REDUCTION AT INDIAN POINT UNITS 1 & 2 TURNING AROUND THE LARGE VOLUME GENERATOR

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ABSTRACT

Consolidated Edison's Indian Point Station has significantly reduced radwaste generation from a high of 56,000 cubic feet in 1981 to less than 8,000 cubic feet in 1987. The success of the volume reduction program has been its concentration on radwaste source minimization and end-of-pipe wastestream volume reduction. This paper describes the results of the program and the overall multiphased volume reduction approach.

INTRODUCTION

Indian Point Units 1 & 2 are located on the Hudson River in Buchanan, New York. Consolidated Edison Co., as owners and operators of the operating PWR Unit #2 and the retired PWR Unit #1, are interested in minimizing low-level radioactive waste generation and its potential negative effects on plant operations:

- More shipments of LLRW result in increased worker exposure, greater chances of transportation incidents and higher processing, transportation and burial costs.
- Greater use of Anti-C clothing increases unproductive dress-out time and resulted in higher laundry costs.
- Higher radwaste generation is an indicator of more equipment leakage, more equipment breakdowns and lower equipment availability.
- Greater amounts of radwaste increases potential for NRC violations due to a lack of good housekeeping and increased shipment paperwork.
- It reduces the ability to attract qualified experienced workers and lowers plant morale due to the perception of Indian Point Unit #2 as a "dirty" plant.

These factors combined with lower LLRW allocations and burial restrictions as designated by the LLRW Policy Act of 1980 and the LLRW Policy Amendments Act of 1985 spurred the plant to develop a multidisciplinary volume reduction program. The major objectives of the program were to reduce Indian Point LLRW generation to meet the INPO Performance Indicator for LLRW generation and to meet our burial site allocation of 10,452 ft^3 per year per reactor. In order the meet the 1990 INPO goal of 240 cubic meters (8,475 ft^3), Indian Point instituted a program of both LLRW source reduction and end-of-pipe volume reduction. The program that was developed is illustrated in Fig. 1.

The results of this program, which was implemented in stages beginning in 1981 have been dramatic. Indian Point went from a high of 55,821 ft^3 of waste shipped in 1981 to 7,255 ft^3 shipped in 1987. Figure 2 illustrates the average 25% per year drop in LLRW shipment volumes from 1981 to the present. Waste curie content has also dropped from typically 2,000 curies or greater per year in the early 1980's to several hundred curies in recent years. This has been mainly due to improved reactor coolant chemistry which will be discussed below.

SOURCE REDUCTION

Preventing uncontaminated material from becoming radwaste is the cornerstone behind a successful volume reduction program. Indian Point has achieved this goal through a combination of six techniques.

Area Decontamination

Getting areas clean and keeping them that way requires the use of the appropriate decontamination equipment for the area to be cleaned, a schedule for decontamination, and a contamination goal for the area. Too often we repeated decontamination of cells and areas over a short time period resulting in the generation of excessive amounts of mops, buckets, herculite and paper cloths. The solution has been in better planning for decontamination including coordination of leak control, work activities, and contamination tracking in order to assure that decontamination will be successful. Three decontamination goals have been set for the station:

- Releasing areas from Anit-C Clothing (< 1,000 dpm/100 cm^2)
- Releasing areas from Respiratory Protection (< 100,000 dpm/100 cm^2)
- Preventing Cross Contamination by separating zones of varied contamination

The release of areas from contaminated status requiring the use of protective clothing has required daily contamination monitoring and a knowledge of on-going work in areas adjacent to clean areas. Work in these adjacent areas must be conducted in a way to prevent cross contamination. Periodic field inspections by Health Physics and

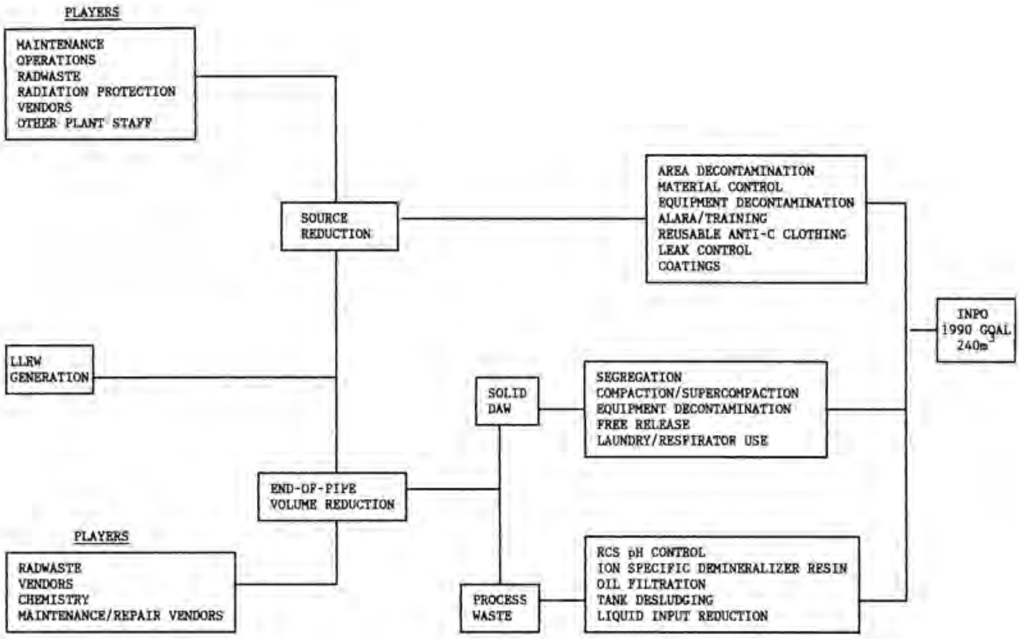

Fig. 1. Indian Point Units 1 & 2 Multidisciplinary VR Program.

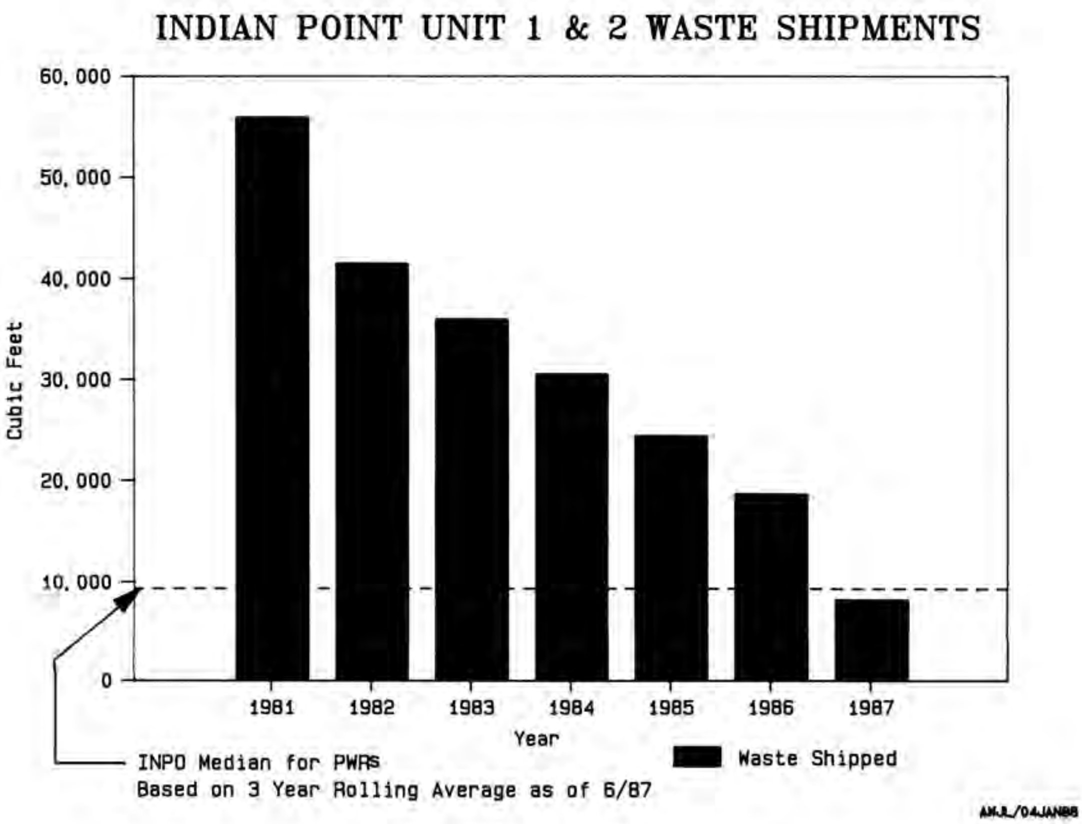

Fig. 2. Indian Point 1 & 2 Waste Shipments.

Radwaste staff combined with improved work practices help to ensure that this is the case.

Release of areas from respiratory protection requires job preplanning, leak control and/or containment and a decontamination window prior to the start of work. The station has used water blasting and steam cleaning as the main ways to reduce gross contamination.

The separation of contaminated zones from non-contaminated zones within a defined area allows tasks such as operator rounds and technical inspections to be conducted without Anti-C clothing and thus results in lower radwaste volumes. This philosophy has been achieved through the use of step-off-pads, contaminated boundary tape and sticky pads throughout the cells and equipment rooms in the Radiologically Controlled Area (RCA). The use of well-maintained step-off-pads to separate areas of gross contamination 100,000 dpm from areas of lower contamination has aided the station in preventing cross contamination.

Area decontamination techniques have combined to increase the percentage of Unit #2 radiologically clean areas from 41.5% to 70% from January 1986 to October 1987. These techniques have also shown a month by month shift in contamination as shown in Fig. 3. Goals for 1988 include recovering as clean 3 of the 22 cells remaining and a 5% reduction in contamination zone levels in the remaining areas.

Material Control

In addition to the previously established program of restricting clean packaging material and wood from entering the RCA, the plant has instituted a tagging program for all material coming into the RCA. The tag includes the name and location of the owner and a description of the object. Initial assessments of this program during the 1987 outage were favorable, however, greater personnel adherence would occur if a 24 hour door guard equipped with tags was posted during periods of job setup and close-out. This would encourage staff and vendors to take home what they came with. The station has encouraged vendors to bring refueling equipment in modular boxes during outages. This has meant that less herculite and fewer plastic bags have been used once jobs are completed and equipment needs to be moved out. In addition, all gas bottles entering the V.C. must be covered to prevent their contamination.

Radwaste management has published a punch list of equipment and material that must be removed from the Containment Building prior to the end of an outage. This list is highlighted at outage meetings and owners are contacted.

Equipment Decontamination

Removing contaminated components to self-contained environments in order to allow repairs without spreading contamination has worked well at Indian Point. The setup of four portable HEPA-filtered metal buildings has allowed decontamination and repair work on numerous components including Reactor Studs, CRDM fans, valves and other RCS components. The plant staff has also encouraged individuals to bring in small (200 lb.) objects for in-house decontamination using grit blasting, freon cleaning, liquid bead blasting and handwiping. In the past, this equipment may have become radwaste, now it can be re-used.

Alara/Training Controls

In 1984, Indian Point Unit #2 initiated steps to upgrade its radiation protection program. A major focus of the upgrade was enhanced training of personnel with regard to their individual responsibilities and requiring better work habits by procedure and example. During the upgrade, the relationship between the radiation protection program and LLRW generation became clearer. Station procedure implemented by the Radiological Engineering Section now requires a formal ALARA Review for all jobs > 1 man rem, having gamma dose rates 5R/hr, or contamination levels greater than 10^6 dpm/100 cm^2. These reviews must consider decontamination, containments and the number of workers assigned to the job. They are reviewed in the field by the Health Physics staff to ensure adherence to their requirements and those of the RWP. These dose intensive jobs are typically large LLRW generators. This planning combined with better maintenance procedures have resulted in lower LLRW generation. Radwaste that is generated is better controlled though the use of shield-ed storage areas and well planned removal and processing schemes.

Reusable Anti-C Clothing

In May of 1987, the station began using washable cloth high shoecovers and rubber low shoecovers. The reusable shoecover program was introduced on a trial basis in Unit #1. After its success in Unit #1, the training department required all individuals to use the new shoecovers during the practical factors dress-out portion of radiation badge training. Subsequent to this training, all disposable shoecovers were removed from shelves. The program was a proven success during the 1987 outage. The reusable shoecovers program is estimated to save the plant $36,000/yr and eliminates approximately 1,900 ft^3/yr of DAW associated with 450,000 pairs of disposable plastic shoe-covers.

Leak Control

Indian Point has used an aggressive program in leak control to limit the number of contaminated areas and their resulting LLRW generation. The plant began the use of live-loaded packing for 60 valves during the 1987 refueling outage, ten of these located in the Radiologically Controlled Area (RCA). These valves will be monitored and the live loading will continue if results are promising. Data from Atomic Energy of Canada indicates that the frequency of repacking after live load packing is instal-led is 0-1 per 100

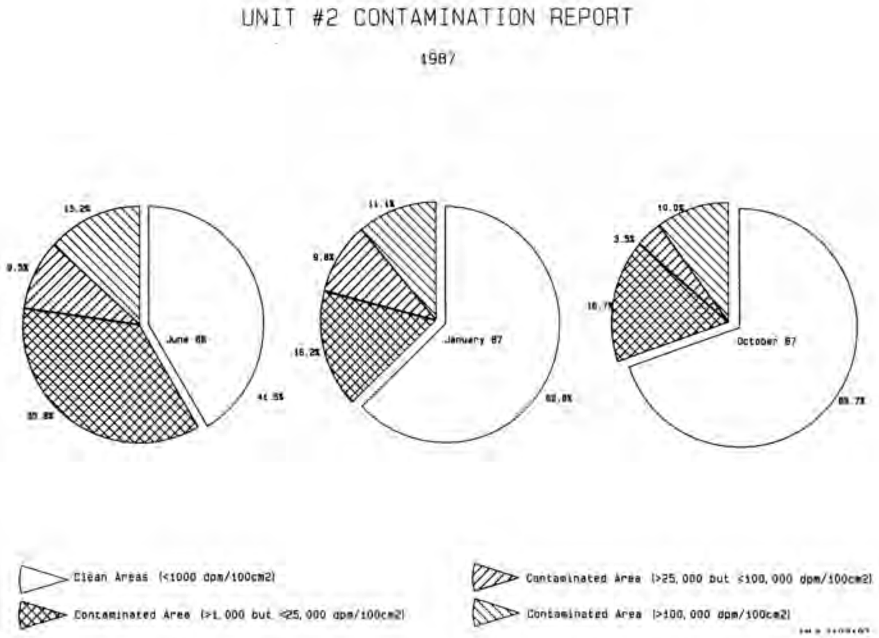

Fig. 3. Indian Point Unit #2 Contamination Report.

valves per year. Leakage is only a small fraction of conventional loadings. When components do leak, the resulting water must be contained and routed to a contaminated drain. Station procedures, ALARA Reviews, worker training and meetings have concentrated on the use of leak catchers and containers. These items are kept in the Class & Stock equipment list for quick order and use. They can be ordered by any department for use in the RCA. Radwaste personnel use the maintenance work order computer system to identify leaking components and assign them a high repair priority. These assignments are followed up with personnel who are responsible for repair and work coordination. Leak awareness and quick repair allow nuclear power operators and all workers in the RCA to perform these functions efficiently and with a minimum amount of protective clothing.

Coatings

Durable, easy-to-decon coatings facilitate maintenance of a clean radiologically controlled area. In a joint EPRI-Con Edison program, a 4000 ft^2 area of our Maintenance and Outage Building was robotically scabbled. This area was then coated with Silikal brand R-61 acrylic resin floor surfacer. Silikal brand was chosen after a test pad area was scabbled and covered with several different coatings and surfacing materials. The heavily used area was then observed for signs of wear and ease of decontamination before a coating was chosen. We plan to coat our entire solid waste handling building floor during the next two years.

END-OF-PIPE VOLUME REDUCTION

A complete review of LLRW generation was conducted in order to determine the optimum way to reduce its volume based on its character, radiation level, contamination level, chemistry, and burial requirements. Solid dry active waste was examined separately from process waste due to obvious differences in processing.

Solid Dry Active Waste (DAW)

Indian Point has used a multi-colored bag system to segregate used items in the RCA since 1985. Examination of this system indicated that, if improved, it could be used as the main building block in a DAW volume reduction system. Improvements made to the system include:

- Classroom and full dress out mockup training on bag system use
- Sufficient supply of bags on all RCA elevations
- Signs at step-off-pads explaining proper bag use
- Technicians to monitor step-off-pads during outages to assure compliance
- Use of yellow herculite for large contaminated objects instead of multiple bags

Once these improvements were made, the bags and herculited equipment could then enter the DAW volume reduction system shown in Fig. 4. This volume reduction system has been a success and recently resulted in a INPO good practice during a October 1987 evaluation.

Segregation

All compactable material in orange radtrash bags with a radiation level less than 1R/hr are segregated in a negative ventilation HEPA sorting table. Recoverable items and wet wastes inadvertently put into bags are removed. Small metallic items are cut using port-able saws or tools. Remaining radtrash is baled with a drum compactor into 52 gallon 20 gauge soda ash drums to a minimum weight of 260 lbs. These drums are then shipped for offsite supercompaction. Trash over 1R/hr is held in temporary storage to await batch baling without segregation, unless a bag appears to have objects that will damage the compactor. These objects are removed. Once compacted, these drums are held in a shielded room for periodic shipment to Barn-well, S.C.

Compaction/Supercompaction

Past practice at the station was to generate 55 gallon drums of compactable DAW that weighed between 200 to 325 lbs (27 to 43 lbs/ft^3). Generating consistent drum weights of 300 lbs. (with DAW heavily ladened with plastic) was possible but very labor intensive. In order to improve densities, a 1000 ton mobile super-compactor was brought on site in 1985. DAW precompacted into 52 gallon soda ash drums to a minimum weight of 260 lbs was supercompacted into "hockey pucks" that resulted in an average 55 gallon drum overpack of 516 lbs. Subtracting the weight of the soda ash drums yielded a final average weight of 456 lbs (61 lbs/ft^3). Compared to historical practices (300 lb drums), a VR of 1.53 to 1 was obtained.

In 1987, the station used an offsite 1,500 ton supercompactor. packaged in 52 gallon drums was packed to an average weight of 260 lbs per drum. Using the above methodology, a final VR of 1.76 to 1 was obtained when compared to historical baling practices.

Equipment Decontamination

Equipment and materials to be saved or reused at Indian Point are either placed in red bags if they can be hand-carried, or are wrapped and marked in yellow herculite if they are large. As shown in Fig. 4, this material is processed based on its size and contamination levels. The goal of each process is to assure that material doesn't become LLRW without undergoing some kind of decontamination process. Each component in the system is summarized below:

Small Tool/Equipment Decontamination

Equipment:

HEPA Sorting Table, Freon Degreaser, Liquid Bead Blaster.

Capacity:

Material up to 6' long, up to 1 ton in weight

Volume Reduction/Benefits:

50 ft^3/month

$87,000 total replacement savings for 6 months of 1987

1 mile of hose/wiring, 2,555 tools, 682 misc. items in 6 months

Grit Blasting

Equipment:

Steel grit gun used in a metal decontamination booth (steel grit replaced sand in 1987)

Capacity:

Material up to 10' in length

Volume Reduction/Benefits:

Recovery of thousands of dollars of equipment for reuse or free release. (See Free Release Section)

Large Equipment Decontamination

Equipment:

Offsite vendor services including grit blasting, freon degreasing, chemical cleaning, supercompaction, cutting equipment, dismantling equipment.

Capacity:

Based on license limits, equipment and staff. Items shipped by the station include: tanks, fan cooler units, valves, and scaffolding

Volume Reduction/Benefits:

Contractual guarantee of 5 to 1 VR or metallic components. 4,932 ft^3 sent off-site in 1987.

Miscellaneous Outage Decontamination Areas

Equipment:

Electric cutting equipment ultra-sonic sink (future), manual-wipe down in various plant areas.

Capacity:

300 sq ft. area assigned to vendors with Radwaste technicians supplied to

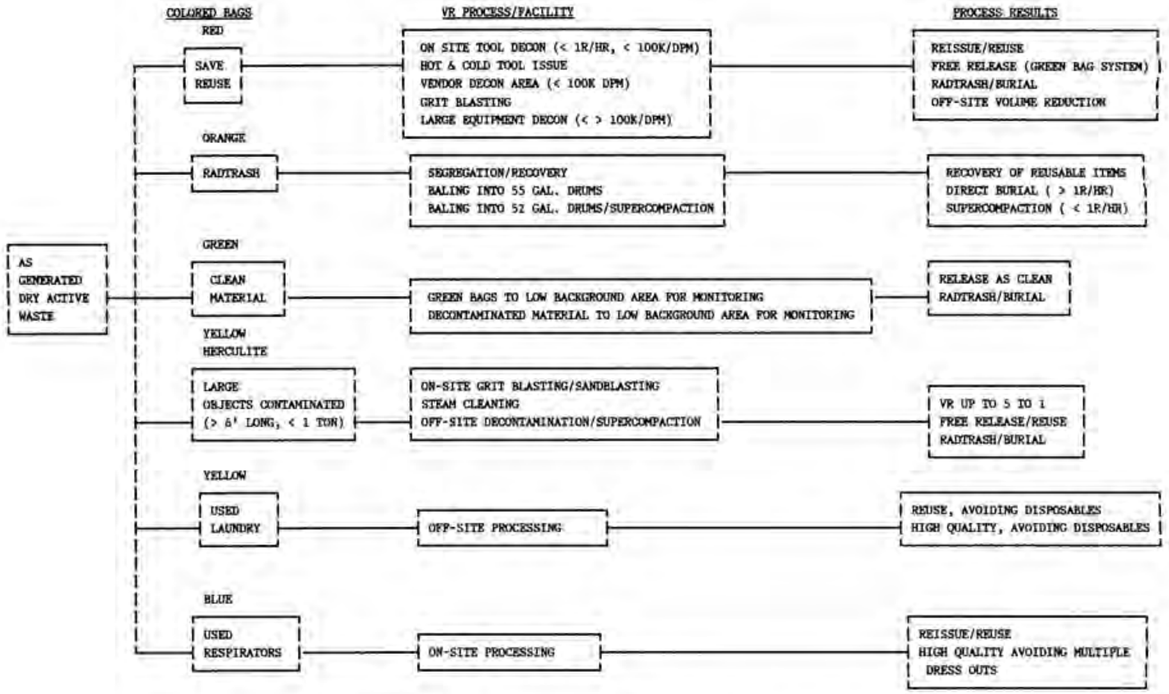

Fig. 4. DAW Volume Reduction System.

decontaminate/dismantle equipment for reuse or free release.

Volume Reduction/Benefits:

1,000 ft^3 of material not disposed of as LLRW

Tool Control

Equipment:

3 issue stations, tool card accounting system for all RCA employees

Capacity:

Tools handled in contaminated areas only are issued from 250 ft^2 tool bin. Tool cards required. Non-contaminated tools are also issued in RCA to work on clean equipment.

Volume Reduction/Benefits:

System is supplied by the small tool decontamination facilities. Several hundred ft^3 of tools/yr are saved and are not disposed of as LLRW.

It should be noted that the ability to increase worker awareness of the equipment decontamination facilities and make them a part of day-to-day operations have increased program effectiveness.

Free Release

Materials that have entered the Controlled Area but have not come in contact with levels of contamination greater than 1000 dpm/100 cm^2 are segregated by plant staff into green bags. Similarly, materials that have been decontaminated using in-house equipment are subject to evaluation as clean material. Once monitored mater-ials are either released or cycled to radtrash. During 1987, 12,741 ft^3 of material was released due to sandblasting, grit blasting, hydrolasing, steam cleaning, manual wipe down and the green bag program. Considering Health Physics and Radwaste labor and sandblasting grit generated, the net savings for 1987 was $454,000.

Laundry and Respirator Use

Establishing a segregation system for used Anti-C clothing and respirators using yellow and blue colored bags has reduced the incidence of these materials ending up in Radtrash. In addition, quick routing of these materials for cleaning and reissuance has improved the supply of respirators and clothing. A good supply of these high quality materials has resulted in lower LLRW generation by avoiding the use of disposable clothing, multiple dress-outs due to defective respirators or clothing, and the elimination of these reusable items from radtrash.

Process Waste

Burial volumes associated with liquid radwaste processing have been reduced by a factor of 5 from 1981 to 1987. Part of the improvement is associated with a reduction in waste water conductivity from an average of 800 to

1000 umhos/cm to a current level of 50 to 100 umhos/cm. Lower average conductivity and total suspended solids levels greatly extend the service life of water processing resin and filters. These levels were achieved by eliminating river water leaks (brackish water) from containment fan coolers, improving area cleanliness levels, and by de-sludging five liquid waste hold-up tanks.

Resin throughput has also improved as the result of our use of ion specific resins, more realistic criteria for release of processed waste water, and a new state-of-the-art sluiceable demineralization system.

Improvements in plant primary chemistry have been implemented as the result of our change-over to a constant high pH in the RCS in December 1984. In the past, we generated and shipped spent resins and filters on a regular basis, approximately three resin shipments and one filter shipment per year. Radiation levels and personnel exposure associated with these shipments were significant and transportation and burial costs were reaching $75,000 for a single spent resin shipment. Similar problems were experienced with spent filters. Con-current with our pH change, we have seen a significant drop in the generation of this radio-active waste; in fact we have not generated sufficient quantity of primary spent resins or filters to make a ship-ment for a 24 month period and what material we have generated has significantly reduced radiation levels.

Finally, as mentioned above, the plant recently installed live-loaded packings on ten valves in the Radiologically Controlled Area to improve contamination control and reduce liquid processing. Additional packings will be scheduled for our next outage upon successful completion of our current test program.

Oil Filtration

The station conducted preliminary tests that established filtration of radioactively contaminated waste oil as a viable option. Based on this data, we have issued a purchase order to a vendor for filtration of 75 barrels of oil during the first half of 1988. A technical program to burn the filtered oil as non-contaminated waste is being developed. To reduce future processing costs, Con Edison is co-funding a program with EPRI for optimizing processing technology.

FUTURE STEPS

Further reductions in waste generation will require source term reduction through a combination of reactor coolant system decontamination, higher pH primary coolant chemistry, and the use of ion selective resin for the plant makeup and purification system. Each of these measures will facilitate reductions in radwaste associated with the activity contained in system leakage. A preliminary scoping study is underway investigating the use of water-dissolvable plastic (polyvinyl alcohol) films as a replacement for floor and equipment wrapping. Increased use will also be placed on launderable items such as canvas floor coverings and cloth laundry bags wherever practical, to avoid burial volumes associated with disposable items. Finally, we will expedite the use of robotics to replace manual decontamination activities thereby reducing personnel exposure and increasing productivity. Indian Point Unit #2 and Peach Bottom Unit #3 have been chosen by EPRI to be host utilitites for a project to assess and identify a robot for radwaste handling. The goal of this project is to identify a robot or robotic system to improve radwaste handling and/or processing efficiency, thereby saving money and cutting LLRW volumes.