U. S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 50-213/89-17

Docket No. 50-213

License No. DPR-61

Licensee: Connecticut Yankee Atomic Power Company

Facility Name: Haddam Neck Power Station

Inspection At: Haddam Neck, Connecticut

Inspection Conducted: October 2-6, 1989

Inspector: for S. Sherbini, Senior Radiation Specialist, Facilities Radiation Protection Section — 11-01-89 date

Approved by: RL Nimitz for W. Pasciak, Chief, Facilities Radiation Protection Section, DRSS — 11/1/89 date

Inspection Summary: Inspection Conducted October 2-6, 1989 (Inspection Report No. 50-213/89-17).

Areas Inspected: Routine, unannounced inspection of radiological controls activities during the refueling outage and of the radiological controls program on site.

Results: No violations were identified.

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DETAILS

1.0 Personnel Contacted

1.1 Licensee Personnel

* H. Clow, Health Physics Supervisor
  W. Gates, Assistant Radiation Protection Supervisor, Operations
  R. McGrath, Senior Radiological Engineer
* D. Miller, Station Superintendent
* W. Nevelos, Radiation Protection Supervisor, Operations
  J. Powell, ALARA Coordinator
* M. Quinn, Chemistry Supervisor
  L. Silvia, Health Physicist
* M. Sweeney, Radiation Protection Supervisor, Services

1.2 NRC Personnel

  T. Shedlosky, Senior Resident Inspector
* A. Asars, Resident Inspector

* Indicates attendance at the exit meeting.

2.0 Qualifications

The training and qualifications of contractor health physics technicians were reviewed. A review of the hiring data showed that of a total of about 230 resumes submitted, 61% were approved. The approval rate for resumes submitted for the senior technician positions was slightly lower, approximately 57%. About 40% of the approved applications were from returning technicians, that is, technicians who had previously worked at Haddam Neck. About 90 contractor health physics technicians were hired for the current outage, 55 of those being senior technicians. About 30 of the senior technicians were returning technicians. Based on this data and discussions with the licensee, the recruiting and selection system for hiring technicians for outage work appears to function well; the relatively high fraction of the senior technicians who are returning technicians, coupled with the relatively high rate of rejection of applications from senior technicians (43%), suggests that the hiring system in use provides reasonable assurance that the quality of contractor technicians on site will be good.

The resumes of the contractor technicians who had been hired for the outage were reviewed, together with the results of the required basic health physics principles examinations and procedure qualification tests. All resumes reviewed showed that the qualifications of the senior technicians met the minimum requirements of ANSI N18.1-1971, the ANSI standard to which the licensee is committed by Technical Specifications. Most senior technicians had much more extensive experience than the required minimum, which is two years of health physics experience. The licensee requires as a minimum 4000 hours of documented working experience in radiological protection, received in no less than 20 months, and a high school diploma. The acceptable type of experience is: 400 hours maximum (10% of the total minimum) for services type work (which includes calibrations, whole body counting, respirator fitting, dosimetry issue); 8.5 months maximum for control point monitoring that involved surveys and field work; and full credit for all plant coverage of jobs in radiological areas. In addition, contractor technicians who are assigned supervisory positions must have at least 3 years of experience in radiological protection and documented supervisory training. The resume files indicated that the resumes were verified by contacting the most recent place of employment. If the most recent place of employment represented only a short employment period, the place of employment previous to that is contacted.

Before being assigned to duty on site, contractor health physics technicians receive procedure training and then fill out a procedure acknowledgement sheet followed by an examination on site procedures. They are also given a technician level health physics knowledge examination. Tests scores on required examinations must be at least 80% to pass. Technicians are only assigned to tasks for which they had been trained and evaluated. Contractor technicians assigned to rotating shift duties must receive additional training which includes health physics fundamentals, first aid, fire brigade, and any other on-the-job training that had not been previously given. The technician is also placed on the quarterly and annual continuing training schedule as long as the rotating shift duties are maintained.

Some areas for improvement in the selection and initial testing process were identified during this review:

. The licensee is currently crediting navy ELT experience on a 1:1 basis, that is, one year of ELT counts for one year of health physics experience. There is also no requirement that the technician have any commercial nuclear power experience. The licensee stated that they unofficially require at least a few months of commercial experience before appointment as senior technician. The licensee also stated that they have very few technicians who fall into this category. However, this practice is contrary to current industry practice. The guidance provided by a recent revision of ANSI N18.1-1971 (ANSI/ANS 3.1-1987) states that ELT experience may qualify on a two-for-one time basis toward nuclear power experience. The standard also specifies a minimum of 1 year of nuclear power plant experience for senior HP technicians.

. A review of the questions and answers that constitute the basic health physics examination given to all incoming contractor HP technicians shows that the material needs to be reviewed to improve its quality and relevance. Many of the questions were found to be such that they would not give the site personnel selection committee adequate guidance regarding the technician's ability to understand the bases for activities conducted on site and to make informed decisions in radiological controls situations. Also, the specified correct answers to some of the questions were either incorrect or at least misleading.

A review of one of the licensee's internal audits entitled "Contractor Technician Qualifications" showed that the audit identified some further areas for improvement, including:

. Incomplete resumes were supplied by the vendors for their contractor technicians.

. Technicians who did not pass the required initial tests were given the same test a second time after counseling. The audit suggests that a different test may be more appropriate.

. The sign-offs on the required on-the-job (OJT) training cards were made at the end of the OJT cycle rather than at the end of each self-contained segment. The problem with this practice is that site procedures allow the technician to perform duties covered by the individual OJT segment as soon as that segment is completed and not after the entire cycle is completed. A review of the OJT record may therefore suggest that the technicians were allowed to perform functions before they had finished the OJT for that function as indicated by the date of the signature on the OJT card.

. Scheduling and other problems arose because the testing practices at Millstone and Haddam Neck are not the same. A reciprocity agreement exists between the two sites regarding technician training, but the agreement does not address technician testing. The passing grade criteria and the degree of difficulty of the exams were different for the two sites. These differences resulted in the retesting, at Haddam Neck, of all the technicians who had been tested at Millstone. In a uniform program, such an agreement would allow technicians trained or examined at one site to be exempted from these requirements at the other site.

The licensee stated that they will review these concerns and take appropriate actions. These items will be reviewed during a future inspection.

3 Audits and Assessments

The radiological controls program on site was routinely audited by corporate health physics staff until the end of 1987. At that time, an NRC inspection identified a problem with these audits, namely that they lacked depth and were not a significant factor in upgrading the quality of radiological controls on site (Inspection Report 50-213/88-05). The licensee at that time stated that they recognized that weakness in the audit function and that they were changing this function from an audit to an appraisal. This shifted the emphasis from one of compliance to one of assessment of strengths and weaknesses. The assessments were to take place on a quarterly basis, and the assessment team was to include at least one technical expert in the field being appraised.

However, both the audit and the assessment functions have ceased as of the end of 1988, and therefore the corporate assessment function is no longer being provided. The site health physics organization has implemented an internal audit function performed by its own staff. Some of the areas audited as part of this program include use of supplied air respirators, air sampling program, unconditional release of material, count room operations, radiological controls in the turbine building, internal exposure tracking system, laundry receipts, and steam generator surveys. A review of these audits showed that they were of high quality and identified many areas for improvement. However, these audits, although they were found to be objective, are nevertheless a self-assessment effort. In addition to this effort, there remains a need for periodic external reviews of the program. The licensee stated that the corporate assessments had stopped because of staff attrition. The inspector expressed concern that the licensee had discontinued their independent assessment functions within a short time of making a commitment to improve this function. The licensee stated that they intend to continue with the program as soon as the staffing returns to an adequate level. No specific time frame was given. This item will be reviewed during a future inspection.

4.0 Laundry

The licensee's protective clothing is sent out to a commercial laundry for cleaning. A review of the licensee's practices for receipt of the laundry from the vendor showed that the practices are adequate but that there are several areas for improvement:

. The licensee surveys samples of laundry from each batch received. The survey is done using a scanning machine consisting of several pancake probes under which the articles are moved. The acceptance criteria are 15,000 net counts per minute (cpm) by direct frisk with a pancake probe for coveralls, lab coats, surgeon's caps and hoods, and 35,000 net cpm for gloves, and shoe covers. The inspector stated that these acceptance limits are much higher than generally accepted industry standards. For example, INPO recommends 5000 cpm maximum. Regulatory Guide 8.21, "Health Physics Surveys for Byproduct Materials at NRC Licensed Processing and Manufacturing Plants" recommends a maximum contamination level of 1E-4 uCi/sq. cm for protective clothing. For a pancake probe, this is equivalent to less than 1000 cpm. The licensee stated that the limits they currently use were derived by assuming that a hot particle on the clothing irradiates the skin for a period of 12 hours. The licensee stated that a maximum irradiation period of 12 hours was quite conservative and that, based on that irradiation time, the dose limits of 7.5, and 18.75 rems would be reached by particles that produced 15,000 and 35,000 net cpm, respectively, on a pancake probe. The licensee stated that the laundry that is randomly selected for survey from lots received from the vendor rarely exceed 1500 cpm. The licensee also stated that they will revise the acceptance limits down from 15,000 to 5,000 cpm and from 35,000 to 15,000 cpm. These changes were implemented during the inspection. The new limits are still at the high end of accepted industry practice, but they are an improvement over those used previously. In any case, the change is not expected to have any significant effect on most items of protective clothing since, as stated above, most of these items show count rate levels far below the newly adopted limits.

. One of the internal audits performed by the licensee's health physics staff was on protective clothing surveys. This audit identified the excessively high acceptance levels for protective clothing and recommended lowering that level to 5,000 cpm. The audit also identified a number of weaknesses in the receipt survey program. These included the fact that only two sides of the garments are frisked rather than all four surfaces (front and back on the outside and front and back on the inside of the garments). The site technical staff determined that it would be unlikely to detect a hot particle by the current survey methods if the particle was located on one of the unsurveyed sides. The audit also identified that the detectors used in surveying received laundry are not subjected to routine function checks despite the fact that the detectors are used frequently.

The licensee stated that they will review and correct these weaknesses. These items will be reviewed during a future inspection.

5.0 Unconditional Release Facility

The licensee has completed work on a facility to be used for releasing material from site to unconditional use or disposal as non-radioactive waste. The facility contains a table monitor, a bag monitor, and a shredder. The facility is used to check material coming from the radiological controls area (RCA) but that is not expected to be contaminated. This material comes mainly from the "Green is Clean" receptacles, which are green trash cans located throughout the plant and meant to be for disposal of non-radioactive waste.

Bagged trash entering the facility is first emptied on the sorting table. This table is equipped with multiple detectors distributed over the surface of the table with each detector viewing a well defined segment of the surface. Each detector has its own alarm indicator, and this arrangement allows identification of the items spread out on the table that cause the alarm. Any items that alarm the system are removed and treated as radioactive waste. After this check the material is visually scanned and any items that suggest radioactive material such as yellow items or items bearing the radioactive material sign are removed and taken to the shredder or "granulator" where they are shredded before being bagged as clean waste. The checked material is bagged and the bag is placed in the bag monitor. If the monitor alarms, the whole bag is considered radioactive waste and taken for disposal accordingly. If the monitor clears the bag, it is released as clean waste.

Items that cannot fit into the bag monitor are surveyed with a pancake probe before release. Items that are too large to be taken into the facility are frisked using a pancake probe at the plant gate before release. Clean trash is picked up by Building Services for disposal and radioactive bags are picked up by the Radwaste Group for disposal. The limit for unconditional release of items by hand frisking with a pancake probe is 100 cpm above background for beta/gamma and 4 cpm for alpha activity. The maximum background for performing the surveys is 200 cpm beta/gamma and 1 cpm alpha. Inaccessible areas that cannot be frisked directly are smeared. The basis for the release limits is that no item shall be unconditionally released if it contains detectable activity. Detectable activity is considered by the licensee to be any beta/gamma activity that registers over 100 net cpm on the frisker. The basis for the 200 cpm maximum background was obtained from NRC Circular 81-07.

The alarm set points for the table and bag monitors in the unconditional release facility were set on the same basis as that used for hand frisking, namely that no material may be unconditionally released if it shows any detectable radioactivity. The background of the system was determined by counting bags of clean trash obtained from areas of the plant outside the RCA, such as offices. The activity measured from these items averaged about 15 nCi. The licensee used this value and the variability in the readings of clean bags to calculate the lower limit of detection of the system and then to calculate an alarm set point of 32 nCi. The method used by the licensee to perform the calculations appears to be appropriate and was based on methods described in NUREG/CR-4007.

6.0 Counting Laboratory

The licensee has recently upgraded their counting laboratory by adding several pieces of equipment to upgrade the capability of the laboratory. The main items added are two intrinsic germanium detectors and a computer system to control and acquire data from these detectors and to perform other calculations. A review of the equipment and the computer software during this inspection showed that the new system represents a significant improvement in capability that should increase the sample volume capability of the laboratory and should also make system calibration easier and more reliable to perform. Graphics capabilities have been added that significantly enhance the ease of performing these functions. The licensee stated that they are in the process of developing computer software that would incorporate the counting laboratory procedures. Once this is completed, the computer software would indicate to the laboratory technician the next step to take in sample analysis, notification of supervisors, and so on based on the results of the initial sample analysis. The inspection also showed that the level of housekeeping and orderliness in the laboratory have been significantly improved.

7.0 Neutron Dose Limits

Based on a National Council on Radiation Protection and Measurements (NCRP) recommendation made in 1980, the licensee had imposed a limit on neutron dose equivalent that is separate from that for other types of radiation. This practice is different from that specified in 10 CFR Part 20, but it is not in conflict with that practice, and is more conservative. The rationale for this limit was the NRCP's finding that the neutron quality factor may be significantly higher, possibly by as much as a factor of ten, than the value then in use and recommended by the NRC, namely 10. The licensee's limit on neutron exposure was set to 300 millirem per quarter.

The NCRP has recently (1987) changed its recommendations regarding neutron exposure and the current thinking of the Council is that the quality factor may be only a factor of two higher than the currently recommended value of ten. In response to this finding, the licensee has adopted a policy that weights neutron dose equivalents by a factor of two before adding them to the dose equivalents form other radiations. The formula used is

(Neutron dose equivalent x 2) + Non-neutron dose equivalent

<= dose equivalent dose limit

This is equivalent to use of a quality factor for neutron exposure that is twice as high as the currently recommended value. A review of this policy shows that it is not in conflict with regulatory requirements and that it introduces a degree of conservatism in controlling neutron exposures. The effect of these changes on the licensee's operation is small because neutron exposures on site are generally much lower than the limits.

The licensee also stated that they are considering adopting a new dose limitation system by 1991 that would be in keeping with the developing trend in many nuclear installations worldwide. This trend is to limit the whole body dose equivalent to 1 rem/year if the lifetime exposure is greater than the age of the worker, and to 2 rem/year otherwise.

8.0 Outage Work Scope and Facility Tours

The outage cumulative exposure goal for the current refueling outage (cycle 15) is 687 rem. The fractions of this total assigned to the various work areas and groups are as follows:

Steam generator work	20 %	(137 man-rem)
Health physics/radwaste	12 %	(80 man-rem)
Refueling work	12 %	(80 man-rem)
Valve maintenance	11 %	(73 man-rem)
Inspections	8 %	(57 man-rem)
Special projects	18 %	(126 man-rem)
Subtotal	81 %	

The remaining exposure is assigned to the various departments, split pin work, and RHR work. Included in the special projects category are projects to modernize the reactor protection system, upgrade the nuclear instrumentation system, and upgrade the fire detection and fire protection systems.

The outage started on the first week of September and is scheduled to continue until about the middle of October when the system startup procedure is scheduled to begin. However, delays of at least several weeks are expected, primarily because of difficulties encountered during core barrel inspection work. The cumulative exposure as of October 4, 1989 is 314 man-rem. The licensee stated that they expect to meet the outage goal. A review of the individual jobs showed that most appear to be within the expected exposure given the fraction completed. Some jobs appear to be certain of exceeding their goal, or have already exceeded it. Notable amongst these is fuel reconstitution work, which has already exceeded its goal but the work is estimated to be only 5% complete. The reason for this is the unexpected expansion of the amount of reconstitution work that would have to be done. The effect on overall outage performance is not expected to be significant because this is a relatively low exposure job, the goal having been 1 man-rem.

Tours of the facility showed that house keeping and general orderliness was quite good. The various jobs observed appeared to be under good control by radiological controls technicians. Access control was found to be good and technicians at the zone control points appeared to be knowledgeable of the work in progress in their zones. An exception to good work practices was observed during fuel reconstitution work in the fuel storage building. The reconstitution work is done in the fuel storage pool and the workers manipulate the long handled tools and other equipment from the bridge over the pool. Observation of this work showed that contamination control procedures in effect were not sufficiently stringent considering the nature of the work. Workers were observed bringing tools out of the pool without surveys and without wiping them down, although there was some attempt to flush these tools with clean water as they were withdrawn from the pool. Also, some of the workers were observed to withdraw tools from the pool and then proceed to a laydown area adjacent to the pool to handle some other equipment without changing or wiping their gloves before they left the bridge. Finally, the workers were observed to be wearing different protective clothing, with some wearing hoods over their heads and some without, even though they were all on the same RWP and were engaged in the same work. A radiological controls technician was covering the work at the time, but the workers were often finished with their activities before the technician was able to survey to control the activities. The inspector expressed these concerns to the licensee and corrective actions were taken immediately to improve radiological controls in that area.

9.0 ALARA

A review of the ALARA efforts on site indicated that the efforts of the site staff to reduce exposure continue to be extensive and effective. Amongst the initiatives taken during this outage in that area was the extensive use of robots, particularly in steam generator work. This application of robots is particularly important because the dose rates in the channel heads at Haddam Neck are relatively high, being 18 rem/hr in the general bowl area with hot spots reaching 20-40 rems/hr. Because of the use of these robots and the consequent expected decrease or elimination of the number of jumps or partial jumps into the steam generators, the licensee stated that they found that channel head decontamination would not be cost effective and so it was not done. New desludging equipment and mobile demineralizers systems have reduced exposures connected with handling of radioactive wastes. Other efforts started during the previous outage continue to be pursued. These include careful review of all projects before the outage to ensure that they are needed and that they have included ALARA measures, designing projects so as to minimize radwaste handling, improved cavity filtration system, and better coordination of scaffolding work by coordinating the work of the various scaffolding crews, better training for these crews, and the use of movable and adjustable scaffolds on some jobs and also the use of quick disconnect scaffolds.

A review of the long term ALARA efforts showed that although many projects are being implemented or are in the planning stage, the effort is scattered amongst many individuals and there did not seem to be a person or group in charge of coordinating this effort, tracking the details of all the projects, and establishing time tables for implementation. The annual cumulative exposure at the site has shown a downward trend recently. The power operations exposure appears to have leveled off since 1987 at approximately 6 man-rem per month after a steady drop from 11 man-rem per month in 1984, 10 man-rem in 1985 and 9 man-rem in 1986. The annual exposures including outages has also shown a marked decrease but also appears to be leveling off at about 750 man-rem per year. The exposures were 1216 man-rem in 1984, 101 man-rem in 1985, 1567 man-rem in 1986, 749 in 1987, 220 for 1988, and is projected to be over 760 man-rem in 1989. Based on these figures, the three-year average for 1987-1989 would be 576 man-rem. The three-year average in 1992 is projected by the licensee to reach 495 man-rem. This is to be achieved by slightly lowering the 1991 and 1992 exposures to 705 and 680 man-rem, respectively, and to have a non-outage year in 1990 of 100 man-rem. Although this figure represents an improvement over the 1989 figures of 576, it is still significantly higher than the INPO goal for pressurized water reactors of slightly under 300 man-rem for a three-year average.

The licensee stated that the ALARA projects designed to further reduce exposures on site and that are already underway or under evaluation include the following:

. Improvements in reactor water chemistry to reduce buildup of activated corrosion products in the system. The licensee stated that they have observed significantly reduced exposure rates in many areas of the plant, particularly the loop areas, by as much as a factor of two from the previous outage, although no corresponding decrease was observed in the steam generator channel heads. The licensee is not certain why this decrease was observed but attributes it to improved water chemistry that was in effect during the past cycle. This effort is to continue and expand.

. Full system decontamination is being considered, and the earliest date for implementation, if approved, would be in 1993.

. Better control of inservice inspection work scope to ensure that only those items that need to be inspected are inspected. The licensee stated that they believe the ISI work scope may be broader than it need be.

. Replacement of the stainless steel fuel cladding currently in use with zircalloy cladding. This will be done in stages, with about one third of the core being changed over by 1991. The licensee stated that the fuel assemblies were being ordered with reduced cobalt components.

. Improved valve maintenance techniques. There is now an extensive training program for a work crew that specializes in valve repair work. A new valve packing remover is in use to reduce the time spent in that type of work. The licensee stated that they expect to adopt new procedures to improve valve maintenance work and reduce the introduction of valve metal particles into the primary system during valve work. The licensee stated that maintenance procedures are not currently being formally reviewed by Health Physics for inclusion of ALARA measures. The licensee stated that maintenance personnel who develop and review the procedures are aware of ALARA considerations and do include them into the procedures, and that Health Physics also informally reviews maintenance work either by discussions with maintenance personnel during job planning or by review of RWP requests that require an ALARA review.

. Valves throughout the plant are being identified by clearly visible tags and their positions are also being marked on drawings that will make it easier to locate these valves for inspection or other purposes. An extension of this system is a tagging system that is used by operators and other personnel doing routine inspections. Components that are found to require maintenance or repair are tagged when found so that they are later easily located. The licensee stated that locating welds for inspection is still a problem because the welds are usually covered by insulation. The licensee stated that they are considering several options to address this problem.

. Live load packing for valves has not yet been used but is being evaluated.

. New insulation in the form of pads that can be quickly removed and installed is being used.

. Exposure to health physics personnel, a group that traditionally accumulates high exposures, is being reduced. Measures to accomplish this include use of remote cameras to observe and control ongoing work and minimizing the scope and frequency of routine surveys without affecting safety.

. Continue the hot spot reduction program. This program includes desludging tanks, replacing highly radioactive valves, and shielding of active sections of piping in high traffic areas.

The planning and implementation of long-term ALARA measures was not fully reviewed during this inspection but will be reviewed during a future inspection.

10. Exit Meeting

The inspector met with licensee representatives at the end of this inspection on October 6, 1989. The inspector reviewed the purpose and scope of the inspection and discussed the inspection findings.