEMORANDUM TO: Michael Cullingford, Special Assistant to the Director,
Office of Nuclear Reactor Regulation

FROM: Theodore R. Quay, Chief **/RA/**
Equipment and Human Performance Branch
Division of Inspection Program Management, NRR

SUBJECT: SOUTH AFRICA NATIONAL NUCLEAR REGULATOR QUESTIONS
PERTAINING TO OPERATOR LICENSING AND NUREG-1021 (TAC
NO. MA8508)

On November 2, 2001, the NRC's Office of International Programs (OIP) received an e-mail from Mr. Peter Drake, a South African nuclear regulator. This e-mail consisted of a series of questions pertaining to operator licensing at power reactors in the United States, and in particular to questions concerning NUREG-1021, "Operator Licensing Examination Standards for Power Reactors." This e-mail was subsequently forwarded to the Operator Licensing and Human Performance Section (IOHS), Office of Nuclear Reactor Regulation (NRR). Attached is the NRC staff's response to each of Mr. Drake's questions. If you have any questions, please contact David Trimble, Chief, Operator Licensing and Human Performance Section (IOHS), NRR, at (301)415-2942.

Enclosure: As stated

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NUREG-1021 QUERIES

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Question #1

"It was stated that the competencies checklist form ES-301-6 is not used. As I understand the NUREG the checklist is used to ensure that all the competencies are adequately assessed during the evaluation and is in fact required as part of ES-301 D.4.d. and item 10 of ES-301-4 'Simulator Scenario Quality Checklist'."

NRC RESPONSE

Form ES-301-6, "Competencies Checklist," is required to be used. Mr. Drake is correct that both ES-301 section D.4.d and form ES-301-4, "Simulator Scenario Quality Checklist," require form ES-301-6 to be used and submitted along with the simulator scenarios. In addition, for any exam administered, the NRC regional office is required to retain a copy of the ES-301-6 forms, in accordance with ES-501, section F.1.h.

Question #2

"It was stated that the NRC does not perform a check to ensure that items in the NRC examination have not been tested during the applicants' audit exam. This appears in direct conflict with item c of ES-301-3 'Operating Test Quality Checklist' and ES-301 D.2.i."

NRC RESPONSE

The NRC is required to perform a check to ensure that items in the NRC examination have not been tested during the applicants' audit exam, IF the facility licensee wrote the operating test. Section E.2.a of ES-301 requires the NRC to check the applicable items on form ES-301-3, "Operating Test Quality Checklist." For operating tests written by facility licensees, item 1.c of form ES-301-3 is applicable, and item 1.c states: "The operating test shall not duplicate items from the applicant's audit test(s)(see section D.1.a)." Section D.1.a of ES-301 provides additional details:

"Operating tests written by the facility licensee may not duplicate test items (simulator scenarios or JPMs) from the applicants' audit test (or tests if the applicant is retaking the examination) given at or near the end of the license training class."

ATTACHMENT

Question #3

"It was stated that all events used during the dynamic simulator examination are required to be safety significant, if there was no degradation in safety of the plant then the demonstrated competencies have no evaluation validity. An inherent assumption of the NUREG methodology appears to be that the evaluated competencies are a "sample" of the competencies that the applicant possesses. Surely the same thing can be said of competency exhibited during non-safety significant events? If degradation of plant safety is required for an unsatisfactory determination then the NUREG should stipulate this very clearly, the evaluation then deviates from a "competency evaluation" to a "competency evaluation during safety significant events". The inference that is drawn is that the applicant may (or is expected to,) act differently in events that are safety significant and those which are not. In this regard "contextualising" becomes an issue. If the sample performance cannot be extrapolated and used as an indicator of expected performance in other scenarios then the examination methodology is called into question. If there is to be no extrapolation then all that is proved during the exam is the ability to adequately handle the given events in the given sequence at that time. There is no assurance that the candidate will perform adequately in other events in other sequences at other times. The inherent assumption in adopting a sampling methodology is that performance in or of the items (events) sampled should be adequate to provide assurance that the performance in or of items (events) not sampled will meet the necessary criteria."

NRC RESPONSE

All events during the dynamic simulator examination are not necessarily required to be safety significant. The requirements for dynamic simulator events are presented in section ES-301 and Appendix D of NUREG-1021, and include [reference]:

- (a) Each scenario set must, at a minimum, require each applicant to respond to the types of evolutions, failures, and transients in the quantities identified for the applicant's license level on form ES-301-5. [ES-301 D.4.d]
- (b) An applicant should only be given credit for those events that require the applicant to perform verifiable actions that provide insight to the applicant's competence. [ES-301 D.4.d]
- (c) Each scenario set must also allow the examiner to evaluate the applicant's performance on each competency and rating factor germane to the applicant's license level. [ES-301 D.4.d]
- (d) Uncomplicated events that require no operator action beyond the acknowledgment of alarms and verification of automatic actions provide little basis for evaluating the operators' competence and should not be included on the operating test unless they are necessary to set the stage for subsequent events. [Appendix D B.3]

(e) Events must be incorporated into the scenario that will allow an unsatisfactory evaluation of an operator or a crew in a particular rating factor if they perform poorly. Scenarios that require little analysis or problem-solving and few operator actions may not provide an adequate basis to evaluate the required rating factors. [Appendix D C.1.d]

With regard to the competencies and rating factors, each applicant must be exposed to events that could result in a score of from "1" to "3" for each and every rating factor and competency. It is true that most rating factor scores of "1" require some form of plant degradation. However, some rating factors do not require plant degradation for a score of "1". In addition, some rating factors may be observed and evaluated during multiple scenario events. In accordance with ES-303, section D.2.c, a rating of "1" would be justified if the applicant committed multiple errors of lesser significance that have a bearing on the rating factor.

Questions 4, 5, 6, and 7

NRC COMMENTS

These four questions pertain to the grading of license applicants during dynamic simulator scenarios. In accordance with NUREG-1021 section ES-303, dynamic simulator examination grading is performed as follows:

1. Evaluate all rough notes and documentation generated while administering the dynamic simulator examination to determine the areas in which the applicant was deficient. Label or highlight every action, response, note or comment that may constitute a performance deficiency.
2. Using as a guide the competency and rating factors descriptions in Appendix D and on form ES-303-3 (RO) or form ES-303-4 (SRO), evaluate each performance deficiency and circle the integral rating value (1 through 3) on form ES-303-1 corresponding to the behavioral anchor that most accurately reflects the applicant's performance. Whenever possible, attempt to identify the root cause of the applicant's deficiencies and assign each deficiency to no more than two different rating factors. However, one significant deficiency may be assigned to additional rating factors if the error can be shown to be relevant to each of the cited rating factors.
3. A rating of "1" would be justified if the applicant missed a critical task (i.e., by omission or incorrect performance) or committed multiple errors of lesser significance that have a bearing on the rating factor.
4. Missing one or more critical tasks does not necessarily mean that the applicant will fail the simulator test, nor does success on every critical task prevent the examiner from recommending a failure if the applicant had other deficiencies that, in the aggregate, justify the failure based on the competency evaluations.

Questions 4, 5, 6, and 7 are individually responded to below, in reference to the above stated grading policies.

Question #4

"It was stated that for a deviation to be considered adequate to downgrade a candidates' performance (say from a 3 to a 2,) the plant must have degraded in some way during the scenario. This becomes problematic when the effects of the deviation are not seen due to the nature of the scenario. Numerous deviations will have absolutely no effect on the observed condition of the plant during the limited duration of the scenario but are still indicative of undesirable performance e.g. in a steam generator tube rupture event the candidate is expected to set the steam generator power operated relief valve setpoint to just below the steam generator safety valve setpoint. Suppose the candidate in fact isolates the steam generator power operated relief valve by closing the mechanical block valve, in the traditional, uncomplicated steam generator tube rupture event this will have no effect but is in fact a potentially safety significant deviation."

NRC RESPONSE

Plant degradation is not required to downgrade an applicant's performance during the dynamic simulator examination. As stated in the above grading policies, NRC examiners are required to evaluate *every* action, response, note or comment that may constitute a performance deficiency against the competency and rating factors described in Appendix D and listed on form ES-303-3 (RO) or form ES-303-4 (SRO). Based on the wording of the rating factors listed on forms ES-303-3 and 303-4, a score of "2" for an individual rating factor typically does NOT require plant degradation. However, for a score of "1", the wording of the rating factors typically do require plant degradation. Also, as presented above in grading policy item number 3, a score of "1" is justified for a missed a critical task or by multiple errors of lesser significance that have a bearing on the rating factor.

Question #5

"It was stated that the threshold for downgrading a candidates' performance in any rating factor from a 3 to a 2 is high. A single occurrence of deficient performance in any one rating factor during a scenario is not sufficient to affect the overall rating. Similarly if the deviation has no affect it cannot be graded less than a 3. This appears to conflict with the wording for all rating factors in forms ES-303-3 and ES-304-4. In all instances a 2 rating is indicated for minor deficiencies, a 3 rating is warranted for performance without deficiencies."

NRC RESPONSE

An applicant is not required to perform flawlessly to achieve rating factor grades of "3", nor must an applicant err more than once to receive a grade of "2" in any one rating factor. NRC examiners are required to evaluate *every* action, response, note or comment that may constitute a performance deficiency against the competency and rating factors described in Appendix D and listed on form ES-303-3 (RO) or form ES-303-4 (SRO). Each performance deficiency is assigned to the rating factor(s) it most accurately reflects. A single occurrence of deficient performance could affect one (or possibly more) rating factors. Also, as discussed above in answering question #4, plant degradation is not required to downgrade an applicant's performance during the dynamic simulator examination.

Question #6

"It was stated that it was extremely rare to allocate a performance deficiency to two different rating factors and allocation to three different rating factors was never performed. This appears to conflict with the information in ES-303 D.1.e and the training at the TTC. While the root cause should be established, some performance deficiencies will span two, or more, competency ratings and the "double, or multiple hit" is justified. I don't know how often this is seen during NRC examinations but we have seen circumstances where more than one rating factor is affected."

NRC RESPONSE

It has been our experience that it is unusual to allocate a performance deficiency to multiple rating factors. However, on some occasions, a single performance error has been allocated to more than one rating factor and/or competency. NUREG-1021 prescribes when "multiple hits" are warranted, as discussed in grading policy item number 2 above:

"Whenever possible, attempt to identify the root cause of the applicant's deficiencies and assign each deficiency to no more than two different rating factors. However, one significant deficiency may be assigned to additional rating factors if the error can be shown to be relevant to each of the cited rating factors."

Question #7

"It was stated that downgrading a candidates' performance to a 1 rating due to multiple errors in a single rating factor is inappropriate. Only a single rating downgrade is allowed for multiple deficiencies. This appears to conflict with the information in ES-303 D.2.c. If the performance deficiency has no effect then it was stated that it cannot be graded less than a 3 (see points 4 and 5.) This implies that multiple errors that have no impact during the scenario but are of some safety significance could only be graded 2."

NRC RESPONSE

Multiple errors in a single rating factor can result in a score of "1", as discussed in grading policy item number 3 above:

"A rating of "1" would be justified if the applicant missed a critical task (i.e., by omission or incorrect performance) or *committed multiple errors of lesser significance that have a bearing on the rating factor.*" [italics added for emphasis].

Also, as previously stated in the response to question #4, plant degradation is not required to downgrade an applicant's performance during the dynamic simulator examination.

Final Question (No number)

"I would also be grateful for information on your examiner qualification programme, i.e. after the course how long do the trainee examiners "understudy" a certified examiner, what additional training is required for examiner certification, and, what sort of requalification/refresher training is performed for examiners?"

NRC RESPONSE

Personnel who enter the NRC as prospective examiners typically possess significant past nuclear operating experience (e.g., nuclear operator (military or civilian), nuclear training instructor) and/or a four year engineering degree.

Initial Examiner Qualification, key items:

- Reactor technology classroom training courses - reactor systems, transient response, and technical specifications (5 weeks of instruction).
- Plant simulator training course - includes training on the use of normal, abnormal, and emergency operating procedures (2 weeks of instruction, primarily performed on NRC-owned and operated plant simulators).

NOTE: Reactor technology and plant simulator training courses can also be met by appropriate past commercial nuclear power experience (e.g., previously licensed operator).

- Directed self study of Operator Licensing related documents - NUREG-1021, Title 10 Part 55 of the *Code of Federal Regulations* (10 CFR 55), applicable NRC Regulatory Guides, applicable ANSI standards, etc.
- Examiner techniques training courses - for both the written and operating tests (2 weeks of total instruction).
- Exam observations - requires observation and limited participation in the administration of three NRC exams. (Three exam observations typically will require 3 weeks total time to complete.)

Upon completion of the above activities, the trainee will write and administer one NRC exam:

- Exam development - under the instruction of a certified examiner, the trainee will write an entire NRC exam (written and operating tests) for a particular plant. (Writing an entire exam can take 4-6 weeks.)
- Exam administration and grading - under the observation and instruction of a certified examiner, the trainee will administer and grade an NRC exam for one or more licensed applicants at a particular plant. (Exam administration and grading can take 2-4 weeks to complete.)

Successfully completing the above training results in the trainee being certified to write and administer NRC exams for a *particular reactor technology* (boiling-water or Westinghouse pressurized-water reactors).

Other Qualifications

- In order to “cross-certify” from boiling water reactor technology to Westinghouse pressurized water reactor technology (or vice-versa), the applicable full course of reactor technology and plant simulator instruction (5 weeks in the classroom, 2 weeks in the simulator) must be completed.
- In order to “cross-certify” from Westinghouse pressurized water reactor technology to other pressurized water reactor technology (Babcock and Wilcox, Combustion Engineering), shorter, 3 week courses must be completed.

NOTE: As before, these technology training requirements can also be met by appropriate past commercial nuclear power experience (e.g., previously licensed operator).

- Each NRC exam has a designated exam supervisor, or chief examiner. In order to qualify as chief examiner, an examiner must perform all the supervisory functions, under the instruction of a certified chief examiner, for one NRC exam. (An NRC exam, from the start to finalizing all documentation, can take 8-12 weeks.)

Refresher Training Requirements

- Each NRC examiner/chief examiner must be observed/audited during the administration of one NRC exam or inspection per calendar year by the examiner's/chief examiner's supervisor.
- To maintain certification, all examiners must attend a refresher training course at least once every two calendar years. The refresher training requirement can be satisfied by attending either a reactor technology based course (refresher courses are 2 weeks long) or an examiner techniques course (1 week).

Recertification Training Requirements

- Any examiner who does not maintain certification, shall recertify before administering operating tests. Recertification shall, at a minimum, consist of being audited by a certified chief examiner during administration of a complete operating test and attending an examiner techniques refresher training course.