RADIATION CENTER

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March 30, 2000

U.S. Nuclear Regulatory Commission
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References:
1. Oregon State University TRIGA Reactor (OSTR), Docket No. 50-243, License No. R-106
2. Letter to the Region V Regional Administrator from A. G. Johnson dated February 5, 1985: Written Report of an Item Previously Reported by Telephone Under Section 6.7.a.8 of the OSTR Technical Specifications

Subject: Eliminating Routine Gamma Spectroscopy Analysis of Reactor Top Continuous Air Monitor Filter

Gentlemen:

The OSTR staff would like to respectfully inform the Commission that as of March 1, 2000, we are no longer performing routine gamma spectroscopy analysis on the reactor top continuous air monitor (CAM) filter. In a letter dated February 5, 1985, (see Enclosure 1), the OSTR made a commitment that this analysis would be done weekly after elevated CAM readings were detected the previous week. However, after 15 years of continuous and consistent results, the OSTR staff feels that the intention of the analysis and commitment has been met and is no longer necessary.

A complete synopsis of the events leading to the routine filter gamma spectroscopy analysis was documented in the February 5, 1985 letter. Briefly, on January 22, 1985, the reactor top CAM showed the presence of low-level particulate radioactivity. Gamma spectroscopy analysis of the filter indicated that short-lived fission products could be contributing to the elevated CAM readings. An exact determination could not be made due to the low count rates observed (typically < 0.01 counts per second). The intent of the analysis was to quickly observe a reappearance of elevated CAM readings. Changes or abnormalities would be indicative of a fuel element leak, which was the scenario the OSTR staff was most concerned with.

The results of the gamma spectroscopy analysis of the reactor top CAM filter has changed very little

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since its routine inception in 1985. An example of the analysis results can be seen in Enclosure 2. This graph shows results of this analysis from November 22, 1996 to February 1, 2000. The filter number corresponds with the week the analysis was performed since inception. These results are typical of data gathered prior to November 22, 1996.

As the data have remained unchanged over the years, we have concluded that a fuel leak did not occur. The source of the particulate activity is more than likely tramp fuel. As these are very low levels of activity, routine gamma spectroscopy analysis is not need as part of a program to detect a fuel leak. The reactor top CAM would adequately detect any fuel element leak that is likely to occur. It also would provide sufficient time to evacuate the facility and take the necessary steps to prevent the spread of radioactivity to the surroundings (Tech Spec 3.6.1). Therefore, the OSTR has decided to discontinue routine gamma spectroscopy analysis of the reactor top CAM filter.

This change has been reviewed by the OSTR operations staff and approved by the Reactor Operations Committee. If there are any questions regarding this, please let me know.

I declare under penalty of perjury that the foregoing is true and correct.

Sincerely,

Stephen E. Binney
Director

Executed on: 3/30/00

c: Al Adams, Nuclear Regulatory Commission
Dave Stewart-Smith, Oregon Office of Energy
Steve Reese, OSU Reactor Administrator
Art Hall, OSU Reactor Supervisor

Enclosures

ENCLOSURE 1

Oregon State University TRIGA Reactor (OSTR)
License No. R-106, Docket No. 50-243

Letter to the Region V Regional Administrator from A. G. Johnson dated February 5, 1985: Written Report of an Item Previously Reported by Telephone Under Section 6.7.a.8 of the OSTR Technical Specifications

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Radiation Center | Oregon State University | Corvallis, Oregon 97331 (503) 754-2341

February 5, 1985

U.S. Nuclear Regulatory Commission
Region V
1450 Maria Lane, Suite 210
Walnut Creek, CA 94596-5368

Attention: Regional Administrator

Reference: Oregon State University TRIGA Reactor (OSTR), License No. R-106, Docket No. 50-243

Subject: Written report of an item previously reported by telephone under section 6.7.a.8 of the OSTR Technical Specifications

Gentlemen:

Section 6.7.b.2 of the OSTR Technical Specifications requires a written followup report of items previously reported to your organization by telephone under section 6.7.a of the subject Technical Specifications. This report is intended to fulfill our obligation for such a written report.

On January 23, 1985, A. G. Johnson of the OSTR staff contacted Mr. Dennis Willett of the NRC's Region V staff regarding observations we deemed reportable according to the OSTR Technical Specifications. Mr. Willett referred the information to Mr. Ray Fish, also of the Region V staff, who in turn called Mr. Johnson back on January 23. On January 24, 1985, Mr. Johnson received a call from Mr. Mike Silis of Region V, who explained that he had been assigned the inspection responsibility for the parts of the OSTR operation involved in our previous telephone report.

The information conveyed during all three telephone conversations was essentially the same and dealt primarily with a description of the OSTR staff's response to indications of very low level particulate radioactivity, above normal background, on the reactor top continuous air monitor (CAM). In the course of all of the discussions, it was explained that gamma spectroscopy analysis of CAM particulate channel filter papers gave at least an indication that the non-background contributors to the radioactivity could be short-lived particulate fission products (e.g., ^{89}Rb, ^{90}Rb, ^{138}Cs, and ^{139}Ba), which in pool-type research reactors can be associated with the possibility of a leaking fuel element. (The radioactivity on the CAM was first noticed on January 22, 1985 following the changing of a bearing in the primary system water pump, which occurred on January 21. Following this maintenance activity, air from drained water lines bubbled through the reactor tank when the primary water pump was restarted, and the resulting turbulence may have disturbed sediment in the reactor tank, which in turn may have contributed to our present observations.)

During the telephone conversations with Region V personnel it was not our position that a fuel element leak actually existed, but we did indicate that our policy was always to act conservatively in the presence of such indicators. As a result, we confirmed to the Region V staff that we were adopting a fuel shuffling procedure approved by the OSTR Reactor Operations Committee, which was also consistent with our own fuel handling procedures and our Technical Specifications. In this procedure, up to three fuel elements at a time would be removed from the core region, three (presumed) non-leaking fuel elements would be placed into the vacant positions, the reactor would be operated at 1 MW for approximately 15 to 30 minutes, the reactor would be shut down, and the filter paper from the reactor top CAM (which would be sampling directly over the reactor tank with the tank covers closed to maximize the concentration) would be analyzed for the previously noted fission product peaks. The logic involved in this procedure assumed that removal of a leaking fuel element would be indicated by the disappearance of the unusual peaks on air samples taken over the reactor tank. Obviously, if there were more than one leaking fuel element this technique could be less than totally successful, but TRIGA reactors have had a very limited history of leaking fuel. Additionally, some suspected leaks have been observed to be intermittant in nature, and some seem to have completely disappeared after giving at least an initial indication of their presence.

Following the conversation with Mr. Silis on January 24, the OSTR staff began the fuel shuffling procedure and continued the process until every fuel element in the core had been removed for one or more reactor test runs. Some suspect elements were removed more than once in several different combinations of three elements. In addition, to aid in establishing a priority for fuel element removal, the Reactor Operations Committee gave approval to use a fuel element sniffer device built by OSTR operations. This sniffer was placed over small sections of the core with the hope that it would capture the fission products (if any) being released within that defined region and ultimately give a stronger positive result on air samples from the reactor top CAM. At the time this sniffing procedure was started, it was becoming obvious to the OSTR staff that the very low count rates on air samples ($\sim 10^{-2}$ counts/second for photopeaks generated by gammas with emission abundances of ~40% to 75%) was making it difficult to separate the results from background, or to achieve acceptable consistency or repeatability in our sampling results.

Since three of the OSTR's control rods have fuel-followers, we also considered the possibility that these could be the source of a leak. The technique used by the OSTR staff to individually leak test each fuel-follower involved carrying out the previously described air monitoring procedure for fission products while operating the reactor with one of the three fuel-followed control rods fully inserted so that the fuel section was not up in the core region.

The results of the described fuel shuffling, fuel sniffing and control rod tests have, in our opinion, failed to provide any positive indication of a fuel cladding defect in the OSTR core. Furthermore, the very low levels of short-lived particulate fission product radioactivity obtained on the air samples, and the subsequent uncertainties derived from this, have lead us to conclude that we should return to normal reactor operation.

However, in the interest of tracking this situation, we are planning to implement the following surveillance program aimed directly at the timely detection of a fuel cladding defect.

1) First, we feel that the OSTR's normal reactor top continuous air monitoring system by itself provides the needed sensitivity to detect positively leaking fuel in the core, and also to detect other types of abnormalities involving the reactor tank, such as failure of in-tank experiments, and changes in the normal production and evolution of argon-41 and nitrogen-16. Not only is this air monitoring system required by our Technical Specifications, but it is an important part of our routine operation. Our reactor staff regularly check and record the strip chart recorder data from the CAM during and after operation, and are sensitive to unidentified variations from background, as this would be an abnormality. Such abnormalities are addressed in our operating procedures and usually require immediate shutdown of the reactor and immediate efforts to identify the nature and cause of the airborne radioactivity. Continuous air monitoring systems similar to the one used by the OSTR (but actually less sophisticated than the one now in use by the OSTR) have been the main basis for other reported fuel element leaks by TRIGA reactors.

2) For a period of at least one month after returning the reactor to normal operation, the reactor top CAM particulate channel filter paper, which is routinely changed at the end of the reactor operating day, will be immediately analyzed (within approximately 30 minutes after removal) by gamma spectroscopy to ascertain the identity and magnitude of the radionuclide contributors to the radioactivity on the filter. The results of these analyses will be recorded along with the day's total megawatt hours and hours at one megawatt.

   Since the obvious purpose of this additional surveillance effort is to collect information which will allow an early response by the OSTR staff in the event a fuel cladding defect seems likely, we will react to changes in current air sample analytical results which indicate the consistent appearance of the full spectrum of normally expected particulate fission products at discernably increased levels over what we are now detecting, or to other changes which might also be significant in light of the overall objective. All actions on our part will be directed towards meeting the requirements of our Technical Specifications.

3) At the conclusion of the time interval during which CAM filter papers will be analyzed each day, we plan to implement a permanent addition to our routine air surveillance program by once a week conducting a gamma spectroscopy analysis of a daily CAM filter paper. This analysis will be initiated within approximately 30 minutes after removal of the filter from the CAM. Normally, the CAM filter chosen will be one used during a long (4 to 7 hours) run at full power. Records of these analyses will be kept along with the corresponding day's reactor power history in terms of megawatt hours and hours at one megawatt, which will probably be about the same for these samples. Indications of abnormalities

of any type will be investigated as per our Technical Specifications, with particular sensitivity towards a reappearance of the situation described in this report.

Records of the various air sample results, analyses of reactor tank water samples (which were extremely low), personnel exposures, and radiation surveys associated with this operation have been completed and are on file with the OSTR radiation protection group.

In order to complete the described fuel movements, it was necessary for the OSTR to commit its spare instrumented fuel element to service. We concluded that this action and the subsequent fuel storage requirements could be conducted within the scope of our currently approved physical security plan.

This report has been reviewed and approved by the OSTR Reactor Operations Committee. Should there be questions regarding any of the information, please let us know.

Yours sincerely,

A. G. Johnson
Acting Reactor Administrator

AGJ:jrl
cc: Director, Office of Inspection and Enforcement, USNRC, Washington, D.C.
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Dr. T. D. Parsons, Vice President for Administration, OSU
Dr. S. E. Binney, Chairman, Reactor Operations Committee
Dr. B. Dodd, Assistant Reactor Administrator
Mr. T. V. Anderson, Reactor Supervisor
Mr. D. Pratt, Radiation Specialist

ENCLOSURE 2

Oregon State University TRIGA Reactor (OSTR)
License No. R-106, Docket No. 50-243

Results of the Reactor Top CAM Gamma Spectroscopy
Analysis from 11/22/96 to 2/1/00

CAM Filter Gamma Spec. Results
11/22/96 to 2/1/00