

**AmerenUE**  
Callaway Plant

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February 15, 2001

U. S. Nuclear Regulatory Commission  
Attn: Document Control Desk  
Mail Stop P1-137  
Washington, DC 20555-0001

ULNRC-4368

Gentlemen:

**REPLY TO NOTICE OF VIOLATION  
INSPECTION REPORT NO. 50-483/00-17  
CALLAWAY PLANT  
UNION ELECTRIC CO.**



This responds to Mr. Ellis W. Merschoff's letter dated January 9, 2001, which transmitted a Notice of Violation (NOV) for events discussed in Inspection Report 50-483/00-17. On February 2, 2001, Mr. William D. Johnson, Chief, Division of Reactor Projects, Branch B, advised Union Electric that the deadline for submitting this response had been extended to February 15, 2001. The response to the NOV is presented in the attachment to this letter.

After in depth review following the regulatory conference of November 9, 2000, Union Electric now disagrees that the observations discussed in the subject report are violations of 10CFR20.1101(b). The NOV inappropriately cites Union Electric for the conduct of its planning of Callaway Plant Refueling Outage 10 in October 1999. However, Union Electric's planning was consistent with industry practice to balance the competing concerns of plant safety, maintaining occupational doses ALARA, and controlling maintenance costs and duration. Although Union Electric does not disagree that there were areas requiring improvement in its performance of ALARA controls during Refueling Outage 10, Union Electric considers it used, to the extent reasonable and practical, procedures and engineering controls to achieve doses ALARA. Specifically, where NRC states commensurate compensatory measures were not taken for planned work, sufficient mock-up training was not conducted and inadequate communications existed, Union Electric disagrees. To the extent the observations in the NOV reflect areas where Union Electric identified that ALARA performance can be improved, Union Electric is committed to reducing exposures further. In fact, Union Electric initiated appropriate action prior to the NRC inspection, consistent with its commitment to the principles of ALARA. The NRC inspection report took no issue with Union Electric's planned actions.

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Union Electric has implemented and maintains an ALARA program as required by NRC regulations. Our research has not identified an enforcement action under previous inspection and enforcement policies relating to inspection of an ALARA program at a commercial nuclear facility. This is not surprising because, like Union Electric, all nuclear plant licensees have an ALARA program and conduct their operations and maintenance activities in a manner generally consistent with that program. The NOV actually creates a new regulatory requirement – dose estimates for radiation work permits must be accurate. This interpretation of 10CFR§20.1101(b) is without doubt “new or different from a previously applicable staff position.” Commission precedent and due process in implementing administrative changes dictate that changes in a Commission policy may not create a new regulatory requirement.

As stated in Union Electric’s letter of February 7, 2001, which appealed the significance assigned to this NOV, the level of significance of one “no color” finding more appropriately reflects the fact that there was no increase in risk to occupational health and safety for these ALARA observations. Union Electric’s corrective action program had already initiated plans to address the areas identified in the examples of the NOV and should be considered adequate without a higher level of NRC response. Union Electric considers escalated enforcement inappropriate for the reasons set forth in this attachment and in the letter of February 7, 2001.

The NRC recently noted that a Significance Determination Process (SDP) for physical protection inspection findings over-estimates the significance of findings, leading to a higher level of NRC response than warranted. The NRC directed suspension of violations arising from force-on-force findings. The NRC expects, however, that deficiencies identified during force-on-force exercises will be promptly addressed by the licensees' corrective action programs. As we discussed in detail in the February 7, 2001, submittal, a similar suspension of the SDP for ALARA is called for.

As a matter of clarification, it should be noted that the 165 person-rem goal discussed in the NOV was not the Refueling Outage 10 dose projection. As noted at the Regulatory Conference of November 9, 2000, the dose projection was actually 210 person-rem based on planned Work Authorizing Documents for Refueling Outage 10.

As discussed in the attachment to this letter and in Union Electric's letter of February 7, 2001, Union Electric planned the conduct of Refueling Outage 10 consistent with industry practice to balance the competing concerns of plant safety, maintaining occupational doses ALARA, and controlling maintenance costs and duration. Although Union Electric does not disagree that there were areas requiring improvement in its performance of ALARA controls, Union Electric considers that it used, to the extent reasonable and practical, procedures and engineering controls to achieve doses ALARA during Callaway Refueling Outage 10 in October 1999.

None of the material in this response to the NOV is considered proprietary by Union Electric.

If you have any questions regarding this response, or if additional information is required, please let me know.

Very truly yours,



G. L. Randolph

GLR/MAR/slk/glw

Attachment: 1) Response to Violation

cc: Mr. Ellis W. Merschoff  
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**DOCKET 50-483**  
**REPLY TO NOTICE OF VIOLATION EA-00-208**  
**NRC INSPECTION REPORT 50-483/00-17**  
**CALLAWAY PLANT**

In a letter dated January 9, 2001 from Ellis W. Merschoff, Regional Administrator, Region IV, to Garry L. Randolph, Senior Vice President and Chief Nuclear Officer, Union Electric Company, the NRC provided the final results of the NRC Staff's determination of significance for the identified findings set forth in the subject inspection report and determined the significance as associated with three White findings. The letter also included Notice of Violation (NOV) EA-00-208 which states a violation of ALARA regulations as set forth below.

In accordance with the instructions provided in the NOV, our reply to the stated violation includes: (1) the basis for disputing the violation and severity level; (2) corrective action taken and the results; (3) corrective actions that will be taken to make further improvement in ALARA performance; and (4) the date by which full compliance was achieved.

**Statement of Violation**

The General Statement of Policy and Procedure for NRC Enforcement Actions, NUREG-1600, identifies that a NOV response should identify the violation. Accordingly, the violation is listed below:

10 CFR 20.1101 (b) requires that the licensee use, to the extent practical, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are as low as is reasonably achievable (ALARA).

Contrary to the above, during Refueling Outage 10, conducted between October and November 1999, the licensee did not use, to the extent practical, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses ALARA. Specifically, although the original dose estimate for Refueling Outage 10 indicated that plant workers would receive exposures totaling 165 person-rem, the actual dose received was 305 person-rem and a significant portion of this increase was attributable to poor ALARA work practices. For example:

- a) the licensee planned and conducted maintenance activities in the vicinity of the reactor coolant system (RCS), during a time period soon after shutdown, when area dose rates were temporarily elevated by a chemical cleaning process designed to remove radioactive particulate from RCS internal surfaces, without commensurate compensatory measures, resulting in doses that were not ALARA.
- b) the licensee planned and conducted maintenance activities in the vicinity of the steam generators before the steam generator bowl drains were flushed, resulting in higher than normal area dose rates without commensurate compensatory measures, resulting in doses that were not ALARA.
- c) the licensee conducted maintenance activities on the reactor coolant pumps and steam generators without the steam generator secondary sides filled with water, resulting in higher than normal area dose rates without commensurate compensatory measures, resulting in doses that were not ALARA.
- d) the licensee conducted maintenance activities without sufficient mock-up training to familiarize contract workers with plant equipment, use of tools, and techniques to effectively reduce the dose that they would receive.
- e) the licensee performed maintenance activities with ineffective communications between radiation protection personnel and the primary contractor, which resulted in additional worker exposure due to ineffective planning and sequencing of work activities.

### **The Basis For Disputing The Violation**

Union Electric disagrees that the observations discussed in the subject report are violations of 10CFR20.1101(b). The NOV inappropriately cites Union Electric for the conduct of its planning of Callaway Plant Refueling Outage 10 in October 1999. However, Union Electric's planning was consistent with industry practice to balance the competing concerns of plant safety, maintaining occupational doses ALARA, and controlling maintenance costs and duration. Although Union Electric does not disagree that there were areas requiring improvement in its performance of ALARA controls during Refueling Outage 10, Union Electric considers that it used, to the extent reasonable and practical, procedures and engineering controls to achieve doses ALARA. Specifically, where NRC states that commensurate compensatory measures were not taken for planned work, sufficient mock-up training was not conducted and inadequate communications existed, Union Electric disagrees. To the extent the observations in the NOV reflect areas where Union Electric identified that ALARA performance can be improved, Union Electric is committed to reducing exposures further. In fact, Union Electric initiated appropriate action prior to the NRC inspection, consistent with its commitment to the principles of ALARA. The NRC inspection report took no issue with Union Electric's planned actions.

Union Electric has implemented and maintains an ALARA program as required by NRC regulations. NRC rules at 10 CFR Part 20 Subpart B, Radiation Protection Programs, §20.1101(b) state: "The licensee shall use, to the extent practical, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are as low as is reasonably achievable (ALARA)." This requirement was promulgated under a 1991 rule change that codified the previously hortatory requirement for Licensee's to develop and maintain an ALARA program. Along with the codification of this requirement, the NRC agreed there would be advantages to establishing a floor, below which efforts to further reduce collective exposure would be left to licensee ALARA programs without NRC oversight. The rule also established that compliance with the ALARA requirement is judged on whether the licensee has incorporated measures to track, and, if necessary, reduce exposures.<sup>1</sup> NRC regulations establish limits for individual occupational exposure and for individual members of the public, not for aggregate population (collective) dose. The ALARA concept is an important part of an adequate radiation protection program. Due to the practice of maintaining radiation exposures ALARA, the average worker's dose is well below limits. This is consistent with the concept of the ALARA regulation as intended to be an operating principle.<sup>2</sup> Our research has not identified an enforcement action under previous inspection and enforcement policies relating to inspection of an ALARA program at a commercial nuclear facility. This is not surprising because, like Union Electric, all nuclear plant licensees have an ALARA program<sup>3</sup> and conduct their operations and maintenance activities in a manner generally consistent with that program.

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<sup>1</sup> See, *Standards for Protection Against Radiation – Final Rule*, 56 Fed. Reg. 23360 at 23367 (1991), "Compliance with this requirement will be judged on whether the licensee has incorporated measures to track and, if necessary, to reduce exposures and not whether exposures and doses represent an absolute minimum or whether the licensee has used all possible methods to reduce exposures."

<sup>2</sup> See, *Standards for Protection Against Radiation – Final Rule*, 56 Fed. Reg. 23360 at 23366 (1991), "This shift is to emphasize that the ALARA concept is intended to be an operating principle rather than an absolute minimization of exposures."

<sup>3</sup> As currently required by 10 C.F.R. § 20.1101(b), and, prior to 1991, suggested by 10 C.F.R. § 20.1(c).

Operating a nuclear power plant safely will require some occupational exposure; the amount depends on balancing the risks of exposure against the need to do maintenance and modifications to ensure safe operation and to operate the plant economically. These decisions involve many non-fungible factors, including nuclear safety risk, ALARA goals, and operating or maintenance costs. Other plants have planned to perform steam generator maintenance starting earlier in a refueling outage with a goal of reducing outage duration and hence cost and collective exposure (performing the work hot mid-loop).<sup>4</sup> Performing work at hot mid-loop plant conditions trades off the potential for some higher collective exposures for jobs done sooner in the outage with higher radiation levels for a lower collective exposures on jobs that are directly related to a shorter outage duration.

The collective exposure for the outage also depends on the scope of work needed to ensure safety. For example, during Refueling Outage 10, Union Electric tried an innovative steam generator maintenance strategy, electrosleeving, to improve reactor coolant boundary integrity. The process was not as efficient as projected by the vendor. The decision to shift from electrosleeving to plugging for the last two of the four steam generators reduced collective dose for Refueling Outage 10. (Cost and schedule savings were also factors in the decision along with ALARA concerns.)<sup>5</sup> The collective dose for a future outage will be higher to reflect steam generator replacement.<sup>6</sup> Achieving collective exposures ALARA is a continuing balancing judgment as to what maintenance work is needed for plant safety and what actions to minimize collective dose are practical.

ALARA regulations require licensees to have and follow a process to minimize exposure, without specifying a particular outcome. Collective dose measurement and assessment is an inexact indicator of the success of a licensee's process unless it is evaluated with judgment and experience.<sup>7</sup> As such Union Electric considers it is inappropriate to judge the success of its ALARA program based on an original dose goal of 165 person-rem compared to the actual dose received of 305 person-rem and believes it is improper to conclude that a significant portion of this excess collective exposure was the result of poor ALARA work practices. Not only is the actual excess collective exposure significantly less than these numbers indicate, but also a

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<sup>4</sup> See, NRC Information Notice 2000-13, page 5, "The majority of the PWR outages which were assessed employed an early 'hot' midloop or reduced inventory configuration. This was almost exclusively an economic consideration in that the early midloop allowed for earlier entry into the steam generators to perform the required inspection activities" and page 8- 9, "With respect to the PWR outages, 94% of those assessed employed an early hot midloop or reduced inventory configuration ... The average time after shutdown prior to entering midloop was a little over 3 ½ days, with the most aggressive schedule being about 2 ½ days after shutdown ... For the vast majority of the PWR outages, either the steam generator inspections or the actual refueling activities themselves constituted the critical path for the outage."

<sup>5</sup> The collective dose for electrosleeving two of four steam generators was 24.3 person-rem, providing an indication of the likely collective exposure reduction for canceling the work on the last two steam generators.

<sup>6</sup> Union Electric currently plans steam generator replacement in 2005. Union Electric presentation at November 9, 2000, regulatory conference, Slide 20.

<sup>7</sup> See, e.g., NRC Inspection Manual, Inspection Procedure 71121, Attachment 2, paragraph 02.06, which states, "The significance of ALARA findings will often depend on reasonably accurate exposure estimates. Reasonable implies that they be based on good assumptions and correct calculations with some flexibility given with regard to expected variability due to the limits of forecasting."



better measure of the strength of the ALARA program at the Callaway Plant is its ability to find areas needing improvement and to initiate effective actions to reduce collective exposures.

Supporting that comparison to 165 person-rem exposure goal is inappropriate, Union Electric notes that the NOV incorrectly identifies that it originally estimated that plant workers would receive exposures totaling 165 person-rem during Refueling Outage 10. In fact, 165 person-rem was the management goal established over a year prior to the start of the exposure estimating process. The budget established at the completion of the dose estimating process, in September 1999 at the start of Refueling Outage 10, was 210 person-rem.<sup>8</sup>

It is also appropriate, in evaluating Union Electric's ALARA performance during Refueling Outage 10, to adjust the original estimate by 25% for higher dose levels than expected during exposure estimating. Dose rate levels were found during the entry to be 25 to 50% higher than the dose rate levels expected during planning. Using only the lower value of 25% would account for 35 person-rem of the increase over the 210 person-rem budget.<sup>9</sup> The estimate of dose rates during ALARA planning was properly based on past operating experience. Dose rate estimating was not included as an example of poor ALARA practices in the NOV. One of the key features of a strong ALARA program is the ability to find areas requiring improvement and take corrective action. Compliance with the ALARA requirement is judged on whether the licensee has incorporated measures to track, and, if necessary, reduce exposures.<sup>10</sup> One reason for setting aggressive exposure goals prior to a job is to provide a screen to identify jobs, which warrant additional scrutiny for possible corrective actions. At Callaway, the ALARA program was working as designed; aggressive dose projections led to identifying many jobs from Refueling Outage 10 where improvements could be made.<sup>11</sup> Union Electric made a decision to maintain the original estimates in the face of mounting evidence during the outage that the estimates were too low, in part to highlight areas for potential improvement in ALARA work practices at Callaway.<sup>12</sup>

Emergent work such as some RCP seal replacement work, resulted in an increase in scope to the Refueling Outage 10. This added work would account for 13 person-rem of the increase over the 210 person-rem budget.<sup>13</sup> This emergent work should not be considered due to ALARA planning or work practices as it would establish an undesirable precedent

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<sup>8</sup> Union Electric presentation at November 9, 2000, regulatory conference, Slide 5.

<sup>9</sup> Union Electric presentation at November 9, 2000, regulatory conference, Slide 5.

<sup>10</sup> See, *Standards for Protection Against Radiation – Final Rule*, 56 Fed. Reg. 23360 at 23367 (1991), "Compliance with this requirement will be judged on whether the licensee has incorporated measures to track and, if necessary, to reduce exposures and not whether exposures and doses represent an absolute minimum or whether the licensee has used all possible methods to reduce exposures."

<sup>11</sup> See, Union Electric's report, *Refuel 10 ALARA Outage Report (October 2, 1999 to November 5, 1999)*, issued in June 2000.

<sup>12</sup> Union Electric letter from R. D. Affolter (Vice President, Nuclear) (ULNRC-4343) to the NRC of November 16, 2000, Attachment 1, page 8.

<sup>13</sup> Union Electric presentation at November 9, 2000, regulatory conference, Slide 5.

that emergent work cannot be added to an outage without deleting other work or risking enforcement action.

After subtracting the exposure attributable to higher dose rates and increased work scope, the remaining excess exposure for Refueling Outage 10 is 47 person-rem (about 25% of the 210 person-rem budget). This is the maximum possible excess collective exposure for Refueling Outage 10 attributable to ALARA work practices. In fact, the excess collective exposure attributable to ALARA is probably less than that as some of the excess is likely due to emergent problems during the outage, such as foreign object retrieval from the steam generator.<sup>14</sup>

In response to the examples identified in the NOV, Union Electric notes the following specific points of disagreement with NRC statements that commensurate compensatory measures were not taken for planned work, sufficient mock-up training was not conducted and inadequate communications existed:

**NOV Example a):** "The licensee planned and conducted maintenance activities in the vicinity of the reactor coolant system (RCS), during a time period soon after shutdown, when area dose rates were temporarily elevated by a chemical cleaning process designed to remove radioactive particulate from RCS internal surfaces, without commensurate compensatory measures, resulting in doses that were not ALARA."

This example is not a violation of 10 C.F.R. § 20.1101(b) because Union Electric did take commensurate compensatory measures for planning to conduct work in the vicinity of the RCS as early in the outage as other plants. Scheduling work in the vicinity of the RCS at this time of the outage is typical for Region IV reactor licensees.<sup>15</sup> The shortening of refueling outages is a significant contributor to lowering station doses. Union Electric was selective in deciding which work to plan and conduct in the vicinity of the RCS during the shut down chemistry control phase of the outage. Only work authorized during the Outage Review Board meetings was allowed to be performed during this time period. Work that was practical to delay until the end of the clean up period was deferred.

Additionally, Union Electric did take commensurate compensatory measures as temporary shielding was installed and activities were evaluated by plant management to ensure, to the maximum extent practical, that authorized work proceeded as scheduled. These measures are consistent with the NRC policy on ALARA.<sup>16</sup> Consequently, methods were in place

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<sup>14</sup> Union Electric, *Refuel 10 ALARA Outage Report (October 2, 1999 to November 5, 1999)* issued June 2000 identifies examples of excess collective exposures due to reasons other than ALARA work practices.

<sup>15</sup> Region IV Refueling Outage Risk - an Operational Perspective, authored by J. L. Shackelford and W. B. Jones, Senior Reactor Analysts, USNRC

<sup>16</sup> See, e.g., NRC Inspection Manual, Attachment 71121.02, ALARA Planning and Controls, Section 03.05, Radiological Work Planning, which states in part: "the ALARA rule in 10CFR20 does not require every ALARA effort to demonstrate optimized exposure performance" and NRC Inspection Manual, Chapter 0609C, Occupational Radiation Safety Significance Determination Process, which states "[a] licensee's compliance with this requirement will be judged on whether the licensee has incorporated measures to track and, if necessary, to reduce exposures and not whether exposures and doses represent an absolute minimum or whether the licensee has used all possible methods to reduce exposures."

to monitor and track doses as well as a management evaluation of the doses to be incurred by placing this work at this stage of the outage.

Union Electric performed this work at this stage of the outage in order to reduce outage duration which has one advantage of attempting to reduce overall collective dose at the station.

**NOV Example b):** "The licensee planned and conducted maintenance activities in the vicinity of the steam generators before the steam generator bowl drains were flushed, resulting in higher than normal area dose rates without commensurate compensatory measures, resulting in doses that were not ALARA."

This example is not a violation of 10 C.F.R. § 20.1101(b) because Union Electric did take action to flush the steam generator bowl drains as soon as plant conditions allowed. Some work was performed in the vicinity of the steam generator bowl drains prior to flushing; however, the area(s) around the bowl drains were controlled appropriately to ensure workers would avoid these higher dose rates. The dose rates caused by the accumulation of corrosion products in these components is a "localized issue" and did not affect a significant area on the steam generator platforms. To the extent that the NOV cites Union Electric's decision to perform work under hot mid-loop plant conditions, this criticism is unjustified for the same reasons as discussed in response to NOV Example a), above.

**NOV Example c):** "The licensee conducted maintenance activities on the reactor coolant pumps and steam generators without the steam generator secondary sides filled with water, resulting in higher than normal area dose rates without commensurate compensatory measures, resulting in doses that were not ALARA."

This example is not a violation of 10 C.F.R. § 20.1101(b) because Union Electric did take action to fill the steam generators as soon as plant conditions allowed. Original planning anticipated that all work on the RCP seals and motors would occur with the steam generators full. In the course of work on one side of the plant, the discovery of a foreign object during FOSAR and the FOSAR equipment becoming caught within the steam generator, delayed refill. In addition, Union Electric decided to work all four of the RCP seals and motors to improve RCS boundary integrity. During the outage, work was continued with an objective to fill the steam generators as soon as practical, both to reduce dose rates and to provide appropriate secondary side chemistry to inhibit corrosion. To the extent that the NOV cites Union Electric's decision to perform work under hot mid-loop plant conditions, this criticism is unjustified for the same reasons as discussed in response to NOV Example a), above.

In addition, as a measure of how disproportionate the NOV is compared to licensee performance, the specific excess exposure potentially attributable to Examples a), b) and c), above, is relatively small. These three examples were identified in the NRC Inspection Report as associated with four Radiation Work Permits (RWPs). The NRC inspection

report notes that increased dose rates were only a 25% factor on exposure increase.<sup>17</sup> It would now appear that the NRC has determined that planning for work in areas that would result in a 25% increase in dose rates is a violation of ALARA regulations.

**NOV Example d):** "The licensee conducted maintenance activities without sufficient mock-up training to familiarize contract workers with plant equipment, use of tools, and techniques to effectively reduce the dose that they would receive."

This example is not a violation of 10 C.F.R. § 20.1101(b) because Union Electric did conduct mock-up training to familiarize the contract workers with the plant, equipment, use of tools and techniques that was considered appropriate prior to the outage. The NOV assertion that work was conducted "without sufficient mock-up training" is subjective and unsupported. The NRC inspection report does not provide any specific examples of events that contributed to excess collective exposure that could have been avoided by additional mock-up training, even with the benefit of hindsight.<sup>18</sup> In this case, there was training provided and it was evaluated pre-outage to be appropriate for the activities being performed. The personnel involved had training on the equipment at the vendor facilities and it was not evident during the mock-up training provided on-site that additional training was needed.

Union Electric considers the mock-up training conducted prior to Refueling Outage 10 reasonable based on historical performance and considers it took reasonable actions during and subsequent to the outage when indications of inadequate training occurred. Historical man-hour and production rate estimates from the vendor had proven to be accurate and gave no indication that additional or special training would be warranted above the level historically provided. It became apparent through work progress reviews that the vendor was unable to maintain the estimates provided for the contracted work. Union Electric identified at that time that worker experience and training levels were significant contributors to the inability to meet production estimates. As a result of this inability and in an attempt to reduce overall dose, cost and schedule, Union Electric curtailed electrosleeving activities from four Steam Generators to two Steam Generators. As part of the normal review process, as well as a formal root cause evaluation, Union Electric identified improvement opportunities relative to handling and mitigating this situation.

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<sup>17</sup> NRC Inspection Report 50-483/00-17 of October 4, 2000, enclosure Section 2OS2.b.

<sup>18</sup> Union Electric, *Refuel 10 ALARA Outage Report (October 2, 1999 to November 5, 1999)* issued June 2000, identifies that during down times, additional mock-up training was not conducted due to not having a second set of equipment on site. Union Electric is taking action to have a second set of equipment available in the future to ensure as much mock-up training is conducted as possible. A missed opportunity to conduct additional mock-up training is not equivalent to insufficient training.

In addition, as a measure of how disproportionate the NOV is compared to licensee performance, the specific excess exposure potentially attributable to this example is relatively small. Conducting insufficient mock-up training was associated with three RWPs in the NRC Inspection Report. The actual fraction of excess exposure attributable to this example is not clear, but it could not have been a 50% factor on exposure.<sup>19</sup>

**NOV Example e):** "The licensee performed maintenance activities with ineffective communications between radiation protection personnel and the primary contractor, which resulted in additional worker exposure due to ineffective planning and sequencing of work activities."

This example is not a violation of 10 C.F.R. § 20.1101(b) because Union Electric did provide communications equipment for workers during foreign object removal from the steam generator.<sup>20</sup> Also, to the extent the NRC is citing the lack of direct communications between steam generator vendor workers and Callaway Plant health physics personnel, the criticism is speculative.<sup>21</sup> Union Electric considers that direct flow of information between vendor workers and experienced health physics personnel may help both parties work more efficiently. During Refueling Outage 10, the vendor centralized review of all ALARA observations through its on-site ALARA coordinator. Even if it is assumed that the information exchange could have been improved, that observation in no way supports a conclusion that doses were not ALARA unless one assumes the vendor ALARA

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<sup>19</sup> NRC Inspection Report 50-483/00-17 of October 4, 2000, enclosure Section 2OS2.b, identifies the three RWPs as 99-53321, 99-53323 and 99-53324 where additional mock-up training should have been provided. Only by assuming that all of the growth of man-hours for the work could have been avoided by mock-up training would there be a 50% increase in exposure due to insufficient mock-up training. Union Electric, *Refuel 10 ALARA Outage Report (October 2, 1999 to November 5, 1999)* issued June 2000, pages 12 and 13, notes that RWP 99-53321 was for manway cover work which expended 513 man-hours compared to 300-350 normally, (about 50%) but also notes that some of this growth was due to response to spreads of contamination. Pages 12 and 14 note that RWP 99-53323 was for eddy current testing and electrosleeving and the man-hours for this first large scale application of electrosleeving were difficult to estimate what expected man-hour performance should have been. The man-hours for eddy current work was about twice previous experience, but this was less than half the work so could not be more than a 50% factor on exposure. Pages 12 and 15 note that RWP 99-53324 was for health physics support and that the man-hour growth for this RWP was about 62%, primarily, but not solely due to growth in the steam generator work.

<sup>20</sup> NRC Inspection Report 50-483/00-17 of October 4, 2000, enclosure Section 2OS2.b, identifies the one of the two RWPs associated with this example as 99-53022. Union Electric, *Refuel 10 ALARA Outage Report (October 2, 1999 to November 5, 1999)* issued June 2000, page 16 notes that RWP 99-53022 was for foreign object removal from the steam generator secondary side. The higher exposure was due to higher work scope, as more objects needed to be removed. Although communication systems could be improved, communications during Refueling Outage 10 was better than past experience due to incorporating lessons learned.

<sup>21</sup> NRC Inspection Report 50-483/00-17 of October 4, 2000, enclosure Section 2OS2.b, identifies one of the two RWPs associated with this example as 99-53324. Union Electric, *Refuel 10 ALARA Outage Report (October 2, 1999 to November 5, 1999)* issued June 2000, pages 12 and 15 note that RWP 99-53324 was for health physics support, the manhour growth for this RWP was about 62% and, although poor communications were a factor, the increase was primarily due to growth in the steam generator work.

coordinator was ineffective.<sup>22</sup> Union Electric's vendor revised from past practice the method of coordinating ALARA reviews to put more responsibility on its coordinator. Prior to the outage, there was no reason to think that increasing vendor responsibility for ALARA was inappropriate. In fact, it would have been reasonable to believe that such increased responsibility might improve vendor ALARA performance. In hindsight, Union Electric concludes that it would be an improvement to return to the past practice of having additional experienced Callaway Plant personnel more directly involved in improving vendor ALARA performance. Previously, NRC policy encouraged innovation in implementing ALARA.<sup>23</sup> It would be inconsistent with the principles of ALARA if the NRC was now creating a requirement that innovations in procedures and organizations for implementing ALARA requirements are acceptable not only if these innovations have the potential to reduce collective dose, but also if they actually reduce collective dose.

In addition, as a measure of how disproportionate the NOV is compared to licensee performance, the specific excess exposure potentially attributable to this example is relatively small. Ineffective communications between Union Electric and the primary contractor was associated with two RWPs by the NRC Inspection Report. The actual fraction of excess exposure attributable to this example is not clear, but it could not have been a significant factor on exposure.<sup>24</sup>

In conclusion, Union Electric planned the conduct of Refueling Outage 10 consistent with industry practice to balance the competing concerns of plant safety, maintaining occupational doses ALARA, and controlling maintenance costs and duration. Although Union Electric does not disagree that there were areas requiring improvement in its performance of ALARA controls, Union Electric considers it used to the extent practical, procedures and engineering controls to achieve doses ALARA during Callaway Refueling Outage 10 in October 1999. Specifically, where NRC states that commensurate compensatory measures were not taken for planned work, sufficient mock-up training was not conducted and inadequate communications existed, Union Electric disagrees. Union Electric is committed to reducing exposures further and initiated appropriate action prior

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<sup>22</sup> See, e.g., Post-Job ALARA Review for RWP 99-53324, which states, "The most effective method of reducing overall steam generator dose (workers and HP) is to have better communications between the groups. The flow of information between FTI and HP was not as free as it has been in the past outages with other vendors.... The main reason appears to be the presence of an FTI ALARA coordinator and the training FTI gives their workers that all information flow should be through that coordinator."

<sup>23</sup> See generally, NRC Reg. Guide 8.8 (1976) discussing methods to reduce occupational exposures, noting, "The methods are deliberately stated such that considerable flexibility can be used in the manner by which the objective s can be achieved. Differences among stations might necessitate further innovation in methods used to achieve the objective" (page 8.8-4).

<sup>24</sup> NRC Inspection Report 50-483/00-17 of October 4, 2000, enclosure Section 2OS2.b, identifies the two RWPs as 99-53324 and 99-53022. Union Electric, *Refuel 10 ALARA Outage Report (October 2, 1999 to November 5, 1999)* issued June 2000, pages 12 and 15 note that RWP 99-53324 was for health physics support, the man-hour growth for this RWP was about 62% and, although poor communications were a factor, the increase was primarily due to growth in the steam generator work. Page 16 notes that RWP 99-53022 was for foreign object removal from the steam generator secondary side. The higher exposure was due to higher work scope, as more objects needed to be removed. Although communication systems could be improved, communications during Refueling Outage 10 was better than past experience due to incorporating lessons learned.

to the NRC inspection, consistent with its commitment to the principles of ALARA of maintaining a strong self-critical program that identifies and initiates action to improve ALARA performance.

**Corrective Steps Taken and Results Achieved:**

A strong ALARA program uses noted observations and potential areas for improvement as effective feedback to initiate actions to achieve progress in maintaining doses ALARA. Consistent with its commitment to maintaining a strong ALARA program, Union Electric has implemented steps to pursue the actions previously identified through our ALARA program mechanisms and self assessment, which were described during the Regulatory Conference of November 9, 2000. That Union Electric has taken corrective steps is an indication that Union Electric has a healthy ALARA program and is inconsistent with the NRC allegation that there has been a violation of 10 C.F.R. § 20.1101(b).

A formal root cause evaluation was completed in November 2000, prior to NRC initiating enforcement action. Performance improvements and corrective actions were entered into the Callaway Corrective Action Program. Lessons learned are being incorporated into the planning for Callaway Refueling Outage 11.<sup>25</sup>

NRC Inspections and peer evaluations of the Callaway ALARA program consistently found a strong, effectively implemented program prior to the August 2000 NRC Inspection. A March 2000 NRC Inspection looked, in part, at Union Electric ALARA performance during Refueling Outage 10 and made findings consistent with a May 1998 NRC inspection that concluded Union Electric had a very good ALARA program effectively implemented. An August 2000 NRC Inspection looked at Union Electric ALARA performance during Refueling Outage 10 and came to a dramatically different conclusion. The Callaway ALARA program did not change during the period between NRC inspections. Rather, the new NRC metric that was applied for the first time evaluated something entirely different than the inspections had addressed in the past.

During Refueling Outage 10, Union Electric recognized that the execution of work did not maintain aggregate occupational exposure as low as desired and requested assistance from INPO to focus on the ALARA program. The INPO Assist Visit was conducted in January 2000 and a list of actions for consideration was issued by INPO in February 2000. The INPO Assist Visit team proposed actions in seven focus areas, including source term reduction, scheduling and planning, and ALARA process reviews.<sup>26</sup> These focus area actions cover the five examples of Refueling Outage 10 ALARA work practices noted in the NRC NOV of January 9, 2001, almost a year before the NRC issued its NOV. Union Electric developed plans to implement actions in the seven focus areas, which were available for NRC review. The NRC did not raise any issues with the planned actions during the August 2000 inspection.

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<sup>25</sup> See, e.g., AmerenUE presentation on collective radiation dose at Regulatory Conference of November 9, 2000, Slide 25.

<sup>26</sup> INPO (Steven L. Driscoll, Manger, Radiation Protection Programs) letter to Union Electric of February 4, 2000.

Union Electric conducted a peer review of the ALARA program at Callaway utilizing personnel from Callaway and three other nuclear power plants for a week in June 2000 and established detailed action plans. The self-assessment focused on incorporation of ALARA into the planning of work, but also touched on daily dose budgeting and incorporation of ALARA into supervisory pre-job briefs. The review generated eighteen Suggestion/Occurrence/Solution (SOS) action documents to address needed improvements.<sup>27</sup> This review was completed almost two months before the NRC ALARA inspection. The NRC did not raise any issues with the planned actions during the August 2000 inspection.

The NRC conducted an inspection of the radiation protection activities at Callaway in March 2000 and, with regards to ALARA, noted only that exposure trends were increasing, attributable to increased outage work scope and increased source term from an axial offset anomaly. The NRC inspection reviewed Callaway dose totals and averages for the three previous years. In addition to increased refueling outage work scope, the increasing trend in doses was attributed to a higher source term, which was exacerbated by a reactor fuel condition known as an axial offset anomaly.<sup>28</sup> Union Electric actions in response to this anomaly had been previously evaluated by the NRC as conservative and in accordance with regulatory requirements in December 1997.<sup>29</sup> These March 2000 NRC findings are consistent with the May 1998 NRC inspection, which concluded that Union Electric had a very good ALARA program, effectively implemented.

Areas for potential improvement were investigated and corrective actions initiated, prior to the August 2000 NRC inspection. The five cited examples of Refueling Outage 10 ALARA work practices identified in the NOV had all been investigated by Union Electric prior to the NRC inspection and corrective action had been initiated where appropriate. The NRC inspection report and NOV do not take issue with any of the corrective actions Union Electric has taken or planned.

#### **Corrective Steps to Avoid Further Violations:**

As previously stated by the NRC,<sup>30</sup> the best measure of the success of Union Electric's efforts to improve ALARA performance will be the performance during upcoming Refueling Outage 11. Union Electric will continue to plan and execute work balancing the concerns for plant safety, achieving ALARA, and controlling operation and maintenance costs. Performance during Refueling Outage 11 will provide an important milestone in assessing Union Electric's continued progress toward achieving collective exposures as low as reasonably achievable.

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<sup>27</sup> Union Electric Report SA00-HP-001, *ALARA Work Planning/Support and Radiation Worker Knowledge Self-Assessment*, dated June 16, 2000.

<sup>28</sup> NRC Inspection Report 50-483/00-07 of March 28, 2000.

<sup>29</sup> NRC Inspection Report 50-483/97-19 of December 18, 1997.

<sup>30</sup> NRC Inspection Report 50-483/00-07 of March 28, 2000.



**Date when Full Compliance will be Achieved:**

Based on an in-depth review subsequent to the November 9, 2000, regulatory conference and for the reasons stated above, Union Electric now considers that it has always been and continues to be in compliance with the requirements of 10 C.F.R. § 20.1101(b).

**The Basis For Disputing The Severity Level:**

In a letter dated January 9, 2001 from Ellis W. Merschoff, Regional Administrator, Region IV, to Garry L. Randolph, Senior Vice President and Chief Nuclear Officer, Union Electric Company, the NRC provided the final results of the NRC Staff's determination of significance for the identified findings set forth in the subject inspection report and determined the significance as associated with three White findings. Union Electric previously submitted an appeal to this significance determination,<sup>31</sup> as required,<sup>32</sup> and requested the Significance Determination Process (SDP) for ALARA be suspended as inconsistent with the risk-informed basis of the Regulatory Oversight Process and counter-productive to the intent of ALARA. In the alternative, if the SDP for ALARA was not suspended, Union Electric stated that the significance had been assigned retroactively, inappropriately and/or incorrectly. The significance should be assigned as one "no color" finding, not three White findings.

The NRC recently noted that a SDP for security exercises inspection findings over-estimate the significance of findings, leading to a higher level of NRC response than warranted. The NRC directed suspension of issuing violations arising from force-on-force findings. The NRC expects, however, that deficiencies identified during force-on-force exercises will be promptly addressed by the licensees' corrective action programs.<sup>33</sup> NRC action on the SDP for security is consistent with what Union Electric considers appropriate for the SDP for ALARA. As stated in Union Electric's appeal of the significance assigned to this violation, the level of significance of one "no color" finding more appropriately reflects that there was no increase in risk to public health and safety. Union Electric's corrective action program had already initiated plans to address the areas identified in the examples of the NOV and should be considered adequate without a higher level of NRC response.

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<sup>31</sup> Union Electric letter from G. L. Randolph (Senior Vice President and Chief Nuclear Officer) (ULNRC-4378) to the NRC of February 7, 2001.

<sup>32</sup> NRC Inspection Manual Chapter 0609, Attachment 3

<sup>33</sup> NRC News Release No. 01-013 of February 8, 2001.