APPENDIX C

Questions and Answers for Inspecting Manual Brachytherapy Prostate Implants

Note: The Questions and Answers below replace/supersede the Q&As distributed as Enclosure 1 of the letter dated May 17, 2011.

The following supplemental questions and answers are intended to clarify and enhance the guidance available for U.S. Nuclear Regulatory Commission (NRC) Regional Inspectors in Inspection Manual Chapter 2800 and Inspection Procedure (IP) 87132. The scope of the questions and answers (Qs and As) is limited to prostate permanent implant brachytherapy. The Qs and As are applicable to all prostate permanent implant brachytherapy procedures, whether the treatment plans are based upon nomographs; pre-planned, using 2D or 3D methods; or the use of "real time" treatment planning methods.

Inspectors are reminded that IP 87132 provides all of the official inspection guidance for prostate implants, and that these Qs and As are designed to only provide the inspector with additional insight. Furthermore, licensed programs are not required to "fit" one or more of these scenarios,

Question 1

Do the requirements in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 35 require that the prescribed dose in the written directive (WD) be expressed in units of absorbed dose (gray (Gy) or rad), or may licensees also express the prescribed dose in units of total source strength and exposure time)?

Answer 1

In accordance with the definition of "prescribed dose" in 10 CFR 35.2, the licensee may express the dose as described in the WD in units of absorbed dose (Gy/rad) or in terms of total source strength and exposure time. However, in order for the licensee to be in compliance with the requirements in 10 CFR 35.3045, if specifying dose in terms of total source strength and exposure time, the licensee should also provide enough information to allow for the calculation of the absorbed dose. The need to determine the absorbed dose is because 10 CFR 35.3045 requires that a licensee report, as a Medical Event (ME), a dose that differs from the prescribed dose by more than 5 rem (effective dose equivalent), 50 rem to an organ or tissue, or 50 rem to the skin (shallow dose equivalent) plus additional conditions.

Question 2

What relief can be provided to licensees from the ME reporting requirements that the delivered dose must be within 20 percent of the prescribed dose?

Answer 2

None. In accordance with the requirements found in 10 CFR 35.3045, if the dose that is ultimately delivered to the treatment site (as defined on the WD by the Authorized User (AU)) is outside the limit of 20 percent or more of the prescribed dose, the licensee is required to report that instance as a ME.

Many key stakeholders have stated that, in accordance with accepted protocols, the AU may start with an objective of delivering a prescribed dose to the treatment site. To accomplish this task, the medical physicist may develop a treatment plan to define placement of each seed within the treatment site and calculate various dosimetric and volumetric data to assist the AU in his/her clinical evaluation of the implant data and approval of the number or seeds and seed activity to be ordered.

The medical physicist may also draft the WD that includes documentation of:

(i) the number and activity of seeds of a particular radioisotope to be permanently implanted;
(ii) the treatment site; and
(iii) the assumed dosimetric value obtained if each seed is implanted exactly as indicated by the treatment plan or nomogram with no seed migration.

To successfully implement this practice, the medical physicist and the AU should communicate to ensure that both the AU and the medical physicist are satisfied with the WD and the treatment plan (if one is developed) and that both agree on the method for documenting and evaluating the prescribed dose. In addition, the AU and medical physicist should exercise care to ensure that the delivered dose does not differ from the prescribed dose as documented in the WD by 20 percent or more.

To illustrate Question 2, Answer 2 further, the following hypothetical cases are provided:

Case Number 1

An AU “prescribed” a minimum dose of 145 Gy to be delivered to the entire prostate, and recorded this in the WD. The AU signed and dated the WD. The medical physicist prepared a treatment plan with 100 percent of the target volume [entire prostate] receiving a minimum dose of 145 Gy (i.e., V100 of 100 percent) and D90 dose to the entire prostate of 165 Gy. The authorized user reviewed and approved the treatment plan as being consistent with the WD, recognizing that the D90 dose is expected to be higher than the minimum dose delivered to the entire target.

Post-implant CT imaging was performed, with a calculated V100 of 100% and D90 of 180 Gy. This D90 was greater than 20 percent above the 145 Gy prescribed to be delivered to the entire prostate, but within 20 percent of the D90 designated in the treatment plan.

In this hypothetical case, in accordance with NRC regulations, a ME has not occurred: the entire prostate received a minimum dose of 145 Gy, consistent with the WD, and the delivered D90 of 180 Gy differed by less than 20 percent from the D90 of 165 Gy from the treatment plan.

Case Number 2

An AU reviewed the pre-implant ultrasound images and based on a traditional nomogram for iodine-125, documented in a WD a prescribed dose of 35 millicuries(mCi) (total source strength) for a permanent implant (exposure time) using 70 seeds, each seed containing 0.5 mCi. The nomogram used by the AU was designed to deliver a dose of 145 Gy to the entire volume of the prostate. The AU signed and dated the WD; however, only 55 seeds were implanted.

The medical physicist performed post-implant dosimetry which showed a final delivered dose of 114 Gy to the entire prostate volume. Furthermore, assume that the licensee's documented procedures for evaluation of post-treatment imaging data documents prescribed total source strength as the regulatory evaluation tool.

In this hypothetical case, in accordance with NRC regulations, a ME has occurred, since:

(1) the total dose delivered differs from the prescribed dose by 20 percent or more (i.e., the delivered total source strength differs by 20 percent or more of the prescribed total source strength); and
(2) the delivered dose differs from the prescribed dose by more than 50 rem to an organ or tissue.

Note that since the prescribed dose on the WD includes the total source strength for a permanent implant, the “permanent” documented exposure time here can be assumed to be infinity. However, if the exposure time had not been documented on the WD, the WD would have been incomplete.

Question 3

What constitutes “high confidence” as used in 10 CFR 35.41?

Answer 3

See the two examples listed below for two hypothetical situations at a licensee's facility:

EXAMPLE OF A LICENSEE WHO HAS INADEQUATE WRITTEN PROCEDURES THAT DID NOT PROVIDE HIGH CONFIDENCE

An inspection was performed to review the circumstances, root and contributing causes, and proposed corrective actions related to a ME involving an iodine-125 brachytherapy treatment for prostate carcinoma. Specifically, the dose delivered to the patient, 13,200 rads, was 20 percent more than the prescribed dose of 11,000 rads. (10 CFR 35.3045(a)(1)(i)).

In accordance with the WD, the radiation oncology staff planned to implant 63 iodine-125 seeds, each seed containing 0.27 mCi (source strength); however, the manufacturer shipped 63 iodine-125 seeds, each seed containing 0.37 mCi.

The licensee had not developed written procedures to verify the iodine-125 seed strengths prior to the implants by comparing the manufacturer's specification sheets with the WD and treatment plans. Nonetheless, licensee staff routinely verified the seed strengths prior to the implants by comparing the manufacturer's specification sheets with the WD and treatment plans, with one exception that resulted in this ME.

In the case of this one exception, it was determined that the root cause of the ME was a failure to develop written procedures as required in 10 CFR 35.41(a), to provide high confidence that the administrations of iodine-125 seeds for brachytherapy treatments was in accordance with the WD. As a result, the 63 seeds with the higher activity were implanted in the patient. The error was discovered after the implant was completed.

CONCLUSION

The licensee failed to develop written procedures as required in 10 CFR 35.41(a) to provide high confidence that the administrations of iodine-125 seeds for brachytherapy treatments are in accordance with the WD. Specifically, the licensee's written procedure was silent regarding verification of the seed strength prior to the implants. As a result, a ME occurred.

EXAMPLE OF A LICENSEE WHO HAS WRITTEN PROCEDURES BUT DOES NOT FULLY IMPLEMENT THE WRITTEN PROCEDURES

During a routine inspection of a licensee authorized for use of 10 CFR 35.400 material, selected staff were interviewed regarding the licensee's procedures for verification that the treatments were given in accordance with the WDs and treatment plans.

The licensee provided the inspector with its written Policy and Procedure for Manual Brachytherapy (procedures). The procedures included obtaining CT images (or other appropriate images) 3-5 weeks post implant for identification of seed localization. In addition, the procedures required that the AU review the images, outline the treatment site structure and any organs at risk, assess the absorbed doses, and generate a post-implant report. The procedures also required that an annual Quality Assurance (QA) review be performed on 25 percent of the treatments to provide "high confidence" that the treatments were administered in accordance with the WDs and treatment plans. The QA review includes analyses of the post-implant reports for the selected treatments.

The licensee conducted the annual QA review of 25 percent of the treatments that were performed. However, the licensee had not analyzed the post-implant reports for the selected treatments because the post implant imaging was completed at the AU's office and the licensee did not have access to the post-implant reports.

The inspector requested that the licensee obtain copies of the post-implant reports that were completed by the AU for the treatments that had the QA review. The inspector identified three un-reported MEs while reviewing the post-implant reports.

CONCLUSION

The licensee failed to fully implement its procedures as required in 10 CFR 35.41(b)(2) for verifying that the administrations were in accordance with the treatment plans and the WDs. Specifically, the licensee failed to analyze the post-implant reports for the selected treatments which resulted in lost opportunities to identify MEs.

Question 4

How long do licensees have to complete the documentation of the post-implant WD?

Answer 4

10 CFR 35.40(b) states the WD must contain the patient or human research subject's name and the following information:

10 CFR 35.40(b)(6)(ii) states that after implantation, but before completion of the procedure, the WD must contain the radionuclide, treatment site, number of sources, and total source strength and exposure time (or the total dose).

Based on these regulations, the licensee needs to complete the post-implant documentation before the completion of the procedure. Unless circumstances justify otherwise, it is generally accepted that a procedure is complete when the patient leaves the post procedure recovery area.