U.S. NUCLEAR REGULATORY COMMISSION
ATOMIC SAFETY & LICENSING BOARD

IN THE MATTER OF	**§**	**DOCKET NOS.**
STP NUCLEAR OPERATING COMPANY	**§**	**52-012 & 52-013**
(SOUTH TEXAS PROJECT UNITS 3 &4)	**§**	**(COL)**

REBUTTAL TESTIMONY

OF

CLARENCE L. JOHNSON

ON BEHALF OF THE

INTERVENORS

May 31, 2011

DIRECT TESTIMONY OF CLARENCE JOHNSON
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I. INTRODUCTION

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Clarence Johnson. My address is 3707 Robinson Ave., Austin, Texas 78722.

Q. ON WHOSE BEHALF ARE YOU PRESENTING REBUTTAL TESTIMONY IN THIS PROCEEDING?

A. I am presenting testimony on behalf of the intervenors.

Q. ARE YOU THE SAME CLARENCE JOHNSON WHO PREVIOUSLY FILED DIRECT TESTIMONY IN THIS PROCEEDING?

A. Yes.

Q. WHAT IS THE PURPOSE OF YOUR REBUTTAL TESTIMONY IN THIS PROCEEDING?

A. My testimony rebuts the direct testimony regarding contention CL-002 filed by the NRC Staff and Applicant. To the extent my testimony does not address particular statements or concepts presented in Staff and Applicant testimony, such omission should not be construed as agreement with those statements or concepts.

Q. HAVE YOU REVIEWED ANY ANALYSES PRESENTED BY APPLICANTS AND STAFF?

A. Yes. I reviewed the testimony of Applicant witnesses Zimmerly and Pieniazek and Staff witnesses Emch, Rishel, and Anderson.

II. REBUTTAL OF STAFF TESTIMONY

Q. PLEASE DISCUSS THE STAFF'S CHANGES TO THE SCREENING ANALYSIS FOR SAMDAs ("SEVERE ACCIDENT MITIGATION DESIGN ALTERNATIVES")?

A. The Staff corrected and revised assumptions in the Applicant's estimation of replacement power costs. This has the impact of increasing averted costs associated with SAMDAs. The Staff also increased the escalation rate for converting SAMDA implementation costs from 1991 dollars to 2009 dollars. In terms of the effect on the relative costs and benefits of SAMDA, the two changes tend to offset each other.

Q. WHAT IS THE IMPACT ON THE SCREENING ANALYSIS IF STAFF'S REVISIONS TO AVERTED COSTS ARE APPLIED, BUT THE APPLICANT'S ESCALATION RATES FOR SAMDA IMPLEMENTATION ARE NOT CHANGED?

A. If the Applicant's screening analysis is modified to reflect the Staff's averted costs, the averted costs exceed the minimum SAMDA implementation cost under either the 7% or 3% discount rate. The lowest cost SAMDA in the Applicant's screening analysis is $158,000.[1] The Staff's maximum averted cost at a 7% discount rate is $176,213.[2] The Staff did not provide the averted cost at a 3% discount rate, but a reasonable estimate is $216,711.[3] Thus, inserting the Staff's averted costs into the Applicant's screening analysis results in averted costs exceeding the minimum SAMDA implementation.

[1] STPNOC Motion for Summary Disposition of Contention CL-02, Joint Affidavit at 30; Zimmerly-Pieniazak testimony ("Applicant Testimony") at 23.
[2] NRC Staff Exhibit 0000004 at Table 13.
[3] This is based on applying a 1.23 factor to the 7% discount rate value; the 1.23 factor is based on the ratio of the maximum averted costs at 7% and 3% discount rates shown on Table 11 of Applicant Testimony.

Q. DO YOU AGREE WITH STAFF'S PROPOSED ESCALATION FACTOR FOR SAMDA IMPLEMENTATION COSTS?

A. No. The Staff proposes to use the non-residential structures component of the GDP implicit price deflator. My testimony proposed to use either the PCE, which is comparable to the Applicant's use of the CPI, or the overall GDP implicit price deflator, with a preference for the core versions of each index. The Staff's rationale is that the non-residential structures component of the GDP deflator is "more specific to private capital investment than other inflation indexes…"[4] The results for this component are an extreme outlier from other general inflation measures, whether the PPI, PCE, CPI, or GDP implicit price deflator. Furthermore, the SAMDA projects appear to be more narrow in composition than overall nuclear plant construction costs. Perhaps the non-residential structure component index would be appropriate for inflatingthe overall total costs of a plant or building. But the Staff has not demonstrated that the individual SAMDA projects are composed of costs appropriately compared to the structures index. The non-residential structure component is composed of specific ratios of labor, construction commodities, equipment, electrical devices, furnishings, etc. If the SAMDA projects are not comprised of similar ratios for those sub-components, the structure index could result in extremely inaccurate inflation results---because the sub-components have a wide range of different price inflation results. The structure component index is not the only index comprising GDP private non-residential fixed investment. Equipment and Software is the other component of GDP private non-residential fixed investment. Unlike

[4] Staff Testimony at 37.

the structure index, the equipment and software index is *negative*for the period 1991 – 2009. "Equipment" likely would be a significant component of the SAMDA projects, but the Staff has not shown whether the equipment ratio for the SAMDAs is more aligned with the composition of all non-residential structures or the equipment and software component.[5]Yet the difference in the two indices spans a range from a negative value to a high positive value.

Q. CAN YOU EXPLAIN WHY A MORE GENERAL GDP COMPONENT INDEX WOULD BE APPROPRIATE?

A. Yes. I can understand the Staff's view that household consumer inflation should be excluded from the escalation index. However, more general GDP indices are available that do not include personal consumer expenditures. The 1991 – 2009 inflators based on various categories of capital components that exclude household expendituresare shown below.

COMPONENT INDEX 2009/1991

Gross Domestic Private Investment 1.19
Non-Residential Fixed Investment 1.033
Non-Residential Structures 2.25
Equipment & Software 0.78

The Staff has chosen the most extreme escalator from the investment indices. Without a more detailed review of the composition of SAMDA costs, a higher level index, such as Gross Domestic Private Investment, would be a more reasonable choice. That index would result in an escalation of SAMDA implementation costs significantly less than my recommendation (1.31).

[5] The Bureau of Economic Analysis NIPA Handbook referenced by Staff defines the Equipment and Software component as "purchases by private businesses and non-profit institutions of new equipment (such as furniture,

In addition, price indices reflect only changes in prices, and therefore do not account directly for productivity growth. The U.S. Bureau of Labor and Standards calculates total factor productivity (TFP) growth, which tends to offset pure price inflation. The TFP growth for the period in question is approximately 1.4% per annum. By including "equipment and software," which is one of the principal sources of productivity increases in the business sector, the gross domestic private investment index indirectly recognizes productivity growth.

Q. THE USE OF PRICE INDICES TO ESTIMATE SAMDA COSTS HAS PRODUCED A WIDE RANGE OF SAMDA IMPLEMENTATION COSTS. IS THIS AN IDEAL METHOD OF ESTIMATING SAMDA IMPLEMENTATION COSTS?

A. Not at all. But it is the consequence of the environmental report's use of SAMDA cost estimates produced in 1991. If one assumes that the proposed STP units 3 & 4 cannot be put into service until 2020 at the earliest (a reasonable assumption, given the current status of the plant), the original cost estimates for the SAMDAs will be almost 30 years old. Clearly, a preferable—and more accurate---course of action would have been to prepare new current cost estimates with the Applicant's filing. Instead, applying 18 year escalation rates to 1991 budgeted estimates will produce a greater margin of error; and even fractional differences in the choice of escalation indices will result in material differences.

Q. PLEASE SUMMARIZE YOUR CONCLUSION REGARDING THE ESCALATION RATE APPLIED BY THE STAFF.

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machinery, and motor vehicles) and of computer software which meets the definition of fixed investment." (p. 6-5)

A. Inflating the 1991 SAMDA costs by 2.25, as recommended by the Staff, should be rejected. The inflation rate used by the Staff falls outside the range of generally applied indicia of price inflation for that period, and should not be used in the absence of more detailed review of the composition of SAMDA cost estimates. To the extent that personal consumer expenditures should be excluded from the inflation index, a more generalized private domestic fixed investment index would result in an inflation multiplier less than I recommended in my direct testimony.

III. REBUTTAL OF APPLICANT TESTIMONY

Q. APPLICANT'S TESTIMONY USES ELEVEN MONTHS OF ERCOT PRICING DATA FROM 2010 TO SUPPORT THE USE OF 2009 ERCOT PRICES FOR CALCULATING REPLACEMENT POWER. WHAT IS YOUR RESPONSE?

A. Neither 2009 or 2010 should be considered representative of future power prices for STP replacement power. As I noted in my testimony, 2009 prices were influenced by historically low natural gas prices which were suppressed by the impact of a major national economic recession. The national economy has begun to recover, but in a relatively slow fashion. As a result, 2010 gas prices continue to be somewhat depressed, and electric power prices for 2010 are likely to reflect lower pricing than the future years which are relevant to STP 3 & 4 replacement power costs. Furthermore, balancing energy prices reflect only a small percentage of the overall ERCOT energy market. The average power costs reflect the costs of entering into bilateral contracts, hedging and trading costs, and ancillary services. The owners of STP are unlikely to rely on the relatively shallow balancing energy market to replace STP generation for an extended period of time, but instead are likely to enter into bilateral contracts to purchase power to

replace the STP generation. 2010 Texas power sales by NRG Energy, owner of the largest share of the current STP units, provide an alternative benchmark for power costs in the Houston and South zones of ERCOT. The average cost per MWH can be calculated from NRG's SEC Form 10-K, based on NRG's total Texas power sales revenues and annual power output.[6] NRG's generated and sold powerat an average price of $68.39 per megawatt-hour in 2010.[7] This is substantially more than the $37 range of 2009 and 2010 balancing energy power prices reflected in Applicant's testimony.

Q. THE APPLICANT'S TESTIMONY DISCUSSES THE $60 - $63 PER MWH PRICE OF POWER USED IN YOUR INITIAL REPORT. CAN YOU DISCUSS THE CONTEXT OF THAT ANALYSIS?

A. Yes.In my initial report, I attempted to develop a methodology for projecting the price of power during the period that STP 3 & 4 would be in operation. The method was based on projecting implicit generation heat rates and gas prices over a long term period, and it produces a $60 - $63 per MWH (real $2008) price for the period 2020 – 2025, which I assumed to be the initial three or four years of operation. My initial report assumed real gas price escalation (e.g., a rate higher than general inflation) over the long term. A 2020 commercial operation date implies that the relevant period for forecasting power prices could extend out to 2060. Extending the methodology in my initial report over the 40 year life of STP 3 & 4 would produce much higher real power prices than the 2008 balancing energy prices used as a "sensitivity" by the Application. Given that the Applicant's 2008 ERCOT price sensitivity produced power prices that are more

[6] NRG 2010 SEC Form 10-K at 15-16; $3.057 billion in power revenues divided by 44.7 million MWHs.

representative of the long or intermediate term future than the depressed 2009 prices, I chose to accept the Applicant's 2008 ERCOT price in order to avoid potential confusion which could arise from interjecting a different priceforecast. However, I disagree with Applicant's contention that the 2008 ERCOT prices are conservative, given the fact that natural gas prices are likely to escalate faster than inflation over the long term.

Q. APPLICANT'S TESTIMONY AGREES THAT FUTURE WHOLESALE POWER PRICES WILL BE DRIVEN BY GAS PRICES, BUT DISPUTES THAT SUCH PRICES WILL GROW AT A FASTER RATE THAN INFLATION. APPLICANT'S TESTIMONY AT PAGE 38 POINTS TO DECLINES IN 2009 POWER PRICES AS EVIDENCE OF THE LACK OF REAL ESCALATION. HOW DO YOU RESPOND?

A. First, one should look at the long term price trend for real escalation rates, rather than 1 or 2 individual years. I have already addressed the economic conditions which led to a decline in 2009 gas prices. Over any short term period, gas prices can be very volatile and may rise and fall with short term conditions. However, natural gas is a finite resource, and over the long term the price is likely to grow at a rate in excess of general inflation. The Applicant's testimony foresees "stable" gas prices over the next decade. However, it requires a great deal of optimism to assume that STP 3 & 4 will even be operating within the next decade. The more relevant time period is the potential 40 year operational period extending to approximately 2060. Second, the U.S. Energy Information Administration's 2011 Annual Energy Outlook projects a long term 2.3% real escalation rate (above inflation) in natural gas spot prices at the Henry Hub.[8] Third,

[8] EIA spreadsheet, aeotab_13-1

ERCOT's Long Term Planning Task Force forecasts real ($2009) natural gas prices of $8.49 per mmbtu and an average locational marginal price of $87.75 per MWH in 2030.[9] The ERCOT planning study reflects real increases in both gas prices and power prices, and supports my position that the Applicant's use of 2008 balancing energy prices as a sensitivity should not be characterized as conservative. Fourth, STP 3 & 4 is unlikely to be built unless natural gas prices are forecasted to rise substantially. The economic feasibility of the project depends on high gas prices.

Q. APPLICANT'S TESTIMONY STATES THAT THE POSSIBILITY OF A SEVERE ACCIDENT AT ONE OF THE ABWR'S, FOLLOWED BY THE SHUTDOWN OF THE REMAINING STP UNITS, AND THE LOSS OF THE ERCOT GRID IS "SPECULATIVE AND REMOTE." PLEASE RESPOND TO THAT ASSERTION.

A. My testimony indicates that this is a low probability event with very large consequences. However, the Applicant does not appear to consider the potential for a common mode event which could affect the ABWR and other generating units in ERCOT at the same time. For example, natural disasters like a hurricane or tornados could remove other generating units from the grid at the same time that the natural event has increased the risk of a severe accident at the STP site.

Q. THE APPLICANT POINTS TO THE FEB. 2, 2011 ROLLING BLACKOUTS IN ERCOT AS EVIDENCE THAT THE SIMUELTANEOUS LOSS OF THE STP UNITS WOULD NOT CAUSE SERIOUS EFFECTS ON THE ERCOT GRID. DO YOU AGREE?

[9] ERCOT Long Term Planning Task Force, May 2011, "Process Overview and Interim Results," at 7, May 2011.

A. Not necessarily. First, contrary to the impression given by Applicant's testimony, the loss of generation on Feb. 2, 2011 due to freezing weather was a very serious event. The Independent Market Monitor stated that responsive reserve capacity fell as low as 445 MWs (compared to a minimum requirement of 2,300 MW) and characterized the operating reserves as "perilously low for a sustained period of time."[10] Also, of 15 units that had contracts with ERCOT to provide black start service[11], one unit failed to start and 8 units tripped.[12] This implies that ERCOT could have faced major obstacles to recovery if all or part of the grid had gone black. Second, the Feb. 2, 2011 event illustrates the possibility of significant risk to the grid if a STP forced outage occurred at the same time that other generating units have incurred outages due to severe weather events. Third, unlike the large amount of capacity shut down by freezing weather and gradually brought back into service on Feb. 2d and 3d, the STP capacity (after a ABWR accident) cannot be returned to service over a short period of time.

Q. APPLICANT'S TESTIMONY SUGGESTS THAT MOTHBALLED GAS CAPACITY AND ERCOT'S 13.75% INSTALLED CAPACITY RESERVE MARGIN WOULD PREVENT BLACK OUTS AND PRICE SPIKES IF THE STP UNITS WERE SHUT DOWN. PLEASE RESPOND TO THAT ASSERTION.

A. ERCOT does not control the construction of capacity to meet reserve requirements, and instead relies on the market to meet installed reserve requirements. The possibility exists that ERCOT installed capacity will fall below the required reserve margin at various points in time during the future. A recent ERCOT study examined the impact of

[10] "IMM Report on Investigation of ERCOT Energy Emergency Level 3 on Feb. 2, 2001" at 6, 19 (April 21, 2011).
[11] "Black Start units" refer to generating units that will be used by ERCOT to re-start the grid if a black out were to occur.
[12] Texas Reliability Entity Report, May 13, 2011 at 18.

proposed EPA environmental regulations, and predicted that the regulations would cause 8,000 MW of older gas fired generation to be retired, resulting in a reserve margin of 2% in 2015.[13] Furthermore, results of ERCOT's Long Range Planning Task Force Study project reserve margins as low as 4% - 6% in 2030 under the Business as Usual scenario.[14] The ERCOT impact resulting from a severe accident at one of the ABWRs will be affected by the amount of installed generation reserves at the time the accident occurs.

Q. THE APPLICANT'S TESTIMONY STATES THAT NO ERCOT GENERATOR HAS EVER BEEN FOUND GUILTY OF MARKET POWER ABUSE, AND IMPLIES THAT THIS JUSTIFIES AN ASSUMPTION OF PERFECT COMPETITION IN THE SIMULATION MODEL USED TO CALCULATE MARKET IMPACTS OF A STP SHUTDOWN. DO YOU AGREE?

A. No. The staff of the Public Utility Commission has brought numerous enforcement actions for market manipulation, but in most cases, a settlement was reached whereby the generator pays a fine or restitution and agrees to take mitigation measures in the future. Although the settlements may not require an admission of market power abuse, that is not sufficient basis to ignore the *possibility* of market power. Among the notable cases, Luminant agreed to pay a $15 million fine for alleged market manipulation during a series of winter price spikes in 2005. I also disagree with the Applicant Testimony's claim that the price impact of market power would be the same for both the with- and without- STP cases in its simulation of ERCOT prices. Shortage situations allow pivotal

[13] "Review of Proposed Environmental Regulations on ERCOT" at i. ERCOT System Planning, May 11, 2011.
[14] ERCOT Long Range Planning Task Force, May 2011.

generators[15] to charge higher prices than they would in normal supply conditions. Therefore, the price impact of market power can increase when the STP units are removed from the market. Although I agree with the Applicant that market power impacts cannot be quantified precisely, the Applicant could have attempted to approximate a market power premium to the prices in the without-STP case.

Q. APPLICANT'S TESTIMONY CLAIMS THAT PRICE INDICES APPLIED TO SAMDA COSTS SHOULD NOT BE ADJUSTED FOR REGIONAL OR LOCAL PRICE DIFFERENTIALS BECAUSE MOST OF THE EQUIPMENT IS PURCHASED AT NATIONWIDE PRICES FROM OUTSIDE THE REGION OR LOCALITY. DO YOU AGREE THAT IT IS INAPPROPRIATE TO RECOGNIZE LOCAL OR REGIONAL COST DIFFERENCES?

A. No. Even if one assumes that materials and equipment are purchased outside the region or locality, local labor costs will be incurred; and salary and wage rates vary by region.

IV. STAFF & APPLICANT'S RISK ADJUSTED SAMDA

Q. HAS THE APPLICANT'S TESTIMONY CHANGED THE 2009 DOLLAR AMOUNT OF THE LOWEST COST SAMDA FROM THE AMOUNT USED IN THE AFFIDAVIT ATTACHED TO THE APPLICANT'S MOTION FOR SUMMARY JUDGEMENT?

A. Yes. Page 30 of the affidavit attached to the Applicant's motion for summary judgement identifies the lowest cost SAMDA as $158,000 ($2009). In the corresponding paragraph

[15] "Pivotal" generation refers to suppliers whose capacity is necessary in order to meet hourly demand at a particular time.

of Applicant's direct testimony (page 63), the lowestcost SAMDA is shown as $982,500 ($2009). From the standpoint of intervenors, this gives the perception of a moving target.

Q. WHAT IS THE BASIS FOR THE CHANGE?

A. The approach used in the Applicant's environmental report and affidavit was to perform a screening analysis which did not identifyeach SAMDA's contribution to core damage frequency (CDR) in the quantification of SAMDA implementation costs. Intervenors responded to the screening analysis methodology in preparing their support for Contention CL-002. Applicant's direct testimony has increased the SAMDA implementation cost to reflect risk-adjusted costs, i.e., the SAMDA costs have been increased to reflect the claimed effect of the SAMDA action in reducing the probability of core damage. In other words, the Applicant's testimony increases SAMDA implementation costs to reflect the claim that each individual alternative measure produces a relatively small reduction in CDR. The conclusion of Applicant's direct testimony (p. 64-65) describes this change obliquely: "we also have removed some of the conservatism included in the Joint Affidavit."

Q. HAS THE STAFF TAKEN A SIMILAR POSITION?

A. Yes. The Staff's testimony takes a similar position, except that the CDF adjustments are applied to averted costs instead of SAMDA costs.

Q. SHOULD THE RISK ADJUSTMENTS BE RELIED UPON TO REJECT INTERVENORS' TESTIMONY?

A. No. Intervenors contended that the environmental reports' replacement power costs for monetizing the collocation severe accident impact was understated, and my testimony

demonstrates that to be true. Intervenors contested the Applicant's claim that none of the SAMDAs passed the screening test used by the Applicant. My testimony shows that the lowest cost SAMDA, based on the screening methodology relied upon by the Applicant, is less than averted costs if ERCOT power cost impacts are recognized and the 1991 cost estimates are properly converted to 2009 dollars.

Q. WHAT IS YOUR RECOMMENDATION?

A. I contend that intervenors have shown that the Applicant dismissed further review of SAMDAs based upon an incorrect conclusion that no SAMDAs passed the screening test. My recommendation is that a positive screening test should trigger a more robust review of the SAMDAs by the Applicant. The Applicant's effort to make the screening test results "less conservative" by changing the costs to risk adjusted dollars does not permit intervenors to effectively respond to a fundamentally different analysis. If the Applicant, instead, is required to provide a more in depth analysis of SAMDA costs, the results will be more transparent and comprehensive. Given the significant potential costs of a severe accident to residents, consumers, and the economy in Texas, my recommended approach should provide greater assurance and confidence to the public that all potential mitigation measures have been adequately reviewed.

Q. PLEASE DESCRIBE HOW A MORE ROBUST REVIEW WOULD BE BENEFICIAL.

A. First, more accurate and up-to-date cost estimates for relevant SAMDAs should be developed. As discussed previously in my testimony, the SAMDA cost estimates are 20 years old. Simply escalating those costs for inflation, as presented in this proceeding, does not permit consideration of productivity improvements and technological changes

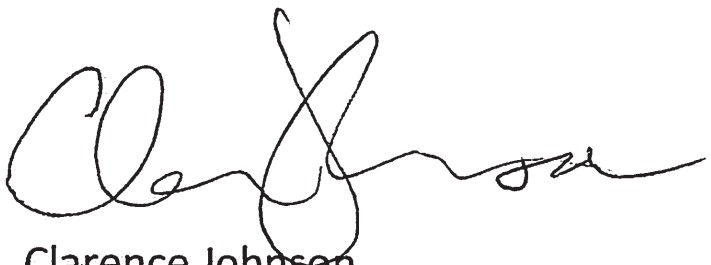
which may change the costs and/or effectiveness of an alternative. Second, the Staff and Applicant have not provided adequate support for their assumption that measures which mitigate, rather than prevent, core damage have no effect on collocated units or off-site replacement power. For example, is it possible that a mitigation measure which does not contribute to CDR may still reduce the amount of damage incurred at collocated units or reduce the duration of shut downs at collocated units? Third, the Applicant can evaluate whether any lessons learned from the severe accident at Fukushima Daiichi would change the conclusions regarding particular SAMDA alternatives. The CDR for a unit like Fukushima (in the range of 10^{-6}) does not seem consistent with core damage at three reactors. I don't think it is unreasonable for the Staff and Applicant to examine whether any of the events at Fukushima would modify their reliance upon the CDRs used in this application.

Q. DOES THIS CONCLUDE YOUR TESTIMONY AT THIS TIME?

A. Yes.

Affidavit

My name is Clarence L. Johnson and I am a resident of the City of Austin, County of Travis, Texas. I hereby declare, under penalty of perjury, that: (1) I am responsible for the pre-filed Rebuttal Testimony of Clarence Johnson, filed in Docket Nos. 52-012 and 52-013 (COL) before the Atomic Safety & Licensing Board, and attached hereto; and (2) The contents of the testimony are true and correct to the best of my knowledge and belief.



Clarence Johnson

Dated: May 31, 2011