BIG ROCK POINT DECOMMISSIONING

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ABSTRACT

Consumers Energy's Big Rock Point station was our country's fifth commercial nuclear plant to go into operation and was our nation's oldest operating and longest running nuclear plant at the time of is permanent shutdown on August 29, 1997.

Developed as a research and development facility, the plant and its employees achieved several industry breakthroughs that have become standard industry practice at the larger nuclear plants that followed.

As plant employees moved into the beginning stages of decommissioning, industry leadership has continued with innovative efforts in the areas of chemical decontamination, decommissioning power supplies and employee relations.

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It's Sept. 27, 1962. Plant superintendent Lee Hausler and the operating crew are in the control room at the Big Rock Point nuclear plant. The crew is anxiously awaiting the dawn of a new day for Consumers Energy - nuclear generated electricity. Hausler pulls the control rods and Big Rock Point goes critical.

The initial criticality occurs just 34 months after the Consumers Power (now Consumers Energy) board of directors issues approval to construct what would become the longest running nuclear plant in the United States.

THE BEGINNING

Constructed on the shores of Lake Michigan near the resort town of Charlevoix, Mich., Big Rock Point began operation as a research and development plant. The proposal to construct the plant was jointly submitted by Consumers Power and General Electric and was intended to demonstrate that a nuclear power plant could be used to commercially generate electricity.

In contrast to today's environment, the licensing process moved exceedingly fast when Big Rock Point was proposed. On Jan. 18, 1960, Consumers Power submitted its formal proposal to the Atomic Energy Commission (AEC) for a construction permit and operating license. On May 31, a mere four months later, the construction permit was granted.

Ground breaking for the plant was held July 20, 1960 and the plant was officially completed 26 months later when initial criticality was achieved.

SMALL PLANT, BIG CONTRIBUTIONS

Big Rock Point was a relatively small 67 megawatt plant that has made large contributions to the nuclear industry.

As the world's first high power-density boiling water reactor, one goal was to demonstrate that nuclear plants could generate electricity more economically. The AEC research program at Big Rock Point was to demonstrate that the plant could be operated at 75 MW gross

electrical output using fuel with an average power density of 45 kilowatts per liter of active core (compared to an average power density of 30 kilowatts per liter of active core at the earlier completed Dresden plant located in Illinois). Other research was focused on increasing fuel life and reducing fuel fabrication costs. Results of this research were used for application in the larger nuclear plants that followed Big Rock Point.

The 1979 accident at Three Mile Island resulted in the U.S. Nuclear Regulatory Commission (NRC) issuing numerous and costly recommendations and renovations for nuclear plants. The cost of implementing the recommendations at Big Rock Point -- estimated in the millions of dollars -- would have forced management to shut the plant down. In response, Big Rock Point employees performed one of the first comprehensive risk assessments of plant operations. The assessment and alternative modifications proposed to increase plant safety margins allowed the NRC to approve a plan that met the intent of the Three Mile Island recommendations more economically. This pioneering, aggressive approach to risk analysis saved the plant millions of dollars and enabled continued operation.

A similar challenge occurred several years later when all nuclear plants in the United States were required to have a site-specific control room simulator.

For years, Big Rock Point operators had received required training at a simulator site in Illinois. Now plant management was faced with costs of approximately $15 to 20 million to purchase a new simulator.

After reviewing the options, plant management decided to construct the first microprocessor based nuclear plant simulator using plant employees and contractors to build it.

By utilizing in-house knowledge and resources, the company completed the simulator for approximately $2 million, a savings of up to $18 million compared to the cost of purchasing a new simulator.

HISTORIC ACCOMPLISHMENTS

Big Rock Point has continuously achieved significant milestones throughout its operating history:

- For 11 years the reactor was used to produce cobalt 60 to treat cancer patients. It was estimated by the company which utilized the cobalt 60 that this effort helped save more than 120,000 lives.

- In 1977 Big Rock Point set a world record for boiling water reactors by operating for 343 consecutive days.

- Big Rock Point was the most efficient General Electric boiling water reactor in the world in 1987 with an availability of 95.5 percent.

- The American Nuclear Society named Big Rock Point a Nuclear Historic Landmark in 1991 for its many contributions to the nuclear and medical communities.

- In early 1992 Big Rock Point became the oldest operating nuclear plant in the United States following the closing of the Yankee Rowe plant in Rowe, Mass. In June 1996, Big Rock Point became the longest running nuclear plant in the United States, surpassing the previous record of 30 years and 92 days held by the Yankee Rowe plant.

Big Rock Point continued to operate well and set records as it approached the end of its operating life. In 1995 the plant set a site yearly generation record by producing 516,209 megawatt hours. Plant employees ended that same year with a cumulative dose of 53 person-rem, the lowest in its commercial operating history.

To the end, safety remained the highest priority. On August 3, 1997, Big Rock Point employees completed 20 years without missing a day of work due to any type of injury.

THE FINAL SHUTDOWN

The day was August 29, 1997, the 35th anniversary of the Atomic Energy Commission issuing an operational license to Big Rock Point.

All former Big Rock Point employees had received an invitation to attend the "Success Celebration" to honor the accomplishments of the plant and its employees. The night before, all eight of the managers in the plant's history were honored at a special dinner. On this day, a thousand people, including industry and local leaders, elected officials, and family and friends, gathered under huge tents erected in the plant parking lot.

Speeches were made and introductions given. The crowd stared intently at the 16 video monitors stationed around the tents. The final shutdown would be broadcast live.

Once again, in the control room, was Lee Hausler. He was there for the first critical and he would now be there for the last.

Plant general manager Ken Powers requested permission, on behalf of all current and former Big Rock Point employees, to shut the plant down for the final time. Consumer Energy chief executive officer William McCormick granted permission. The information was relayed via head phones and video monitor to the control room.

Final checks were made and instructions issued. The crowd was silent, straining to hear the commands being issued in the control room. Finally, after precisely following procedures, nuclear control operator Andy Loe extended his hand toward the scram button.

He pushed the button, scramming the reactor, and ending 35 years of electrical generation. "Goodbye Big Rock. Sorry to see you go," he said.

The crowd rose and delivered a standing ovation. There were more than a few tears in the crowd. It was the end of an era.

Final remarks were made and interviews conducted with news media. Slowly the crowd dispersed around the site. Employees, their families and other guests, including several anti-nuclear activists, enjoyed the rest of the day with a catered lunch, horse and buggy rides and children's activities. Thousands of dollars of plant merchandise were purchased; the profits donated to a fund for local families. A professional photographer snapped pictures of families posing in front of the plant while, all around, friends reminisced.

While one era has ended, another has begun at Big Rock Point. Following the shutdown, the plant entered into an ambitious decommissioning and site restoration phase. Many of the same employees who so successfully operated the plant will now return the site to a "green field."

Big Rock Point employees have gained the public's trust through 35 years of safe performance and community involvement. The initial success through the first few months of decommissioning reflects their commitment to carry on the plant's motto, "A Good Friend and Neighbor since 1962."

ESTABLISHING A DECOMMISSIONING ORGANIZATION

After 35 years of safe and successful operation, the management and employees of Big Rock Point faced a new challenge: Safe and efficient decommissioning and site restoration.

We chose to immediately dismantle the plant after initially considering a plan that called for a long storage period prior to dismantlement. Our goal is to restore the site to a green field status within seven years, by 2005.

Immediate dismantlement is the environmentally right option and will be more cost effective than letting the plant sit idle for up to 26 years in a safe storage mode. With the uncertainty concerning the continued availability of a low-level radioactive waste disposal facility, and facing the reality of hiring a new crew of employees 26 years from now to dismantle the plant, it was concluded that the right choice was immediate dismantlement.

Decommissioning planning, by necessity, began several months before the final shutdown. One of the key goals was establishing a decommissioning work force without any lay-offs. Key Big Rock Point employees were identified and assigned to leadership positions. The balance of the plant work force was either offered a reclassified job, encouraged to bid on jobs outside Big Rock Point, or offered a severance package with an established job end date. A new contract was negotiated with the union employees that reclassified their jobs enabling them to work a broader range of tasks.

To ensure key personnel were retained, a bonus package was established that offered financial incentives to remain at Big Rock Point until released by the general manager. Due to this initial planning, employees transferred within Consumers Energy, accepted jobs with the decommissioning organization or voluntarily left the company. No lay-offs were necessary.

Additional contracted personnel were necessary to complete the decommissioning staff. Industry experience has indicated that teamwork was problematic between a large contracted work force and long-time utility employees. To avoid this, a conscious decision was made to add contracted personnel to the plant staff reporting directly to the site general manager and to have Consumers Energy employees report to contracted personnel. An additional decision was made to establish the use of one hard hat on site to help visually link all employees as working on the same team.

PRE-SHUTDOWN EFFORTS

In order to move into decommissioning following the final shutdown, work began to revise licensing documents, including technical specifications, emergency plans, and security plans. Plant employees also began the task of reclassifying plant equipment no longer necessary for the storage of spent fuel.

A major effort undertaken was the mobilization of the decommissioning work force and securing office space for a workforce that doubled in the months immediately preceding and following the final shutdown. Temporary office space on site was added as were two off site buildings. Additional parking lots were constructed.

The enormous task of training new employees, many of whom had never worked in a nuclear plant before, was supervised by a joint task force consisting of human resources, training, security and contracted personnel. This required extraordinary coordination between all work groups.

The reactor was defueled in September 1997. Certification of permanent shutdown status was secured which authorized the start of major decommissioning activities.

MAINTAINING EMPLOYEE MORAL

Experience has demonstrated that the single largest cost associated with decommissioning are employee wages. Many decisions were based on establishing trust with the work force to ensure employee moral and productivity stayed high in the face of the potentially devastating final shutdown and uncertain future.

Employee communications were established as a key component of maintaining employee moral. As corporate personnel began studying options associated with continued operation or permanent plant shutdown, all-employee meetings were established to communicate the progress of the studies. The site general manager met with all employees in group meetings at least every two weeks to discuss the study, possible outcomes, and rumors. The meetings also discussed action plans associated with whatever decision was made. These meetings served to help prepare employees for the future and prevented any from being surprised by the decision to shut down the plant.

On June 11, 1997 all employees were gathered to hear the announcement. The CEO, president of the electric division and site general manager delivered the news that continued operation was uneconomical and the plant would be shutdown. Rather than an immediate shutdown, the date chosen to close the plant was August 29, 1997, the 35th anniversary of Big Rock Point receiving its operating license.

Corporate governmental affairs employees met with key state officials and a news release was faxed to media as the announcement was being made to employees.

Following the announcement and a lunch break, meetings were held with management, support and union employees to discuss their individual concerns and options. Resulting media coverage of the shutdown demonstrated that the communication effort was successful in maintaining employee moral. Employees quoted in news stories expressed no surprise at the announcement and stated that they had been prepared for any decision.

The communication effort increased as the employees prepared for the historic final shut down. A continued emphasis was placed on the continued safe operation of the plant -- to ensure that the plant and its employees would enjoy a day of dignity on August 29.

Early on the decision was made that the final shutdown would be a “Success Celebration,” rather than a shutdown due to perceived economic failure. Big Rock Point employees established a high standard of operation and there was nothing that could be done about the small size of the plant and resulting economics. The final shutdown would celebrate the historical achievements of Big Rock Point and its employees.

A committee was established to plan the celebration. Rather than a small group of people overseeing the final shutdown, the event would be worthy of the plant and its many accomplishments. Groups were formed to invite every former Big Rock Point employee and their family members. Invitations also went out to industry, corporate, governmental and local leaders. Catering and entertainment plans were needed. Mementos needed to be ordered. Parking and transportation would have to be established. Tents to house the 1,000 expected guests had to be secured. A video explaining a nuclear plant shutdown would have to be taped. Video production equipment and monitors had to be secured and properly located around the tents due to the live nature of the shutdown.

While planning for the historic shutdown progressed, employee communications continued. The emphasis on safe operation was constantly reinforced to ensure the plant was retired with pride. Additional communications involved preparing employees for life after Big

Rock Point. Human resources personnel conducted surveys to determine employee interest in assistance to plan for the future. Additional resources were made available for employees including: retirement planning, estate planning, expanded education reimbursement, job interest seminars, resume writing and networking skills workshops, and job opportunities in and outside of the company.

This intense communication effort was carried forward primarily in all employee, face-to-face meetings and supported with the plant newsletter. This concentrated effort to communicate the implications of future decisions and to prepare employees for the future was a key factor in keeping employee moral high as they moved toward the final shutdown and into decommissioning.

DECOMMISSIONING ACCOMPLISHMENTS

- Nureg 0568, the Final Generic Environmental Impact Statement for Decommissioning of Nuclear Facilities, requires performing a chemical decontamination of the primary coolant system (PCS). Decontamination of Big Rock Point's PCS was estimated to save approximately 200 rem of employee exposure during PCS dismantlement.

A number of chemical decontamination processes were evaluated. Based on overall project cost (including end-of-process waste disposal) PN Services was selected to apply the EPRI Decontamination for Decommissioning (DfD) process. The process not only removes the built-up contaminated corrosion layer but a small percentage of the base metal which results in effective, overall activity removal.

Decontamination efforts began in late December 1997 and was completed on January 14, 1998. A series of six hot (185-205 degree F)DfD cycles were applied to the stainless steel portions of the reactor recirculation system including the reactor vessel and steam drum. Following the hot DfD cycles, the solvent was cooled and the carbon steel portions of the primary and support systems were valved in.

The chemical decontamination process at Big Rock Point lasted for approximately nine days. The radioactivity from the interior surfaces of the piping and components deposited on the cation exchange resin and particulate filters totaled more than 418 curies with dose reduced by factors of 15-20 in specified locations. Significant employee dose reduction during the preparation and subsequent dismantling of the decontaminated systems has been realized.

The DfD process utilized at Big Rock Point was the recipient of R&D Magazine's R&D 100 Award as one of 1998's 100 most technologically significant processes. It was the first time the process had been used to decontaminate an entire plant system.

- Lessons learned from visits to other retired nuclear plants by Big Rock Point personnel indicated that it was not always obvious which plant systems were energized and which systems were not. To ensure the safety of plant employees and to eliminate the possibility of inadvertently interrupting power to the spent fuel pool, a new substation and distribution system was installed to provide power to plant equipment necessary for decommissioning. Wires, junction boxes and other equipment associated with the new system is marked with a yellow color, identifying it as "live." A complete switch-over to the new electric system was completed in early 1999.

- Significant plant equipment has been removed during the first 15 months of decommissioning including: turbine, generator, exciter, condensate pumps, acid tank,

recirculation pump motors, reactor feed pumps, and the reactor shield plug was cut into manageable pieces using diamond saw technology and removed from site.

- Other significant progress includes the start of the site survey and characterization to determine areas that will require remediation for free release, a HEPA filter installation, reactor vessel piping cut and capped, major hazard reduction by removing unnecessary flammables, explosives and corrosive materials, steam drum hot spot removal, and the installation of a new liquid radiological waste system and decommissioning air supply.

- A key challenge as the plant moved into the decommissioning and site restoration process was changing the focus of employees from an operating plant to a construction site. This resulted in a concentrated effort to refocus on safety and the different dangers facing employees in an construction atmosphere. To ensure employees were able to make the transition and to maintain the plant's outstanding safety record, three entire days, exclusively devoted to personnel and plant safety, have been held. In addition, each department is required to hold at least one safety meeting per month to reinforce the commitment to working safely.

The commitment to safety was enhanced with the forming of a Restoration Safety and Review Committee (RSRC) and establishing an on-site consultant to oversee safety matters. The RSRC consists of three recognized nuclear experts who have experience in decommissioning plants, radiological safety, and spent fuel storage. The committee meets three times a year at Big Rock Point to review and critique decommissioning progress. The on-site consultant is tasked with identifying problems associated with nuclear, radiological and industrial safety and solving them before they become major concerns.

These efforts have helped maintain an unwavering commitment to safety. The plant's most significant accomplishment occurred on August 3, 1998 as plant employees achieved 21 years without a lost time accident.

- A major asbestos removal project has been steadily progressing. Employees have received training to earn asbestos removal supervisor qualification. The material is being removed from equipment where it was once used as insulation. It is analyzed for content, packaged, and shipped off site for disposal. As of December 1998, asbestos removal is approximately 45 percent complete with about 2,500 cubic feet removed.

- The submittal and approval by the NRC of the plant's defueled technical specifications and emergency plan were two more hard-won success stories in 1998.

INDUSTRY LEADERSHIP

Decommissioning efforts at Big Rock Point have received national and international attention. The plant's Success Celebration was featured on the cover of three industry magazines. Three groups from Japan and representatives from several plants from around the United States have visited Big Rock Point to discuss decommissioning methods and progress. In addition, plant employees have made numerous presentations around the country concerning the chemical decontamination process, the decommissioning power supply, and effectively handling employee issues. Mentioned earlier, the plant and it's participating contractors received an R&D 100 Award for the chemical decontamination process.

FUTURE PROJECTS

As Big Rock Point moves toward the vision of a green field by 2005, major projects remain. Projects scheduled for 1999 include cleaning out the spent fuel pool. This projects

involves the characterization and shipping to a disposal site of all non-fuel components stored in the spent fuel pool.

Asbestos abatement and radiological waste shipping will continue throughout the year.

In January 1999 a major component removal contract was signed with BNFL. Under terms of the contract, BNFL will be responsible for the removal of all major plant components and the demolition of plant buildings. Work scheduled in 1999 includes the following:

- Reactor vessel characterization
- Installation of an alternate liquid radwaste system
- Dismantlement of the control room
- Establishment of a spent fuel pool monitoring station
- Completion of the spent fuel pool cooling skid
- Chemical decontamination of chromated systems
- Condenser removal
- Feedwater heater removal
- Condensate tank removal
- Switchyard dismantlement
- Control rod drive room dismantlement

Meeting the site restoration project time goal depends on receiving timely certification and receipt of a transportable dry cask fuel storage system. In 1998, the plant submitted it's proposal to the NRC and at this writing, was awaiting approval. A mock-up of the dry cask storage system will be delivered by Westinghouse to Big Rock Point in 1999 to allow plant employees to begin fuel loading training. Initial site characterization for the Independent Spent Fuel Storage Installation began in late 1998. Plans call for cask loading to begin and be completed in 2002. This will allow dismantlement of the containment structure and remaining spent fuel pool support systems.

ECONOMICS

The estimated cost to decommission Big Rock Point is $293.8 million in 1997 dollars. Based on established ratepayer surcharges, the fund would have fallen several million dollars short of being fully funded. In order to keep ratepayer surcharges at the established levels and avoid a cost increase, Consumer Energy proposed to the Michigan Public Service Commission (MPSC) that the shortfall be made up by investing collected decommissioning monies. The conservative investing of decommissioning monies to fully fund decommissioning was reviewed and approved by both the MPSC and NRC. The fund is regularly reviewed to ensure financial goals are met and the necessary money will be available for decommissioning.

The decommissioning plan at Big Rock Point calls for the $293.8 million to be spent the following major areas:

- Staffing ~ 40 percent
- Other (including spent fuel storage) ~ 24 percent
- Off site burial ~ 12 percent
- Equipment, building removal ~ 8 percent
- Decontamination ~ 1 percent

The above figures are strictly estimates. They are extremely variable and subject to change based on several factors, including the continued availability of a low-level radiological waste disposal site.

While many challenges remain, the first 16 months of decommissioning at Big Rock Point have progressed on schedule and on budget.