ORIGINAL

BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION

In re: Petition to Recover Costs of Crystal River Unit 3 Uprate through the Fuel Clause

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AMENDED DIRECT TESTIMONY OF DANIEL L. RODERICK

ON BEHALF OF PROGRESS ENERGY FLORIDA

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IN RE: PETITION TO RECOVER THE COSTS OF THE CRYSTAL RIVER UNIT 3 UPRATE THROUGH THE FUEL CLAUSE

BY PROGRESS ENERGY FLORIDA

FPSC DOCKET NO. 070052

AMENDED DIRECT TESTIMONY OF DANIEL L. RODERICK

I. INTRODUCTION AND QUALIFICATIONS

Q. Please state your name and business address.

A. My name is Daniel L. Roderick. My business address is Crystal River Energy Complex, Site Administration 2C, 15760 West Power Line Street, Crystal River, Florida 34428.

Q. By whom are you employed and in what capacity?

A. I am employed by Progress Energy Florida ("PEF" or the "Company") in the Nuclear Generation Group and serve as the Vice President Nuclear Projects and Construction at Crystal River Unit 3 ("CR3"), PEF's nuclear plant. Formerly, I was Director of Site Operations at CR3.

Q. What are your responsibilities as the Vice President Nuclear Projects and Construction?

A. I am an officer of PEF and I am responsible for all aspects of major projects and construction of nuclear generating assets in Florida.

Formerly, as director of Site Operations, I was responsible for the safe, efficient, and reliable generation of electricity from CR3 and all plant functions reported to me and were under my supervision.

Q. Please summarize your educational background and work experience.

A. I have a Bachelor of Science and Master of Science degree in Industrial Engineering from the University of Arkansas and a Senior Reactor Operator License. I have been at CR3 since 1996, serving in my current position as Vice President Nuclear Projects and Construction and, prior to that position, Director of Site Operations, Plant General Manager, Engineering Manager, and Outage Manager, respectively. Prior to my employment with the Company, I was employed for twelve years with Entergy Corporation at its Arkansas Nuclear One plant in Russellville, Arkansas with responsibilities in Plant Operations and Engineering.

II. PURPOSE AND SUMMARY OF AMENDED TESTIMONY

Q. Did you previously file direct testimony in this proceeding?

A. Yes, I did.

Q. What is the purpose of your previously filed direct testimony?

A. The purpose of my direct testimony is to support the Company's request for cost recovery through the fuel clause for the replacement and

modification of equipment at CR3 to support an increase in reactor power from the nuclear plant.

Specifically, I generally describe the Crystal River site and CR 3. I explain the current planned changes to the nuclear plant that are necessary to support the power uprate project. I also generally describe the expected impact of the power uprate on the transmission system and thermal limits on the discharged cooling water that must be addressed to obtain the full benefits of the power uprate project at CR3. I also present the Company's current cost estimates for the project, explain the procedures in place to ensure the costs incurred for the project are reasonable and prudent, and explain the economic need for the project because the project will provide additional, reliable base load capacity to customers while generating substantial fuel savings. I also explained the adverse consequences to the Company and its customers if the CR3 uprate project is delayed.

Q. What is the purpose of your amended direct testimony?

A. I am amending my direct testimony to explain the division of the CR3 uprate project into three phases, with the expected completion of the first phase of the project during the 2007 nuclear refueling outage, followed by additional uprate project phases during the 2009 and 2011 refueling outages, respectively. In my previously filed direct testimony, based on the best information available at the time, the CR3 uprate project was

divided into two phases covering the 2009 and 2011 refueling outages. Now, based on additional information and the necessary review and approval of the uprate project by the Nuclear Regulatory Commission ("NRC") as explained below, the uprate project needs to be in three phases with the first phase beginning during the 2007 nuclear refueling outage. This means PEF's customers will receive additional nuclear power from the CR3 uprate, and the corresponding fuel savings, earlier than previously planned.

When I first filed my direct testimony it was in support of PEF's Petition for a Determination of Need for Expansion of an Electrical Power Plant, for Exemption from Rule 25-22.082, F.A.C., and for Cost Recovery through the Fuel Clause. The Commission has now granted PEF's Petition for a determination of need and for exemption from Rule 25-22.082, F.A.C. for the CR3 Power Uprate. Accordingly, in my amendment to my direct testimony to explain the changes to the CR3 uprate project, I have omitted my testimony in support of the requests in PEF's Petition that the Commission has already granted. I include only my previously filed direct testimony, as amended, that has a bearing on PEF's remaining request in its Petition for recovery of the costs of the CR3 Power Uprate through the Fuel Clause.

Q. Why is the Company considering the CR3 power uprate project?

A. The primary reason for this project is to reduce total fuel costs to customers over the extended life of CR3 by increasing low cost nuclear fuel generation and reducing or replacing generation from higher cost fuel power plants or purchased power obligations. The Company has performed studies to find innovative ways to reduce the total fuel cost to the customer by expanding existing nuclear generation and implementing new technological innovations. To illustrate, in preparing for the steam generator replacement and related work during the Company's upcoming 2009 nuclear refueling outages necessary to extend the remaining life of the nuclear unit, the Company determined that additional power can be generated through increased efficiencies from technological advancements and additional modifications to accommodate nuclear fuel enrichment at the unit. The result of a power uprate at the nuclear unit from these additional technological efficiencies and fuel enrichment modifications will be increased generation capacity from the Company's lowest cost fuel source. This will allow PEF to replace or reduce higher cost generation from alternative fuel sources, resulting in significant fuel savings for customers.

Q. Do you have any exhibits to your testimony?

A. Yes, I have supervised the preparation of or prepared the following exhibits to my direct testimony.

- Exhibit No. ___ (DLR-1), an aerial view of the Crystal River complex, including CR3.
- Exhibit No. ___ (DLR-2), a picture of the primary plant configuration for the pressurized water reactor nuclear plant at CR3 that shows the major components of the nuclear reactor and primary coolant system.
- Exhibit No. ___ (DLR-3), a schematic of the major components in the primary system and the balance of the nuclear plant that shows the major components in the secondary systems, including the main turbine and main generator.

All of these exhibits are true and accurate.

Q. Please give an overview of the Company's presentation in this proceeding.

A. In addition to my own testimony, the Company will present the amended testimony of the following witnesses:

- Mr. Samuel Waters, who will provide testimony regarding the significant fuel savings that will be realized from the CR 3 power uprate project. Mr. Waters will further generally describe the Company's existing facilities and other supply resources and the Company's Demand-Side Management resources (DSM).
- Mr. Javier Portuondo, who will generally discuss the costs of the CR3 power uprate project and the anticipated fuel savings including the net present value of the benefit to customers. Mr. Portuondo will further

explain that the CR3 power uprate project costs were not anticipated in the Company's last base rate proceeding and are not recognized in the Company's base rates. Finally, Mr. Portuondo will explain that the significant fuel savings the Company's customers will realize from the project justify recovery of the power uprate project costs by the Company through the Fuel and Purchase Power Cost Recovery Clause ("Fuel Clause").

Q. Please summarize your amended testimony.

A. The CR3 power uprate project is an innovative application of technological advancements and efficiencies during existing planned outages at CR3 to obtain increased nuclear fuel generation capacity. The result of this increased production with low cost nuclear fuel will be the reduction in or replacement of higher cost fossil fuel and purchased power generation resources, yielding substantial fuel savings at a net savings to the cost of the project for customers. The power uprate will increase the level of nuclear production in the fuel supply mix on PEF's system, increasing fuel diversity for PEF and the State of Florida. The CR3 power uprate project represents a unique opportunity to increase fuel diversity and reduce the reliance on fossil fuel generation at no net cost to customers, but rather at a net savings to customers.

III. THE CRYSTAL RIVER SITE AND CR3 UNIT

Q. Please describe the Crystal River site.

A. The Crystal River site is a 4,700 acre site located in Citrus County, Florida that contains four coal-fired generating units, one nuclear generating unit, and related support facilities, such as fuel transportation and storage facilities. The site generators are connected to a transmission substation. The Crystal River substation contains both 230 kv and 500 kv transmission lines that supply power generated at the site to the Company's transmission system. The four coal-fired and one nuclear power units at the site generate approximately 3,200 MWe. Exhibit No. ___ (DLR-1) is an aerial photograph that accurately depicts the Crystal River site, including CR3.

Q. Please describe the nuclear generating unit at the Crystal River site.

A. CR3, the nuclear generating unit, is a B&W pressurized water reactor that includes a Primary and Secondary System. The Primary System is located within the containment building and includes the reactor vessel, pressurizer, steam generators, primary coolant system, and related equipment. Exhibit No. ___ (DLR-2) is a picture of the major components of the Primary System, including the nuclear reactor and the primary reactor coolant system.

The Primary System is a closed loop system. The nuclear reactor produces heat that eventually is turned into steam then into electricity. The heat is removed from the reactor by water in the primary coolant system that is continuously pumped around the Primary System. Heat transfers from the fuel cells to the surrounding metal fuel cladding which in turn heats the water flowing between and around the fuel rods. The heated water then travels from the core through pipes to the steam generators. In the steam generators, heat is transferred from the reactor primary coolant system to the physically separated secondary coolant system producing steam in the secondary system. The Primary System operates at about 600 degrees F and 2150 PSI. The high pressure prevents the water in the primary system from turning to steam.

The secondary water coolant system is under less pressure, operating at over 450 degrees F and 850 PSI, and when the water in the secondary coolant system is heated it turns to steam, which turns the turbine that powers the generator. The steam exiting the turbine is then condensed to water. The water is pumped back to the steam generators by a series of pumps and heat exchangers where it is once again converted to steam, thereby completing the cycle. Exhibit No. ___ (DLR-3) is a schematic of the major components of the Primary and Secondary Systems, including the main turbine and main generator. It also shows the electricity produced in the generator passes through some transformers before being passed on to the switchyard at Crystal River, and then onto

the transmission grid. The Company's transmission system is part of the peninsular Florida interconnected electrical grid of all transmission-owning electric utilities in the State and also part of the interface with the transmission facilities of utilities in the Southeastern United States at the Florida border.

CR3 was the third generating unit constructed at the site and it currently produces about 900 MWe. CR3 provides power into the 500 kv transmission system connected to the Crystal River site and uses the 230 kv system at the site for on-site backup power. CR3 supplies its own power needs during normal operation.

IV. THE CR3 POWER UPRATE PROJECT

Q. What is the CR3 power uprate project?

A. The power uprate project for CR3 increases the electrical power output from the plant from about 900 MWe by approximately 180 MWe to 1,080 MWe. The total cost for the uprate project is estimated at $381.8 million. Of this amount, approximately $250 million is for the power uprate itself. The additional costs address anticipated modifications to the transmission system to handle the additional power, estimated at $89 million, and anticipated modifications to address Point of Discharge ("POD") issues caused by the additional heat generated by the power increase, which are preliminarily estimated at $43 million.

The power uprate project involves increasing the power or thermal MWs produced in the reactor core by making modifications to the design to allow for use of more highly enriched fuel. The costs associated with this are for making the physical changes needed to allow for use of this more highly enriched uranium in a safe and economical fashion, not the fuel itself. In addition, some modifications to supporting equipment are necessary to support the additional heat from the power increase to accommodate all designed accident conditions in the plant. The additional heat will raise the temperature exchange between the Primary and Secondary Systems and create more steam to turn the turbines.

In the design of these plants in the 1960's, the analytical modeling that exists today was not available, and the result was that the best designs of the time over-compensated for the available computer modeling with built-in assumptions having very large safety margins to ensure adequate protection was in place to accomplish all intended functions. Many of these initial safety margins, given today's analytical engineering tools and advanced testing capabilities, allow for an increase in reactor power with limited physical primary plant changes. Most of these primary system changes may involve increasing Emergency Cooling Pump flow rates and the setpoints for actuation of safety systems.

The major modifications resulting from the power uprate involve the secondary system specifically, the turbine generator set, which has three parts, two low pressure and one high pressure rotors, and the

generator, plus their supporting systems and equipment. The secondary system must be modified to accept the additional heat produced by the reactor core. This is accomplished by increasing the secondary system water flow to the steam generators. Increasing the flow requires larger pumping capacity than currently exists, which requires modification or replacement of some existing pumps and heat exchangers. A detailed pinch point study for these flows will define which pumps and motors will need to be upgraded or replaced based on the lowest cost required to achieve the necessary secondary system water flow.

In addition to the reactor power increase, design improvements to some major system components will allow for increased efficiencies, providing additional steam power beyond that obtained from the more enriched fuel. These design improvements to obtain the steam efficiencies are factored into the CR3 power uprate costs. For example, when the steam turbine high pressure rotor was designed in 1962, a multi-piece assembly was made. These multi-piece assemblies cause drag on the system, but better technology did not exist at the time. Since then, in the late 1990's, technological advancements have resulted in a single piece rotor blade that has less drag and, therefore, provides increased megawatt output for the same steam input.

The CR3 power uprate project, including all modifications and technological advancements, will generate an additional 180 MWe by the end of 2011. The power uprate project will make CR3 the largest single

generating unit in Florida at 1,080 MWe. On April 25, 2007, we requested a licensed power change for CR3 from the NRC for the Phase 1 uprate project that addresses the Measurement Uncertainty Recapture ("MUR") and we have met with the NRC to develop a plan to gain approval in November 2007.

Q. Has a power uprate of this kind ever been performed on a B&W pressurized water reactor?

A. While the innovative power uprate planned for CR3 has not been undertaken at any other B&W designed plant, similar power uprates have been accomplished and approved by the NRC at other nuclear plants designed by Westinghouse and General Electric. Initial discussions with the NRC indicate that a similar process to the one used for licensing power uprates at Westinghouse and General Electric designed plants would be used to license CR3 to the additional power level.

Q. What is the likelihood that the NRC will approve the license extension for CR3?

A. The power uprate project assumes that the ongoing activities to renew the license of CR3 will be successful and that the license now due to expire in 2016 will be extended to 2036. License renewal of nuclear power plants is an ongoing nuclear industry process that requires technical information submitted by the applicant and approval by the NRC for the operating

license to be extended for 20 years. License renewals have been granted for Progress Energy's Robinson and Brunswick Units 1 and 2 plants. In addition, four of the seven plants of a similar design to CR3 have already received approval for license renewal. No license extensions for plants have been rejected after a detailed NRC review and no utility has been told that it would not be able to renew its license. As a result, there is a high likelihood that the license renewal for CR3 will be granted by the NRC and therefore the 2036 date used in the economic model for the power uprate can be achieved.

Q. Are there any environmental benefits from the CR3 power uprate project?

A. Yes, there are. The CR3 power uprate will use nuclear fuel, which is the cleanest fuel source on PEF's system. During normal operations, there are no greenhouse gas emissions and no emissions of other pollutants common to other fuel sources for power production such as carbon monoxide, sulphur dioxide, aerosols, mercury, nitrogen oxides, and particulates or photochemical smog. Further, because the CR3 power uprate will displace higher cost fossil fuels with nuclear fuel there likely will also be a reduction in the greenhouse gas and other emissions from fossil fuel resources. From an environmental viewpoint, the CR3 power uprate project is an attractive means of obtaining cost-effective generating capacity.

Q. What is the schedule for the CR3 uprate project?

A. The CR3 power uprate project is planned for the scheduled refueling outages for CR3 in 2007, 2009 and 2011. Phase I, the MUR, is being installed during the 2007 refueling outage. The MUR is a series of engineering analyses to measure the "secondary heat balance" with improved accuracy through modifications to plant instrumentation and associated calculations. The improved accuracy in measuring the secondary heat balance, however, allows the rated thermal power to be increased by 12 MWe. The cost estimate for the MUR is about $6 million. NRC approval of the MUR is required but the process for obtaining such approval is well-documented because the MUR has been successfully completed at a number of nuclear plants throughout the nation.

The MUR was originally part of the work contemplated for the 2009 refueling outage. As a result of further, detailed evaluations of the CR3 uprate project and meetings with the NRC and industry operating experiences, PEF and the NRC agreed that PEF should separate the MUR away from the major turbine and steam generator work that was taking place in 2009. For planning purposes the PEF project team then made Phase 1 the MUR to be installed in the fall of 2007, followed in 2009 by the remaining steam efficiencies described below as Phase 2, and then the actual extended power uprate in Phase 3 in 2011.

Phase 2 of this project is a series of improvements to the efficiency of the secondary plant also known as the Balance of Plant ("BOP"). The Company currently anticipates, for example, that all or at least part of the turbine and electrical generator replacement can be completed during the BOP phase. The BOP phase is scheduled concurrently with the steam generator replacement during the 2009 refueling outage. Other modifications and replacements will be evaluated for inclusion in the 2009 refueling outage if the outage is not extended, appropriate resources are available to support the changes, and the impact of further modifications or replacements for the power uprate project on the duration of the scheduled 2011 refueling outage can be minimized.

The changes during the BOP phase do not increase the licensed output of the nuclear reactor but they will improve the efficient use of that output to produce a higher electrical output. The estimated increase in output is 28 MWe from the BOP phase.

The full power uprate is scheduled for the 2011 refueling outage, when the remaining work necessary to provide the full 180 MWe power uprate, called the Extended Power Uprate ("EPU") phase, will be completed. The BOP phase improvements will be sized to support the EPU. The EPU maximizes the output of the reactor and the BOP to their ultimate capacity.

The modifications and equipment changes necessary to support the CR3 uprate will be scheduled to minimize any plant outage time while assuring that appropriate resources are available to support the changes. To meet the schedule and ensure that the CR3 uprate project is performed during the scheduled outages, PEF has already ordered equipment and material.

Q. Will the CR3 uprate project require changes to other units or the Crystal River site?

A. No. All changes necessary to generate the full power uprate are internal to the CR3 power block and switchyard. No changes to the Company's current plant siting are required. However, modifications to the transmission system and to address POD issues to accommodate the full 180 MWe power uprate may be necessary.

Q. Why may changes to the current transmission system be necessary as part of the CR3 power uprate project?

A. After the power uprate project is complete, CR3 will become the largest power generator on the Company's system. Changes may be necessary to the transmission system to accommodate the 1,080 MWe CR3 will generate following the uprate project. The Company is studying and will continue to study the impacts of this additional power to the transmission system and what modifications, if any, are necessary. The final study will

not be completed until closer to the time that the power uprate project commences because the transmission system changes periodically with transmission additions or modifications that are occasioned by other generators and users on the interconnected transmission grid, particularly within peninsular Florida, but also extending to the interface with the southeastern United States utility transmission systems. Current cost estimates of $89 million are preliminary, based on the existing transmission system and known transmission projects that are underway. The Company believes these cost estimates are reasonable and sufficient for the Company to proceed with the project. Refinements to the cost estimates, however, will be made over time to account for any changes to the transmission system or changes in labor, commodity, and land market conditions.

Q. What changes are anticipated to address the POD issues?

A. The power uprate from the project will generate additional heat and steam thereby increasing the water temperature of the cooling water for the CR3 unit. This additional heat will likely cause the Company to exceed the thermal permit requirements for the cooling water discharge. An optimal solution has not yet been identified but we have preliminarily assumed an estimated cost of $43 million to address the POD issues at the discharge canal associated with the uprate project. The Company will evaluate all reasonable options before making a final determination of how to address

the POD issue. Whatever modifications are necessary to address the thermal cooling water discharge limit, however, will accommodate the full power generated by CR3.

Q. Is the POD impact the only environmental issue associated with the CR3 power uprate?

A. Yes, we believe it is. CR3 is located at the Crystal River Energy Complex and is currently being operated under license from the NRC and necessary federal and state permits. The environmental issues associated with the Crystal River site have therefore been addressed and resolved under the prior license and permits. Because the CR3 power uprate project is limited to the CR3 power block and switchyard the project's impact on the site is minimal and most if not all of the current permit requirements for the operation of CR3 will not be affected by the power uprate project. The potential impact to the environment that we see from the project is the effect of the additional heat from the power uprate on the temperature of the discharge water.

Q. Are the costs of the power uprate project reasonable and prudent?

A. Yes. The Company will conduct competitive bids for the purchase of major components for the power uprate project. This process involves a detailed review of designs and pricing to make sure the best quality for the price is obtained. In addition, benchmark comparison to power uprates

performed at other plants in Progress Energy's system will be made to factor in the latest experience gained from those uprates. By incorporating a competitive bidding process and relying on efficiencies achieved from experience, the Company will ensure that the power uprate costs are reasonable and prudent.

V. CONCLUSION

Q. Please summarize the benefits of the CR3 power uprate project.

A. By undertaking and completing the CR3 power uprate project PEF will generate substantial fuel savings for its customers that will be a significant benefit to them and the Company. The Company will also increase fuel diversity to its benefit and the benefit of the state, all by providing additional, reliable base load generation from an environmentally friendly source. No additional base load generation source can provide additional, reliable electrical power at a net fuel savings to customers comparable to that provided by the CR3 power uprate project. We urge the Commission to approve the cost recovery of the project through the Fuel Clause.

Q. Does this conclude your testimony?

A. Yes, it does.

Exhibit 1
General Site Layout

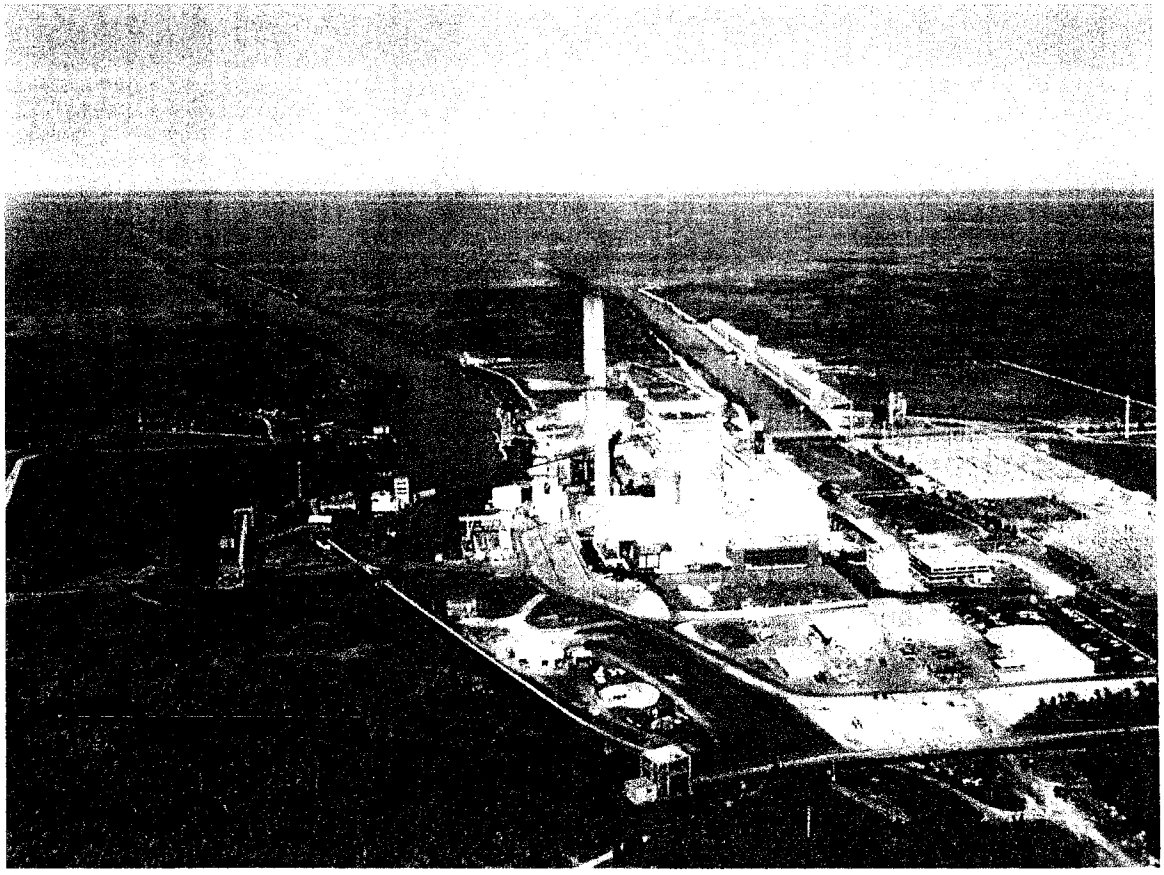

Exhibit 2

Primary Plant Configuration

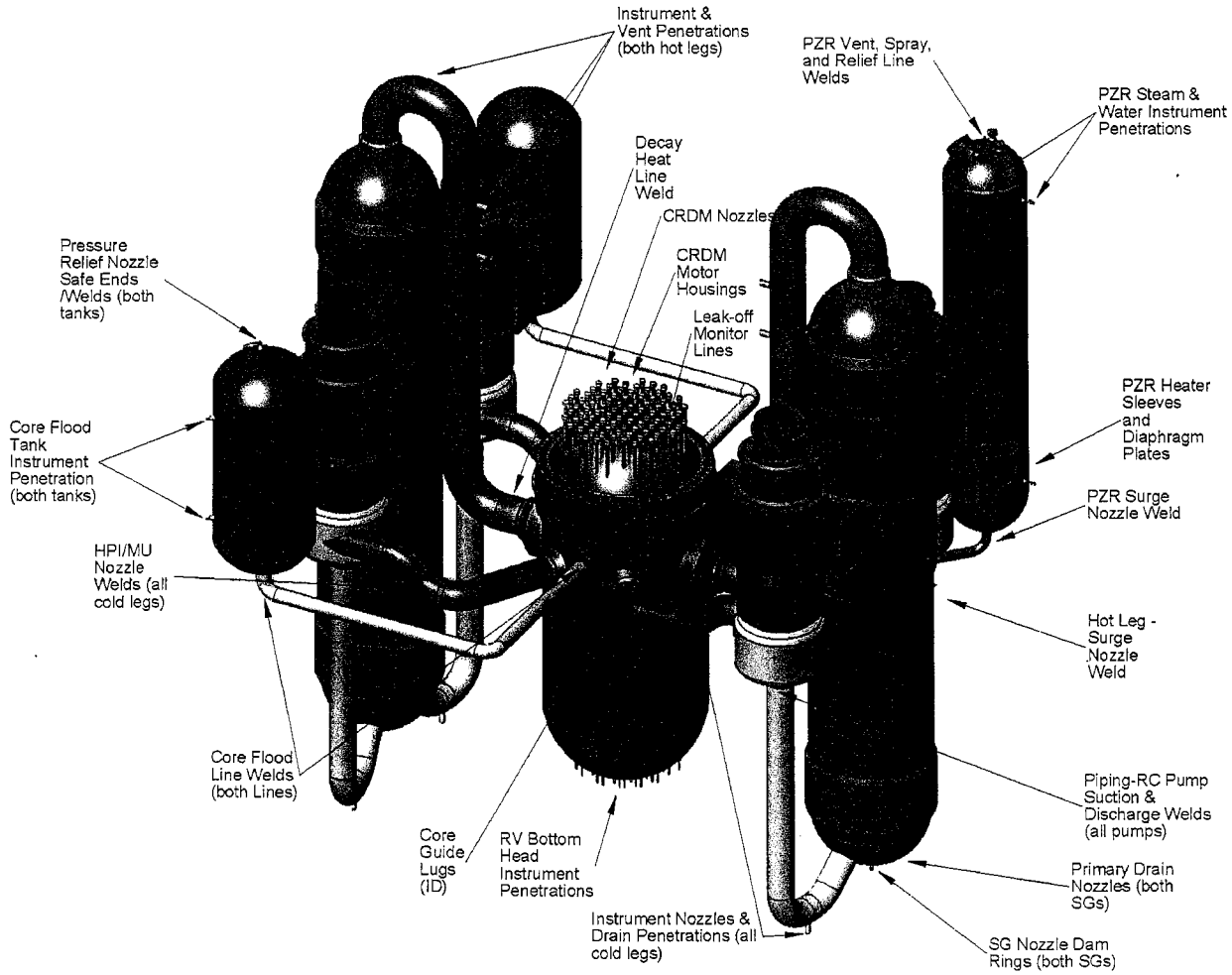

Exhibit 3
Secondary Plant Interface