



Public Service

**Public Service
Company of Colorado**
P.O. Box 840
Denver CO 80201-0840

April 25, 1990
Fort St. Vrain
Unit No. 1
P-90123

A. Clegg Crawford
Vice President
Nuclear Operations

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

ATTN: Mr. Seymour H. Weiss, Director
Non-Power Reactor, Decommissioning and
Environmental Project Directorate

Docket No. 50-267

SUBJECT: **ENVIRONMENTAL ANALYSIS RELATED TO THE PERMANENT SHUTDOWN OF
FORT ST. VRAIN**

Dear Mr. Weiss:

As requested by Mr. Peter Erickson in a telephone conference call on March 13, 1990, the attached environmental analysis is forwarded for your review. This environmental analysis has been prepared to evaluate the environmental consequences of the permanent shutdown of Fort St. Vrain. In response to the above request, the environmental information provided generally addresses the topics contained in 10 CFR 51.45 as they pertain to PSC's decision to permanently shut down Fort St. Vrain.

The attached environmental analysis addresses only those issues associated with the permanent shutdown of Fort St. Vrain. Decommissioning and possible conversion of Fort St. Vrain are mentioned, but are not addressed in detail. A separate environmental analysis, prepared in accordance with 10 CFR 51.53(b), Supplement to the Environmental Report (Post Operating License Stage), will be prepared to address the effects of decommissioning Fort St. Vrain. This separate analysis will be submitted in conjunction with the Proposed Decommissioning Plan.

If you have any questions related to the information provided in the attachment, please contact Mr. M.H. Holmes at (303) 480-6960.

Very truly yours,

A. C. Crawford

A. C. Crawford
Vice President
Nuclear Operations

Ltr Encl

9005010064 900425
FDR ADOCK 05000267
P FDC

Acc/ Add:
1/
AECD/DSP/TPAD
NRR/DET/ESG-13
Region 4 DRSS/RPB
EG&G Simpson, F.

1/
1/
1/
1/

P-90123
April 25, 1990
Page 2

ACC:MHH/cb

Attachment

cc: Regional Administrator, Region IV
ATTN: Mr. J.B. Baird
Technical Assistant
Division of Reactor Projects

Mr. Robert Farrell
Senior Resident Inspector
Fort St. Vrain

Mr. Robert M. Quillin, Director
Radiation Control Division
Colorado Department of Health
4210 East 11th Avenue
Denver, CO 80220

ATTACHMENT TO P-90123
ENVIRONMENTAL ANALYSIS
RELATED TO THE PERMANENT SHUTDOWN
OF
FORT ST. VRAIN

I. COMMITTED ACTION:

Public Service Company of Colorado (PSC) has permanently shut down the Fort St. Vrain Nuclear Generating Station.

II. PURPOSE:

This analysis has been prepared to evaluate the environmental consequences of the permanent shutdown of Fort St. Vrain. In response to the NRC Staff request, the environmental information provided generally addresses the topics contained in 10 CFR 51.45 as they pertain to PSC's decision to permanently shutdown Fort St. Vrain.

Based on the unacceptable economics and technical problems that forced an earlier than planned shutdown in August 1989, Fort St. Vrain is not capable of producing nuclear generated electrical power at an economically viable rate. Fort St. Vrain has been removed from the rate base, and customers are not willing to pay the cost of Fort St. Vrain nuclear generation. PSC shareholders cannot sustain the ongoing economic losses resulting from plant operation. There are technical problems with plant steam generators and control rod drives which physically prohibit plant operation for at least a five year period.

III. AFFECTED ENVIRONMENTS:

The following areas, not restricted to the immediate area of the plant, will be directly affected by the permanent shutdown of Fort St. Vrain:

- | | |
|---|---|
| (1) Fort St. Vrain site | - Same areas as disturbed during plant construction and operation |
| (2) Replacement power sources | - Same power sources as utilized during plant operation |
| (3) Radioactive Low Level Waste (LLW) Site | - Same sites as have been utilized during plant operation |
| (4) DOE Idaho Graphite Storage Facility (GSF) | - Same facility as utilized during previous refuelings |

A. IMPACT ON THE ENVIRONMENT

The eventual Fort St. Vrain dismantlement and decommissioning were evaluated by the U.S. Atomic Energy Commission in the Final Environmental Statement (FES) related to the operation of Fort St. Vrain Nuclear Generating Station, issued in August 1972. The FES concluded that: (1) the overall impact of dismantling Fort St. Vrain will be beneficial to the environment, and (2) decommissioning is expected to have no significant radiological impact on the environment.

The FES further stated that:

"Dismantling the (Fort St. Vrain) Station will have many of the same impacts on the environment as the original site preparation and Station construction. There will be temporary disturbances due to the dismantling activities and the permanent restoration of most of the site to ecological productivity."

More recently, the NRC has evaluated the generic implications of decommissioning power reactors in NUREG-0586, "Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities", dated August 1988. NUREG-0586 concluded that:

"Decommissioning of nuclear facilities is not an imminent health and safety problem. Decommissioning of a nuclear facility generally has a positive environmental impact. At the end of facility life, termination of a nuclear license is the goal. Termination requires decontamination of the facility so that the level of any residual radioactivity remaining in the facility or on the site is low enough to allow unrestricted use of the facility and site. Commitment of resources, compared to operational aspects, is generally small. The major environmental impact of decommissioning is the commitment of small amounts of land for waste burial in exchange for reuse of the facility and site for other purposes."

The overall environmental impact of the permanent shutdown of Fort St. Vrain should be minimal and will include the following benefits:

- Reduced radioactive gas and liquid waste releases
- Reduced traffic (fewer employees, contractors and materials shipments than required to support an operating plant)
- Less cooling water makeup/blowdown
- No use of highly enriched uranium (HEU)
- Less cooling tower chemical emissions/draft
- Reduced radiation exposure to occupationally and non-occupationally exposed individuals

During the permanent shutdown of Fort St. Vrain and prior to eventual decommissioning activities, the auxiliary boiler will be the primary source of plant emissions. While the plant was in operation, the auxiliary boilers, rated at 160,000 lbm/hr (total), were relied upon during shutdown conditions and startup operations to provide the steam motive power for the main feed pumps and helium circulators. The auxiliary boilers also provided steam heating for plant buildings and the Prestressed Concrete Reactor Vessel (PCRV). During the permanent shutdown period, one auxiliary boiler has been modified and derated to a maximum capacity of 15,000 lbm/hr and will only be used for building heating and PCRV liner heating (while fuel is in the reactor).

Decommissioning of Fort St. Vrain will also result in discontinuing the use of highly enriched uranium (HEU) in the nation's commercial nuclear power program, which has been a long-term objective of the NRC. As a direct result, there will be no further need for related extraordinary security precautions in the commercial nuclear power program.

B. UNAVOIDABLE ENVIRONMENTAL IMPACTS

(1) Replacement Power

Permanent shutdown of Fort St. Vrain will have minimal impact on the amount of replacement power purchased by PSC and will have no new adverse environmental impact. Due to a historical capacity factor of less than 15%, PSC has not relied on the power produced by Fort St. Vrain and has routinely purchased replacement power to offset lack of consistent power generation capacity.

PSC is a member of the Inland Power Pool, which is composed of approximately 22 members, each of which owns and/or operates electric generation and/or transmission systems which are interconnected to one or more other member systems. The objective of the Pool is to provide capacity to meet summer and winter system peak demands, to replace generation from company-owned units unavailable because of maintenance and unplanned outages, to provide the company's operating reserve obligation to the Inland Power Pool, and to obtain energy at a lower cost than that which could be produced by higher-cost company-owned units and for other operating requirements.

PSC is contracted to various Pool members for the purchase of "firm purchased power". The majority of these contracts extend to the mid-1990's with one to the year 2016. Over the last three years, an average of approximately 40% of PSC's total electric system supply has been purchased from either "firm" or "non-firm" (short-term) power sources. Of this amount, approximately 70% of the purchased power is "firm" power and the remaining 30% is "non-firm" short-term purchased power.

The plants which produce PSC's "firm" purchased power are all fueled with western low sulfur coal. These plants are also relatively new (average age less than fifteen years) and contain state-of-the-art pollution control equipment which reduces emissions to levels much lower than required by the EPA New Source Performance Standards (40 CFR 60). These plants are all located in areas which meet the national ambient air quality standards for SO₂ and NO₂. Therefore, while the small amount of power which was generated at Fort St. Vrain will now be generated at coal fired power plants, the environmental effect will be very small and well within the levels permitted by EPA.

Regardless of whether Fort St. Vrain is converted and utilized as a fossil fueled generation source, PSC research indicates that there will be sufficient capacity available for purchase in the Rocky Mountain Region to enable it to defer the addition of new generating capacity until the year 2000. This excess capacity is readily available, as illustrated by the point that a local utility has been forced into bankruptcy due to the inability to sell its excess generating capacity.

(2) Socio-Economic Impact

The largest concentration of Fort St. Vrain employees, approximately 275 employees, reside in the Weld and Larimer County areas. Permanent shutdown of Fort St. Vrain and its eventual decommissioning could result in the gradual reduction of this employee work force, which represents only 0.3% of the work force and spending revenue in the Weld and Larimer County areas. From an economic perspective, PSC's 1990 contribution in property taxes from Fort St. Vrain will not be reduced. Estimated taxes to be paid in 1990 are about \$309,000 for Weld County, compared to about \$234,000 in 1989. Estimated taxes to be paid to the school district in 1990 are about \$598,000, compared to about \$460,000 in 1989. The overall economic effect resulting from loss of spending and tax revenues associated with the permanent shutdown of Fort St. Vrain will be gradual and minimal. The possible conversion of Fort St. Vrain to a fossil-fueled generating facility would have a positive economic effect.

C. BASIS FOR THE COMMITTED ACTION

(1) Cost Benefit Analysis of Continued Operation

Fort St. Vrain's record of operation after initial criticality (see Figure 1) has been inconsistent, with a historical capacity factor of less than 15% caused by technical problems and implementation of regulatory requirements, including:

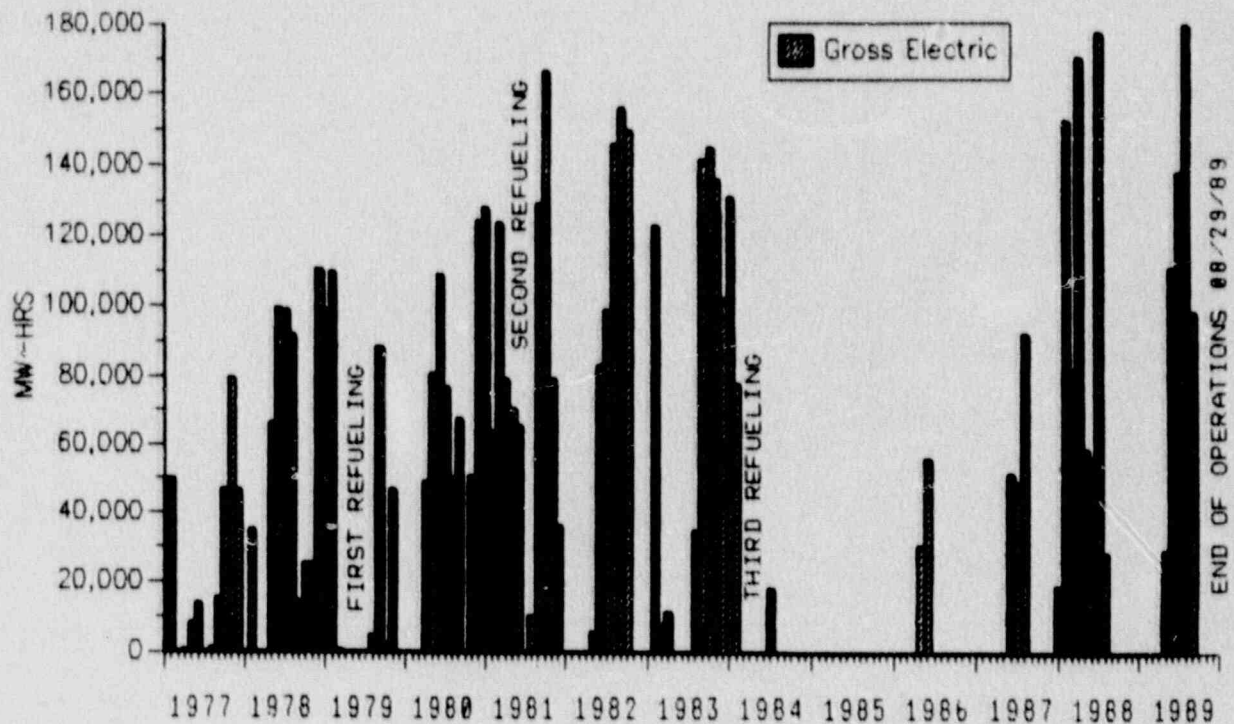


Figure 1
 Fort St. Vrain Generation (1977 - 1989)

- o core thermal and neutron flux oscillations
- o moisture ingress problems
- o multiple control rod drive failures to automatically scram
- o implementation of an environmental qualification program
- o helium circulator material failures
- o major turbine building fire damage
- o inadequate original design analyses (limiting maximum capacity to 82%)
- o recent technical problems related to control rod drive material failures and cracking of steam generator steam outlet piping

In response to Fort St. Vrain's historically reduced levels of generation, the Colorado Public Utilities Commission (CPUC) instituted penalties against PSC to reduce the revenues recovered from its customers. The Office of Consumer Counsel (OCC) filed a complaint with the CPUC against PSC alleging that in light of its operating history, Fort St. Vrain was not "used and useful" in rendering a utility service. In view of the various legal and administrative proceedings regarding Fort St. Vrain, PSC entered into a Stipulation and Settlement Agreement in September 1986 with the CPUC, the OCC and other parties. Significant provisions of the 1986 Settlement Agreement included: (1) removal of Fort St. Vrain from the

rate base; (2) a provision for the sale of future energy produced at Fort St. Vrain to PSC customers at rate of 4.8 cents per Kwh; and (3) recovery over 5 years of \$11.5 million of decommissioning costs. This effectively made Fort St. Vrain an independent power producer, with the associated risks of operation assumed solely by the PSC shareholders.

As a result of its unfavorable plant operating performance, Fort St. Vrain did not produce revenues adequate to offset expenses during 1987 - 1989. Shortfalls of approximately \$24.5 million (1987), \$35.6 million (1988) and \$30.1 million (1989) were recorded in unrecoverable operating and capital expenditures.

The latest annual budget while operating (1989) was \$77.9 million, which included all O&M costs, as well as capital improvement expenses required to meet regulatory requirements and NRC commitments. Assuming a maximum power limit of 82% (based on safe shutdown reanalyses), Fort St. Vrain would have to operate at a capacity factor of 68% to break even based on the 4.8 cents per Kwh allowed by the 1986 Settlement Agreement. In order to purchase new fuel (annual expense - \$26 million) for continued future operations, a capacity factor of greater than 90% is required. To cover eventual defueling and decommissioning expenses (present value - \$180 million), the required capacity factor exceeds 100%. Reanalyses of the safe shutdown limits to allow full power operation (330 Mwe) would still require a capacity factor in excess of 85% in order to break even. Without third-party support, Fort St. Vrain is unable to generate enough electricity to support annual expenses. The benefits of plant operation do not justify this use of resources.

(2) New Fuel Production

Fort St. Vrain is a one-of-a-kind HTGR, utilizing highly enriched (93.15%) uranium fuel with thorium fertile material, encapsulated in "triso" coated fuel particles and loaded in graphite blocks. The reactor core consists of a total of 1482 of these fuel elements, and approximately one-sixth of the core was replaced during each refueling. Due to the uniqueness of the fuel elements and fuel fabrication process, fuel fabrication is highly labor intensive and fuel costs are very high. Fuel costs for Fort St. Vrain are approximately 25 mils/Kwh, as opposed to less than 10 mils/Kwh for a conventional LWR.

As a result of PSC's decision to decommission Fort St. Vrain, General Atomics has proceeded with the decontamination and decommissioning of their fuel fabrication facility, which was the only facility capable of producing Fort St. Vrain's fuel. In order to restart Fort St. Vrain, a new fuel fabrication facility would need to be designed, licensed and constructed. Construction of a new fuel fabrication facility would, in all probability, increase the annual expenditure required for new fuel beyond the previously estimated annual cost of \$26 million.

(3) Repair of Existing Problems

To repair the physical problems that resulted in the August 1989 shutdown, new steam generator main steam ring headers would have to be designed, qualified, fabricated, installed and tested. Many of the control rod drive clevis pins would also have to be replaced. In addition to these repairs, a new training simulator would have to be installed and a fuel supplier would have to be developed. PSC's preliminary estimates are that these long lead time projects would require at least five years to complete at a direct cost of up to \$50 million. Additionally, radiation exposures of plant personnel will increase due to repair of the control rod drives, steam generators, and other causes for low-capacity factors.

Successful repair of the known problems with the steam generators and control rod drives will not be adequate to address greater generic issues associated with these repairs. For the steam generators, analyses, inspections and repairs will in all likelihood extend beyond the known problems in the steam ring headers. Even if the known steam generator problems are evaluated and repaired, both PSC and the NRC would need to be convinced that the steam generators do not have similar problems in inaccessible areas and that the plant is safe to operate. Similarly, failure of the clevis pins are only the latest in a history of problems with the control rod drive mechanisms. Return to critical operation would require significant analyses and possible modifications to correct known problems and prevent potential common mode failure mechanisms. Resolution of these generic problems could conceivably take 10 to 15 years, if corrections are even feasible.

(4) Maintenance of Existing Plant Systems and Experienced Personnel

In addition to the cost of the repairs of known problems, Fort St. Vrain would continue to incur annual costs of approximately \$40 million associated with maintenance of plant systems and staff necessary to support future operations. These costs are necessary to maintain the plant systems, as well as retain sufficient trained, licensed and experienced personnel to safely and properly operate the plant, should it restart. Other intangible costs are also present which cannot be quantified, such as the need to obtain NRC permission to restart the plant which could cause indeterminate delays in the actual restart.

D. RELATIONSHIP OF LOCAL SHORT-TERM USES TO LONG-TERM PRODUCTIVITY

The site consists of 2798 acres owned by PSC. Approximately 600 acres within the site area is designated as the industrial complex, containing the reactor and power producing facility. Farming has been continued on the remaining site areas, including a portion of the industrial area.

One potential option originally considered but rejected was to repair and operate as a nuclear facility. Based on the projected repair and monthly support costs, restart as a nuclear entity was determined NOT to be a viable option. In addition to the minimum of five years that would be required to repair Fort St. Vrain's known problems and restore the plant to a safe operating condition, PSC is convinced that any future operation of the plant would result in substantial financial loss. Based on Fort St. Vrain's history of operational problems and lifetime capacity factor of less than 15%, PSC has little confidence that these repairs and improvements would result in significantly improved performance and an economically viable power plant.

(1) Short-Term Uses

As noted previously, repairs to return the plant to an operational status would take a minimum of five years to complete. Therefore, no alternative exists for use of the plant during this period. Only the plant switchyard has a beneficial use during the short-term period following the permanent shutdown, by performing transmission switching functions for northeastern Colorado. Short-term uses of the site area, including the agricultural area and the industrial facility, will not be altered by the permanent shutdown of Fort St. Vrain.

(2) Long-Term Productivity

Since restart of the existing nuclear facility is not a viable option, there is no apparent benefit to either PSC or the NRC to retain the 10 CFR 50 operating license. As noted previously, PSC would continue to incur annual costs of approximately \$40 million associated with maintenance of plant systems and staff necessary for a licensed facility and the NRC would be forced to expend additional resources to monitor the shutdown plant under the existing license and standards. Therefore, it is in the best interests of both parties to obtain the "zero power" license to allow a systematic reduction of program commitments.

PSC currently plans to retain the site indefinitely as an agricultural and industrial complex, with few or minor changes to the area distribution. The remaining option which exists for the maintenance and enhancement of Fort St. Vrain's long-term productivity as an industrial complex is a decision to convert Fort St. Vrain to a fossil-fueled facility. PSC is now evaluating bids which would convert Fort St. Vrain to fossil-fueled generating facility. Preliminary PSC projections indicate that this converted plant could be placed in service in approximately 1995.

E. IRREVERSIBLE/IRRETRIEVABLE COMMITMENTS OF RESOURCES

The following statements summarize the key considerations associated with the commitment of resources associated with the permanent shutdown of Fort St. Vrain.

- (1) Resources affected by the permanent shutdown of Fort St. Vrain (see previous Section III) are already committed.
- (2) The committed action involves no new commitment of resources.
- (3) The committed action would conserve resources for better uses - the overall impact on resources is not significant but is in the direction of resource conservation.

IV. CONCLUSIONS

PSC believes that Fort St. Vrain has contributed much useful information towards HTGR technology development. However, multiple technical and economic considerations led PSC's Board of Directors to decide to permanently shut down the plant. PSC concluded that it was not cost effective for PSC to continue operation alone in light of high operating costs and historically low plant availability. Over a two year period from 1986 to 1988, PSC made significant attempts to obtain support for continued Fort St. Vrain operations from interested third parties, including governmental agencies and domestic and foreign business concerns. These attempts were not successful.

Based on the unacceptable economics associated with Fort St. Vrain operation, and on other specific technical problems that forced an earlier than planned shutdown in August 1989, Fort St. Vrain is not capable of producing nuclear generated electrical power at an economically viable rate. The environmental impacts associated with the permanent shutdown of Fort St. Vrain are minimal and are generally beneficial.