Appendix E

State Historic Preservation Officer Correspondence

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Exelon.
Nuclear

Exelon Generation
4300 Winfield Road
Warrenville IL 60555

www.exeloncorp.com

RS-01-293

January 11, 2002

Mr. William Wheeler
State Historic Preservation Office Representative
Illinois Historic Preservation Agency
500 East Madison
Springfield, Illinois 62701

Subject. Dresden Nuclear Power Station, Units 2 and 3 License Renewal: Request For Information in Historic/Archeological Resources

Exelon Generation Company (EGC), LLC (formerly Commonwealth Edison Company) is currently preparing an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating licenses for the Dresden Nuclear Power Station (DNPS) Units 2 and 3. The current operating licenses for Unit 2 and 3 expire in 2009 and 2011, respectively. The renewal term would be for an additional 20 years beyond the original license expiration date. As part of the license renewal process, NRC requires license renewal applicants to "assess whether any historic or archeological properties will be affected by the proposed project." By contacting your office early in the application process, we hope to identify any issues that we may need to address or any information that we should provide to your office to expedite your evaluation of the potential impact of the continued operation of DNPS on historic and archeological resources

Exelon has operated DNPS and its associated transmission lines since 1970. As shown on Attachment A, DNPS is located in Goose Lake Township, Grundy County, Illinois, on the south shore of the Illinois River, at the confluence of the Des Plaines and Kankakee Rivers at river mile 272.4. The DNPS site is owned by EGC and it consists of approximately 2,500 acres, with an additional 17 acres of river frontage leased from the State of Illinois. No major metropolitan areas occur within six miles of DNPS. The site contains the two operating nuclear reactors and their turbine building, intake and discharge canals, a cooling pond and canals, cooling towers, auxiliary buildings, switchyards, and the retired DNPS Unit 1. In 1991, the American Nuclear Society designated DNPS Unit 1 as a Nuclear Historic Landmark. As shown on Attachment B, the 1,275-acre cooling pond is divided almost equally between Grundy and Will Counties.

January 11, 2002
Illinois Historic Preservation Agency
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As shown on Attachments A and B, DNPS is connected to the power grid through seven 345-kilovolt lines The Electric Junction corridor contains two lines running east from the plant and then turning north, crossing the Illinois River. The lines run 31.1 miles and have a right-of-way ranging from 130 to 380 feet wide. Two Goodings Grove lines cross the Kankakee River south of DNPS and then run northeast and terminate at the Elwood Substation. The Goodings Grove corridor is 12 4 miles long, with a 250-foot wide right-of-way. Pontiac Mid-Point is a 43.3-mile line that runs in a southwesterly direction, terminating south of Pontiac, Illinois. Powerton is a 104.5-mile line that crosses the Kankakee River twice before heading southwest and terminating near the Illinois River. This corridor has a right-of-way of 250 feet wide in most areas. The Collins Station line extends 11.8 miles from DNPS to the nearby Collins Station. These lines are the only transmission lines/corridors under review during this license renewal process.

EGC does not expect the operation of DNPS, including maintenance of the identified transmission lines, through the license renewal term to adversely affect cultural or historical resources in the area and region No major structural modifications have been identified for the purposes of supporting license renewal Any maintenance activities necessary to support license renewal would be limited to previously disturbed areas. No additional land disturbance is anticipated in support of license renewal. Accordingly, we request your concurrence with our determination that the license renewal process would have no effect on any historic or archeological properties

After your review, we request receiving your input by March 29, 2002. In your response, please detail any concerns you may have about historic/archeological properties in the area or confirming our conclusion that operation of DNPS over license renewal term would have no effect on any historic or archeological properties in Illinois. This will enable us to meet our NRC application submittal schedule. EGC will include a copy of this letter and your response in the Environmental Report that will be submitted to the NRC as part of the DNPS license renewal application

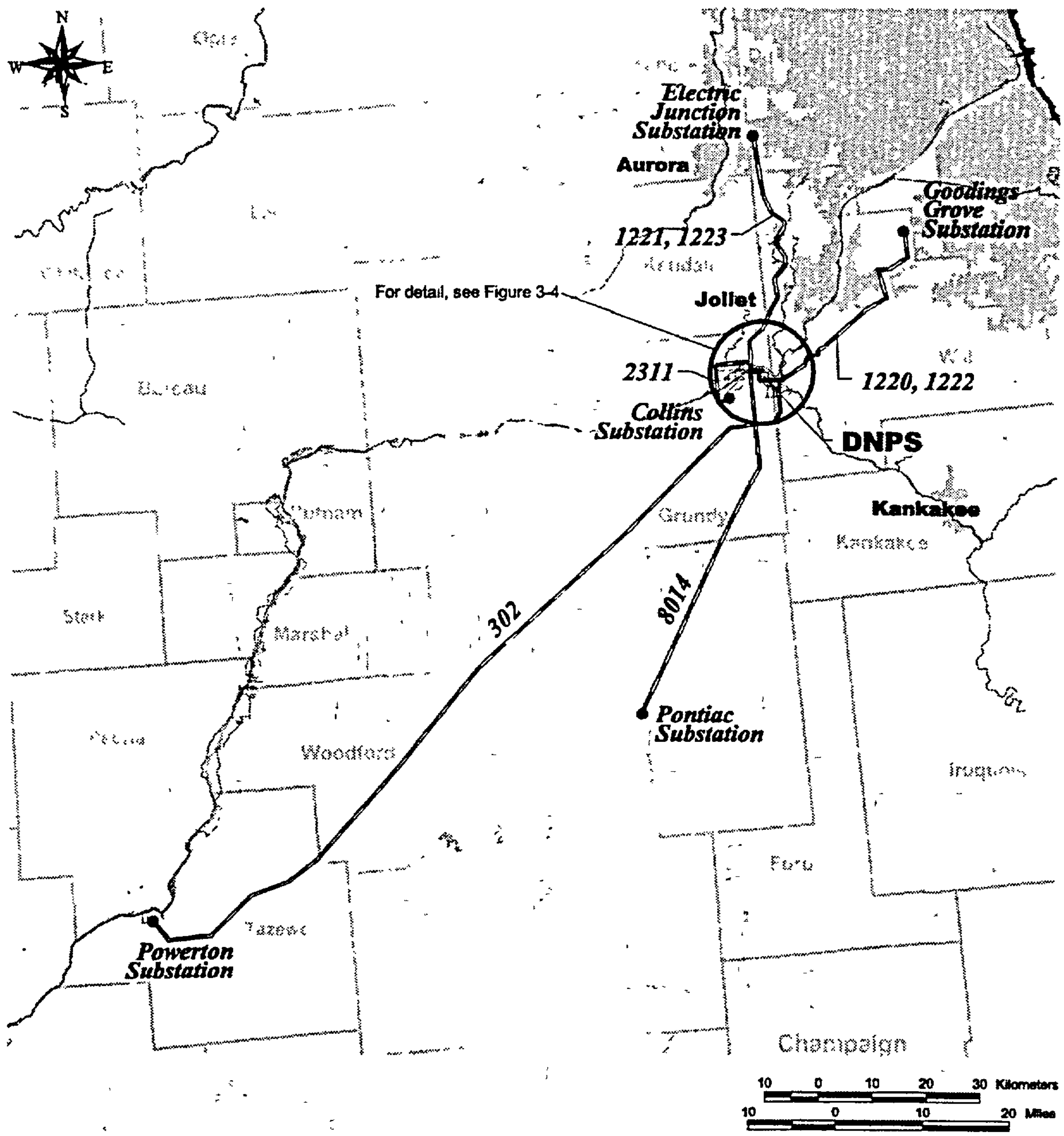
Should you have questions concerning this letter, please contact Mr. Terry Steinert at (630) 657-3213.

Respectfully,

Keith R Jury

K. R. Jury
Director – Licensing
Mid-West Regional Operating Group

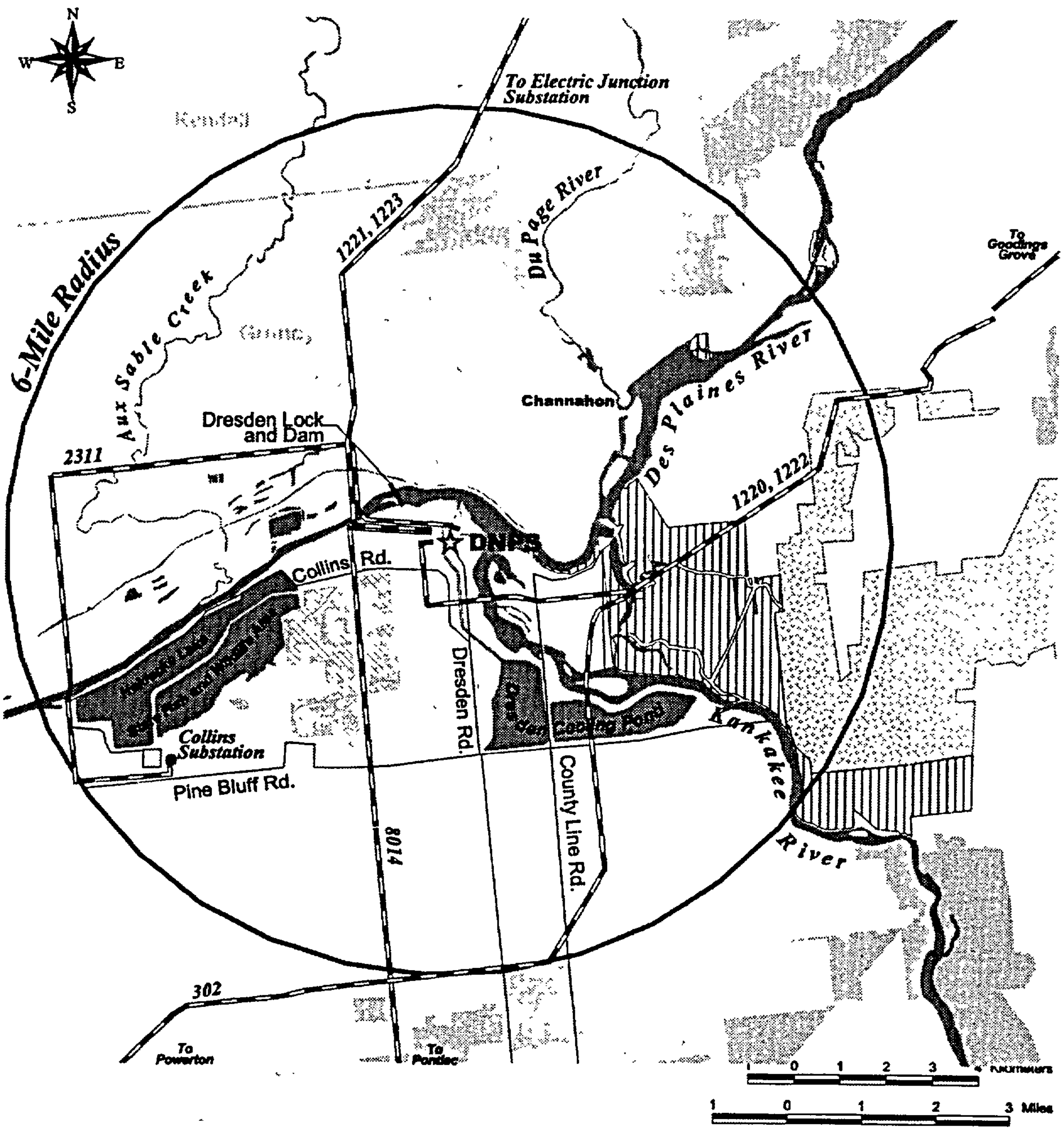
Attachments: Attachment A, Figure 3-3, Transmission Line Map
Attachment B, Figure 3-4, Detailed Transmission Line Map



LEGEND

- Substations
- Transmission Lines
- State Boundary
- Lakes and Rivers
- County Boundaries
- Urban Areas

FIGURE 3-3
Transmission Line Map



LEGEND

- Substations
- Transmission Lines
- County Boundaries
- Lakes and Rivers
- Des Plaines Conservation Area
- Goose Lake Prairie Natural Area
- Midewin National Tallgrass Prairie
- Urban Areas

FIGURE 3-4
Transmission Line Map Detail

Illinois Historic
Preservation Agency

1 Old State Capitol Plaza • Springfield Illinois 62701-1507 • (217) 782-4836 • TTY (217) 524-7128

Grundy County
Morris
Dresden Nuclear Power Station-Units 3 & 4 License Renewal
North of Dresden Road
IHPA LOG #0201160019WGR

January 30, 2002

K.R. Jury
Exelon Nuclear
Exelon Generation
4300 Winfield Road
Warrenville, IL 60555

Dear Mr. Jury:

We have reviewed the documentation submitted for the referenced project(s) in accordance with 36 CFR Part 800.4. Based upon the information provided, no historic properties are affected. We, therefore, have no objection to the undertaking proceeding as planned.

Please retain this letter in your files as evidence of compliance with section 106 of the National Historic Preservation Act of 1966, as amended. This clearance remains in effect for one year from date of issuance. It does not pertain to any discovery during construction, nor is it a clearance for purposes of the Illinois Human Skeletal Remains Protection Act (20 ILCS 3440).

If you have any further questions, please contact Cody Wright, Cultural Resources Manager, Illinois Historic Preservation Agency, 1 Old State Capitol Plaza, Springfield, IL 62701, 217/785-3977.

Sincerely,

Anne E. Haaker

Anne E. Haaker
Deputy State Historic
Preservation Officer

AEH:CW:as

Appendix F

SAMA ANALYSIS

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Appendix F

Severe Accident Mitigation Alternatives

The severe accident mitigation alternatives (SAMA) analysis discussed in 4.20 is presented below.

F.1 METHODOLOGY

The methodology selected for this analysis involves identifying SAMA candidates that have the highest potential for reducing core damage frequency and person-rem and determining whether or not the implementation of those candidates is beneficial on a cost-risk reduction basis. This process consists of the following steps:

- Dresden Probabilistic Safety Assessment (PSA) Model – Use the Dresden (DR) PSA model as the basis for the analysis (Section F.2).
- Level 3 PSA Analysis – Use DR Level 1 and 2 PSA output and site-specific meteorology, demographic, land use, and emergency response data as input in performing a Level 3 probabilistic safety assessment (PSA) using the MELCOR Accident Consequences Code System Version 2 (MAACS2) (Section F.3).
- Baseline Risk Monetization – Use NRC regulatory analysis techniques, calculate the monetary value of the unmitigated DR severe accident risk. This becomes the maximum averted cost-risk that is possible. (Section F.4).
- Phase I SAMA Analysis – Identify potential SAMA candidates based on DR, NRC, and industry documents. Screen out Phase 1 SAMA candidates that are not applicable to the DR design or are of low benefit in boiling water reactors (BWRs) such as DR, candidates that have already been implemented at DR or whose benefits have been achieved at DR using other means, and candidates whose estimated cost exceeds the maximum possible averted cost-risk (Section F.5).
- Phase II SAMA Analysis – Calculate the risk reduction attributable to each remaining SAMA candidate and compare to an estimated implementation cost to identify any net cost benefit. Probabilistic safety assessment (PSA) insights are also used to screen SAMA candidates in this phase (Section F.6).
- Uncertainty Analysis – Evaluate how a reduced discount value might affect the cost/benefit analyses.
- Conclusions – Summarize results and identify conclusions (Section F.8).

The steps outlined above are described in more detail in the subsections of this appendix and Figure F-1 provides a graphical representation of the SAMA process.

F.1.1 DRESDEN SPECIFIC SAMA

The initial list of Severe Accident Mitigation Alternative candidates for DR was developed from lists of SAMAs at other nuclear power plants (References 101, 9, 5, 7, 4, 12 and 13), NRC documents (References 1, 2, 3, 6, 8, 15, 16, and 19), and documents related to advanced power reactor designs (References 17, 10, and 11). In addition, plant specific analyses (References 36, 62, 64) have been used to identify potential SAMAs which address DR vulnerabilities. This process is considered to adequately address the requirement of identifying significant safety improvements that could be performed at DR. The initial SAMA list, Table F-1, includes a column which documents the reference sources for each individual SAMA.

The DR IPEEE (Reference 62) also identified potential opportunities for plant improvements. As a result of the Seismic and Fire Analysis, potential plant changes were considered and dispositioned according to their importance.

Given the existing assessments of external events and internal fires at DR, the cost benefit analysis uses the internal events PSA as the basis for measuring the impact of SAMA implementation. No fire or external events models are used in this analysis as the fire and IPEEE programs are considered to have already addressed potential plant improvements related to those categories

F.2 DRESDEN PSA MODEL

The 2002 update to the Dresden PRA is the most recent evaluation of the risk profile at the Dresden Unit 2 for internal event challenges. It is a periodic update, in accordance with EGC internal guidance, ER-AA-600-1015, "Full Power Internal Events (FPIE) PRA Model Update." There have been a series of probabilistic evaluations beginning with the Individual Plant Examination (IPE) issued in 1993 as requested by the NRC in Generic Letter 88-20.

The baseline CDF is 1.9E-06/yr. The radionuclide release frequencies including LERF are provided in Section F.3.

The Dresden 2002 update includes the following changes since the 1999 update:

- Approximately 17% Extended Power Uprate (EPU) plant configuration and MAAP 4.0.4 analysis
- Revised human reliability analysis (HRA) based on the most recent operator interviews
- Revised electric power dependency logic
- Bayesian updated initiating event frequencies utilizing Dresden most recent operating experience

- Revised LOOP/DLOOP analysis for initiating event frequencies and non-recovery probabilities based upon a Midwest regional data filtering approach
- Revised mechanical and electrical ATWS probabilities, based on information in NUREG/CR-5500
- Response to Dresden BWROG Peer Review comments using the NEI PRA Peer Review Process (NEI 00-02)
- Incorporated internal flood sequences into model
- Updated selected equipment failure rates
- Added credit for feedwater in Medium LOCA event tree and added a higher HEP for operators to depressurize with a water break Medium LOCA
- Added a conditional probability of 0.1 that Recirculation Pump Seal failure results in a need for vessel makeup to the Isolation Condenser logic during Station Blackout event
- Increased the HEP for Operator Switching ECCS pump injection to the CST during decay heat removal scenarios

The Dresden PRA model update has been performed with as-built, as-operated information, current as of June 2001. This includes plant-specific initiating event data for the 4-1/2-yr period ending in June 2001.

The documentation to support the PRA Update has been compiled in a set of modularized notebooks to provide the specific information needed for the PRA Update.

The PRA computer model has been developed within the CAFTA environment. The model exists in two logic formats:

- A sequence model – PRAQUANT
- A single top fault tree model -- ONE4ALL

Both quantification methodologies (PRAQuant and ONE4ALL) use the same PRA model logic and data input. The PRAQuant sequence quantification was retained because it provides sequence-level results and CDF contribution by accident class, which is not provided by ONE4ALL. The ONE4ALL methodology permits quantification at a lower truncation limit, consistent for every sequence, and the single top model is used for most sensitivity studies and for assessing the risk of on-line maintenance.

F.2.1 ANALYSIS

The Dresden plant has undergone an approximate 17% power uprate.

The approximate 17% power uprate was accompanied by hardware, set point, and power operation configuration changes that are reflected in the 2002 model. In addition, success criteria and accident sequence timing changes resulted in changes to the PSA model to reflect the higher power operation.

Dresden specific MAAP 4.0.4 calculations for the approximate 17% power uprate were performed to provide the new success criteria, sequence timing, and radionuclide release fractions.

An additional quantitative difference identified for the SAMA evaluation due to power uprate is in the calculation of replacement power costs. A scaling factor is required to fit the calculation to a given plant based on net electric output. The post power uprate output of approximately 912 MWe is used for the analysis.

In summary, the Dresden power uprate has been explicitly included in the PSA model and the supporting thermal hydraulic analyses.

F.3 LEVEL 3 PRA ANALYSIS

F.3.1 ANALYSIS

The MACCS2 code (Reference 91) was used to perform the level 3 probabilistic risk assessment (PRA) for the Dresden Nuclear Generating Station (DNGS). The input parameters given with the MACCS2 "Sample Problem A," which included the NUREG-1150 food model (Reference 92), formed the basis for the present analysis. These generic values were supplemented with parameters specific to DNGS and the surrounding area. Site-specific data included population distribution, economic parameters, and agricultural production. Plant-specific release data included the time-nuclide distribution of releases, release frequencies, and release locations. The behavior of the population during a release (evacuation parameters) was based on plant and site-specific set points (i.e., declaration of a General Emergency) and the emergency planning zone (EPZ) evacuation table (Reference 96). These data were used in combination with site-specific meteorology to simulate the probability distribution of impact risks (exposure and economic) to the surrounding (within 50 miles) population from the accident sequences at DNGS.

F.3.2 POPULATION

The population surrounding the DNGS site was estimated for the year 2031. Population projections within 50 miles of DNGS were determined using a geographic information system (GIS), U.S Census block-group level population data for 2000 allocated to each sector based on the area fraction of the census block-groups in each sector, and populations growth rates estimates for each county. The projected county growth rates were weighted by the fraction of each county in the 50-mile radius. The calculated growth rate of 1.408 from 2000 to 2031 was applied uniformly to all sectors. The distribution was given in terms of population at distances to 1, 2, 3, 4, 5, 10, 20, 30, 40 and 50 miles from the plant and in the direction of each of the 16 compass points (i.e., N, NNE, NE, NNW). The total year 2031 population for the 160 sectors (10 distances ×

16 directions) in the region was estimated as 9,967,934, the distribution of which is given in Tables F-2 and F-3.

F.3.3 ECONOMY

MACCS2 requires the spatial distribution of certain economic data (fraction of land devoted to farming, annual farm sales, fraction of farm sales resulting from dairy production, and property value of farm and non-farm land) in the same manner as the population. This was done by updating the database in the SECPOP90 code (Reference 93) for each of the 21 counties surrounding the plant to a distance of 50 miles, using the methodology in Reference 93 and data from References 94, 97, 98, 99, and 95. The values for up to 97 economic zones allocated to each of the 160 sectors were then calculated using SECPOP90 code with the updated economic and agricultural database.

In addition, generic economic data that are applied to the region as a whole were revised from the MACCS2 sample problem input when better information was available. These revised parameters include per diem living expenses (applied to owners of interdicted properties and relocated populations), relocation costs (for owners of interdicted properties), value of farm and non-farm wealth, and fraction of farm wealth from improvements (e.g., buildings, equipment).

F.3.4 AGRICULTURE

Agricultural production information was taken from the 1997 Agricultural Census (Reference 95). Production within 50 miles of the site was estimated based on those counties within this radius. Production in those counties, which lie partially outside of this area, was multiplied by the fraction of the county within the area of interest. Of the food crops, grain (56 percent of the total cropland, made up of corn and wheat), and legumes (46 percent of the total cropland, made up of soybeans) were harvested from the largest areas. Pasture (2.3 percent) and stored forage (1.6 percent of total cropland, consisting of hay) made up most of the remaining harvested cropland. The lengths of the growing seasons for grains and legumes were obtained from Reference 100. The duration of the growing season for the remaining crop categories (pasture, stored forage, green leafy vegetables, roots/tubers and other food crops) was based on reasonable estimates. The uncertainty in these estimates does not have a significant impact due to the much smaller fraction of land dedicated to these crops.

F.3.5 NUCLIDE RELEASE

The core inventory at the time of the accident was based on the input supplied in the MACCS2 User's Guide (Reference 91). The core inventory corresponds to the end-of-cycle values for a 3578-MWth BWR plant. A scaling factor of 0.8264 was used to provide a representative core inventory of 2957-MWth at DNGS. DNGS nuclide release categories were related to the MACCS2 categories as shown in Table F-4. Each DNGS category corresponded with a single release duration (either puff or continuous).

All releases were modeled as occurring at ground level. The thermal content of each of the releases was conservatively assumed to be the same as ambient; i.e., buoyant plume rise was not modeled.

F.3.6 EVACUATION

Scram for each sequence was taken as time zero relative to the core containment response times. A General Emergency is declared when plant conditions degrade to the point where it is judged that there is a credible risk to the public.

The MACCS2 User's Guide input parameters of 95 percent of the population within 10 miles of the plant (Emergency Planning Zone) evacuating and 5 percent not evacuating were employed. These values have been used in similar studies (e.g., Hatch, Calvert Cliffs, References 101 and 19) and are conservative relative to the NUREG-1150 study, which assumed evacuation of 99.5 percent of the population within the emergency planning zone (Reference 92). The evacuees are assumed to begin evacuation 15 minutes (Reference 96) after a General Emergency has been declared and are evacuated at an average radial speed of 2.7 miles per hour (1.19 m/sec). This speed is calculated from the maximum evacuation time of 225 minutes from the full 0-10mi. EPZ under daytime adverse weather conditions, and includes the average times required for leaving work, traveling home, and preparing home for evacuation (120 minutes) after having received notice of evacuation (Reference 96).

F.3.7 METEOROLOGY

Annual meteorology data sets from 1998 through 2001 were investigated for use in MACCS2. The 2000 data set was used, supplemented as follows to fill in the data gaps:

1. Available tower data were used whenever possible. For example, if the lower wind direction was unavailable, mid and/or upper directions were used to estimate the lower wind direction (or speed). If only a brief period of missing data existed, interpolation was used between hours.
2. Indirect measurements of other parameters were used to help fill data gaps (rapidly lowering temperatures may indicate a wind shift has occurred).
3. Hourly observations from the Joliet municipal airport were utilized to fill in the larger data voids, and the Romeo airport was used when Joliet data were incomplete.
4. Two meteorologists (one with over 20 years experience and the other with over 15 years experience) reviewed the data to interpret and suggest values to fill data gaps.

Wind speed and direction from the 10-meter sensor were combined with precipitation (hourly cumulative) and atmospheric stability (specified according to the vertical temperature gradient as measured between the 60-meter and 10-meter levels). Atmospheric mixing heights were specified for AM and PM hours. These values were taken as 500 and 1200 meters, respectively (Reference 102).

F.3.8 MACCS2 RESULTS

Table F-5 shows the mean off-site doses and economic impacts to the region within 50 miles of DNGS for each of eight release categories calculated using MACCS2. These impacts are multiplied by the annual frequency for each release category and then summed to obtain the risk-weighted mean doses and economic costs. Two of the 10 release categories (L2-3 and L2-6) did not have any reported release data and were not subjected to the Level 3 analysis. Table F-6 provides a summary of the Dresden Level 2 PRA results.

F.4 BASELINE RISK MONETIZATION

F.4.1 OFF-SITE EXPOSURE COST

This section explains how EGC calculated the monetized value of the status quo (i.e., accident consequences without SAMA implementation). EGC also used this analysis to establish the maximum benefit that a SAMA could achieve if it eliminated all DR risk.

F.4.2 OFF-SITE EXPOSURE COST

The baseline annual off-site exposure risk was converted to dollars using the NRC's conversion factor of $2,000 per person-rem (Reference 90), and discounting to present value using NRC standard formula (Reference 90):

$$W_{pha} = C \times Z_{pha}$$

Where:

W_{pha}	=	monetary value of public health risk after discounting
C	=	$[1-\exp(-rt_f)]/r$
t_f	=	years remaining until end of facility life = 20 years
r	=	real discount rate (as fraction) = 0.07/year
Z_{pha}	=	monetary value of public health (accident) risk per year before discounting ($/year)

The Level 3 analysis showed an annual off-site population dose risk of 10.23 person-rem. The calculated value for C using 20 years and a 7 percent discount rate is approximately 10.76. Therefore, calculating the discounted monetary equivalent of accident risk involves multiplying the dose (person-rem per year) by $2,000 and by the C value (10.76). The calculated off-site exposure cost is $220,209.

F.4.3 OFF-SITE ECONOMIC COST RISK (OECR)

The Level 3 analysis showed an annual off-site economic risk of $18,410. Calculated values for off-site economic costs caused by severe accidents must be discounted to present value as well. This is performed in the same manner as for public health risks and uses the same C value. The resulting value is $198,145.

F.4.4 ON-SITE EXPOSURE COST RISK

Occupational health was evaluated using the NRC methodology in Reference 90, which involves separately evaluating "immediate" and long-term doses.

Immediate Dose - For the case where the plant is in operation, the equation that NRC recommends using (Reference 90) is:

Equation 1:

$$W_{IO} = R\{(FD_{IO})_S - (FD_{IO})_A\}\{[1 - \exp(-rt_f)]/r\}$$

Where:

W_{IO} = monetary value of accident risk avoided due to immediate doses, after discounting
R = monetary equivalent of unit dose ($/person-rem)
F = accident frequency (events/yr)
D_{IO} = immediate occupational dose (person-rem/event)
$_S$ = subscript denoting status quo (current conditions)
$_A$ = subscript denoting after implementation of proposed action
r = real discount rate
t_f = years remaining until end of facility life.

The values used in the Dresden analysis are:

R = $2,000/person-rem
r = 0.07
D_{IO} = 3,300 person-rem/accident (best estimate)
t_f = 20 years (license extension period)
F = 1.89E-6 (total core damage frequency)

For the basis discount rate, assuming F_A is zero, the best estimate of the immediate dose cost is:

$$W_{IO} = R\,(FD_{IO})_S\{[1 - \exp(-rt_f)]/r\}$$
$$= 2{,}000*1.89\text{E-}6*3{,}300*\{[1 - \exp(-0.07*20)]/0.07\}$$
$$= \$134$$

Long-Term Dose - For the case where the plant is in operation, the NRC equation (Reference 90) is:

Equation 2:

$$W_{LTO} = R\{(FD_{LTO})_S - (FD_{LTO})_A\}\{[1 - \exp(-rt_f)]/r\}\{[1 - \exp(-rm)]/rm\}$$

Where:

W_{IO} = monetary value of accident risk avoided long-term doses, after discounting, $

m = years over which long-term doses accrue

The values used in the Dresden analysis are:

R = $2,000/person-rem
r = 0.07
D_{LTO} = 20,000 person-rem/accident (best estimate)
m = "as long as 10 years"
t_f = 20 years (license extension period)
F = 1.89E-6 (total core damage frequency)

For the basis discount rate, assuming F_A is zero, the best estimate of the long-term dose is:

W_{LTO} = R $(FD_{LTO})_S$ {[1 - exp(-rt$_f$)]/r} {[1 - exp(-rm)]/rm}
= 2,000*1.89E-6 *20,000*{ [1 - exp(-0.07*20)]/0.07} {[1 -exp(-0.07*10)]/0.07*10}
= $584

Total Occupational Exposure - Combining Equations 1 and 2 above and using the above numerical values, the total accident related on-site (occupational) exposure avoided (W_O) is:

$W_O = W_{IO} + W_{LTO}$ = ($134 + $584) = $718

F.4.5 ON-SITE CLEANUP AND DECONTAMINATION COST

The net present value that NRC provides for cleanup and decontamination for a single event is $1.1 billion, discounted over a 10-year cleanup period (Reference 90). NRC uses the following equation to integrate the net present value over the average number of remaining service years:

U_{CD} = [PV_{CD}/r][1-exp(-rt$_f$)]

Where:

PV_{CD} = net present value of a single event
r = real discount rate
t_f = years remaining until end of facility life.

The values used in the Dresden analysis are:

PV_{CD} = $1.1E+9
r = 0.07
t_f = 20

The resulting net present value of cleanup integrated over the license renewal term, $1.18E+10, must be multiplied by the total core damage frequency of 1.89E-6 to determine the expected value of cleanup and decontamination costs. The resulting monetary equivalent is $22,329.

F.4.6 REPLACEMENT POWER COST

Long-term replacement power costs was determined following the NRC methodology in Reference 90. The net present value of replacement power for a single event, PV_{RP}, was determined using the following equation:

$$PV_{RP} = [\$1.2E+8/r] * [1 - \exp(-rt_f)]^2$$

Where:

PV_{RP} = net present value of replacement power for a single event, ($)
r = 0.07
t_f = 20 years (license renewal period)

To attain a summation of the single-event costs over the entire license renewal period, the following equation is used:

$$U_{RP} = [PV_{RP} / r] * [1 - \exp(-rt_f)]^2$$

Where:

U_{RP} = net present value of replacement power over life of facility ($-year)

After applying a correction factor to account for DR's size relative to the "generic" reactor described in NUREG/BR-0184 (Reference 90)(i.e., 912 MWe/910 MWe), the replacement power costs are determined to be 7.9E+9 ($-year). Multiplying this value by the CDF (1.89E-6/yr) results in a replacement power cost of $14,914.

F.4.7 TOTAL

The sum of the baseline costs is as follows:

Off-site exposure cost	=	$220,209
Off-site economic cost	=	$198,145
On-site exposure cost	=	$718
On-site cleanup cost	=	$22,329
Replacement Power cost	=	$14,914
Total cost	=	$456,314

EGC rounded this value up to $457,000 to use in screening out SAMAs as economically infeasible. The averted cost-risk calculations account for this rounding such that it does not impact the result. This cost estimate was used in screening out SAMAs that are not economically feasible; if the estimated cost of implementing a SAMA exceeded $457,000 it was discarded from further analysis. Exceeding this threshold would mean that a SAMA would not have a positive net value even if it could eliminate all severe accident costs. On the other hand, if the cost of implementation is less than this value, then a more detailed examination of the potential fractional risk benefit that can be attributed to the SAMA is performed.

F.5 PHASE I SAMA ANALYSIS

F.5.1 SAMA IDENTIFICATION

The initial list of Severe Accident Mitigation Alternative candidates for DR was developed from lists of SAMAs at other nuclear power plants (References 101, 9, 5, 7, 4, 12, and 13), NRC documents (References 1, 2, 3, 6, 8, 15, 16, and 19), and documents related to advanced power reactor designs (ABWR SAMAs) (References 17, 10, and 11). In addition, plant specific analyses (References 36,62,64) have been used to identify potential SAMAs which address DR vulnerabilities. This process is considered to adequately address the requirement of identifying significant safety improvements that could be performed at DR. The initial SAMA list, Table F-1, includes a column which documents the reference sources for each individual SAMA.

The DR IPEEE (Reference 62) also identified potential opportunities for plant improvements. As a result of the Seismic and Fire Analysis, potential plant changes were considered and dispositioned according to their importance.

Given the existing assessments of external events and internal fires at DR, the cost benefit analysis uses the internal events PSA as the basis for measuring the impact of SAMA implementation. No fire or external events models are used in this analysis as the fire and IPEEE programs are considered to have already addressed potential plant improvements related to those categories.

F.5.2 SCREENING

An initial list of SAMA candidates is presented in Table F-1. This initial list was then screened to remove those candidates that were not applicable to DR due to design differences or high implementation cost. In addition, SAMAs were eliminated if they were related to changes that would be made during the design phase of a plant rather than to an existing plant. These would typically screen on high cost, but they are categorized separately for reference purposes. The SAMA screening process is summarized in Figure F-1.

A majority of the SAMAs were removed from further consideration as they did not apply to the GE BWR3/Mark I design used at DR. The SAMA candidates that were found to be implemented at DR were screened from further consideration.

The SAMAs related to design changes prior to construction (primarily consisting of those candidates taken from the ABWR SAMAs) were removed as they were not applicable to an existing site. Any candidate known to have an implementation cost that far exceeds any possible risk benefit is screened from further analysis. Any SAMA candidates that were sufficiently similar to other SAMA candidates were treated in the same manner to those that they were related to either combined or screened from further consideration.

A preliminary cost estimate was prepared for each of the remaining candidates to focus on those that had the possibility of having a positive benefit and to eliminate those whose costs were beyond the possibility of any corresponding benefit (as determined by the DR baseline screening cost). When the screening cutoff of $457,000 was applied, a majority of the remaining SAMA candidates were eliminated, as their implementation costs were more expensive than the maximum postulated benefit associated with the elimination of all risk associated with full power internal events. This left 10 candidates for further analysis. Those SAMAs that required a more detailed cost benefit analysis are evaluated in Section F.6. A list of these SAMAs is provided in Table F-7.

F.6 PHASE II SAMA ANALYSIS

For each of the remaining SAMA candidates that could not be eliminated based on screening cost or PSA/application insights, a more detailed conceptual design was prepared. This information was then used to evaluate the effect of the candidates' changes upon the plant safety model.

The final cost-risk based screening method used to determine the desirability of implementing the SAMA is defined by the following equation:

Net Value = (baseline cost-risk of plant operation – cost-risk of plant operation with SAMA implemented) – cost of implementation

If the net value of the SAMA is negative, the cost of implementation is larger than the benefit associated with the SAMA and the SAMA is not considered beneficial. The baseline cost-risk of plant operation was derived using the methodology presented in Section F.4. The cost-risk of plant operation with the SAMA implemented is determined in the same manner with the exception that the PSA results reflect the application of the SAMA to the plant (the baseline input is replaced by the results of a PSA sensitivity with the SAMA change in effect).

Subsections F.6.1 – F.6.10 describe the detailed cost benefit analysis that was used to determine how the remaining candidates were ultimately treated.

F.6.1 PHASE II SAMA NUMBER 1

Description: Enhance RCS Seal Cooling.

The Dresden plant has new improved recirculation pump seals that prevent or minimize any leakage. This SAMA is a procedure change to the EOPs that would direct RPV depressurization given the loss of recirculation pump seal cooling or damage to the seals.

The approach to assessing this SAMA is to assume complete reliability of the recirculation pump seals. This would be the maximum benefit associated with a procedure change that is intended to minimize the leakage.

Phase II SAMA Number 1 Model Changes

Gate and / or Basic Event ID and Description	Description of Change
Basic Event 2RXSE-LEAK---L--	Set failure of seals to 0.0

F.6.1.1 PSA Model Results for Phase II SAMA Number 1

The results from this case indicate a decrease from the base CDF of 1.89E-6/yr to 1.83E-6/yr (SAMA number 1). The decrease in CDF applies primarily to late station blackout scenarios (Class IBL). The radionuclide release frequencies are modified as shown in Table F-8. The results of the cost benefit analysis are shown below:

Phase II SAMA Number 1 Net Value

Base Case: Cost-Risk for Dresden	SAMA 1 Cost-Risk for Dresden	Averted Cost-Risk	Cost of Implementation	Net Value
$457,000	$448,682	$8,318	Not Required	**Not Cost Beneficial**

Implementation of this SAMA would include potential procedural modifications to the plant. In addition, engineering analysis would be required to assess the benefit of this proposed action. It is estimated that the total cost to implement such changes would be substantially higher than the averted cost-risk. This SAMA would not be cost beneficial for Dresden.

F.6.2 PHASE II SAMA NUMBER 2

Description: Provide alternate means to LPCI heat exchanger cooling.

This is a hardware change to provide an alternate means of cooling the LPCI heat exchangers. This could take the form of a separate diesel driven pump that provides secondary cooling to the LPCI heat exchangers.

The approach to assessing this SAMA is to assume complete reliability of the CCSW cooling function for the LPCI heat exchangers. This would be the maximum benefit associated with a change that provides alternate cooling to the LPCI torus cooling heat exchangers.

Phase II SAMA Number 2 Model Changes

Gate and / or Basic Event ID and Description	Description of Change
Gate SPC (Loss of suppression pool cooling)	Delete all CCSW cooling dependencies from model for torus cooling.

F.6.2.1 PSA Model Results for Phase II SAMA Number 2

The results from this case indicate a decrease from the base CDF of 1.89E-6/yr to 1.85E-6/yr (SAMA number 2). The decrease in CDF applies primarily to loss of DHR scenarios (Class II). The radionuclide release frequencies are modified as shown in Table F-9. The results of the cost benefit analysis are shown below:

Phase II SAMA Number 2 Net Value

Base Case: Cost-Risk for Dresden	SAMA 2 Cost-Risk for Dresden	Averted Cost-Risk	Cost of Implementation	Net Value
$457,000	$449,287	$7,713	Not Required	**Not Cost Beneficial**

Implementation of this SAMA would include extensive hardware modifications to the plant. It is estimated that the cost of such changes would be substantially higher than the averted cost-risk. This SAMA would not be cost beneficial for Dresden.

F.6.3 PHASE II SAMA NUMBER 3

Description: Develop an enhanced drywell spray system.

The Fire Protection system cannot currently provide adequate water to the LPCI system at Dresden (1); in addition, no procedures have been developed to use it as a containment spray source. This containment spray function could be further enhanced at Dresden.

The modeling approach for this SAMA is to assign complete success to the drywell spray effectiveness in Level 2 for all sequences except Class II, IV, and V.

This will require both hardware and procedure changes in addition to engineering analysis to support the use of fire water in this manner.

Note, no reduction in CDF is expected from this SAMA, however, there is a reduction in the Level 2 consequences.

Phase II SAMA Number 3 Model Changes

Gate and / or Basic Event ID and Description	Description of Change
Level 2 SI node	Change split fraction to 0.0(2)

F.6.3.1 PSA Model Results for Phase II SAMA Number 3

The results from this case indicate no reduction in CDF (base CDF = 1.89E-6/yr). The radionuclide release frequencies are modified as shown in Table F-10. The results of the cost benefit analysis are shown below:

Phase II SAMA Number 3 Net Value

Base Case: Cost-Risk for Dresden	SAMA 3 Cost-Risk for Dresden	Averted Cost-Risk	Cost of Implementation	Net Value
$457,000	$388,050	$68,950	~$265,000	**-196,050**

Implementation of this SAMA would involve procedural and hardware changes to the plant. In addition, engineering analysis would be required to justify the use of fire water in this capacity. The cost for implementing such a modification has been estimated to be at least $265,000, approximately $15,000 for the procedure change and $250,000 for the hardware and engineering analysis. The total cost would, therefore, be

(1) This is based on input provided from Dr. R.H. Johnson (Dresden Risk Management Engineer) and the LPCI System Engineer.
(2) For depressurized RPV conditions only.

significantly more than the averted cost-risk. This SAMA would not be cost beneficial for Dresden.

F.6.4 PHASE II SAMA NUMBER 4

Description: Provide procedural enhancement to re-open MSIVs.

This SAMA provides an enhanced procedure that allows the MSIVs to be reopened to re-establish the main condenser as the heat sink. This provides a containment heat removal path.

The modeling approach for this SAMA is to modify the condenser availability gate "COND-FAILS" to allow restoration of the condenser for MSIV closure initiators. The failure of the restoration is changed from the current 0.5 (unlikely) to the assessed HEP for cases with a procedure and training as assessed for Quad Cities of 3.7E-3. See the change below to the basic event "2CDAV-MSIV---C--".

Phase II SAMA Number 4 Model Changes

Gate and / or Basic Event ID and Description	Description of Change
2CDAV-MSIV---C--	Change from 0.5 to 3.7E-3

F.6.4.1 PSA Model Results for Phase II SAMA Number 4

The results from this case indicate no decrease from the base CDF of 1.89E-6/yr (SAMA number 4). The zero decrease in CDF occurs because of the low frequency of loss of DHR accident sequences. The radionuclide release frequencies are modified as shown in Table F-11. The results of the cost benefit analysis are shown below:

Phase II SAMA Number 4 Net Value

Base Case: Cost-Risk for Dresden	SAMA 4 Cost-Risk for Dresden	Averted Cost-Risk	Cost of Implementation	Net Value
$457,000	$457,000	$0.00	Not Required	**Not Cost Beneficial**

This SAMA has essentially no impact on the calculated CDF and would cost substantially more than the averted cost-risk value. Implementation of this SAMA, therefore, would not be cost beneficial for Dresden.

F.6.5 PHASE II SAMA NUMBER 5

Description: Enhance seismic ruggedness of plant components

This SAMA remains under investigation for resolution as part of the Dresden close out of the IPEEE commitments (GL 88-20).

No further quantification is performed.

F.6.6 PHASE II SAMA NUMBER 6

Description: Include passive containment vent system.

This SAMA is to provide a containment vent system for containment heat removal that does not require operator intervention for initiation.

The modeling of this SAMA creates a containment vent success path for non-ATWS sequences with no operator intervention or active components required. A rupture disk is used to provide the containment boundary.

This SAMA is modeled by providing an automatic relief for all non-ATWS sequences.

Phase II SAMA Number 6 Model Changes

Gate and / or Basic Event ID and Description	Description of Change
2CNPVDWRUPT--R--	Set failure prob. to 0.0

F.6.6.1 PSA Model Results for Phase II SAMA Number 6

The results from this case indicate a decrease from the base CDF of 1.89E-6/yr to 1.85E-6/yr (SAMA number 6). The decrease in CDF applies to loss of DHR scenarios (Class II). The radionuclide release frequencies are modified as shown in Table F-12. The results of the cost benefit analysis are shown below:

Phase II SAMA Number 6 Net Value

Base Case: Cost-Risk for Dresden	SAMA 6 Cost-Risk for Dresden	Averted Cost-Risk	Cost of Implementation	Net Value
$457,000	$450,631	$6,369	Not Required	**Not Cost Beneficial**

This SAMA would involve extensive hardware changes to the plant in addition to engineering analysis to support the modification. The total implementation cost would be substantially more than the averted cost-risk. Implementation of this SAMA, therefore, would not be cost beneficial for Dresden.

F.6.7 PHASE II SAMA NUMBER 7

Description: Diversify the explosive valve operation.

An alternate means of opening a pathway to the RPV for SBLC injection would improve the success probability for reactor shutdown.

This SAMA is modeled by assuming that the random and common cause failure of the SLC explosive valves goes to zero by providing a perfectly redundant flow path.

Phase II SAMA Number 7 Model Changes

Gate and / or Basic Event ID and Description	Description of Change
2SLEV2-1106ABDCC (CCF of SLC injection valve)	Set Failure mode to zero.
2SLEV2-1106A-D-- (Failure of SLC A injection valve)	Set Failure mode to zero.
2SLEV2-1106B-D-- (Failure of SLC B injection valve)	Set Failure mode to zero.

F.6.7.1 PSA Model Results for Phase II SAMA Number 7

The results from this case indicate a decrease from the base CDF of 1.89E-6/yr to 1.85E-6/yr (SAMA number 7). The decrease in CDF applies to ATWS scenarios (Class IV). The radionuclide release frequencies are modified as shown in Table F-13. The results of the cost benefit analysis are shown below:

Phase II SAMA Number 7 Net Value

Base Case: Cost-Risk for Dresden	SAMA 7 Cost-Risk for Dresden	Averted Cost-Risk	Cost of Implementation	Net Value
$457,000	$432,485	$24,515	Not Required	**Not Cost Beneficial**

This SAMA would involve hardware changes to the plant and would cost substantially more than the averted cost-risk value. Implementation of this SAMA, therefore, would not be cost beneficial for Dresden.

F.6.8 PHASE II SAMA NUMBER 8

Description: Enrich Boron.

The increased boron concentration will reduce the time required to achieve the shutdown concentration. This will provide increased margin in the accident timeline for successful operator activation of SBLC.

The modeling approach used in this evaluation is to reduce the HEPs for boron initiation and RPV water level control by 50% to reflect the approximate improvement in operator success when the allowed time for action is increased due to the enriched boron.

Phase II SAMA Number 8 Model Changes

Gate and / or Basic Event ID and Description	Description of Change
2RXOP-LVLCTRLH-- (Oper. Fails to control level low early)	Change HEP from 4.4E-2 to 2.4E-02
2RXOP-LATELVLH-- (Oper. Fails to control level low late)	(Conditional HEP - no change)
2SLOP-IN-ERLYH-- (Oper. Fails to inject SLC early)	Change HEP from 4.8E-2 to 2.4E-02
2SLOP-IN-LATEH-- (Oper. Fails to inject SLC late)	(Conditional HEP - no change)

F.6.8.1 PSA Model Results for Phase II SAMA Number 8

The results from this case indicate a slight decrease from the base CDF of 1.89E-6/yr (SAMA number 8). The radionuclide release frequencies are shown in Table F-14. The results of the cost benefit analysis are shown below:

Phase II SAMA Number 8 Net Value

Base Case: Cost-Risk for Dresden	SAMA 8 Cost-Risk for Dresden	Averted Cost-Risk	Cost of Implementation	Net Value
$457,000	$455,561	$1,439	Not Required	**Not Cost Beneficial**

This SAMA has essentially no impact on the calculated CDF and would cost substantially more than the averted cost-risk value. Implementation of this SAMA, therefore, would not be cost beneficial for Dresden.

F.6.9 PHASE II SAMA NUMBER 9

Description: Bypass the low RPV pressure permissive on ECCS injection valves.

This SAMA is to allow operator intervention to bypass the low RPV pressure permissive signal that inhibits the opening of the ECCS injection valves when RPV pressure is too high. This operator intervention could be performed by a bypass switch and associated circuitry. It would be implemented when the crew recognizes by confirmed signals that: (1) RPV pressure is low; (2) RPV injection is needed; but, (3) the ECCS injection valves have been inhibited from opening due to sensor or logic failures in the low pressure permissive logic.

This SAMA is conservatively modeled by setting the logic, sensor, and miscalibration failure modes to zero in the sensitivity model. This maximizes the potential benefit of the SAMA.

Phase II SAMA Number 9 Model Changes

Gate and / or Basic Event ID and Description	Description of Change
2CAHU-52-A-B2HCC	PREINIT: MISCALIBRATE CAS PRESSURE SWITCHES 52A AND 52B DUE TO CC; CHANGE FROM 8E-5 TO 0.0
2CAHU263-052AH--	PREINIT: CAS PRESSURE SWITCH 52A MISCALIBRATED; CHANGE FROM 2E-3 TO 0.0
2CAHU263-052BH--	PREINIT: CAS PRESSURE SWITCH 52B MISCALIBRATED; CHANGE FROM 2E-3 TO 0.0
2CAPS-52-A-B2FCC	CAS PRESSURE SWITCHES 52A AND 52B FAIL TO FUNCTION DUE TO CC; CHANGE FROM 1.18E-5 TO 0.0
2CAPS263-052AF--	CAS PRESSURE SWITCH 263-52A FAILS TO FUNCTION; CHANGE FROM 2.5E-4 TO 0.0
2CAPS263-052BF--	CAS PRESSURE SWITCH 263-52B FAILS TO FUNCTION; CHANGE FROM 2.5E-4 TO 0.0

F.6.9.1 PSA Model Results for Phase II SAMA Number 9

The results from this case indicate a decrease from the base CDF of 1.89E-6/yr to 1.86E-6/yr (SAMA number 9). The decrease in CDF applies to loss of injection for Class IIIC and Class ID. The radionuclide release frequencies are modified as shown in Table F-15. The results of the cost benefit analysis are shown below:

Phase II SAMA Number 9 Net Value

Base Case: Cost-Risk for Dresden	SAMA 9 Cost-Risk for Dresden	Averted Cost-Risk	Cost of Implementation	Net Value
$457,000	$432,391	$24,609	Not Required	**Not Cost Beneficial**

This SAMA would involve both procedure and hardware changes to the plant that would substantially exceed the averted cost-risk value. Implementation of this SAMA, therefore, would not be cost beneficial for Dresden.

F.6.10 PHASE II SAMA NUMBER 10

Description: Provide supplemental air supply to the containment hard pipe vent path AOVs.

The containment hard pipe vent paths have valves that require air to operate the valves. Instrument air is a non-safety system. The availability of supplemental air provides a viable method to open these valves under scenarios where instrument air may be unavailable.

This SAMA is conservatively modeled by setting the instrument air recovery basic event 2CVOP-REC-IA-H-- to 0.0. See table below on the basic event change used to perform this. This modeling maximizes the potential risk reduction for the proposed SAMA.

Phase II SAMA Number 10 Model Changes

Gate and / or Basic Event ID and Description	Description of Change
2CVOP-REC-IA-H--	Set failure mode to zero.

F.6.10.1 PSA Model Results for Phase II SAMA Number 10

The results from this case indicate a decrease from the base CDF of 1.89E-6/yr to 1.85E-6/yr (SAMA number 10). The decrease in CDF applies to ATWS scenarios (Class II). The radionuclide release frequencies are modified as shown in Table F-16. The results of the cost benefit analysis are shown below:

Phase II SAMA Number 10 Net Value

Base Case: Cost-Risk for Dresden	SAMA 10 Cost-Risk for Dresden	Averted Cost-Risk	Cost of Implementation	Net Value
$457,000	$450,974	$6,026	Not Required	**Not Cost Beneficial**

This SAMA would involve a hardware change to the plant and would cost substantially more than the averted cost-risk value. Implementation of this SAMA, therefore, would not be cost beneficial for Dresden.

F.6.11 PHASE II SAMA ANALYSIS SUMMARY

The SAMA candidates which could not be eliminated from consideration by the baseline screening process or other PSA insights required the performance of a detailed analysis of the averted cost-risk and SAMA implementation costs. SAMA candidates are potentially justified only if the averted cost-risk resulting from the modification is greater than the cost of implementing the SAMA. None of the SAMAs analyzed were found to be cost-beneficial as defined by the methodology used in this study. However, this evaluation should not necessarily be considered a definitive guide in determining the disposition of a plant modification that has been analyzed using other engineering methods. These results are intended to provide information about the relative estimated risk benefit associated with a plant change or modification compared with its cost of implementation and should be used as an aid in the decision making process. The results of the detailed analysis are shown below:

Summary of the Detailed SAMA Analyses

Phase II SAMA ID	Averted Cost- Risk	Cost of Implementation	Net Value	Cost Beneficial?
1	$8,318	Not Required	N/A	No
2	$7,713	Not Required	N/A	No
3	$68,950	Est. ~ $265,000	-$196,050	No
4	$0.00	Not Required	N/A	No
5	Not quantified			
6	$6,369	Not Required	N/A	No
7	$24,515	Not Required	N/A	No
8	$1,439	Not Required	N/A	No
9	$24,609	Not Required	N/A	No
10	$6,026	Not Required	N/A	No

F.7 UNCERTAINTY ANALYSIS

The following uncertainty was further investigated as to the impact on the overall SAMA evaluation:

- Assume a discount rate of 3 percent, instead of 7 percent used in the original base case analysis.

This was investigated by re-calculating the total averted cost-risk associated with eliminating all severe accident risk with an assumed discount rate of 3 percent. The revised analysis results in a total averted cost of $627,402 compared to the base case value of $457,000. This represents a 37 percent increase in the total averted cost. The Phase 1 SAMA list was reviewed to see if any of the items screened would be impacted by this uncertainty in the assumed discount rate. None were found. In addition, increasing the cost benefit of those items analyzed in Phase II by 37 percent would not impact the overall conclusions summarized in Section F.6.

F.8 CONCLUSIONS

The benefits of revising the operational strategies in place at Dresden and/or implementing hardware modifications can be evaluated without the insight from a risk-based analysis. Use of the PSA in conjunction with cost benefit analysis methodologies has, however, provided an enhanced understanding of the effects of the proposed changes relative to the cost of implementation and projected impact on a much larger future population. The results of this study indicate that none of the identified potential improvements were cost beneficial based on the methodology applied in this analysis.

F.9 TABLES AND FIGURES

TABLE F-1
PHASE I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
Improvements Related to RCP Seal LOCAs (Loss of CC or SW)							
1	Cap downstream piping of normally closed component cooling water drain and vent valves.	1	SAMA would reduce the frequency of a loss of component cooling event, a large portion of which was derived from catastrophic failure of one of the many single isolation valves.	#4 - No significant safety benefit.	The RBCCW system and the SW system vent and drain valves are not observed to be failure modes at Dresden Their failures are not included in the Dresden PSA The risk impact of vent and drain valve failures is estimated to be negligible at Dresden.	Reference 79	N/A
2	Enhance loss of component cooling procedure to facilitate stopping reactor coolant pumps.	2	SAMA would reduce the potential for reactor coolant pump (RCP) seal damage due to pump bearing failure	#3 - Already implemented at Dresden	The Dresden procedures specify the stopping of recirculation pumps on loss of adequate seal cooling, including high temperatures of the recirculation pumps seals Following the loss of RBCCW, trip of the recirculation pumps is required within one minute. Otherwise, damage may occur to the recirculation pump seals and bearings (DOA-3700-01, Rev 16) Operators are trained on this procedure. Therefore, Recirculation pump seal failure or excessive leakage is not expected for scrams that involve loss of RBCCW Therefore, seal leakage is not considered a risk significant failure mode. No additional training is required.	Reference 79	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
3	Enhance loss of component cooling procedure to present desirability of cooling down reactor coolant system (RCS) prior to seal LOCA	2	SAMA would reduce the potential for RCP seal failure.	#6 - Retain		Reference 79	1
4	Provide additional training on the loss of component cooling.	2	SAMA would potentially improve the success rate of operator actions after a loss of component cooling (to restore RCP seal damage)	#3 - Already implemented at Dresden	Following the loss of RBCCW, trip of the recirculation pumps is required within one minute Otherwise, damage may occur to the recirculation pump seals and bearings (DOA-3700-01, Rev. 16) Operators are trained on this procedure Therefore, recirculation pump seal failure or excessive leakage is not expected for scrams that involve loss of RBCCW Therefore, seal leakage is not considered a risk significant failure mode. No additional training is required	Reference 79	N/A
5	Provide hardware connections to allow another essential raw cooling water system to cool charging pump seals	1 2	SAMA would reduce effect of loss of component cooling by providing a means to maintain the centrifugal charging pump seal injection after a loss of component cooling.	#1 - Not applicable to the Dresden Design	BWRs do not have charging pumps and the potential equivalents, the CRD pumps, are not risk significant components	Reference 46	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
6	Procedure changes to allow cross connection of motor cooling for RHRSW pumps.	12	SAMA would allow continued operation of both RHRSW pumps on a failure of one train of PSW.	#1 - Not applicable to the Dresden Design	The Vault Coolers are designed to maintain CCSW Pump Vault temperatures less than 105°F during CCSW Pump operation to prevent overheating of the pump motor. 55 gpm from the B and C CCSW Pump discharge are supplied to the cooler and returned to the CCSW Pump suction. The coolers are located in the vault. If there is a water supply to the pumps, then the cooling supply for the pump-motor sets is also available. The A&D pumps are not located in vaults.	Reference 26	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number

7	Proceduralize shedding component cooling water loads to extend component cooling heatup on loss of essential raw cooling water.	2	SAMA would increase time before the loss of component cooling (and reactor coolant pump seal failure) in the loss of essential raw cooling water sequences.	#4 - No significant safety benefit.	PWR RCP seal leakage issue. The competing risks associated with shedding other RBCCW loads is not considered justified. Therefore, this SAMA is not pursued.
					
					Dresden has the following features that reduce the impact of loss of Recirculation Pump seal cooling:
					
					- Minimal Seal leakage might occur if both the cooling from RBCCW and the purge flow from CRD become unavailable. This is postulated for SBO events or loss of SW events
					- a new improved Recirculation pump seal with significantly reduced potential for leakage (12 5 gpm/pump versus some PWR estimates of 480gpm/pump)
					- multiple high pressure injection systems that provide RPV makeup capability to assure adequate RPV inventory. These include:
					  - HPCI (turbine driven system)
					  - CRD (Unit 2 and Unit 3)
					  - SBLC from test tank or SBLC tank
					  - Feedwater
					- HPCI and SBLC are independent of SW and RBCCW failure
					- FW and CRD are independent of RBCCW failure
					
					Because of the availability of multiple high pressure injection systems, the small Recirculation Pump seal leakage is not a significant contributor to the risk profile.
						Reference 79	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
8	Increase charging pump lube oil capacity.	2	SAMA would lengthen the time before centrifugal charging pump failure due to lube oil overheating in loss of CC sequences	#1 - Not applicable to the Dresden Design	BWRs do not have charging pumps and the potential equivalents, the CRD pumps, are not risk significant components.	Reference 46	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number

9	Eliminate the RCP thermal barrier dependence on component cooling such that loss of component cooling does not result directly in core damage.	2	SAMA would prevent the loss of recirculation pump seal integrity after a loss of component cooling. Watts Bar Nuclear Plant IPE said that they could do this with essential raw cooling water connection to RCP seals.	#3 - Already implemented at Dresden	PWR RCP seal leakage issue.
					
					Dresden has the following features that reduce the impact of loss of Recirculation Pump seal cooling:
					- Minimal Seal leakage might occur if both the cooling from RBCCW and the purge flow from CRD become unavailable. This is postulated for SBO events or loss of SW events
					- a new improved Recirculation pump seal with significantly reduced potential for leakage (12.5 gpm/pump versus some PWR estimates of 480gpm/pump)
					- multiple high pressure injection systems that provide RPV makeup capability to assure adequate RPV inventory. These include:
					  - HPCI (turbine driven system)
					  - CRD (Unit 2 and Unit 3)
					  - SBLC from test tank or SBLC tank
					  - Feedwater
					- HPCI and SBLC are independent of SW and RBCCW failure
					- FW and CRD are independent of RBCCW failure
					
					Because of the availability of multiple high pressure injection systems, the small Recirculation Pump seal leakage is not a significant contributor to the risk profile
						Reference 79	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
10	Add redundant DC control power for PSW pumps C & D.	3	SAMA would increase reliability of PSW and decrease core damage frequency due to a loss of SW.	#3 - Already implemented at Dresden	The equivalent system at Dresden is SW. The 2/3 SW pump is that it has two alternate 4 kV AC power supplies Bus 24 and Bus 34. The other four SW pump each have only one AC power supply. The 2/3 SW pump has a normal and reserve DC control power supply to the breakers that power the 2/3 SW pump	References 28 and 49	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number

11	Create an independent RCP seal injection system, with a dedicated diesel.	1	SAMA would add redundancy to RCP seal cooling alternatives, reducing CDF from loss of component cooling or service water or from a station blackout event.	#5 - Cost would be more than risk benefit	Dresden has the following features that reduce the impact of loss of Recirculation Pump seal cooling:
					- Minimal Seal leakage might occur if both the cooling from RBCCW and the purge flow from CRD become unavailable. This is postulated for SBO events or loss of SW events
					- a new improved Recirculation pump seal with significantly reduced potential for leakage (12 5 gpm/pump versus some PWR estimates of 480gpm/pump)
					- multiple high pressure injection systems that provide RPV makeup capability to assure adequate RPV inventory. These include:
					  - HPCI (turbine driven system)
					  - CRD (Unit 2 and Unit 3)
					  - SBLC from test tank or SBLC tank
					  - Feedwater
					- HPCI and SBLC are independent of SW and RBCCW failure
					- FW and CRD are independent of RBCCW failure
					
					Because of the availability of multiple high pressure injection systems, the small Recirculation Pump seal leakage is not a significant contributor to the risk profile
						Reference 79	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number

12	Use existing hydro-test pump for RCP seal injection	4	SAMA would provide an independent seal injection source, without the cost of a new system	#5 - Cost would be more than risk benefit	Dresden has the following features that reduce the impact of loss of Recirculation Pump seal cooling:
					- Minimal Seal leakage might occur if both the cooling from RBCCW and the purge flow from CRD become unavailable This is postulated for SBO events or loss of SW events
					- a new improved Recirculation pump seal with significantly reduced potential for leakage (12 5 gpm/pump versus some PWR estimates of 480gpm/pump)
					- multiple high pressure injection systems that provide RPV makeup capability to assure adequate RPV inventory These include
					  - HPCI (turbine driven system)
					  - CRD (Unit 2 and Unit 3)
					  - SBLC from test tank or SBLC tank
					  - Feedwater
					- HPCI and SBLC are independent of SW and RBCCW failure
					- FW and CRD are independent of RBCCW failure
					
					Because of the availability of multiple high pressure injection systems, the small Recirculation Pump seal leakage is not a contributor to the risk profile.
						Reference 79	N/A

13	Replace ECCS pump motor with air-cooled motors	1	SAMA would eliminate ECCS dependency on component cooling system (but not on room cooling).	#1 - Not applicable to the Dresden Design	Dresden ECCS motors are not dependent on component cooling for operation. Dresden's ECCS (LPCI and CS) Pump motors are cooled by their own discharge water, which is re-routed back to the pump suction	References 29 and 30	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
14	Install improved RCS pumps seals.	1	SAMA would reduce probability of RCP seal LOCA by installing RCP seal O-ring constructed of improved materials	#3 - Already implemented at Dresden	Improved Recirc Pump seals have been installed.	Reference 79	N/A
15	Install additional component cooling water pump.	1	SAMA would reduce probability of loss of component cooling leading to RCP seal LOCA.	#3 - Already implemented at Dresden	Each Dresden unit has two dedicated RBCCW pumps. There is also a shared 2/3 RBCCW pump that can provide cooling to either unit via a cross-tie See ID 20.	Reference 79	N/A
16	Prevent centrifugal charging pump flow diversion from the relief valves	1	SAMA modification would reduce the frequency of the loss of RCP seal cooling if relief valve opening causes a flow diversion large enough to prevent RCP seal injection.	#1 - Not applicable to the Dresden Design	Loss of CRD injection flow to the Recirculation Pump seals is not considered to cause seal failure during a scram challenge and therefore the SAMA is not applicable to Dresden	Reference 79	N/A
17	Change procedures to isolate RCP seal letdown flow on loss of component cooling, and guidance on loss of injection during seal LOCA	1	SAMA would reduce CDF from loss of seal cooling	#1 - Not applicable to the Dresden Design	PWR RCP seal leakage issue Seal leakage rate is very low The DEOPs specify operating crew action to make-up to the RPV given a Recirculation pump seal LOCA (I.e., RPV water level dropping).	Reference 79	N/A
18	Implement procedures to stagger high-pressure safety injection (HPSI) pump use after a loss of service water.	1	SAMA would allow HPSI to be extended after a loss of service water.	#1 - Not applicable to the Dresden Design	This SAMA is intended for plants with multiple high pressure injection pumps For a multi-pump plant, operation could be divided between the pumps to prevent overheating At Dresden, intermittent HPCI operation in combination with the Isolation Condenser and would be used to provide level control, as needed, if CRD was not available. No application has been identified for this SAMA at Dresden	Reference 31	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
19	Use fire protection system pumps as a backup seal injection and high-pressure makeup.	1	SAMA would reduce the frequency of the RCP seal LOCA and the SBO CDF.	#5 - Cost would be more than risk benefit	Fire protection is a low head system at Dresden and cannot currently be used as a HP injection source. The ability to provide high pressure injection during an SBO may be beneficial, but the cost of the required modifications would be high. Installation of new high pressure piping, a high head, high flow pump (as it would also have to support the fire system) and a supporting diesel generator or pump motor is similar in scope to SAMA 185 The cost is also considered to be similar ($5 million to $10 million) and is greater than the maximum averted cost-risk for Dresden See also SAMA 178	Reference 19	N/A
20	Enhance procedural guidance for use of cross-tied component cooling or service water pumps	1	SAMA would reduce the frequency of the loss of component cooling water and service water.	#3 - Already implemented at Dresden	At Dresden, Service Water is completely cross-tied (between units and divisions). Inter-unit RBCCW and TBCCW cross-ties are available via manual valves which are normally closed, the different divisions for a given unit already discharge to a common header. The CCSW system does not have cross-ties Procedural guidance for use of the cross ties is available.	References 26, 27, 32, and 33	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
21	Procedure enhancements and operator training in support system failure sequences, with emphasis on anticipating problems and coping.	1 2	SAMA would potentially improve the success rate of operator actions subsequent to support system failures	#2 - Similar item is addressed under other proposed SAMAs.	See SAMAs 20, 27, 30, 91, 95, 96, 98, 104	N/A	N/A
22	Improved ability to cool the residual heat removal heat exchangers	1	SAMA would reduce the probability of a loss of decay heat removal by implementing procedure and hardware modifications to allow manual alignment of the fire protection system or by installing a component cooling water cross-tie A portable diesel-driven pump is under consideration to provide cooling water to a LPCI heat exchanger. This was discussed in the EPU correspondence as the tentative plan for dealing with the seismic outlier of Dresden Island Lock & Dam, i e., loss of UHS, by Fall 2003.	#6 - Retain	Dresden has redundant methods of decay heat removal including: - LPCI in torus cooling - SDC (separate system) - Venting - Main Condenser LPCI in torus cooling is cooled by the CCSW from the intake Dresden's Shutdown Cooling system has heat exchangers that are cooled by RBCCW and SW from the intake. Plant capability and procedures are available to allow cross-tie to the opposite unit's RBCCW system. The portable diesel-driven pump is considered to deal with large reduction in intake level	Reference 27	2
23	8.a. Additional Service Water Pump	17	SAMA would conceivably reduce common cause dependencies from SW system and thus reduce plant risk through system reliability improvement	#5 - Cost would be more than risk benefit	The cost of implementing this SAMA has been estimated at approximately $5 9 million and is greater than the maximum averted cost-risk for Dresden.	Reference 17	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
24	Create an independent RCP seal injection system, without dedicated diesel	1 19	This SAMA would add redundancy to RCP seal cooling alternatives, reducing the CDF from loss of CC or SW, but not SBO.	#4 - No significant safety benefit	The recirculation pump seal leakage at Dresden could compromise the long term success of the Isolation Condenser. An independent safety related seal cooling system could reduce this impact; however, the risk impact of the recirculation seal leak is already very low.	References 1 and 19	N/A
Improvements Related to Heating, Ventilation, and Air Conditioning							
25	Provide reliable power to control building fans.	2	SAMA would increase availability of control room ventilation on a loss of power.	#4 - No significant safety benefit.	Control Room HVAC is powered by Non-ESS buses that can be powered by EDGs given a LOOP. Control Room HVAC is not required for successful accident mitigation	References 28 and 38	N/A
26	Provide a redundant train of ventilation.	1	SAMA would increase the availability of components dependent on room cooling	#5 - Cost would be more than risk benefit	The cost of installing a redundant, diverse train of HVAC for a Switchgear Room has been estimated at $10 million (Reference 19). This estimate far exceeds the maximum averted cost-risk for Dresden. Assuming the cost to install a redundant train of HVAC in other areas is approximately equivalent to this estimate, providing a redundant train of HVAC would not be cost beneficial for any system and is screened from further analysis.	Reference 19	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
27	Procedures for actions on loss of HVAC.	12	SAMA would provide for improved credit to be taken for loss of HVAC sequences (improved affected electrical equipment reliability upon a loss of control building HVAC).	#3 - Already implemented at Dresden	Actions on Loss of HVAC are detailed in procedure DOA 5750-01. This procedure includes restart of normal ventilation after a trip, initiation of backup trains, and directions to implement alternate room cooling methods such as opening doors to allow natural circulation.	Reference 39	N/A
28	Add a diesel building switchgear room high temperature alarm.	1	SAMA would improve diagnosis of a loss of switchgear room HVAC. Option 1: Install high temp alarm. Option 2: Redundant louver and thermostat	#3 - Already implemented at Dresden	The Unit, Swing, and SBO DG rooms are already equipped with control room alarms for high temperatures.	References 40 and 41	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
29	Create ability to switch fan power supply to DC in an SBO event.	1	SAMA would allow continued operation in an SBO event. This SAMA was created for reactor core isolation cooling system room at Fitzpatrick Nuclear Power Plant.	#4 - No significant safety benefit.	The systems that require room cooling and have the capability of operating during an SBO include only HPCI (no IC room cooling dependency) During a postulated SBO, HPCI can operate for the duration of the event which is limited by DC battery life. Use of a DC powered fan would increase the drain on the batteries with no impact on the reliability of the HPCI systems as long as there is no gland seal failure For the low probability event of gland seal failure the crew is directed to bypass high temperature room trips This would avoid the trip of HPCI. Component failures of these systems could also occur, but this is judged to represent a negligible risk impact. As such there is no measurable safety benefit associated with this SAMA.	Reference 52	N/A
30	Enhance procedure to instruct operators to trip unneeded RHR/CS pumps on loss of room ventilation	12	SAMA increases availability of required RHR/CS pumps Reduction in room heat load allows continued operation of required RHR/CS pumps, when room cooling is lost.	#3 - Already implemented at Dresden	LPCI/CS pumps at Dresden do not require room cooling. However, from the DEOPs and training it is clear that LPCI and CS pumps are not to run on minimum flow for extended times. These pumps will be terminated if not required for satisfying a critical safety function	Reference 52	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
31	Stage backup fans in switchgear (SWGR) rooms	19	This SAMA would provide alternate ventilation in the event of a loss of SWGR Room ventilation	#1 - Not applicable to the Dresden Design	At some plants, loss of cooling to electrical switchgear rooms is a concern However, the major switchgear at Dresden is not located in separate rooms. The large AC and DC switchgear at Dresden are located in open areas of the ground, second and third floors of the turbine and reactor building. Loss of ventilation in the open areas of the turbine building during warm times of the year is easily mitigated by opening outer doors of the building, especially the large trackway doors	Reference 46	N/A
Improvements Related to Ex-Vessel Accident Mitigation/Containment Phenomena							
32	Delay containment spray actuation after large LOCA	2	SAMA would lengthen time of RWST availability.	#1 - Not applicable to the Dresden Design	This PWR enhancement applies to plants with automatic containment spray which takes suction on the same outside water source used by ECCS. At Dresden, the LPCI containment spray mode is initiated manually and takes suction from the suppression pool. The CCST volume is therefore not affected by containment spray.	Reference 30	N/A
33	Install containment spray pump header automatic throttle valves.	4 8	SAMA would extend the time over which water remains in the RWST, when full CS flow is not needed	#2 - Similar item is addressed under other proposed SAMAs	See SAMA 32	N/A	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
34	Install an independent method of suppression pool cooling	5 6	SAMA would decrease the probability of loss of containment heat removal. For PWRs, a potential similar enhancement would be to install an independent cooling system for sump water	#5 - Cost would be more than risk benefit	Installation of a new, independent, suppression pool cooling system is similar in scope to installing a new containment spray system, which has been estimated to cost approximately $5 8 million This exceeds the maximum averted cost-risk for Dresden.	Reference 19	N/A
35	Develop an enhanced drywell spray system.	5 6 36 64	SAMA would provide a redundant source of water to the containment to control containment pressure, when used in conjunction with containment heat removal.	#6 - Retain	A potential enhancement would be to proceduralize the crosstie between the containment spray path of one unit to the LPCI system of the opposite unit Another alternative is the addition of a connection between containment spray and the plant's fire protection system (See DEOP 0500-03)	N/A	3
36	Provide dedicated existing drywell spray system.	5 6	SAMA would provide a source of water to the containment to control containment pressure, when used in conjunction with containment heat removal. This would use an existing spray loop instead of developing a new spray system.	#5 - Cost would be more than risk benefit	Installation of a new, independent, containment spray system, has been estimated to cost approximately $5 8 million. This exceeds the maximum averted cost-risk for Dresden	Reference 19	N/A
37	Install an unfiltered hardened containment vent.	5 6	SAMA would provide an alternate decay heat removal method for non-ATWS events, with the released fission products not being scrubbed.	#3 - Already implemented at Dresden	Dresden already has a hard pipe vent from the Torus and Drywell.	References 42 and 76	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
38	Install a filtered containment vent to remove decay heat.	5 6	SAMA would provide an alternate decay heat removal method for non-ATWS events, with the released fission products being scrubbed. Option 1: Gravel Bed Filter Option 2: Multiple Venturi Scrubber	#5 - Cost would be more than risk benefit	Potential to improve both the Level 1 and Level 2 results. Cost expected to exceed the maximum averted cost-risk for Dresden	N/A	N/A
39	Install a containment vent large enough to remove ATWS decay heat	5 6	Assuming that injection is available, this SAMA would provide alternate decay heat removal in an ATWS event.	#5 - Cost would be more than risk benefit	Dresden does not have a hard pipe vent of sufficient capacity to mitigate ATWS pressurization unless other mitigation steps are successful. Cost expected to exceed the maximum averted cost-risk for Dresden	N/A	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
40	Create/enhance hydrogen recombiners with independent power supply.	5 11	SAMA would reduce hydrogen detonation at lower cost, Use either 1) a new independent power supply 2) a non-safety-grade portable generator 3) existing station batteries 4) existing AC/DC independent power supplies	#4 - No significant safety benefit.	The Dresden primary containment is inert. The Nitrogen Make-up system maintains an inerted atmosphere within containment during normal operation. In accident conditions, it provides a feed and bleed function which purges the containment atmosphere of accumulated gases (including oxygen and hydrogen, etc) and replaces them with nitrogen Nitrogen Containment Atmospheric Dilution (NCAD) modification has been installed on both units This system provides a reliable source of Nitrogen for combustible gas control following an accident It would be used should the normal make-up flow path not be available during post-accident conditions. The design flow rate is 29 scfm through each line at 31 psig. Hydrogen recombiners are precluded from operating in conditions with high hydrogen, i e , severe accidents Negligible impact on risk results from adding hydrogen recombiners.	References 42 and 72	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
41	Install hydrogen recombiners.	11	SAMA would provide a means to reduce the chance of hydrogen detonation.	#4 - No significant safety benefit.	The Dresden primary containment is inert. The Nitrogen Make-up system maintains an inerted atmosphere within containment during normal operation. In accident conditions, it provides a feed and bleed function which purges the containment atmosphere of accumulated combustible gases (including oxygen and hydrogen, etc) and replaces them with nitrogen. Nitrogen Containment Atmospheric Dilution (NCAD) this modification has been installed on both units. This system provides a reliable source of Nitrogen for combustible gas control following an accident It would be used should the normal make-up flow path not be available during post-accident conditions. The design flow rate is 29 scfm through each line at 31 psig. The NCAD system is designed to control the O2 and H2 concentrations by venting and purging with nitrogen. In addition, hydrogen recombiners are precluded from operating in conditions with high hydrogen, i.e , severe accidents. In addition, because of their small processing capacity are ineffective in treating the dominant contributors to severe accident risk. Hydrogen recombiners are precluded from operating in conditions with high hydrogen, i e , severe accidents. Negligible impact on risk results from adding hydrogen recombiners	References 42 and 72	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
42	Create a passive design hydrogen ignition system.	4	SAMA would reduce hydrogen denotation system without requiring electric power.	#1 - Not applicable to the Dresden Design	The Dresden primary containment is inert The Nitrogen Make-up system maintains an inerted atmosphere within containment during normal operation. In accident conditions, it provides a feed and bleed function which purges the containment atmosphere of accumulated combustible gases (including oxygen and hydrogen, etc.) and replaces them with nitrogen. Nitrogen Containment Atmospheric Dilution (NCAD) this modification has been installed on both units This system provides a reliable source of Nitrogen for combustible gas control following an accident. It would be used should the normal make-up flow path not be available during post-accident conditions. The design flow rate is 29 scfm through each line at 31 psig Ignition or burning of hydrogen in a Mark I containment (i e , for deinerted conditions) results in rapid overpressurization of the Mark I containment. Igniters are useful for larger containments, such as the Mark III.	References 42 and 72	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
43	Create a large concrete crucible with heat removal potential under the basemat to contain molten core debris	5 6	SAMA would ensure that molten core debris escaping from the vessel would be contained within the crucible. The water cooling mechanism would cool the molten core, preventing a melt-through of the basemat	#5 - Cost would be more than risk benefit	Core retention devices have been investigated in previous studies. IDCOR concluded that "core retention devices are not effective risk reduction devices for degraded core events". Other evaluations have shown the worth value for a core retention device to be on the order of $7000 (averted cost-risk) compared to an estimated implementation cost of over $1 million (per unit)	References 24 and 25	N/A
44	Create a water-cooled rubble bed on the pedestal.	5 6	SAMA would contain molten core debris dropping on to the pedestal and would allow the debris to be cooled	#5 - Cost would be more than risk benefit	Core retention devices have been investigated in previous studies IDCOR concluded that "core retention devices are not effective risk reduction devices for degraded core events". Other evaluations have shown the worth value for a core retention device to be on the order of $7000 (averted cost-risk) compared to an estimated implementation cost of over $1 million (per unit)	References 24 and 25	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
45	Provide modification for flooding the drywell head.	5 6	SAMA would help mitigate accidents that result in the leakage through the drywell head seal.	#4 - No significant safety benefit.	BWR Mark I risk is typically dominated by events that result in early failure of the drywell shell due to direct contact with core debris and events that bypass the containment This is also true at Dresden. The head flooding system would, therefore, not be expected to have any significant impact on the overall risk The potential for competing risks due to Reactor Building flooding is considered to eliminate any positive safety benefit	Reference 48	N/A
46	Enhance fire protection system and/or standby gas treatment system hardware and procedures	6	SAMA would improve fission product scrubbing in severe accidents.	#4 - No significant safety benefit.	Current Standby Gas Treatment Systems do not have sufficient capacity to handle the loads from severe accidents that result in a bypass or breach of the containment. Loads produced as a result of RPV or containment blowdown would require large filtering capacities. These filtered vented systems have been previously investigated and found not to provide sufficient cost benefit Dresden has limited fire protection sprinkler systems in the Reactor Building. Use of these for fission product scrubbing in the R.B. could create competing risks associated with spray failures and flooding of equipment with very limited potential benefit.	References 25 and 43	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
47	Create a reactor cavity flooding system.	1 3 7 8	SAMA would enhance debris coolability, reduce core concrete interaction, and provide fission product scrubbing.	#3 - Already installed.	The Dresden SAMGs specify the desire to flood the drywell floor (and therefore the reactor cavity) under severe accident conditions This is accomplished by the drywell sprays. In addition, flooding of the Dresden containment is proceduralized in the Severe Accident Management Guidelines This is approximately equivalent to flooding the reactor cavity for a PWR.	Reference 73	N/A
48	Create other options for reactor cavity flooding.	1	SAMA would enhance debris coolability, reduce core concrete interaction, and provide fission product scrubbing.	#2 - Similar item is addressed under other proposed SAMAs	See SAMA #35, 36. This is approximately equivalent to flooding the reactor cavity for a PWR.	Reference 73	N/A
49	Enhance air return fans (ice condenser plants).	1	SAMA would provide an independent power supply for the air return fans, reducing containment failure in SBO sequences.	#1 - Not applicable to the Dresden Design	Dresden is not an ice-condenser plant	Reference 46	N/A
50	Create a core melt source reduction system.	9	SAMA would provide cooling and containment of molten core debris. Refractory material would be placed underneath the reactor vessel such that a molten core falling on the material would melt and combine with the material. Subsequent spreading and heat removal form the vitrified compound would be facilitated, and concrete attack would not occur	#5 - Cost would be more than risk benefit	Core retention devices have been investigated in previous studies. IDCOR concluded that "core retention devices are not effective risk reduction devices for degraded core events". Other evaluations have shown the worth value for a core retention device to be on the order of $7000 compared to an estimated implementation cost of over $1 million	Reference 47	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
51	Provide a containment inerting capability.	7 8	SAMA would prevent combustion of hydrogen and carbon monoxide gases.	#3 - Already installed.	Containment is inerted with nitrogen during normal operation. NCAD system also available.	References 42 and 48	N/A
52	Use the fire protection system as a backup source for the containment spray system.	4	SAMA would provide redundant containment spray function without the cost of installing a new system.	#2 - Similar item is addressed under other proposed SAMAs.	See SAMA 35, 36.	N/A	N/A
53	Install a secondary containment filter vent.	10	SAMA would filter fission products released from primary containment	#5 - Cost would be more than risk benefit	Secondary containment at Dresden makes extensive use of blow out panels to protect the structural integrity of the building in the event of internal pressure challenges such as steamline breaks in the reactor building or external pressure challenges such as tornadoes. Major structural redesign of the reactor building would be required to make the reactor building capable of retaining and processing a primary containment failure.	Reference 72	N/A
54	Install a passive containment spray system	10	SAMA would provide redundant containment spray method without high cost.	#5 - Cost would be more than risk benefit	A passive system is another alternative enhancement for the Containment Spray function. See SAMA 35. Cost expected to exceed the maximum averted cost-risk for Dresden.		N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
55	Strengthen primary/secondary containment.	10 11	SAMA would reduce the probability of containment overpressurization to failure	#5 - Cost would be more than risk benefit	BWR Mark I risk is typically dominated by events that result in early failure of the drywell shell due to direct contact with core debris and events that bypass the containment. Strengthening the primary /secondary containment would have a small impact on the overall risk of these accidents. Reference 17 discusses the cost of increasing the containment pressure and temperature capacity, which is effectively strengthening the containment. This cost is estimated assuming the change is made during the design phase whereas for Dresden, the changes would have to be made as a retrofit. The cost estimated for the ABWR was $12 million and it is judged that retrofitting an existing containment would cost more. The cost of implementation for this SAMA exceeds the maximum averted cost-risk for Dresden	References 17, 50, and 51	N/A
56	Increase the depth of the concrete basemat or use an alternative concrete material to ensure melt-through does not occur.	11	SAMA would prevent basemat melt-through.	#5 - Cost would be more than risk benefit	Core retention devices have been investigated in previous studies. IDCOR concluded that "core retention devices are not effective risk reduction devices for degraded core events". Other evaluations have shown the worth value for a core retention device to be on the order of $7000 compared to an estimated implementation cost of over $1 million/site.	References 8, 24, and 25	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
57	Provide a reactor vessel exterior cooling system	11	SAMA would provide the potential to cool a molten core before it causes vessel failure, if the lower head could be submerged in water.	#5 - Cost would be more than risk benefit	This has been estimated to cost $2.5 million and exceeds the maximum averted cost-risk for Dresden ORNL [35] has performed thermal hydraulic calculations on BWR external cooling methods and determined that the current BWR RPV support skirt design makes it impractical to cool the RPV by external cooling to prevent RPV breach Therefore, the modification would require RPV support skirt modification and reanalysis to allow the external cooling to be effective	Reference 19 and 35	N/A
58	Construct a building to be connected to primary/secondary containment that is maintained at a vacuum.	11	SAMA would provide a method to depressurize containment and reduce fission product release.	#5 - Cost would be more than risk benefit	Based on engineering judgement, the cost of this enhancement is expected to greatly exceed the maximum averted cost risk	Reference 34	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
59	Refill CST	16	SAMA would reduce the risk of core damage during events such as extended station blackouts or LOCAs which render the suppression pool unavailable as an injection source due to heat up.	#3 - Already installed.	For SBO conditions, the CST contains enough water to allow make-up injection from HPCI for a period longer than its estimated operability (based on battery life). The 1A, 2/3A and 2/3B CSTs have a combined nominal water volume (typical) of 410,000 gallons For LOCA initiators, the CST does not contain enough water to provide injection for the 24 hour mission time The CST makeup systems do not currently have the capacity to match the inventory loss for a LOCA. Feedwater has connections to unlimited water supplies (SBCS) not dependent on the CST CST connections to Core Spray and LPCI already exist. The ability to refill the CST from external water sources is considered both desirable and not difficult. The Technical Support Guidelines (TSGs) Appendix J provides the makeup sources available to Dresden to allow CST refill. The Isolation Condenser (IC) which is a separate mitigation system also has significant makeup capabilities independent of the CST The TSG Appendix K cites the systems that can make-up to the shell side of the IC This represents a significant benefit at Dresden over other plants without an IC		N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
60	Maintain ECCS suction on CST	16	SAMA would maintain suction on the CST as long as possible to avoid pump failure as a result of high suppression pool temperature	#3 - Already installed.	Swap to/from CST source is procedurally directed EOPs indicate when to use the CST and when it is OK to defeat high torus level transfer. HPCI is aligned to the CST and is directed to be maintained there as long as suction is available. This has been previously investigated by the BWROG EPC. SAMA not considered applicable to LPCI or CS.	Reference 52	N/A
61	Modify containment flooding procedure to restrict flooding to below TAF	14	SAMA would reduce impact of containment venting and may preclude RPV venting	#3 - Already implemented at Dresden	The BWROG EPG/SAG revision has substantially improved the containment flooding contingency to limit containment flooding and nearly eliminates RPV venting. These actions have resulted in substantial reductions in estimated radionuclide releases for severe accidents EGC has taken advantage of these generic developments by implementing the EPG/SAG Rev 2 in the Dresden procedures.	Reference 73	N/A
62	Enhance containment venting procedures with respect to timing, path selection and technique.	64	SAMA would improve likelihood of successful venting strategies.	#3 - Already installed.	Venting techniques are explicitly detailed in the EOPs. DOP 1600-15 provides adequate procedural guidance for post accident venting.	Reference 52 and 53	N/A
63	1 a. Severe Accident EPGs/AMGs	17	SAMA would lead to improved arrest of core melt progress and prevention of containment failure	#3 - Already implemented at Dresden	Dresden has implemented the latest EPG/SAGs accepted by the BWROG.	Reference 73	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
64	1.h. Simulator Training for Severe Accident	17	SAMA would lead to improved arrest of core melt progress and prevention of containment failure	#4 - No significant safety benefit	Simulators could be upgraded and used to provide operator training for severe accidents; however, these scenarios are rare and the instruction time would compete with time required to train operators on more likely scenarios that are severe accident precursors. The benefit of simulator training is difficult to quantify as the results would be based on the improved reliability of human actions in the mitigation of severe accidents Training can positively influence the values of HEPs, but the impact is small In addition, the TSC would be manned in a severe accident evolution and could provide additional support by personnel familiar with the SAMGs Previously assessed by the NRC as not required to support Accident management because of marginal cost benefit.	References 69, 71, and 75	N/A
65	2.g. Dedicated Suppression Pool Cooling	17	SAMA would decrease the probability of loss of containment heat removal.	#2 - Similar item is addressed under other proposed SAMAs	See SAMA 34	N/A	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
66	3.a. Larger Volume Containment	17	SAMA increases time before containment failure and increases time for recovery	#5 - Cost would be more than risk benefit	Enlargement of the containment would be similar in scope to the ABWR design change SAMA to implement a larger volume containment, but would likely exceed the $8 million estimate for that change as a retrofit would be required. This is greater than the maximum averted cost-risk.	Reference 17	N/A
67	3 b. Increased Containment Pressure Capability (sufficient pressure to withstand severe accidents)	17	SAMA minimizes likelihood of large releases	#2 - Similar item is addressed under other proposed SAMAs.	See SAMA 55	N/A	N/A
68	3 c. Improved Vacuum Breakers (redundant valves in each line)	17	SAMA reduces the probability of a stuck open vacuum breaker. See Table 6 and Section A.4.3.3 of ABWR SAMDAs.	#5 - Cost would be more than risk benefit	The Dresden plant has six (6) individual vacuum breaker lines with two vacuum breakers in parallel in each line. Providing redundant vacuum breakers in each line would decrease the potential for vapor suppression failure and suppression pool bypass This plant modification requires new valves, the structural changes to implement the modification, and the outage time to install. Based on the PRA results that vapor suppression failure and pool bypass are negligible risk contributors and the apparent extremely high cost, this proposed SAMA is not considered cost effective.	Reference 46	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
69	3.d Increased Temperature Margin for Seals	17	This SAMA would reduce the potential for containment failure under adverse conditions.	#2 - Similar item is addressed under other proposed SAMAs	See SAMA 55 and 67	N/A	N/A
70	3.e. Improved Leak Detection	17	The intent of this SAMA is to increase piping surveillance in order to identify leaks prior to the onset of complete failure. Improved leak detection would potentially reduce the LOCA frequency.	#3 - Already implemented	This is already implemented where appropriate. Dresden has performed a risk informed study of pipe in-service inspections (RI-ISI) and has adjusted the surveillance frequency consistent with a risk-informed approval. Increased pipe surveillance would be costly in terms of. - Increased radiation - Outage time - Manpower costs The current assessment of pipe surveillance is that it is adequate "as is" except for those areas of possible relaxation of the surveillance requirements that have been the subject of a plant specific risk informed investigation (RI-ISI).	Reference 18	N/A
71	3.f. Suppression Pool Scrubbing	17	This SAMA would reduce the consequences of venting the containment by directing the vent path through the water contained in the suppression pool	#3 - Already implemented	Dresden has a Wetwell vent located in the Wetwell airspace that is filtered via the suppression pool.	Reference 76	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
72	3 g Improved Bottom Penetration Design	17	SAMA reduces failure likelihood of RPV bottom head penetrations	#8 - ABWR Design Issue; not practical.	This is a SAMA that was considered for ABWR design It is not practical to backfit this modification into a plant which is already built and operating.	Reference 17	N/A
73	4 a. Larger Volume Suppression Pool (double effective liquid volume)	17	SAMA would increase the size of the suppression pool so that heatup rate is reduced, allowing more time for recovery of a heat removal system	#8 - ABWR Design Issue; not practical.	This is a SAMA that was considered for ABWR design. It is not practical to backfit this modification into a plant which is already built and operating	Reference 17	N/A
74	5.a/d. Unfiltered Vent	17	SAMA would provide an alternate decay heat removal method with the released fission products not being scrubbed.	#2 - Similar item is addressed under other proposed SAMAs	See SAMA 37	N/A	N/A
75	5.b/c. Filtered Vent	17	SAMA would provide an alternate decay heat removal method with the released fission products being scrubbed.	#2 - Similar item is addressed under other proposed SAMAs.	See SAMA 38 and 53	N/A	N/A
76	6 a. Post Accident Inerting System	17	SAMA would reduce likelihood of gas combustion inside containment	#2 - Similar item is addressed under other proposed SAMAs.	See SAMA 51	N/A	N/A
77	6.b. Hydrogen Control by Venting	17	This SAMA will prevent catastrophic failure of the containment due to hydrogen detonation by venting the hydrogen gas prior to reaching detonable concentration.	#3 - Already implemented	Dresden has adopted the BWROG EPG/SAGs which provide a graded approach to combustible gas control. This graded approach includes the use of purging and containment venting Now further action required for this SAMA.	References 52 and 73	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
78	6.c. Pre-inerting	17	SAMA would reduce likelihood of gas combustion inside containment	#2 - Similar item is addressed under other proposed SAMAs	See SAMA 51.	N/A	N/A
79	6.d. Ignition Systems	17	This SAMA will prevent catastrophic failure of the containment due to hydrogen detonation by burning the hydrogen gas prior to reaching detonable concentration	#2 - Similar item is addressed under other proposed SAMAs	See SAMA 42.	N/A	N/A
80	6 e. Fire Suppression System Inerting	17	This SAMA will prevent catastrophic failure of the containment due to hydrogen detonation by inerting the containment with the fire suppression system	#1 - Not applicable to the Dresden Design	Not applicable since the containment is already inerted. In addition, Dresden has a separate NCAD system to perform post-accident inerting similar to the identified SAMA	References 46 and 72	N/A
81	7.a. Drywell Head Flooding	17	SAMA would provide intentional flooding of the upper drywell head such that if high drywell temperatures occurred, the drywell head seal would not fail.	#2 - Similar item is addressed under other proposed SAMAs.	See SAMA 45		N/A
82	7 b. Containment Spray Augmentation	17	SAMA would provide a redundant source of water to the containment to control containment pressure when used in conjunction with containment heat removal	#2 - Similar item is addressed under other proposed SAMAs	See SAMAs 35, 36		N/A
83	12 b. Integral Basemat	17	This SAMA would improve containment survivability under severe seismic activity.	#8 - ABWR Design Issue; not practical.	Not applicable to Dresden design	References 17 and 34	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
84	13.a. Reactor Building Sprays	17	This SAMA provides the capability to use firewater sprays in the reactor building to mitigate release of fission products into the Rx Bldg following an accident	#2 - Similar item is addressed under other proposed SAMAs	See SAMA 46	N/A	N/A
85	14.a. Flooded Rubble Bed	17	SAMA would contain molten core debris dropping on to the pedestal and would allow the debris to be cooled.	#2 - Similar item is addressed under other proposed SAMAs	See SAMA 44	N/A	N/A
86	14 b Reactor Cavity Flooder	17	SAMA would enhance debris coolability, reduce core concrete interaction, and provide fission product scrubbing	#2 - Similar item is addressed under other proposed SAMAs	Addressed in SAMAs 47 & 57	N/A	N/A
87	14.c. Basaltic Cements	17	SAMA minimizes carbon dioxide production during core concrete interaction	#8 - ABWR Design Issue; not practical.	This is a SAMA that was considered for ABWR design. It is not practical to backfit this modification into a plant which is already built and operating	Reference 17	N/A
88	Provide a core debris control system	19	(Intended for ice condenser plants): This SAMA would prevent the direct core debris attack of the primary containment steel shell by erecting a barrier between the seal table and the containment shell.	#1 - Not applicable to the Dresden Design	Dresden is not an ice condenser plant	Reference 72	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
89	Add ribbing to the containment shell	19	This SAMA would reduce the risk of buckling of containment under reverse pressure loading	#2 - Similar item is addressed under other proposed SAMAs	This item is similar in nature to SAMA 56, but for protection against negative pressure.	N/A	N/A
Improvements Related to Enhanced AC/DC Reliability/Availability							
90	Proceduralize alignment of spare diesel to shutdown board after loss of offsite power and failure of the diesel normally supplying it	1 3 7 64	SAMA would reduce the SBO frequency.	#3 - Already installed.	Dresden has five Diesel Generators between Units 2 and 3. Two Unit DGs, a SBO DG for each Unit, and a swing DG capable of carrying loads from either Unit Procedure DGA-12 has extensive guidance for alignment of these DGs given partial or full loss of AC power.	Reference 55	N/A
91	Provide an additional diesel generator.	1 3 7 11	SAMA would increase the reliability and availability of onsite emergency AC power sources.	#3 - Already installed	Dresden has five Diesel Generators between its two Units Two Unit DGs, an SBO DG for each Unit, and a swing DG capable of carrying loads from either Unit Installation of additional AC power sources would have a small impact on the PSA results.	Reference 41	N/A
92	Provide additional DC battery capacity.	1 3 7 11 12 64	SAMA would ensure longer battery capability during an SBO, reducing the frequency of long-term SBO sequences.	#3 - Already installed. #4 - No significant safety benefit	Dresden already has included spare batteries. These can be used to extend IC operability and allow more credit for AC power recovery. This would decrease the frequency of core damage and offsite releases. The addition of 250V DC batteries could be evaluated to provide all the HPCI DC power requirements. However, room cooling and torus cooling would be more limiting.	Reference 41	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
93	Use fuel cells instead of lead-acid batteries	11	SAMA would extend DC power availability in an SBO.	#5 - Cost would be more than risk benefit	Further extension of battery life with fuel cells is estimated to have a small impact on the Dresden residual risk profile In addition, the cost of hardware (fuel cells), engineering, and hazard analysis is expected to exceed the maximum cost averted	N/A	N/A
94	Procedure to cross-tie high-pressure core spray diesel.	1	SAMA would improve core injection availability by providing a more reliable power supply for the high-pressure core spray pumps.	#1 - Not applicable to the Dresden Design	Dresden does not have a high-pressure core spray system The HPCI (equivalent system) is turbine driven.	Reference 31	N/A
95	Improve 4.16-kV bus cross-tie ability.	1	SAMA would improve AC power reliability.	#3 - Already installed	Procedural guidance is given in DGA-12 to cross-tie 4kV buses that consider many of the possibly significant permutations of 4kv bus faults and diesel generator failures	Reference 55	N/A
96	Incorporate an alternate battery charging capability.	1 8 9 64	SAMA would improve DC power reliability by either cross-tying the AC busses, or installing a portable diesel-driven battery charger.	#3 - Already installed.	Dresden has 2 battery chargers for each 125V DC battery (a normal and an alternate charger). The safety related 125 VDC batteries each have two chargers. The safety related 250 VDC batteries each have one dedicated charger and they share a swing 2/3 charger. Cross tying of AC divisions is also proceduralized allowing chargers to be supplied from the opposite division.	References 56, 57, and 58	N/A
97	Increase/improve DC bus load shedding.	1 8 64	SAMA would extend battery life in an SBO event	#3 - Already installed.	The DC load shedding process is defined in detail in procedure DOA 6900-T2.	Reference 59	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
98	Replace existing batteries with more reliable ones.	11	SAMA would improve DC power reliability and thus increase available SBO recovery time	#3 - Already installed	Reliable batteries are already installed. The Maintenance Rule Program has been implemented and monitors the reliability and availability of the batteries	Reference 22	N/A
99	Mod for DC Bus A reliability.	1	SAMA would increase the reliability of AC power and injection capability Loss of DC Bus A causes a loss of main condenser, prevents transfer from the main transformer to offsite power, and defeats one half of the low vessel pressure permissive for LPCI/CS injection valves	#3 - Already installed	Each Dresden Unit has 1 125V DC division bus and 1 250V DC division bus. Cross-tie capability from the opposite Unit buses exists and is proceduralized A loss of a single DC bus would not lead to loss of condenser Transfer from main transformer to offsite power would also not be deferred	Reference 41	N/A
100	Create AC power cross-tie capability with other unit.	1 8 9	SAMA would improve AC power reliability	#3 - Already installed.	Procedure DGA-12 describes cross-tying 4 kV buses to feed equipment from other 4 kV buses. If a bus to be cross-tied is powered from a Diesel then the SBO Diesel will be used to power the failed bus	Reference 55	N/A
101	Create a cross-tie for diesel fuel oil	1	SAMA would increase diesel fuel oil supply and thus diesel generator, reliability.	#3 - Already installed.	Each of the diesel fuel oil day tanks can be cross filled from existing emergency diesel fuel storage tanks This is procedurally directed in the operating procedures. A Diesel Fuel Oil Storage Tank Transfer pump and a temporary fuel oil transfer pump are available to transfer fuel	Reference 60	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
102	Develop procedures to repair or replace failed 4-kV breakers	1	SAMA would offer a recovery path from a failure of the breakers that perform transfer of 4.16-kV non-emergency busses from unit station service transformers, leading to loss of emergency AC power.	#3 - Already installed	This SAMA would provide a recovery path from loss of 4.16-kV power due to failure of a 4.16-kV breaker. 4 kV breaker repair and replacement is both proceduralized and part of the skill of the craft. Additional procedures are not required	N/A	N/A
103	Emphasize steps in recovery of offsite power after an SBO.	1	SAMA would reduce human error probability during offsite power recovery.	#3 - Already implemented	Restoration of normal power from offsite sources is proceduralized and detailed in DGA-12. Numerous procedures are referenced in DGA-12 concerning the restoration of 4KV buses.	Reference 55	N/A
104	Develop a severe weather conditions procedure.	1 13	For plants that do not already have one, this SAMA would reduce the CDF for external weather-related events.	#3 - Already implemented	PREPARATION FOR SEVERE WEATHER guideline provides the station with items to be considered in the event severe weather is forecasted to impact Dresden.	References 61 and 77	N/A
105	Develop procedures for replenishing diesel fuel oil	1	SAMA would allow for long-term diesel operation.	#3 - Already implemented	Instructions are provided to fill a Diesel Fuel Oil Storage Tank from a fuel oil delivery truck.	Reference 60	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
106	Install gas turbine generator.	1 14	SAMA would improve onsite AC power reliability by providing a redundant and diverse emergency power system.	#5 - Cost would be more than risk benefit	The cost of installing a diverse, redundant, gas turbine generator is similar in scope to installing a new diesel generator. The cost of installing an additional diesel generator has been estimated at over $20 million in Reference 19 This cost of implementation for this SAMA greatly exceeds the maximum averted cost-risk for Dresden. In addition, Dresden already has five diverse on-site AC power sources. Installing a gas turbine would provide minimal safety benefit		N/A
107	Create a backup source for diesel cooling. (Not from existing system)	1	This SAMA would provide a redundant and diverse source of cooling for the diesel generators, which would contribute to enhanced diesel reliability.	#5 - Cost would be more than risk benefit	A new system for diesel cooling would require extensive engineering, safety analysis, hardware and labor for installation. This would exceed the maximum averted cost.		N/A
108	Use fire protection system as a backup source for diesel cooling	1	This SAMA would provide a redundant and diverse source of cooling for the diesel generators, which would contribute to enhanced diesel reliability	#2 - Similar item is addressed under other proposed SAMAs	See SAMA 107		N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
109	Provide a connection to an alternate source of offsite power.	1	SAMA would reduce the probability of a loss of offsite power event.	#3 - Already installed.	Offsite power lines would be exposed to severe weather at some point along the offsite power line route. While the actual cost of this SAMA will vary depending on site characteristics, the cost of connecting to an alternate source of power has been estimated at >$25 million for another commercial US nuclear plant Implementing this SAMA at Dresden is considered to be within the same order of magnitude and exceeds the maximum averted cost-risk for the plant In addition, Dresden has multiple offsite sources and multiple, diverse on-site AC power sources. Providing additional AC power sources would provide minimal safety benefit	Reference 19	N/A
110	Bury offsite power lines.	1	SAMA could improve offsite power reliability, particularly during severe weather.	#5 - Cost would be more than risk benefit	While the actual cost of this SAMA will vary depending on site characteristics, the cost of burying offsite power lines has been estimated at a cost significantly greater than $25 million for another commercial US nuclear plant. Implementing this SAMA at Dresden is considered to be within the same order of magnitude and exceeds the maximum averted cost-risk for the plant.		N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
111	Replace anchor bolts on diesel generator oil cooler.	1	Millstone Nuclear Power Station found a high seismic SBO risk due to failure of the diesel oil cooler anchor bolts For plants with a similar problem, this would reduce seismic risk. Note that these were Fairbanks Morse DGs.	#3 - Already installed.	Concerning anchorage, insights from the IPEEE conclude that the Dresden plant possesses reasonable margin with respect to its design basis earthquake and safe shutdown capacity will not be lost.	Reference 62	N/A
112	Change undervoltage (UV), auxiliary-feedwater actuation signal (AFAS) block and high pressurizer pressure actuation signals to 3-out-of-4, instead of 2-out-of-4 logic	1	SAMA would reduce risk of 2/4 inverter failure.	#1 - Not applicable to the Dresden Design	PWR issue. N/A to BWR		N/A
113	Provide DC power to the 120/240-V vital AC system from the Class 1E station service battery system instead of its own battery	12	SAMA would increase the reliability of the 120-VAC Bus	#4 - No significant safety benefit	1) Loss of 120V AC is not an Initiating Event 2) 120 VAC is not a risk significant support system	Reference 41	N/A
114	Bypass Diesel Generator Trips	14 16	SAMA would allow D/Gs to operate for longer.	#3 - Already installed	Many trips are automatically bypassed on "LOCA start" of diesel In addition, procedures exist that cover troubleshooting of diesel trips and provides guidance on resetting trips and restarting EDGs	Reference 74	N/A
115	2 i. 16 hour Station Blackout Injection	17	SAMA includes improved capability to cope with longer station blackout scenarios.	#2 - Similar item is addressed under other proposed SAMAs	Part of SAMA 124		N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
116	9.a Steam Driven Turbine Generator	17	This SAMA would provide a steam driven turbine generator which uses reactor steam and exhausts to the suppression pool. If large enough, it could provide power to additional equipment.	#3 - Already implemented at Dresden	Dresden has a turbine driven injection system. Depressurization on HCTL typically occurs in the same time frame as battery depletion; therefore, turbine driven generators provide minimal safety benefit.	References 31 and 46	N/A
117	9.b. Alternate Pump Power Source	17	This SAMA would provide a small dedicated power source such as a dedicated diesel or gas turbine for the feedwater or condensate pumps, so that they do not rely on offsite power.	#2 - Similar item is addressed under other proposed SAMAs.	FW and Condensate require substantial AC power for their operation. The addition of a dedicated power source for their operation given failures of other AC sources and RPV injection is similar to SAMA 106.		N/A
118	9.d Additional Diesel Generator	17	SAMA would reduce the SBO frequency.	#2 - Similar item is addressed under other proposed SAMAs.	See SAMAs 90, 91, 106		N/A
119	9.e. Increased Electrical Divisions	17	SAMA would provide increased reliability of AC power system to reduce core damage and release frequencies.	#8 - ABWR Design Issue; not practical.	This is a SAMA that was considered for ABWR design. It is not practical to backfit this modification into a plant which is already built and operating.	Reference 17	N/A
120	9.f. Improved Uninterruptable Power Supplies	17	SAMA would provide increased reliability of power supplies supporting front-line equipment, thus reducing core damage and release frequencies	#4 - No significant safety benefit	1) Loss of 120V AC is not an Initiating Event 2) 120 VAC is not a risk significant support system	Reference 41	N/A
121	9.g AC Bus Cross-Ties	17	SAMA would provide increased reliability of AC power system to reduce core damage and release frequencies.	#2 - Similar item is addressed under other proposed SAMAs.	See SAMAs 95, 100	N/A	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
122	9.h. Gas Turbine	17	SAMA would improve onsite AC power reliability by providing a redundant and diverse emergency power system.	#2 - Similar item is addressed under other proposed SAMAs.	See SAMA 106	N/A	N/A
123	9.i. Dedicated RHR (bunkered) Power Supply	17	SAMA would provide LPCI with more reliable AC power.	#2 - Similar item is addressed under other proposed SAMAs	Additional power supplies are addressed in other SAMAs. See SAMAs 91, 106, 118, 119, and 123	N/A	N/A
124	10.a. Dedicated DC Power Supply	17	This SAMA addresses the use of a diverse DC power system such as an additional battery or fuel cell for the purpose of providing motive power to certain components (e g , HPCI).	#5 - Cost would be more than risk benefit	Dresden has the capability to operate the Isolation Condenser (once initiated) without DC power. This is included in the Dresden PRA as a success path The cost of implementation for this mod is estimated at $3 million, which is greater than the maximum averted cost-risk for Dresden	Reference 17	N/A
125	10.b. Additional Batteries/Divisions	17	This SAMA addresses the use of a diverse DC power system such as an additional battery or fuel cell for the purpose of providing motive power to certain components (e g , HPCI).	#2 - Similar item is addressed under other proposed SAMAs.	Dresden has the capability to operate the Isolation Condenser (once initiated) without DC power. This is included in the Dresden PRA as a success path. SAMAs 93 and 124 address this proposed modification. Dresden has spare batteries already installed and proceduralized for connection to safety related divisions.	N/A	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
126	10.c. Fuel Cells	17	SAMA would extend DC power availability in an SBO.	#2 - Similar item is addressed under other proposed SAMAs	See SAMA 93	N/A	N/A
127	10.d. DC Cross-ties	17	This SAMA would improve DC power reliability.	#3 - Already implemented at Dresden	Cross-Tying of DC buses is procedurally directed Partially addressed by SAMA 96	Reference 67	N/A
128	10.e. Extended Station Blackout Provisions	17	SAMA would provide reduction in SBO sequence frequencies.	#2 - Similar item is addressed under other proposed SAMAs	See SAMAs 29, 90, 92, 96, 97, 98, 103, 105, 118, and 122	N/A	N/A
129	Add an automatic bus transfer feature to allow the automatic transfer of the 120V vital AC bus from the on-line unit to the standby unit	19	Plants are typically sensitive to the loss of one or more 120V vital AC buses Manual transfers to alternate power supplies could be enhanced to transfer automatically.	#4 - No significant safety benefit	1) Loss of 120V AC is not an Initiating Event 2) 120 VAC is not a risk significant support system	Reference 41	N/A
Improvements in Identifying and Mitigating Containment Bypass							
130	Install a redundant spray system to depressurize the primary system during a steam generator tube rupture (SGTR).	1	SAMA would enhance depressurization during a SGTR.	#1 - Not applicable to the Dresden Design	PWR issue. N/A to BWR	Reference 78	N/A
131	Improve SGTR coping abilities.	1 4 11	SAMA would improve instrumentation to detect SGTR, or additional system to scrub fission product releases	#1 - Not applicable to the Dresden Design	PWR issue. N/A to BWR	Reference 78	N/A
132	Add other SGTR coping abilities.	4 10 11	SAMA would decrease the consequences of an SGTR.	#1 - Not applicable to the Dresden Design	PWR issue. N/A to BWR	Reference 78	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
133	Increase secondary side pressure capacity such that an SGTR would not cause the relief valves to lift	10 11	SAMA would eliminate direct release pathway for SGTR sequences.	#1 - Not applicable to the Dresden Design	PWR issue. N/A to BWR	Reference 78	N/A
134	Replace steam generators (SG) with a new design.	1	SAMA would lower the frequency of an SGTR.	#1 - Not applicable to the Dresden Design	PWR issue. N/A to BWR	Reference 78	N/A
135	Revise emergency operating procedures to direct that a faulted SG be isolated.	1	SAMA would reduce the consequences of an SGTR	#1 - Not applicable to the Dresden Design	PWR issue. N/A to BWR	Reference 78	N/A
136	Direct SG flooding after a SGTR, prior to core damage.	10	SAMA would provide for improved scrubbing of SGTR releases.	#1 - Not applicable to the Dresden Design	PWR issue N/A to BWR	Reference 78	N/A
137	Implement a maintenance practice that inspects 100% of the tubes in a SG	11	SAMA would reduce the potential for an SGTR.	#1 - Not applicable to the Dresden Design	PWR issue N/A to BWR	Reference 78	N/A
138	Locate residual heat removal (RHR) inside of containment.	10	SAMA would prevent intersystem LOCA (ISLOCA) out the RHR pathway	#5 - Cost would be more than risk benefit	Competing risks associated with such a design are manifold and would require extensive analysis to demonstrate capability. For an existing plant, the cost of moving an entire system is judged to greatly exceed the maximum averted cost-risk for Dresden. Related to mitigation of an ISLOCA. Per IN-92-36, and its additional supplement, ISLOCA contributes little risk for BWRs, because of the lower primary system pressures	Reference 34	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
139	Install additional instrumentation for ISLOCAs.	3 4 7 8	SAMA would decrease ISLOCA frequency by installing pressure of leak monitoring instruments in between the first two pressure isolation valves on low-pressure inject lines, RHR suction lines, and HPSI lines	#4 - No significant safety benefit	Related to mitigation of an ISLOCA. Per IN-92-36, and its additional supplement, ISLOCA contributes little risk for BWRs, because of the lower primary system pressures.	Reference 63	N/A
140	Increase frequency for valve leak testing.	1	SAMA could reduce ISLOCA frequency	#4 - No significant safety benefit	Related to mitigation of an ISLOCA Per IN-92-36, and its additional supplement, ISLOCA contributes little risk for BWRs, because of the lower primary system pressures.	Reference 63	N/A
141	Improve operator training on ISLOCA coping.	1	SAMA would decrease ISLOCA effects.	#4 - No significant safety benefit	Related to mitigation of an ISLOCA Per IN-92-36, and its additional supplement, ISLOCA contributes little risk for BWRs, because of the lower primary system pressures. In addition, the Dresden EOPs provide secondary containment monitoring parameters which include room specific temperature, room specific radiation, vent radiation, and room specific water level. The instrumentation and procedural guidance help locate and isolate breaks which have bypassed primary containment.	Reference 63	N/A
142	Install relief valves in the CC System.	1	SAMA would relieve pressure buildup from an RCP thermal barrier tube rupture, preventing an ISLOCA.	#1 - Not applicable to the Dresden Design	PWR issue. N/A to BWR	Reference 63	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
143	Provide leak testing of valves in ISLOCA paths.	1	SAMA would help reduce ISLOCA frequency. At Kewaunee Nuclear Power Plant, four MOVs isolating RHR from the RCS were not leak tested	#4 - No significant safety benefit	Related to mitigation of an ISLOCA. Per IN-92-36, and its additional supplement, ISLOCA contributes little risk for BWRs, because of the lower primary system pressures	Reference 63	N/A
144	Revise EOPs to improve ISLOCA identification	1	SAMA would ensure LOCA outside containment could be identified as such. Salem Nuclear Power Plant had a scenario where an RHR ISLOCA could direct initial leakage back to the pressurizer relief tank, giving indication that the LOCA was inside containment.	#1 - Not applicable to the Dresden Design	Related to mitigation of an ISLOCA. Per IN-92-36, and its additional supplement, ISLOCA contributes little risk for BWRs, because of the lower primary system pressures At Westinghouse PWR's, RHR suction relief valves, which are outside containment, dump their discharge back into the PRT inside containment Therefore, an untrained operator could fail to diagnose an ISLOCA from the low-pressure RHR system. The Dresden CS and LPCI relief valves are aligned to discharge outside containment to the Reactor Building equipment drain tank. Therefore, the plant configurations are not the same In addition, the Dresden EOPs provide secondary containment monitoring parameters which include room specific temperature, room specific radiation, vent radiation, and room specific water level. The instrumentation and procedural guidance help locate and isolate breaks which have bypassed primary containment	References 30, 52, and 63	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
145	Ensure all ISLOCA releases are scrubbed.	1	SAMA would scrub all ISLOCA releases One example is to plug drains in the break area so that the break point would cover with water.	#4 - No significant safety benefit	Related to mitigation of an ISLOCA. Per IN-92-36, and its additional supplement, ISLOCA contributes little risk for BWRs, because of the lower primary system pressures The cost of performing the analysis to identify all ISLOCA pathways and to ensure that any physical modifications implemented to mitigate ISLOCAs are not detrimental to the plant (e g , cause flooding hazards) combined with the cost of installing the required equipment is judged to greatly exceed any benefit. Additionally, the suggested enhancement of plugging drain lines would not guarantee a release would be scrubbed as the release may occur above the break location. Room flooding equipment and waterproofing of mitigative components would be required to make this SAMA potentially effective. Such changes would be extremely costly and potential competing risk appears to significantly outweigh any possible safety benefit.	Reference 63	N/A
146	Add redundant and diverse limit switches to each containment isolation valve.	1	SAMA could reduce the frequency of containment isolation failure and ISLOCAs through enhanced isolation valve position indication.	#4 - No significant safety benefit	Related to mitigation of an ISLOCA. Per IN-92-36, and its additional supplement, ISLOCA contributes little risk for BWRs, because of the lower primary system pressures.	Reference 63	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
147	Early detection and mitigation of ISLOCA	14 16	SAMA would limit the effects of ISLOCA accidents by early detection and isolation	#4 - No significant safety benefit	Related to mitigation of an ISLOCA. Per IN-92-36, and its additional supplement, ISLOCA contributes little risk for BWRs, because of the lower primary system pressures	Reference 63	N/A
148	8 e. Improved MSIV Design	17	This SAMA would decrease the likelihood of containment bypass scenarios	#4 - No significant safety benefit	Redundant MSIVs are designed to isolate on severe accidents that could lead to radionuclide release and bypass containment. These include breaks outside containment The MSIVs are leak tested to ensure their adequacy. The maintenance Rule program monitors the performances of the MSIVs providing early feedback on any degradation. The PRA has determined that the risk contribution from MSIV failures to isolate is very small	Reference 46	N/A
149	Proceduralize use of pressurizer vent valves during steam generator tube rupture (SGTR) sequences	19	Some plants may have procedures to direct the use of pressurizer sprays to reduce RCS pressure after an SGTR. Use of the vent valves would provide a back-up method	#1 - Not applicable to the Dresden Design	PWR issue N/A to BWR	N/A	N/A
150	Implement a maintenance practice that inspects 100% of the tubes in an SG	19	This SAMA would reduce the potential for a tube rupture.	#1 - Not applicable to the Dresden Design	PWR issue. N/A to BWR	Reference 78	N/A
151	Locate RHR inside of containment	19	This SAMA would prevent ISLOCA out the RHR pathway.	#2 - Similar item is addressed under other proposed SAMAs	NA to Dresden, See 138	N/A	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
152	Install self-actuating containment isolation valves	19	For plants that do not have this, it would reduce the frequency of isolation failure.	#3 - Already implemented at Dresden	Containment isolation failure for Dresden is found to be a negligible contributor to CDF and LERF. The containment isolation configuration at Dresden is reliable The lines which penetrate the primary containment are all equipped with automatic isolation logic with the exception of those lines required for mitigating a LOCA, such as ECCS injection lines (All low pressure ECCS injection lines have one check valve to provide containment isolation) Feedwater has multiple check valves; HPCI has 2 MOVs on the steam supply and a check valve and MOV on the injection line. The IC has double isolation protection on the steam line and return line Specific logic groups are defined which isolate on reactor or containment parameters significant to the associated group in order to provide automatic valve closures appropriate for a given set of conditions. Containment isolation valves from the containment atmosphere to the environment are, in general, air operated valves that fail closed (isolation position) if power or air is lost The exception to this is the wetwell to Reactor Building vacuum breaker line. For this application, the air operated butterfly valve fails open on loss of power or air and isolation relies on the self actuating check valve. The conclusion is that the containment isolation valves at Dresden meet the intent of this SAMA and there is negligible risk associated with containment isolation valve failure	Reference 72	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
			Improvements in Reducing Internal Flooding Frequency				
153	Modify swing direction of doors separating turbine building basement from areas containing safeguards equipment.	1	SAMA would prevent flood propagation, for a plant where internal flooding from turbine building to safeguards areas is a concern.	#4 - No significant safety benefit	Dresden plant configuration is not susceptible to flood propagation from the Turbine Building to adjacent buildings with safety equipment. Flooding from Turbine Hall into adjacent buildings considered to have negligible impact	Reference 23	N/A
154	Improve inspection of rubber expansion joints on main condenser.	1 14	SAMA would reduce the frequency of internal flooding, for a plant where internal flooding due to a failure of circulating water system expansion joints is a concern.	#3 - Already Installed	On June 7, 1972, a water hammer event occurred at Dresden's sister plant, Quad Cities Unit 1, that led to a failure of a rubber expansion joint in the 120-inch circulating water line and the subsequent flooding of the condenser pit and condensate pump room. As a result of this flooding event and the similarity in design of Quad Cities and Dresden, modifications were implemented at Dresden. These modifications included isolating the condenser pit so that expansion boot failures would <u>not</u> flood the Turbine Building and to construct vaults for 2 of the 4 CCSW pumps to protect them from a flood if a condensate pipe break occurs outside the condenser pit	Reference 23	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
155	Implement internal flood prevention and mitigation enhancements.	1	This SAMA would reduce the consequences of internal flooding.	#4 - No significant safety benefit	The total contribution to CDF from internal flooding is 1.8E-7/yr or less than 10% of the total internal events CDF. Internal flood is not considered to be a dominant contributor to the CDF at Dresden and adequate precautions and training are believed to be in place to prevent and respond to postulated flood	Reference 23	N/A
156	Implement internal flooding improvements such as those implemented at Fort Calhoun.	1	This SAMA would reduce flooding risk by preventing or mitigating rupture in the RCP seal cooler of the component cooling system and ISLOCA in a shutdown cooling line, an auxiliary feedwater (AFW) flood involving the need to remove a watertight door.	#1 - Not applicable to the Dresden Design	PWR issue N/A to BWR	N/A	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
157	Shield electrical equipment from potential water spray	23	SAMA would decrease risk associated with seismically induced internal flooding	#5 - Cost would be more than risk benefit	Protecting equipment from spray may be a cost beneficial means of reducing risk at Dresden However, there are very few, if any, locations that can be effectively protected from water spray adverse effects that are not already protected. This fact coupled with the knowledge that the total CDF from all internal floods is so low, means that any plant modification is nearly impossible to justify. The 4-kV emergency buses in Reactor Building have water hoods Some MCCs have small hoods Additional spray protection could be provided to switchgear in Turbine Building. Main risk reduction would be from providing water spray protection to Unit 3 125 VDC battery bus and switchgear in cage outside of Unit 3 Battery Charger room.	Reference 23	N/A
158	13 c Reduction in Reactor Building Flooding	17	This SAMA reduces the Reactor Building Flood Scenarios contribution to core damage and release	#2 - Similar item is addressed under other proposed SAMAs	See SAMA 158		N/A
Improvements Related to Feedwater/Feed and Bleed Reliability/Availability							
159	Install a digital feedwater upgrade	1	This SAMA would reduce the chance of a loss of main feedwater following a plant trip	#3 - Already installed.	Already installed at Dresden.	Reference 65	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
160	Perform surveillances on manual valves used for backup AFW pump suction.	1	This SAMA would improve success probability for providing alternative water supply to the AFW pumps	#1 - Not applicable to the Dresden Design	PWR issue N/A to BWR	N/A	N/A
161	Install manual isolation valves around AFW turbine-driven steam admission valves.	1	This SAMA would reduce the dual turbine-driven AFW pump maintenance unavailability.	#1 - Not applicable to the Dresden Design	PWR issue N/A to BWR	N/A	N/A
162	Install accumulators for turbine-driven AFW pump flow control valves (CVs).	4 8	This SAMA would provide control air accumulators for the turbine-driven AFW flow CVs, the motor-driven AFW pressure CVs and SG power-operated relief valves (PORVs). This would eliminate the need for local manual action to align nitrogen bottles for control air during a LOOP.	#1 - Not applicable to the Dresden Design	PWR issue. N/A to BWR	N/A	N/A
163	Install separate accumulators for the AFW cross-connect and block valves	19	This SAMA would enhance the operator's ability to operate the AFW cross-connect and block valves following loss of air support.	#1 - Not applicable to the Dresden Design	PWR issue. N/A to BWR	N/A	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
164	Install a new condensate storage tank (CST)	19	Either replace the existing tank with a larger one, or install a back-up tank.	#4 - No significant safety benefit	For SBO conditions, the CST contains enough water to allow make-up injection from HPCI for a period longer than its estimated operability (based on battery life). The 1A, 2/3A and 2/3B CSTs have a combined nominal water volume (typical) of 410,000 gallons For LOCA initiators, the CST does not contain enough water to provide injection for the 24 hour mission time The CST makeup systems do not currently have the capacity to match the inventory loss for a LOCA Feedwater has connections to unlimited water supplies (SBCS) not dependent on the CST CST connections to Core Spray and LPCI already exist The ability to refill the CST from external water sources is considered both desirable and not difficult The Technical Support Guidelines (TSGs) Appendix J provides the makeup sources available to Dresden to allow CST refill. The Isolation Condenser (IC) which is a separate mitigation system also has significant makeup capabilities independent of the CST. The TSG Appendix K cites the systems that can make-up to the shell side of the IC. This represents a significant benefit aver other plants without an IC	N/A	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
165	Provide cooling of the steam-driven AFW pump in an SBO event	19	This SAMA would improve success probability in an SBO by: (1) using the FP system to cool the pump, or (2) making the pump self cooled, or (3) providing a fan cooling capability.	#5 - Cost would be more than risk benefit	AFW is a PWR system for steam generator make-up injection. The HPCI pump at Dresden is equivalent in many respects to the PWR AFW pump. The HPCI turbine requires room cooling over a 24 hour mission time or the SBO mission time of 4 hours Installation of an additional room cooling system for HPCI that would be independent of AC and DC power would be the only type of "system" that would change the risk profile.. This additional system is expected to cost more than the maximum cost averted of and therefore to not be cost beneficial	Reference 31	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
166	Proceduralize local manual operation of AFW when control power is lost.	19	This SAMA would lengthen AFW availability in an SBO Also provides a success path should AFW control power be lost in non-SBO sequences.	#4 - No significant safety benefit	AFW is a PWR system for steam generator make-up injection HPCI is the turbine driven injection system for Dresden. The available injection time for these systems is limited by factors such as battery life, depressurization on HCTL, and injection source volume. HCTL is reached in the suppression pool at approximately 7 hours after the initiating event of an SBO without IC operation. Providing local, manual control capability for the HPCI system (removing the DC dependence) could extend injection an additional three hours beyond the 4 hour battery life However, hardware changes would be necessary in addition to procedure updates for Dresden. For SBOs with the IC operating, HPCI could extend the time of adequate core cooling (by providing RPV makeup for seal LOCA events). This operation of HPCI will allow adequate core cooling to be extended as long as the battery supply of DC can be preserved or the battery (DC) requirement bypassed by manual action. HPCI room cooling is the limiting condition under this scenario DC power is not the limiting support system for HPCI operation. The room cooling requirement for AC power for the HPCI fan is most limiting This SAMA for local generation of HPCI without DC does not result in any noticeable change in CDF because of the small failure profitability of DC and the presence of more limiting failure modes (i e , room cooling). Therefore, the potential benefit for this modification is very small	References 31 and 46	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
167	Provide portable generators to be hooked into the turbine driven AFW, after battery depletion.	19	This SAMA would extend AFW availability in an SBO (assuming the turbine driven AFW requires DC power)	#6 - Retain	AFW is a PWR system for steam generator make-up injection. HPCI is the turbine driven injection system to the RPV for Dresden. The available injection time for HPCI is limited by factors such as battery life, depressurization on HCTL, and injection source volume. HCTL is reached in the suppression pool at approximately 7 hours after the initiating event of an SBO without IC operation. Extending DC power availability to HCTL could allow an additional three hours of injection beyond the 4 hour battery life For SBOs with the IC operating, HPCI could extend the time of adequate core cooling (by providing RPV makeup for seal LOCA events) This operation of HPCI will allow adequate core cooling to be extended as long as the battery supply of DC can be preserved. HPCI room cooling is the limiting condition under this scenario DC power is not the limiting support system for HPCI operation. The room cooling requirement for AC power for the HPCI fan is most limiting This SAMA for local generation of HPCI without DC does not result in any noticeable change in CDF because of the small failure profitability of DC and the presence of more limiting failure modes (i e., room cooling) Therefore, the potential benefit for this modification is very small	References 31 and 46	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
168	Add a motor train of AFW to the Steam trains	19	For PWRs that do not have any motor trains of AFW, this would increase reliability in non-SBO sequences	#1 - Not applicable to the Dresden Design	AFW is a PWR system for steam generator make-up injection. Dresden is equipped with both motor driven and turbine driven injection systems	References 29, 30, and 65	N/A
169	Create ability for emergency connections of existing or alternate water sources to feedwater/condensate	19	This SAMA would be a back-up water supply for the feedwater/condensate systems	#3 - Already implemented at Dresden	The Standby Coolant Supply is available as an alternate water source to the condenser.	Reference 68	N/A
170	Use FP system as a back-up for SG inventory	19	This SAMA would create a back-up to main and AFW for SG water supply.	#1 - Not applicable to the Dresden Design	PWR issue. N/A to BWR. (Dresden has FP makeup to the IC already installed).	Reference 78	N/A
171	Procure a portable diesel pump for isolation condenser make-up	19	This SAMA would provide a back-up to the city water supply and diesel FP system pump for isolation condenser make-up	#3 - Already implemented at Dresden	Dresden has multiple methods of make up to the isolation condenser shell side These methods include - condensate transfer - diesel driven make-up pumps from the CST - fire protection connections See TSGs App K	References 44, 46, and 80	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
172	Install an independent diesel generator for the CST make-up pumps	19	This SAMA would allow continued inventory make-up to the CST during an SBO.	#4 - No significant safety benefit	HPCI is the turbine driven injection system for Dresden. The 1A, 2/3A and 2/3B CSTs have a combined nominal water volume (typical) of 410,000 gallons. Given a battery life of 4 hours (required for HPCI operation), no additional water source would be required for injection during the 4 hour SBO mission time. Minimal benefit would be gained from this SAMA. Even if CST water is exhausted, the switchover of suction from the CST to the torus would continue to allow HPCI injection The limiting time and action for HPCI effectiveness in an SBO (other than batteries) or other accident sequences without DHR is the torus water temperature greater than HCTL. This leads to RPV depressurization and the unavailability of HPCI as an effective RPV make up method regardless of CST volume. Therefore, there is negligible risk benefit associated with increasing CST make up capability under SBO conditions. The Technical Support Guidelines (TSGs) Appendix J provides the makeup sources available to Dresden to allow CST refill. The Isolation Condenser (IC) which is a separate mitigation system also has significant makeup capabilities independent of the CST. The TSG Appendix K cites the systems that can make-up to the shell side of the IC. This represents a significant benefit at Dresden over other plants without an IC	Reference 31	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
173	Change failure position of condenser make-up valve	19	This SAMA would allow greater inventory for the AFW pumps by preventing CST flow diversion to the condenser if the condenser make-up valve fails open on loss of air or power.	#3 - Already implemented at Dresden	The condenser makeup valves fail closed on loss of air. Hotwell makeup from the CSTs is via normal and emergency makeup valves (in parallel), but both of those AOVs Fail Closed (not open) on loss of instrument air. There is an 8" manual bypass valve in parallel with those AOVs that can be used to provide hotwell makeup from the CSTs on loss of instrument air - the manual bypass valve is easily accessible in the Turbine Building	Reference 20	N/A
174	Create passive secondary side coolers.	19	This SAMA would reduce CDF from the loss of Feedwater by providing a passive heat removal loop with a condenser and heat sink	#1 - Not applicable to the Dresden Design	Secondary side cooling is a PWR issue	N/A	N/A
175	Replace current PORVs with larger ones such that only one is required for successful feed and bleed	19	This SAMA would reduce the dependencies required for successful feed and bleed	#1 - Not applicable to the Dresden Design	Dresden has multiple SRVs that provide the capability to support "feed and bleed", i.e , RPV depressurization. See SAMA 190.	Reference 52	N/A
176	Install motor-driven feedwater pump	1 12	SAMA would increase the availability of injection subsequent to MSIV closure	#3 - Already installed	Each Dresden Unit has 3 motor driven feedwater pumps	Reference 65	N/A
Improvements in Core Cooling Systems							
177	Provide the capability for diesel driven, low pressure vessel make-up	19	This SAMA would provide an extra water source in sequences in which the reactor is depressurized and all other injection is unavailable (e.g., FP system)	#3 - Already implemented at Dresden	The Dresden Fire System is equipped with diesel driven pumps that are capable of providing low pressure injection to the RPV. Procedural guidance in DEOP 500-3	Reference 52	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
178	Provide an additional HPSI pump with an independent diesel	19	This SAMA would reduce the frequency of core melt from small LOCA and SBO sequences	#5 - Cost would be more than risk benefit	This is primarily a PWR insight where RPV depressurization is not as easily available. The availability of an additional high pressure water injection source is not a significant risk reduction measure for Dresden because of the existing design. Dresden has substantial high pressure RPV inventory control methods These include: - HPCI - Feedwater (motor driven) - Isolation Condenser - CRD pumps These methods represent substantial high pressure inventory control methods including active HPSI from the turbine driven HPCI system which is independent of AC power initially. Dresden has a turbine driven high pressure injection with the capability to provide a supplement or an alternative to the Isolation Condenser (IC) system for safe shutdown.	Reference 34	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
178 (Cont'd)					FW depends on offsite AC power to provide high-pressure injection. Onsite AC power is available from either unit EDG the swing EDG, or either SBO DG (5 sources) to support CRD operation Because of the cost associated with this SAMA and the existing Dresden capability, a negligible change in risk is calculated Even the maximum cost averted could not justify the engineering and hardware of an additional pump		
179	Install an independent AC HPSI system	19	This SAMA would allow make-up and feed and bleed capabilities during an SBO	#2 - Similar item is addressed under other proposed SAMAs	See SAMA 178, and 185	N/A	N/A
180	Create the ability to manually align ECCS recirculation	19	This SAMA would provide a back-up should automatic or remote operation fail	#3 - Already implemented at Dresden	Dresden has the capability to align ECCS for recirculation via local valve manipulation	N/A	N/A
181	Implement an RWT make-up procedure	19	This SAMA would decrease CDF from ISLOCA scenarios, some smaller break LOCA scenarios, and SGTR.	#2 - Similar item is addressed under other proposed SAMAs.	For a BWR, the functional equivalent would be CST make-up. See SAMA 59	N/A	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
182	Stop low pressure safety injection pumps earlier in medium or large LOCAs.	19	This SAMA would provide more time to perform recirculation swap over.	#1 - Not applicable to the Dresden Design	There is no true equivalent of the PWR "swap over to recirculation" action at Dresden. The normal alignment of LPCI mode is already a recirculation-like flowpath which takes suction from the suppression pool, passes through the LPCI heat exchangers, and injects to the RPV. Suction sources for other injection systems are aligned as directed in the EOPs based on CST and suppression pool levels The procedures were developed based on providing adequate NPSH to the pumps and preventing overfill of the containment. In addition, other injection systems (or the opposite LPCI loop) can provide make-up water to the RPV concurrent with LPCI suppression pool cooling so that it is not necessary to stop one function prior to beginning the other.	References 29 and 30	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
183	Emphasize timely swap over in operator training.	19	This SAMA would reduce human error probability of recirculation failure	#1 - Not applicable to the Dresden Design	There is no true equivalent of the PWR "swap over to recirculation" action at Dresden. The normal alignment of LPCI mode is already a recirculation-like flowpath which takes suction from the suppression pool, passes through the LPCI heat exchangers, and injects to the RPV. Suction sources for other injection systems are aligned as directed in the EOPs based on CST and suppression pool levels. The procedures were developed based on providing adequate NPSH to the pumps and preventing overfill of the containment. In addition, other injection systems (or the opposite LPCI loop) can provide make-up water to the RPV concurrent with LPCI suppression pool cooling so that it is not necessary to stop one function prior to beginning the other.	References 29 and 30	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
184	Upgrade Chemical and Volume Control System to mitigate small LOCAs	19	For a plant like the AP600 where the Chemical and Volume Control System cannot mitigate a Small LOCA, an upgrade would decrease the Small LOCA CDF contribution	#5 - Cost would be more than risk benefit	A potential functional equivalent for Dresden would be the enhancement of the RWCU system such that injection flow rates on the order of 1000 gpm were possible. This change is considered to be similar in function, scope, and cost to SAMA 185 ($5-$10 million) with the exception of the independent power source. However, new power circuits and wiring would likely be needed for the larger pumps The low end of the cost of implementation estimate ($5 million) is judged to be applicable for this SAMA, which is greater than the maximum averted cost risk for Dresden.	Reference 19	N/A
185	Install an active HPSI system	19	For a plant like the AP600 where an active HPSI system does not exist, this SAMA would add redundancy in HPSI.	#2 - Similar item is addressed under other proposed SAMAs	See SAMA 178	N/A	N/A
186	Change "in-containment" RWT suction from 4 check valves to 2 check and 2 air operated valves.	19	This SAMA would remove common mode failure of all four injection paths.	#1 - Not applicable to the Dresden Design	Not a BWR issue. Common cause failure of CST suction valves does not disable the low pressure injection systems. Adequate redundancy in design already exists.	References 29, 30, and 37	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
187	Replace 2 of the 4 safety injection (SI) pumps with diesel-powered pumps.	19	This SAMA would reduce the SI system common cause failure probability. This SAMA was intended for the System 80+, which has four trains of SI.	#4 - No significant safety benefit	Dresden has a diverse set of injection systems and more than one method of containment heat removal. Common cause failure of the 4 train LPCI system is a low contributor to risk and removing the 4/4 system failures would have minimal impact on the results. The CCF of all four LPCI pumps to fail to start or run (2LIPM-2ABCD14ACC, 2LIPM-2ABCD14XCC) does not appear in any CDF cutsets above the truncation limit for the plant model and would not impact the results if it were improved	Reference 46	N/A
188	Align low pressure core injection or core spray to the CST on loss of suppression pool cooling	19	This SAMA would help to ensure low pressure ECCS can be maintained in loss of suppression pool cooling scenarios.	#3 - Already implemented at Dresden	This is already directed at Dresden.	Reference 52	N/A
189	Raise high pressure core injection/reactor core isolation cooling backpressure trip setpoints	19	This SAMA would ensure high pressure core injection/reactor core isolation cooling availability when high suppression pool temperatures exist	#4 - No significant safety benefit	The HPCI high backpressure trip is already set at a pressure above the containment ultimate pressure; thus, raising the trip limits would have no impact.	Reference 31	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
190	Improve the reliability of the automatic depressurization system	19	This SAMA would reduce the frequency of high pressure core damage sequences.	#5 - Cost would be more than risk benefit	High pressure melt scenarios are significant contributors to the Dresden CDF. The SAMA is interpreted to mean improved reliability of the ERVs and Target Rock SRVs and their support systems. A plant modification to eliminate dependence on DC power to increase the success probability of these valves would reduce the high pressure injection accident classes of IA and IE No such design is currently available This would require a research and development project and would exceed the maximum cost averted	Reference 34	N/A
191	Disallow automatic vessel depressurization in non-ATWS scenarios	19	This SAMA would improve operator control of the plant.	#3 - Already implemented at Dresden	The Dresden EOPs provide directions for the operators to inhibit ADS under specific non-ATWS conditions Successful performance of this step demonstrates control of the plant. Given that the operator is not able to complete the ADS inhibit action, the automatic depressurization action is desirable to ensure the next step is taken to ensure adequate core cooling.	Reference 52	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
192	Create automatic swap over to recirculation on RWT depletion	19	This SAMA would reduce the human error contribution from recirculation failure.	#1 - Not applicable to the Dresden Design	There is no true equivalent of the PWR "swap over to recirculation" action at Dresden. The normal alignment of LPCI mode is already a recirculation-like flowpath which takes suction from the suppression pool, passes through the LPCI heat exchangers, and injects to the RPV. Suction sources for other injection systems are aligned as directed in the EOPs based on CST and suppression pool levels The procedures were developed based on providing adequate NPSH to the pumps and preventing overfill of the containment. In addition, other injection systems (or the opposite LPCI loop) can provide make-up water to the RPV concurrent with LPCI suppression pool cooling so that it is not necessary to stop one function prior to beginning the other.	Reference 30	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
193	Proceduralize intermittent operation of HPCI	1	SAMA would allow for extended duration of HPCI availability.	#4 - No significant safety benefit	Limitations on HPCI operation in an SBO are based on battery depletion. Multiple starts and stops of the system are a larger drain on the battery than continuous operation with excess flow directed to the torus. In addition, multiple starts of the system introduce additional start demands which may increase the system failure probability for a given period of operation The principal sequence dependent limitation for operation of HPCI is battery life in SBO and HCTL in other sequences where LPCI suppression pool cooling is not available. Negligible benefit has been identified for this SAMA at Dresden. HPCI pump operation must be controlled for SBO to preclude the minimum flow valve operation from dumping excessive amounts of CST water to the torus HPCI in the CST pressure control mode is recommended and currently preferred operating mode of HPCI.	Reference 31	N/A
194	Increase available net positive suction head (NPSH) for injection pumps	1	SAMA increases the probability that these pumps will be available to inject coolant into the vessel by increasing the available NPSH for the injection pumps	#5 - Cost would be more than risk benefit	Requires major plant changes such as new LPCI/CS pumps, moving the LPCI pumps, a new suppression pool design, a larger CST (only applicable for injection phase), or an additional containment cooling system. The cost of these changes would exceed the maximum averted cost-risk for Dresden	References 52 and 30	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
195	Modify Reactor Water Cleanup (RWCU) for use as a decay heat removal system and proceduralize use	1	SAMA would provide an additional source of decay heat removal.	#5 - Cost would be more than risk benefit	RWCU heat removal capacity is too low for decay heat removal In order to make RWCU a viable heat removal system, the piping, pumps, heat exchangers, and power sources would have to be upgraded. This SAMA is considered to be similar in scope to SAMA 191. The cost of implementation for such a change (approximately $5 million) is greater than the maximum averted cost-risk for Dresden	--	N/A
196	CRD Injection	16 64	SAMA would supply an additional method of level restoration by using a non-safety system.	#3 - Already installed	CRD is procedurally directed for RPV injection CRD is credited in the PRA as adequate for RPV injection after initial success of other injection sources No change in this success criteria is anticipated if the procedure is further enhanced to immediately align both CRD pumps for RPV injection at maximum flow. In addition, such a change could detract from other immediate operator actions thereby introducing competing risks.	References 46 and 52	N/A
197	Condensate Pumps for Injection	16	SAMA to provide an additional option for coolant injection when other systems are unavailable or inadequate	#3 - Already installed.	The PRA credits Condensate as a Low pressure injection source. The use of Condensate as a backup Low pressure injection source is procedurally directed in the EOPs.	References 46 and 52	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
198	Align EDG to CRD	16	SAMA to provide power to an additional injection source during loss of power events	#3 - Already installed.	CRD pumps at Dresden are normally fed from diesel-backed emergency 4 kV buses CRD pumps can be loaded into the diesel supplied buses if sufficient margin is available.	Reference 46	N/A
199	Re-open MSIVs	16 64	SAMA to regain the main condenser as a heat sink by re-opening the MSIVs.	#6 - Retain	There are two important aspects of the MSIV closure response. - For non-ATWS conditions, the ability to rapidly respond to MSIV closure and restore the main condenser as a heat sink is not explicitly directed. - For ATWS conditions, Dresden EOPs direct MSIV low level closure bypass in order to retain the main condenser as a heat sink; however, this assumes the MSIVs have not yet closed. For both cases, explicate procedural direction to re open the MSIVs could be included	Reference 52	4
200	Bypass RCIC Turbine Exhaust Pressure Trip	16	SAMA would allow RCIC to operate longer.	#1 - Not applicable to the Dresden Design	Dresden does not have a RCIC system	N/A	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
201	2 a Passive High Pressure System	17	SAMA will improve prevention of core melt sequences by providing additional high pressure capability to remove decay heat through an isolation condenser type system	#3 - Already installed. #5 - Cost would be more than risk benefit	Dresden has an IC which provides the capability for passive inventory control for a short time following scram. Active systems are used for IC shell makeup and RPV makeup due to Recirculation pump seal leakage The addition of tanks for IC makeup and another Active system for RPV makeup make the "passive" feature not cost beneficial The cost of this enhancement has been estimated to be $1.7 million in Reference 17. This is greater than the maximum averted cost-risk for Dresden	Reference 17	N/A
202	2.c. Suppression Pool Jockey Pump	17	SAMA will improve prevention of core melt sequences by providing a small makeup pump to provide low pressure decay heat removal from the RPV using the suppression pool as a source of water.	#5 - Cost would be more than risk benefit	From a review of the contributors to the Dresden risk profile, it is found that the availability of low pressure pumps for RPV make up is not a dominant contributor. The low pressure pump availability for RPV injection is a negligible contributor to the risk profile. The expense of adding another low pressure injection system without introducing severe competing risks is expected to be high. It can be concluded that the cost will not be able to be justified	Reference 17	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
203	2.d Improved High Pressure Systems	17 64	SAMA will improve prevention of core melt sequences by improving reliability of high pressure capability to remove decay heat	#3 - Already implemented at Dresden	Existing reliability improvement program for HPCI: - GE SILs regarding HPCI reliability improvements. - Maintenance rule See SAMA 176.		N/A
204	2 e. Additional Active High Pressure System	17	SAMA will improve reliability of high pressure decay heat removal by adding an additional system.	#2 - Similar item is addressed under other proposed SAMAs.	Dresden has an Isolation Condenser which is capable of providing reliable high-pressure inventory control and cooling for most accident scenarios. Dresden has a HPCI and motor driven FW See SAMA 185	Reference 46	N/A
205	2.f. Improved Low Pressure System (Firepump)	17	SAMA would provide fire protection system pump(s) for use in low pressure scenarios.	#2 - Similar item is addressed under other proposed SAMAs.	Addressed in SAMAs 52 and 177	N/A	N/A
206	4.b. CUW Decay Heat Removal	17	This SAMA provides a means for Alternate Decay Heat Removal.	#2 - Similar item is addressed under other proposed SAMAs.	See SAMA 195. The CUW system in ABWR is equivalent to the RWCU system.	N/A	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
207	4.c. High Flow Suppression Pool Cooling for ATWS response	17	SAMA would improve suppression pool cooling	#5 - Cost would be more than risk benefit	The Suppression Pool Cooling system is already sized to accommodate flow to remove all decay heat and operate under ATWS conditions with SBLC injection success. Increasing the capabilities of suppression pool would require new pumps, heat exchangers, piping, and other equipment. The implementation cost of this change is considered to be approximately equivalent to SAMA 35 ($5.8 million) and is screened from further review as it is significantly greater than the maximum averted cost-risk for Dresden	Reference 46	N/A
208	8.c. Diverse Injection System	17	SAMA will improve prevention of core melt sequences by providing additional injection capabilities.	#2 - Similar item is addressed under other proposed SAMAs.	See SAMA's 52, 177, 201, 203, and 205	N/A	N/A
Instrument Air/Gas Improvements							
209	Modify EOPs for ability to align diesel power to more air compressors	19	For plants that do not have diesel power to all normal and back-up air compressors, this change would increase the reliability of IA after a LOOP.	#3 - Already implemented at Dresden	DGA-12 directs the operators to power the normal AC buses from the emergency AC buses when the normal power supply is lost to allow operation of required equipment Performance of this procedure provides the Instrument Air system and its support systems with power	Reference 55	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
210	Replace old air compressors with more reliable ones	19	This SAMA would improve reliability and increase availability of the IA compressors.	#3 - Already implemented at Dresden	- Adequate reliability now exists - Loss of IA is not a significant contributor to risk - Maintenance rule program monitors reliability and provides early warning to system degradation - - Cost is expected to exceed any risk benefit	Reference 34	N/A
211	Install nitrogen bottles as a back-up gas supply for safety relief valves.	19	This SAMA would extend operation of safety relief valves during an SBO and loss of air events (BWRs)	#4 - No significant safety benefit	Dresden depressurization capability is primarily supported by DC power. The EMRVs are powered by 125V DC and are available during an SBO The single Target Rock SRV uses nitrogen pneumatic supply as the motive power to open the valve against spring pressure, but 125V DC is still required for valve control An accumulator is available to allow a limited number of SRV openings after loss of Drywell Air. Because of the SRV redundancy with the EMRVs, only a negligible change in risk would be achieved.	Reference 45	N/A
212	Allow cross connection of uninterruptable compressed air supply to opposite unit	12 13	SAMA would increase the ability to vent containment using the hardened vent.	#3 - Already installed.	Instrument Air can be cross-tied to other unit	Reference 46	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
			ATWS Mitigation				
213	Install MG set trip breakers in control room	19	This SAMA would provide trip breakers for the MG sets in the control room. In some plants, MG set breaker trip requires action to be taken outside of the control room. Adding control capability to the control room would reduce the trip failure probability in sequences where immediate action is required (e.g., ATWS).	#1 - Not applicable to the Dresden Design	PWR feature; not applicable to BWRs.	N/A	N/A
214	Add capability to remove power from the bus powering the control rods	19	This SAMA would decrease the time to insert the control rods if the reactor trip breakers fail (during a loss of FW ATWS which has a rapid pressure excursion)	#1 - Not applicable to the Dresden Design	- Only PWRs have reactor trip breakers - - Dresden has backup scram capability via the ARI system	N/A	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
215	Create cross-connect ability for standby liquid control trains	19	This SAMA would improve reliability for boron injection during an ATWS event.	#5 - Cost would be more than risk benefit	Each unit's SLC system has two trains which have common suction and discharge headers. Redundant suction and discharge paths exist beyond these headers, which can be isolated, if required. No further cross connection is beneficial between the trains of a given unit An inter unit cross-tie is a potential enhancement. However, because the SLC system response is dominated by common cause failures of the explosive valves and the operator action to initiate SLC, the ability for use of a cross tie will have limited benefit in the risk profile. This small change in the small ATWS contribution results in little potential safety improvement, but a substantial cost.	Reference 34	N/A
216	Create an alternate boron injection capability (back-up to standby liquid control)	19	This SAMA would improve reliability for boron injection during an ATWS event	#3 - Already implemented at Dresden	Condensate/FW can be used as an alternate boron injection system (DEOP-500-1).	References 52 and 66	N/A
217	Remove or allow override of low pressure core injection during an ATWS	19	On failure on high pressure core injection and condensate, some plants direct reactor depressurization followed by 5 minutes of low pressure core injection. This SAMA would allow control of low pressure core injection immediately.	#3 - Already implemented at Dresden	Currently included as part of simulator training.	Reference 52	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
218	Install a system of relief valves that prevents any equipment damage from a pressure spike during an ATWS	19	This SAMA would improve equipment availability after an ATWS.	#3 - Already implemented at Dresden	This is primarily a PWR insight. BWRs are already equipped with adequate pressure control methods even for the worst case ATWS The pressure relief function during an ATWS at Dresden is assumed to require 12 of 13 SVs with RPT.	Reference 45	N/A
219	Create a boron injection system to back up the mechanical control rods.	19	This SAMA would provide a redundant means to shut down the reactor.	#3 - Already implemented at Dresden	Dresden already has boron injection capabilities.	Reference 46	N/A
220	Provide an additional instrument system for ATWS mitigation (e g , ATWS mitigation scram actuation circuitry)	19	This SAMA would improve instrument and control redundancy and reduce the ATWS frequency.	#3 - Already implemented at Dresden	An alternate instrument system (ARI/RPT) exists for Dresden	N/A	N/A
221	Increase the safety relief valve (SRV) reseat reliability.	1	SAMA addresses the risk associated with dilution of boron caused by the failure of the SRVs to reseat after standby liquid control (SLC) injection.	#3 - Already implemented at Dresden	The SRV reseat reliability at Dresden is not judged to be of low reliability This reliability is already monitored by the Maintenance Rule Program. The SRV reseat reliability has been factored into the PRA and has indicated that the SRV failure to reseat under failure to scram conditions represents a small contribution to risk	N/A	N/A
222	Use control rod drive (CRD) for alternate boron injection.	1	SAMA provides an additional system to address ATWS with SLC failure or unavailability.	#3 - Already Installed.	Alternate Boron Injection is directed by the DEOPs. The Dresden method of alternate boron injection is via the feedwater/condensate system. This method provides high pressure injection capability of the boron solution	Reference 66	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
223	Bypass MSIV isolation in Turbine Trip ATWS scenarios	64	SAMA will afford operators more time to perform actions. The discharge of a substantial fraction of steam to the main condenser (i.e., as opposed to into the primary containment) affords the operator more time to perform actions (e g , SLC injection, lower water level, depressurize RPV) than if the main condenser was unavailable, resulting in lower human error probabilities	#3 - Already installed.	BWROG EPC Issue 98-07 addresses this issue. The bypass of the MSIV isolation was moved upward in the flowchart, rendering it more important. Bypass of MSIV isolation is procedurally directed in the DEOPs under failure to scram conditions.	Reference 52	N/A
224	Enhance operator actions during ATWS	64	SAMA will reduce human error probabilities during ATWS	#3 - Already installed.	Operator actions during ATWS scenarios are clearly directed in the DEOP procedures and receive substantial emphasis in training.	Reference 52	N/A
225	Guard against SLC dilution	16	SAMA to control vessel injection to prevent boron loss or dilution following SLC injection.	#3 - Already installed.	SLC initiation and existing procedures guard against dilution (RWCU isolation and overfill prevention).	Reference 52	N/A
226	11.a. ATWS Sized Vent	17	This SAMA would provide the ability to remove reactor heat from ATWS events.	#2 - Similar item is addressed under other proposed SAMAs.	See SAMA 39	N/A	N/A
227	11.b. Improved ATWS Capability	17	This SAMA includes items which reduce the contribution of ATWS to core damage and release frequencies.	#2 - Similar item is addressed under other proposed SAMAs.	Addressed by SAMAs 191, 220 through 226	N/A	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
			Other Improvements				
228	Provide capability for remote operation of secondary side relief valves in an SBO	19	Manual operation of these valves is required in an SBO scenario. High area temperatures may be encountered in this case (no ventilation to main steam areas), and remote operation could improve success probability.	#1 - Not applicable to the Dresden Design	Dresden does not have secondary side relief valves critical to SBO mitigation. An approximate functional equivalent to the secondary side relief valves at Dresden are the SRVs, but these are already operated from the control room since the valves are located within the primary containment	Reference 45	N/A
229	Create/enhance RCS depressurization ability	19	With either a new depressurization system, or with existing PORVs, head vents, and secondary side valve, RCS depressurization would allow earlier low pressure ECCS injection Even if core damage occurs, low RCS pressure would alleviate some concerns about high pressure melt ejection.	#5 - Cost would be more than risk benefit	PWR issue related to the limited depressurization capability of the PWR In addition, reference 19 estimates the cost of this SAMA to range between $500,000 and $4 6 million For Dresden, more effective depressurization capabilities would require significant hardware changes and/or additions on top of the analysis that would be required to implement the change. The cost estimate for the modification is considered to be on the high end of the range provided in Reference 19. The cost of implementation for this SAMA is judged to greatly exceed the maximum averted cost-risk for Dresden	References 19 and 34	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
230	Make procedural changes only for the RCS depressurization option	19	This SAMA would reduce RCS pressure without the cost of a new system	#3 - Already implemented at Dresden	The EOP procedures recognize the importance of depressurization A list of all alternate depressurization systems is included in the EOPs as well as reference to procedures where applicable. EGC continues to follow closely the BWROG development of generic EOP/SAGs and implements the latest procedural guidance as they become available	Reference 52	N/A
231	Defeat 100% load rejection capability.	19	This SAMA would eliminate the possibility of a stuck open PORV after a LOOP, since PORV opening would not be needed.	#1 - Not applicable to the Dresden Design	This SAMA is a PWR specific issue raised based on the estimated importance of stuck open PORVs at the Calvert Cliffs Nuclear Power Plant. No relevant, beneficial functional equivalent has been identified for BWRs.	Reference 19	N/A
232	Change control rod drive flow CV failure position	19	Change failure position to the "fail-safest" position	#3 - Already implemented at Dresden	The control rod drive valves are set to fail in a position that will result in a scram given failure of supporting motive or control power.	Reference 70	N/A
233	Install secondary side guard pipes up to the MSIVs	19	This SAMA would prevent secondary side depressurization should a steam line break occur upstream of the main steam isolation valves. This SAMA would also guard against or prevent consequential multiple SGTR following a Main Steam Line Break event.	#5 - Cost would be more than risk benefit	This is primarily a PWR issue. The steam lines for a BWR inside the inside MSIV are completely within the containment requiring no guard pipe. Between the two MSIVs is a very short length of pipe that contributes a negligible amount to the CDF and LERF. The addition of a guard pipe to the steam tunnel for the short pipe length is judged to be very expensive and substantially in excess of any potential benefit associated with risk reduction	Reference 46	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
234	Install digital large break LOCA protection	19	Upgrade plant instrumentation and logic to improve the capability to identify symptoms/precursors of a large break LOCA (leak before break).	#1 - Not applicable to the Dresden Design	Large break LOCA risk is low. Upgraded instrumentation is unproven, benefit is not known, cost is highly uncertain The implementation could not be realistically justified	Reference 34	N/A
235	Increase seismic capacity of the plant to a high confidence, low probability failure of twice the Safe Shutdown Earthquake.	19	This SAMA would reduce seismically -induced CDF.	#1 - Not applicable to the Dresden Design	Seismic issues were examined in the Dresden IPEEE and the cost-effective means of reducing plant risk were implemented as part of the program. This SAMA was considered in the System 80+ original design submittal and is not applicable to an existing plant See SAMA No 239	Reference 19	N/A
236	Enhance the reliability of the demineralized water (DW) make-up system through the addition of diesel-backed power to one or both of the DW make-up pumps.	19	Inventory loss due to normal leakage can result in the failure of the CC and the SRW systems. Loss of CC could challenge the RCP seals. Loss of SRW results in the loss of three EDGs and the containment air coolers (CACs).	#3 - Already implemented at Dresden	The Clean Demineralized Water pumps are powered by MCCs that can be powered from buses which are aligned to the EDGs in a LOOP scenario. The Diesel Generator Cooling Water System pumps are already powered from diesel backed buses and are also not closed loop cooling systems	Reference 46	N/A
237	Increase the reliability of safety relief valves by adding signals to open them automatically.	12	SAMA reduces the probability of a certain type of medium break LOCA. Hatch evaluated medium LOCA initiated by an MSIV closure transient with a failure of SRVs to open. Reducing the likelihood of the failure for SRVs to open, subsequently reduces the occurrence of this medium LOCA.	#3 - Already implemented at Dresden	Safety valves open against spring pressure, i.e., they open automatically and on a real demand. Modification already in place at Dresden.	References 45 and 46	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
238	Reduce DC dependency between high-pressure injection system and ADS.	1	SAMA would ensure containment depressurization and high-pressure injection upon a DC failure.	#3 - Already implemented at Dresden	The Dresden plant has redundant DC power supplies that supply high pressure injection system and the RPV depressurization system. In addition, the isolation condenser (IC) can be operated with DC failed, making inventory control at high pressure independent of DC power. Reference 19 estimates the cost of this SAMA to range between $500,000 and $4 6 million For Dresden, more effective depressurization capabilities would require significant hardware changes and/or additions on top of the analysis that would be required	Reference 41	N/A
239	Increase seismic ruggedness of plant components Increase the seismic capacity of components on the safe shutdown paths with capacities less than 0 3g to 0 3g	11 13 81	SAMA would increase the availability of necessary plant equipment during and after seismic events. Extends the safe shutdown path seismic capacity to at least 0.3g.	#6 - Retain	Components were identified in the IPEEE whose seismic ruggedness could be improved	Reference 62, 81	5

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
240	Enhance RPV depressurization capability	15	SAMA would decrease the likelihood of core damage in loss of high pressure coolant injection scenarios	#2 - Similar item is addressed under other proposed SAMAs.	See SAMA 190 and 229. At Dresden all SRVs have two redundant 125 VDC power supplies. The target rock valve acts as a Safety Valve that requires nitrogen supply from a three-way 125VDC solenoid valve. An accumulator and check valve arrangement stores sufficient nitrogen to operate the target rock valve in the event of a loss of the nitrogen supply to the valve. Dresden also benefits from the availability of the Isolation Condenser	Reference 34	N/A
241	Enhance RPV depressurization procedures	15	SAMA would decrease the likelihood of core damage in loss of high pressure coolant injection scenarios	#3 - Already implemented at Dresden	The EOP procedures recognize the importance of depressurization. A list of all alternate depressurization systems is included in the EOPs as well as reference to procedures where applicable	References 45 and 52	N/A
242	1.b. Computer Aided Instrumentation	17	SAMA will improve prevention of core melt sequences by making operator actions more reliable.	#3 - Already implemented at Dresden	The Dresden control room is equipped with an information display system that is linked to the plant computer. This system displays critical reactor and containment parameters in a single location for the operators' reference during an accident (not during SBO)	Reference 54	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
243	1 c/d. Improved Maintenance Procedures/Manuals	17	SAMA will improve prevention of core melt sequences by increasing reliability of important equipment	#3 - Already implemented at Dresden	The Maintenance Rule Program has been implemented in the industry to balance reliability and availability and in doing so attempts to optimize the maintenance process. Root cause analysis is required as part of this program and will result in procedure enhancements where they are necessary and where they will be effective in reducing maintenance errors	Reference 54	N/A
244	1.e. Improved Accident Management Instrumentation	17	SAMA will improve prevention of core melt sequences by making operator actions more reliable.	#5 - Cost would be more than risk benefit	The risk as measured by CDF, LERF, and population dose is low The instrumentation available to the operating crew at Dresden is comparable to that available at other BWRs Based on a review of the accident sequences that contribute to the Dresden risk profile, the estimated risk reduction associated with additional accident mitigation instrumentation is judged to be negligible.	References 46 and 34	N/A
245	1.f. Remote Shutdown Station	17	This SAMA would allow alternate system control in the event that the control room becomes uninhabitable.	#3 - Already implemented at Dresden	Dresden already has remote shutdown stations. The safe shutdown panel includes inboard IC valve control. Additional safe shutdown actions are performed in multiple local areas where components can be manipulated or instruments are available.	N/A	N/A
246	1.g. Security System	17	This SAMA would reduce the potential for sabotage.	#3 - Already implemented at Dresden	Electronic safety measures and trained security personnel provide surveillance for the Dresden site.	N/A	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
247	2 b. Improved Depressurization	17	SAMA will improve depressurization system to allow more reliable access to low pressure systems.	#2 - Similar item is addressed under other proposed SAMAs	Addressed in SAMAs 229, 230, 240, and 241	N/A	N/A
248	2.h Safety Related Condensate Storage Tank	17	SAMA will improve availability of CST following a Seismic event	#5 - Cost would be more than risk benefit	The HPCI system has a safety related water source from the torus. The cost of engineering, installation, and safety analysis of an additional large water source is significantly greater than the maximum cost averted		N/A
249	4.d Passive Overpressure Relief	17	This SAMA will prevent catastrophic failure of the containment. Controlled relief through a selected vent path has a greater potential for reducing the release of radioactive material than through a random break	#6 - Retain	Dresden has installed a hard piped containment vent system that provides a controlled means of containment overpressure relief The passive feature of adding a rupture disk to this system introduces competing risks that limit the usefulness of the vent over the spectrum of severe accidents	References 46 and 76	6
250	8 b. Improved Operating Response	17	This SAMA would improve the likelihood of success of operator actions taken in response to an abnormal condition	#3 - Already implemented at Dresden	Operator response has been a focus at Dresden over the past decade. EPG/SAG Rev. 2 has been implemented at Dresden Training has been improved and procedures have been re-written in an ongoing effort to improve operator reliability The Human Reliability Analysis (HRA) portion of the PRA was updated in 99. Training has been improved and procedures have been re-written in an ongoing effort to improve operator reliability.	Reference 52	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
251	8.d. Operation Experience Feedback	17	This SAMA would provide information on the effectiveness of maintenance practices and equipment reliability	#3 - Already implemented at Dresden	Operational experienced is tracked and incorporated into future plant operating philosophy via programs such as the maintenance rule. Already incorporated at Dresden.	Reference 22	N/A
252	8.e. Improved SRV Design	17	This SAMA would improve SRV reliability, thus increasing the likelihood that sequences could be mitigated using low pressure heat removal.	#2 - Similar item is addressed under other proposed SAMAs	See SAMAs 229, 230, 240, 241, and 259	N/A	N/A
253	12.a. Increased Seismic Margins	17	This SAMA would reduce the risk of core damage and release during seismic events	#2 - Similar item is addressed under other proposed SAMAs.	See SAMAs 111, 239, and 265.	N/A	N/A
254	13.b System Simplification	17	This SAMA is intended to address system simplification by the elimination of unnecessary interlocks, automatic initiation of manual actions or redundancy as a means to reduce overall plant risk.	#2 - Similar item is addressed under other proposed SAMAs.	Addressed by SAMAs 13, 107, 113, 146, 194, 237, 238		N/A
255	Train operations crew for response to inadvertent actuation signals	19	This SAMA would improve chances of a successful response to the loss of two 120V AC buses, which may cause inadvertent signal generation.	#4 - No significant safety benefit.	The 120V AC system is not risk significant at Dresden. While other plants have identified specific 120V AC failure scenarios that would lead the generation of inadvertent signals, no comparable vulnerabilities have been identified at Dresden.	Reference 46	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
256	Install tornado protection on gas turbine generators	19	This SAMA would improve onsite AC power reliability.	#4 - No significant safety benefit	No gas turbines on-site. Additional measures could be taken to improve the protection of other on-site AC power sources; however, the IPEEE investigated risk from high wind events and found it to be negligible.	Reference 62	N/A
257	Provide compensatory actions guidelines during Isolation Condenser unavailability	36	The Dresden IPEEE fire analysis identified the Isolation Condenser as an important system in the mitigation of accidents given a fire initiator Limiting maintenance on other systems and high risk evolutions concurrent with Isolation Condenser maintenance may be beneficial	#3 - Already implemented at Dresden	Contingency plans to reduce risk during Isolation Condenser maintenance are developed based on the on-line maintenance monitoring performed as part of the Maintenance Rule (a)(4)	N/A	N/A
258	Upgrade procedures to identify additional contingency or compensatory actions when the Isolation Condenser is out-of-service	21	SAMA would ensure successful implementation of the Safe Shutdown Procedures when the Isolation Condenser in unavailable.	#2 - Similar item is addressed under other proposed SAMAs.	See SAMAs 257	N/A	N/A
259	Diversify the explosive valve operation	64	An alternate means of opening a pathway to the RPV for SBLC injection would improve the success probability for reactor shutdown	#6 - Retain	SBLC injection failure is a dominant contributor to ATWS mitigation failure. Evaluate SBLC system improvements.	N/A	7
260	Enrich Boron	64	The increased boron concentration will reduce the time required to achieve the shutdown concentration. This will provide increased margin in the accident timeline for successful operator activation of SBLC	#6 - Retain	Increasing the boron concentration for SBLC may be a cost effective means of reducing ATWS risk	N/A	8

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
261	Bypass Low Pressure Permissive	64	LPCI and CS injection valves require a permissive signal from the same 2 pressure sensors in order to open The instruments are currently specified as diverse. However, because this is a "pinch point" for all CS and LPCI injection, it is judged prudent to consider a plant modification to allow a bypass switch (1/division) to insert the permissive if the sensors fail to perform their function. A few other BWRs currently have this capability (e g., Perry)	#6 - Retain	A reduction in this CCF will result in a small decrease in CDF.	N/A	9

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
262	Modify R B. Blowout Panels	64	The Reactor Building blowout panels are designed to blow free from their normal positions. Hinging the Reactor Building blowout panels so they reclose once the reactor building to environment pressure differential subsides has several advantages: - Prevents frigid external air if present from entering the reactor building - Limits reactor building accelerated circulation that could reduce radionuclide residence time in the Reactor Building - - May contribute to improved SGTS operation in the long term where late revolatilization of CsI could be effectively mitigated	#4 - No significant safety benefit	No change in CDF is calculated and no impact on LERF Other risk measures would be affected in a negligible way.	Reference 46	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
263	Supplemental Air Supply for the Containment Vent	64	The containment vent function is among the last resort methods currently specified in BWRs to remove heat from containment and control containment pressure under extremely adverse circumstances. The Dresden air compressors are required to support the containment vent function. The air compressors in turn require cooling, normally from TBCCW/SW. An alternative method to supply air to the vent valves for opening would be desirable if SW were to become inadequate	#6 - Retain	Possible Alternatives: - Air or N2 bottles located near the AOVs that can be remotely valved into the AOVs to allow AOV operation. or - Air supply line connections into the Reactor Building from external to the reactor building to allow Air Bottles or pneumatic supply trucks to supply the required air pressure for AOV operation.	N/A	10
264	LPCI Loop Select Logic	64	The LPCI Loop Select Logic results in selecting a single LPCI injection valve to be used for RPV injection. If no LOCA in the Recirc lines exists, the logic defaults to the "B" loop The logic is such that if the "B" loop valve fails to open, the operating staff cannot permanently align the LPCI injection to the "A" LPCI injection valve. In other words, the LPCI injection valve can be opened, but once it is full open it would receive a close signal from the LPCI Loop Select Logic.	#3 - Already implemented at Dresden	Procedural guidance already exists via DOP 1500-09 on forcing loop selection logic to a specific division; e g., injection could be forced to LOOP A instead of the default to LOOP B This is routinely used during refueling outages but may be used in any mode	N/A	N/A

TABLE F-1
PHASE I SAMA (Cont'd)

Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Screening Criteria [See Notes]	Disposition	Disposition Reference	Phase II SAMA ID number
265	Examine the Dresden Dam Integrity and its impact on seismic capability of the plant.	81	Increase effectiveness of Dresden seismic response.	#2 - Similar item is addressed under other proposed SAMAs	Already being examined as part of NRC commitment for IPEEE and EPU. See SAMA #22	Reference 81	N/A

[shaded box] Indicates Retained Item

Notes to Table F-1

#1 Not applicable to the Dresden Design
#2 Similar item is addressed under other proposed SAMAs.
#3 Already implemented.
#4 No significant safety benefit associated with the systems/items associated with this SAMA.
#5 The cost of implementation is greater than the cost-risk averted for the plant change or modification.
#6 Retain
#7 Requested additional information from Dresden
#8 ABWR Design Issue; not practical.

TABLE F-2
ESTIMATED POPULATION DISTRIBUTION WITHIN A 10-MILE RADIUS OF DNGS, YEAR 2031

Sector	0-1 mile	1-2 miles	2-3 miles	3-4 miles	4-5 miles	5-10 miles	10-mile total
N	25	96	160	227	1,722	1,093	3,323
NNE	25	96	331	902	2,699	11,778	15,831
NE	26	90	357	776	1,320	8,541	11,110
ENE	26	82	131	183	297	2,427	3,146
E	22	80	131	183	236	2,746	3,398
ESE	17	75	102	102	104	493	893
SE	17	45	38	54	69	7,503	7,726
SSE	17	52	64	73	71	3,157	3,434
S	17	52	87	179	227	8,738	9,300
SSW	17	52	87	138	205	4,662	5,161
SW	17	52	87	122	158	1,956	2,392
WSW	17	52	87	122	156	2,547	2,981
W	17	52	78	98	120	13,843	14,208
WNW	17	50	66	92	150	1,690	2,065
NW	18	81	83	200	289	883	1,554
NNW	23	96	159	225	289	898	1,690
Total	317	1,102	2,047	3,675	8,111	72,950	88,202

TABLE F-3
ESTIMATED POPULATION DISTRIBUTION WITHIN A 50-MILE RADIUS OF DNGS, YEAR 2031

Sector	0-10 miles	10-20 miles	20-30 miles	30-40 miles	40-50 miles	50-mile total
N	3,323	14,507	276,244	185,131	262,010	741,215
NNE	15,831	96,745	393,265	622,510	836,085	1,964,436
NE	11,110	166,697	139,921	886,086	2,996,261	4,200,075
ENE	3,146	54,327	236,184	800,958	783,427	1,878,042
E	3,398	9,246	38,013	177,215	288,290	516,162
ESE	893	1,753	17,321	14,360	22,838	57,165
SE	7,726	3,596	89,530	18,553	5,971	125,376
SSE	3,434	5,570	5,232	5,720	9,326	29,282
S	9,300	6,028	2,213	2,409	5,365	25,315
SSW	5,161	3,350	8,882	12,304	16,073	45,770
SW	2,392	2,421	1,962	4,274	6,849	17,898
WSW	2,981	3,468	2,756	29,516	5,498	44,219
W	14,208	4,295	24,645	19,927	49,364	112,439
WNW	2,065	2,385	9,784	6,034	14,900	35,168
NW	1,554	3,245	22,617	4,874	6,720	39,010
NNW	1,690	10,026	25,430	12,753	86,463	136,362
Total	88,202	387,649	1,293,989	2,802,614	5,395,430	9,967,934

TABLE F-4
MACCS2 RELEASE CATEGORIES VS. DNGS RELEASE CATEGORIES

MACCS2 Release Categories	DNGS Release Categories
Xe/Kr	1 – noble gases
I	2 – CsI
Cs	6 – CsOH
Te	10 - Sb (TeO_2 & Te_2 fractions are smaller)
Sr	4 – SrO
Ru	5 – MoO_2 (Mo is in Ru MACCS2 category)
La	8 – La_2O_3
Ce	9 – CeO_2 (included UO_2 in this category)
Ba	7 – BaO

TABLE F-5
FREQUENCY-WEIGHTED OFF-SITE POPULATION DOSE AND ECONOMIC COSTS

MAAP Run	Release Category	Dose (Sv)	Costs($)	Annual Frequency	Weighted Dose (person-rem)	Weighted Cost ($)
DR0024	L2-1	2.22E+05	4.68E+10	3.01E-07	6.682E+00	1.41E+04
DR0040	L2-2	1.86E+05	4.42E+10	1.48E-08	2.753E-01	6.54E+02
DR0034	L2-4	1.21E+05	2.08E+10	1.09E-07	1.319E+00	2.27E+03
DR0031	L2-5	5.44E+04	3.44E+09	2.79E-07	1.518E+00	9.60E+02
DR0028	L2-7	1.17E+05	1.89E+10	3.29E-09	3.849E-02	6.22E+01
DR0042	L2-8	6.07E+04	4.67E+09	5.78E-08	3.508E-01	2.70E+02
DR0039	L2-9	2.79E+05	6.19E+10	1.74E-09	4.855E-02	1.08E+02
DR0043	L2-10	2.08E+01	8.25E+04	1.12E-06	2.330E-03	9.24E-02
Frequency Weighted Totals (p-rem and $)				1.89E-06	10.23	18408

TABLE F.6
ACCIDENT SEQUENCE TIMINGS AS A FUNCTION OF CONSEQUENCE CATEGORY

Consequence Category	Dominant Release Category	MAAP Case	Time to TAF	Time to Core Damage	Time of Initial Release	Time of Gen Emg. Declaration	Time of End of Release	EAL Basis
L2-1	H/E(LERF) (23%)[2]	DR 0024 IA-L2-1A-NSPR	26 min	54 min	4.1 hr	60 min	36 hr	FG1
L2-2	H/I (35%)	DR 0040 IIA-L2-9C(1)	46.0 hr(1)	47.5 hr	47.5 hr	15 hr	72 hr	HG2
L2-3	H/L	None	--	--	--	--	--	--
L2-4	M/E (1.7%)	DR 0034 IVA-L2-14A-ED-DW	8.6 min	1.4 hr	1.1 hr	1.1 hr	36 hr	FG1
L2-5	M/I (1.8%)	DR 0031 IIA-l2-9a	34.9 hr	37.8 hr	37.8 hr	15 hr	72 hr	HG2
L2-6	M/L	None	--	--	--	--	--	--
L2-7	L or LL/E (0.35%)	DR 0028 ID-L2-7B NSPR	26 min	40 min	5.7 hr	45 min	36 hr	FG1
L2-8	L or LL/I or L or LL/L (0.22%)	DR 0042 ID-L2-7BA-SPRY	26 min	40 min	5.7 hr	45 min	36 hr	HG2
L2-9	Class V (96%)	DR 0039 V-L2-17	1.5 min	17 min	17 min	20 min	36 hr	FG1
L2-10	Intact	DR 0043 IB-L2-22	26 min	49 min	48 min	60 min	36 hr	FG1

(1) Containment fails at 45.9 hr.

(2) % of CsI released at end of release.

TABLE F-7
PHASE II SAMA

Phase II SAMA ID number	Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Potential Cost	Phase 2 Disposition
1	3	Enhance loss of component cooling procedure to present desirability of cooling down reactor coolant system (RCS) prior to seal LOCA.	2	SAMA would reduce the potential for RCP seal failure.	Not Required	Not Cost Beneficial (Refer to Section F.6.1)
2	22	Improved ability to cool the residual heat removal heat exchangers	1	SAMA would reduce the probability of a loss of decay heat removal by implementing procedure and hardware modifications to allow manual alignment of the fire protection system or by installing a component cooling water cross-tie A portable diesel-driven pump is under consideration to provide cooling water to a LPCI heat exchanger. This was discussed in the EPU correspondence as the tentative plan for dealing with the seismic outlier of Dresden Island Lock & Dam, i.e., loss of UHS, by Fall 2003.	Not Required	Not Cost Beneficial (Refer to Section F 6 2)
3	35	Develop an enhanced drywell spray system.	5 6 36 64	SAMA would provide a redundant source of water to the containment to control containment pressure, when used in conjunction with containment heat removal	$265,000 (estimated)	Not Cost Beneficial (Refer to Section F.6.3)
4	199	Re-open MSIVs	16 64	SAMA to regain the main condenser as a heat sink by re-opening the MSIVs	Not Required	Not Cost Beneficial (Refer to Section F.6 4)

TABLE F-7
PHASE II SAMA (CONT'D)

Phase II SAMA ID number	Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Potential Cost	Phase 2 Disposition
5	239	Increase seismic ruggedness of plant components. Increase the seismic capacity of components on the safe shutdown paths with capacities less than 0 3g to 0.3g	11 13 81	SAMA would increase the availability of necessary plant equipment during and after seismic events Extends the safe shutdown path seismic capacity to at least 0.3g	Not evaluated	(Refer to Section F 6 5)
6	249	4.d. Passive Overpressure Relief	17	This SAMA will prevent catastrophic failure of the containment Controlled relief through a selected vent path has a greater potential for reducing the release of radioactive material than through a random break.	Not Required	Not Cost Beneficial (Refer to Section F 6 6)
7	259	Diversify the explosive valve operation	64	An alternate means of opening a pathway to the RPV for SBLC injection would improve the success probability for reactor shutdown	Not Required	Not Cost Beneficial (Refer to Section F.6.7)
8	260	Enrich Boron	64	The increased boron concentration will reduce the time required to achieve the shutdown concentration. This will provide increased margin in the accident timeline for successful operator activation of SBLC.	Not Required	Not Cost Beneficial (Refer to Section F 6 8)
9	261	Bypass Low Pressure Permissive	64	LPCI and CS injection valves require a permissive signal from the same 2 pressure sensors in order to open. The instruments are currently specified as diverse However, because this is a "pinch point" for all CS and LPCI injection, it is judged prudent to consider a plant modification to allow a bypass switch (1/division) to insert the permissive if the sensors fail to perform their function. A few other BWRs currently have this capability (e g , Perry)	Not Required	Not Cost Beneficial (Refer to Section F.6 9)

TABLE F-7
PHASE II SAMA (CONT'D)

Phase II SAMA ID number	Phase I SAMA ID number	SAMA title	Source Reference of SAMA	Result of potential enhancement	Potential Cost	Phase 2 Disposition
10	263	Supplemental Air Supply for the Containment Vent	64	The containment vent function is among the last resort methods currently specified in BWRs to remove heat from containment and control containment pressure under extremely adverse circumstances. The Dresden air compressors are required to support the containment vent function. The air compressors in turn require cooling, normally from TBCCW/SW. An alternative method to supply air to the vent valves for opening would be desirable if SW were to become inadequate.	Not Required	Not Cost Beneficial (Refer to Section F.6 10)

TABLE F-8
ACCIDENT SEQUENCE RELEASE FREQUENCY CHANGES AS A FUNCTION OF CONSEQUENCE CATEGORY - SAMA #1

Consequence Category	Dominant Release Category	MAAP Case	Release Frequency (Per Rx Yr)	
			Base	SAMA
L2-1	H/E (LERF)	DR 0024 IA-L2-1A-NSPR	3.0E-07	3.0E-07
L2-2, L2-3	H/I or H/L	DR 0040 IIA-L2-9C(1)	1.5E-08	1.2E-08
L2-4	M/E	DR 0034 IVA-L2-14A-ED-DW	1.1E-07	1.1E-07
L2-5	M/I	DR 0031 IIA-I2-9A	2.8E-07	2.5E-07
L2-6	M/L	None	0.0E+00	0.0E+00
L2-7	L/E or LL/E	DR 0028 ID-L2-7B NSPR	3.3E-09	3.3E-09
L2-8	L/I or LL/I or L/L or LL/L	DR 0042 ID-L2-7BA-SPRY	5.8E-08	5.7E-08
L2-9	Class V	DR 0039 V-L2-17	1.7E-09	1.7E-09
L2-10	Intact	DR 0043 IB-L2-22	1.1E-06	1.1E-06

(1) Containment fails at 45.9 hr.

TABLE F-9
ACCIDENT SEQUENCE RELEASE FREQUENCY CHANGES AS A FUNCTION OF CONSEQUENCE CATEGORY - SAMA #2

Consequence Category	Dominant Release Category	MAAP Case	Release Frequency (Per Rx Yr)	
			Base	SAMA
L2-1	H/E (LERF)	DR 0024 IA-L2-1A-NSPR	3.0E-07	3.0E-07
L2-2, L2-3	H/I or H/L	DR 0040 IIA-L2-9C(1)	1.5E-08	1.4E-08
L2-4	M/E	DR 0034 IVA-L2-14A-ED-DW	1.1E-07	1.1E-07
L2-5	M/I	DR 0031 IIA-I2-9A	2.8E-07	2.4E-07
L2-6	M/L	None	0.0E+00	0.0E+00
L2-7	L/E or LL/E	DR 0028 ID-L2-7B NSPR	3.3E-09	3.3E-09
L2-8	L/I or LL/I or L/L or LL/L	DR 0042 ID-L2-7BA-SPRY	5.8E-08	5.8E-08
L2-9	Class V	DR 0039 V-L2-17	1.7E-09	1.7E-09
L2-10	Intact	DR 0043 IB-L2-22	1.1E-06	1.1E-06

(1) Containment fails at 45.9 hr.

TABLE F-10
ACCIDENT SEQUENCE RELEASE FREQUENCY CHANGES AS A FUNCTION OF CONSEQUENCE CATEGORY - SAMA #3

Consequence Category	Dominant Release Category	MAAP Case	Release Frequency (Per Rx Yr)	
			Base	SAMA
L2-1	H/E (LERF)	DR 0024 IA-L2-1A-NSPR	3.0E-07	2.4E-07
L2-2, L2-3	H/I or H/L	DR 0040 IIA-L2-9C(1)	1.5E-08	1.6E-08
L2-4	M/E	DR 0034 IVA-L2-14A-ED-DW	1.1E-07	1.3E-07
L2-5	M/I	DR 0031 IIA-I2-9A	2.8E-07	8.0E-08
L2-6	M/L	None	0.0E+00	4.8E-10
L2-7	L/E or LL/E	DR 0028 ID-L2-7B NSPR	3.3E-09	3.3E-09
L2-8	L/I or LL/I or L/L or LL/L	DR 0042 ID-L2-7BA-SPRY	5.8E-08	1.0E-07
L2-9	Class V	DR 0039 V-L2-17	1.7E-09	1.7E-09
L2-10	Intact	DR 0043 IB-L2-22	1.1E-06	1.3E-06

(1) Containment fails at 45.9 hr.

TABLE F-11
ACCIDENT SEQUENCE RELEASE FREQUENCY CHANGES AS A FUNCTION OF CONSEQUENCE CATEGORY - SAMA #4

Consequence Category	Dominant Release Category	MAAP Case	Release Frequency (Per Rx Yr)	
			Base	SAMA
L2-1	H/E (LERF)	DR 0024 IA-L2-1A-NSPR	3.0E-07	3.0E-07
L2-2, L2-3	H/I or H/L	DR 0040 IIA-L2-9C[1]	1.5E-08	1.5E-08
L2-4	M/E	DR 0034 IVA-L2-14A-ED-DW	1.1E-07	1.1E-07
L2-5	M/I	DR 0031 IIA-I2-9A	2.8E-07	2.8E-07
L2-6	M/L	None	0.0E+00	0.0E+00
L2-7	L/E or LL/E	DR 0028 ID-L2-7B NSPR	3.3E-09	3.3E-09
L2-8	L/I or LL/I or L/L or LL/L	DR 0042 ID-L2-7BA-SPRY	5.8E-08	5.8E-08
L2-9	Class V	DR 0039 V-L2-17	1.7E-09	1.7E-09
L2-10	Intact	DR 0043 IB-L2-22	1.1E-06	1.1E-06

(1) Containment fails at 45.9 hr.

TABLE F-12
ACCIDENT SEQUENCE RELEASE FREQUENCY CHANGES AS A FUNCTION OF CONSEQUENCE CATEGORY - SAMA #6

Consequence Category	Dominant Release Category	MAAP Case	Release Frequency (Per Rx Yr)	
			Base	SAMA
L2-1	H/E (LERF)	DR 0024 IA-L2-1A-NSPR	3.0E-07	3.0E-07
L2-2, L2-3	H/I or H/L	DR 0040 IIA-L2-9C(1)	1.5E-08	1.5E-08
L2-4	M/E	DR 0034 IVA-L2-14A-ED-DW	1.1E-07	1.1E-07
L2-5	M/I	DR 0031 IIA-I2-9A	2.8E-07	2.5E-07
L2-6	M/L	None	0.0E+00	0.0E+00
L2-7	L/E or LL/E	DR 0028 ID-L2-7B NSPR	3.3E-09	3.3E-09
L2-8	L/I or LL/I or L/L or LL/L	DR 0042 ID-L2-7BA-SPRY	5.8E-08	5.8E-08
L2-9	Class V	DR 0039 V-L2-17	1.7E-09	1.7E-09
L2-10	Intact	DR 0043 IB-L2-22	1.1E-06	1.1E-06

(1) Containment fails at 45.9 hr.

TABLE F-13
ACCIDENT SEQUENCE RELEASE FREQUENCY CHANGES AS A FUNCTION OF CONSEQUENCE CATEGORY - SAMA #7

Consequence Category	Dominant Release Category	MAAP Case	Release Frequency (Per Rx Yr)	
			Base	SAMA
L2-1	H/E (LERF)	DR 0024 IA-L2-1A-NSPR	3.0E-07	2.8E-07
L2-2, L2-3	H/I or H/L	DR 0040 IIA-L2-9C(1)	1.5E-08	1.5E-08
L2-4	M/E	DR 0034 IVA-L2-14A-ED-DW	1.1E-07	9.3E-08
L2-5	M/I	DR 0031 IIA-I2-9A	2.8E-07	2.8E-07
L2-6	M/L	None	0.0E+00	0.0E+00
L2-7	L/E or LL/E	DR 0028 ID-L2-7B NSPR	3.3E-09	3.3E-09
L2-8	L/I or LL/I or L/L or LL/L	DR 0042 ID-L2-7BA-SPRY	5.8E-08	5.8E-08
L2-9	Class V	DR 0039 V-L2-17	1.7E-09	1.7E-09
L2-10	Intact	DR 0043 IB-L2-22	1.1E-06	1.1E-06

(1) Containment fails at 45.9 hr.

TABLE F-14
ACCIDENT SEQUENCE RELEASE FREQUENCY CHANGES AS A FUNCTION OF CONSEQUENCE CATEGORY - SAMA #8

Consequence Category	Dominant Release Category	MAAP Case	Release Frequency (Per Rx Yr)	
			Base	SAMA
L2-1	H/E (LERF)	DR 0024 IA-L2-1A-NSPR	3.0E-07	3.0E-07
L2-2, L2-3	H/I or H/L	DR 0040 IIA-L2-9C(1)	1.5E-08	1.5E-08
L2-4	M/E	DR 0034 IVA-L2-14A-ED-DW	1.1E-07	1.1E-07
L2-5	M/I	DR 0031 IIA-I2-9A	2.8E-07	2.8E-07
L2-6	M/L	None	0.0E+00	0.0E+00
L2-7	L/E or LL/E	DR 0028 ID-L2-7B NSPR	3.3E-09	3.3E-09
L2-8	L/I or LL/I or L/L or LL/L	DR 0042 ID-L2-7BA-SPRY	5.8E-08	5.8E-08
L2-9	Class V	DR 0039 V-L2-17	1.7E-09	1.7E-09
L2-10	Intact	DR 0043 IB-L2-22	1.1E-06	1.1E-06

(1) Containment fails at 45.9 hr.

TABLE F-15
ACCIDENT SEQUENCE RELEASE FREQUENCY CHANGES AS A FUNCTION OF CONSEQUENCE CATEGORY - SAMA #9

Consequence Category	Dominant Release Category	MAAP Case	Release Frequency (Per Rx Yr)	
			Base	SAMA
L2-1	H/E (LERF)	DR 0024 IA-L2-1A-NSPR	3.0E-07	2.8E-07
L2-2, L2-3	H/I or H/L	DR 0040 IIA-L2-9C(1)	1.5E-08	1.5E-08
L2-4	M/E	DR 0034 IVA-L2-14A-ED-DW	1.1E-07	1.1E-07
L2-5	M/I	DR 0031 IIA-I2-9A	2.8E-07	2.8E-07
L2-6	M/L	None	0.0E+00	0.0E+00
L2-7	L/E or LL/E	DR 0028 ID-L2-7B NSPR	3.3E-09	3.3E-09
L2-8	L/I or LL/I or L/L or LL/L	DR 0042 ID-L2-7BA-SPRY	5.8E-08	5.7E-08
L2-9	Class V	DR 0039 V-L2-17	1.7E-09	1.7E-09
L2-10	Intact	DR 0043 IB-L2-22	1.1E-06	1.1E-06

(1) Containment fails at 45.9 hr.

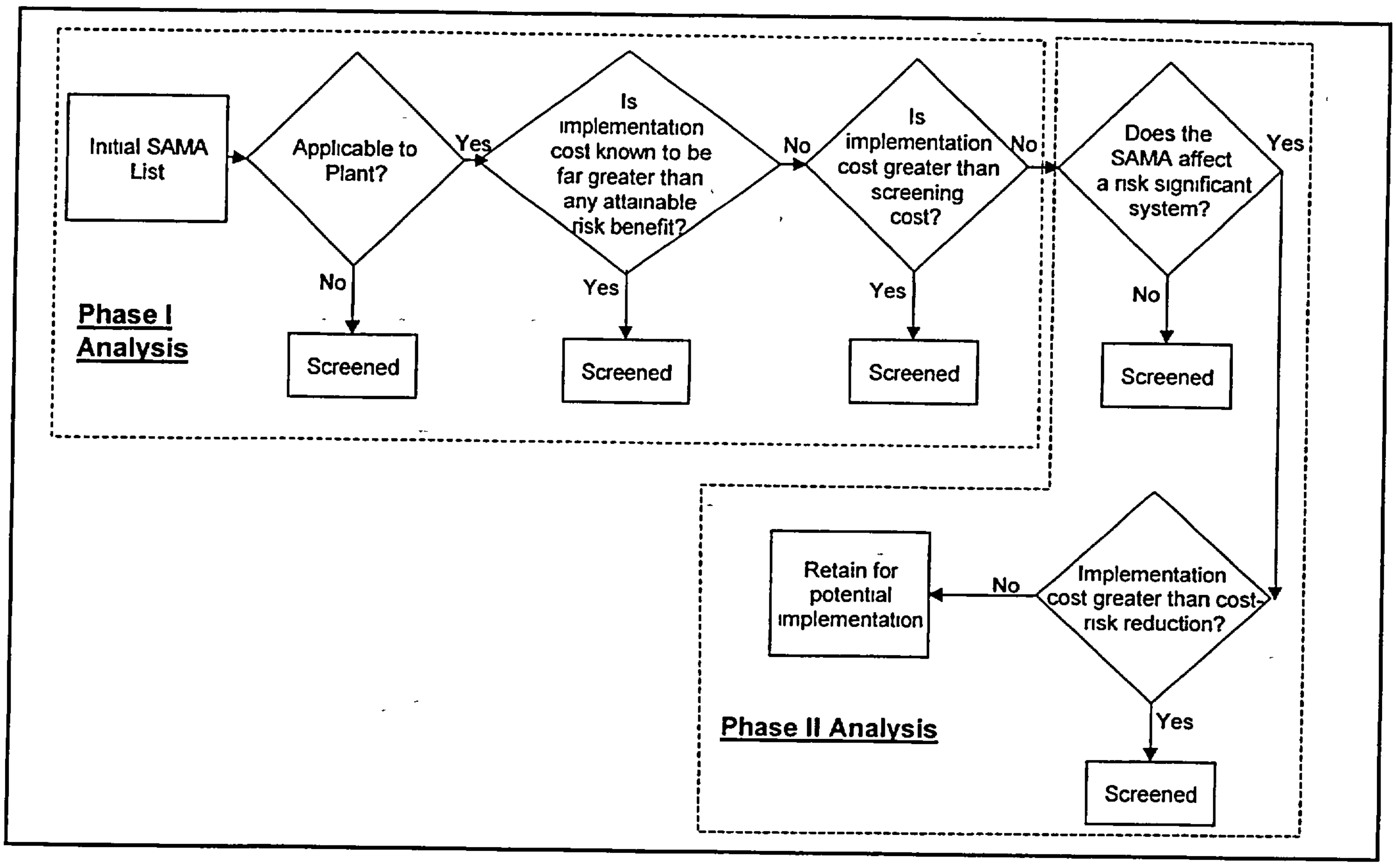
TABLE F-16
ACCIDENT SEQUENCE RELEASE FREQUENCY CHANGES AS A FUNCTION OF CONSEQUENCE CATEGORY - SAMA #10

Consequence Category	Dominant Release Category	MAAP Case	Release Frequency (Per Rx Yr)	
			Base	SAMA
L2-1	H/E (LERF)	DR 0024 IA-L2-1A-NSPR	3.0E-07	3.0E-07
L2-2, L2-3	H/I or H/L	DR 0040 IIA-L2-9C[1]	1.5E-08	1.5E-08
L2-4	M/E	DR 0034 IVA-L2-14A-ED-DW	1.1E-07	1.1E-07
L2-5	M/I	DR 0031 IIA-I2-9A	2.8E-07	2.5E-07
L2-6	M/L	None	0.0E+00	0.0E+00
L2-7	L/E or LL/E	DR 0028 ID-L2-7B NSPR	3.3E-09	3.3E-09
L2-8	L/I or LL/I or L/L or LL/L	DR 0042 ID-L2-7BA-SPRY	5.8E-08	5.8E-08
L2-9	Class V	DR 0039 V-L2-17	1.7E-09	1.7E-09
L2-10	Intact	DR 0043 IB-L2-22	1.1E-06	1.1E-06

[1] Containment fails at 45.9 hr.

Figure F-1

SAMA Screening Process



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a) The inability to isolate the SGTR while the IC tube rupture can be easily isolated

b) The extremely large surface area compared with the Dresden IC

Because of these differences the impact of any SAMA would be significantly less for Dresden. Specifically, the IC tube rupture has a negligible contribution to CDF and LERF.

79 Each Recirc Pump is equipped with a mechanical seal assembly designed to prevent leakage past the pump shaft. The seal assembly consists of two sets of sealing surfaces and breakdown bushing. The seal assembly is designed to allow a small amount of bypass leakage around the seals. The seals are designed to allow minimal leakage.

The seal assembly is designed to allow each seal to accept 1/2 of the pressure drop from the Recirc Pump. To accomplish this an internal leakage flowpath is utilized. Seal #1 is exposed to Recirc (Reactor) pressure. An orificed bypass port bypasses Seal #1 to the Seal #2 cavity. Another line with a restricting orifice bypasses Seal #2 and discharges to the Drywell Equipment Drain Tank (DWEDT). The size of the orifice determines the leakage rate, allowing each seal to share 1/2 of the pressure drop. The normal leakage flow to the DWEDT is 0.75 gpm.

Seal assembly cooling is required to prevent damage to the sealing surfaces. This is accomplished by a cooling water jacket around the seal assembly. The cooling water is supplied by RBCCW at a rate of approximately 50 GPM. Additionally, cooling is provided by the CRD purge water applied to the seals.

RBCCW is the cooling water supply for the Recirc Pump motor upper bearing oil cooler and the seal assembly on the pump. The primary concern on a loss of RBCCW to the Recirc Pump is over heating the seal assembly.

When RBCCW flow to the seal assembly is lost the mechanical seals will quickly heat up and can be damaged. For this reason, procedures direct the operator to trip the Recirc Pumps within 1 minute of the loss of RBCCW.

Following the loss of RBCCW, trip of the recirculation pumps is required within one minute. Otherwise,

damage may occur to the recirculation pump seals and bearings. (DOA-3700-01, Rev. 16). Recirculation

pump seal failure or excessive leakage is not expected for scrams that involve loss of RBCCW. Therefore,

seal leakage is not considered a risk significant failure mode.

Dresden has the following features that reduce the impact of loss of Recirculation Pump seal cooling:

- Minimal Seal leakage might occur if both the cooling from RBCCW <u>and</u> the purge flow from CRD become unavailable. This is postulated for SBO events or loss of SW events.
- a new improved Recirculation pump seal with significantly reduced potential for leakage (12.5gpm/pump versus some PWR estimates of 480gpm/pump)
- multiple high pressure injection systems that provide RPV makeup capability to assure adequate RPV inventory. These include:
  - HPCI (turbine driven system)
  - CRD (Unit 2 and Unit 3)
  - SBLC from test tank or SBLC tank
  - Feedwater

  HPCI and SBLC are independent of SW and RBCCW failure

  FW and CRD are independent of RBCCW failure

Because of the availability of multiple high pressure injection systems the Recirculation Pump seal leakage is not a significant contributor to the risk profile.

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Appendix G

FESOP Permit

The Federally Enforceable State Operating Permit (FESOP) for the Dresden Nuclear Power Station grants EGC to operate emission sources(s) and/or air pollution control equipment as designated in the permit. Appendix G contains a copy of the entire permit.

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

P O Box 19506, Springfield, Illinois 62794-9506
Thomas V Skinner, Director

217/782-2113

FEDERALLY ENFORCEABLE STATE OPERATING PERMIT
NSPS SOURCE

PERMITTEE

Exelon Generation Company, LLC
Attn· Terry Steinert
1411 Opus Place, Suite 250
Downers Grove, Illinois 60515-1182

Application No.: 73020783 I.D. No.. 063806AAC
Applicant's Designation: DRSNSTN Date Received: December 22, 1999
Subject: Diesel generators, boilers and cooling towers
Date Issued: April 19, 2001 Expiration Date: April 19, 2006
Location: Lorenzo Road, 4 miles West of I-55, Morris, Grundy County

This permit is hereby granted to the above-designated Permittee to OPERATE emission source(s) and/or air pollution control equipment consisting of support equipment for the Dresden nuclear generating station, including two - oil fired auxiliary boilers (50 mmBtu/hr each), one - oil fired auxiliary boiler (3.35 mmBtu/hr), five - large diesel generators (three-26 mmBtu/hr and two-38.6 mmBtu/hr), small diesel generators (600 horsepower each or smaller)* and 48 cooling tower cells pursuant to the above-referenced application. This Permit is subject to standard conditions attached hereto and the following special condition(s):

* This permit does not address emergency engines maintained at the source by the Illinois Department of Nuclear Safety.

1a. This Federally Enforceable State Operating Permit (FESOP) is issued to limit the emissions of air pollutants from all the emission units combined, as listed in the above paragraph to less than major source thresholds, for example, less than 100 tons per year of nitrogen oxide (NO_x), as further described in Attachment A. As a result, the source is excluded from requirements to obtain a Clean Air Act Permit Program (CAAPP) permit.

b. Prior to issuance, a draft of this permit has undergone a public notice and comment period.

2a. The two - 50 mmBtu/hr auxiliary boilers are subject to a New Source Performance Standard (NSPS) for small industrial steam generating units, 40 CFR 60, Subparts A and Dc. The Illinois EPA is administering NSPS in Illinois on behalf of the United States EPA under a delegation agreement.

b. These boilers shall only be fired on distillate fuel oil.

c. i. The sulfur dioxide emissions from each boiler shall comply with the applicable limit of the NSPS, 40 CFR 60.42c(d).

George H Ryan, Governor

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ii. The opacity from each boiler shall not exceed 20 percent except for one six-minute period per hour of not more than 27 percent opacity pursuant to 40 CFR 60 43c(c). This limit applies at all times except during startup, shutdown or malfunction, as defined at 40 CFR 60.2.

3a. Emissions and operation of all equipment shall not exceed the following limits:

Item of Equipment	Fuel Usage (Gal/Mo)	(Gal/Yr)	NO_x Emissions (Ton/Yr)
5 Large Diesel Generators	50,000	240,000	53.8
Small Diesel Generators	15,000	72,000	22.2
3 Auxiliary Boilers	600,000	1,930,000	19.0

These limits are based on AP-42 emission factors for internal combustion units and boilers, and maximum usage of fuel oil.

b. Compliance with annual limits shall be determined from a running total of twelve months of data.

4a. The cooling towers shall each be equipped, operated and maintained with drift eliminators or other comparable features designed to limit the loss of water droplets from the cooling tower to not more than 0.008% of the circulating water flow (0.00008 drift).

b. The particulate matter (PM_{10}) emissions from all 48 cooling tower cells shall not exceed 67.2 tons/year, in total. This limit is based on information in the application indicating a nominal emission rate of 0.32 lb/hour for each cooling tower cell operating at a design flow rate of 17,750 gallons/minute and continuous operation of all 48 cooling tower cells.

5a. i. Each gasoline storage tank shall be equipped and operated with a submerged loading pipe pursuant to 35 IAC 218.122(b) and 35 IAC 218.583(a)(1).

ii. A. The capacity of individual gasoline storage tanks shall be less than 575 gallons, pursuant to 35 IAC 218.583(b).

B. The monthly gasoline throughput of the gasoline dispensing operation shall not exceed 10,000 gallons/month, unless the Permittee obtains a control construction permit to address applicable requirements of 35 IAC 218.586.

b. Emissions of volatile organic material (VOM) from storage and handling of gasoline shall not exceed 2.0 ton per year. This limit is based on standard USEPA emission factors for breathing and working losses and information provided in the permit application.

6. The emissions of Hazardous Air Pollutants (HAPs) as listed in Section 112(b) of the Clean Air Act shall not equal or exceed 10 tons per year of any single HAP or 25 tons per year of any combination of such HAPs, or such lesser quantity as USEPA may establish in rule which would require the Permittee to obtain a CAAPP permit from the Illinois EPA. As a result of this condition, this permit is issued based on the emissions of any HAP from this source not triggering the requirement to obtain a CAAPP permit from the Illinois EPA

7. At all times, the Permittee shall to the extent practicable, maintain and operate the above referenced emission sources, in a manner consistent with good air pollution control practice for minimizing emissions.

8a. Organic liquid by-products or waste materials shall not be used in any internal combustion engine without written approval from the Illinois EPA.

b At the above location, the Permittee shall not keep, store, or utilize:

i. Distillate fuel oil (Grades No. 1 and 2) with a sulfur content greater than the larger of the following two values.

A. 0.28 weight percent, or

B. The wt. percent given by the formula: Maximum wt. percent sulfur = (0.000015) x (Gross heating value of oil, Btu/lb).

c. The Illinois EPA shall be allowed to sample all fuels stored at the above location.

9. The Permittee shall maintain records of the following items:

a. Fuel usage for each generator and for each boiler (gallons/month and gallons/year).

b. Emissions of NO_x for the generators and for the boiler (tons/month and tons/year), compiled on at least a quarterly basis.

c. Documentation for sulfur content of fuel oil, e.g., analysis results for representative fuel sample or copies of fuel supplier certifications in accordance with 40 CFR 60.48c(f).

d. The Permittee shall keep the following records for cooling towers with supporting data.

i. The following reference information for the cooling towers, which shall be updated in the event of significant changes to the operation of the tower:

A. Cooling water drift rate (gallons/hour) based on representative operation of the cooling towers; and

B. Cooling water total solids (total dissolved solids and total suspended solids) content, based on representative sampling of water discharge.

ii. The following operating records for each tower:

A. Operation of cooling towers (e.g., log for gallons of water processed each day or number of towers operating each hour).

B. Total operation of cooling towers (e.g., gallons processed for month or operating hours/month); and

C. Emissions of particulate matter (tons/year).

10. All records and logs required by this permit shall be retained at a readily accessible location at the source for at least three years from the date of entry and shall be made available for inspection and copying by the Illinois EPA or USEPA upon request. Any records retained in an electronic format (e.g., computer) shall be capable of being retrieved and printed on paper during normal source office hours so as to be able to respond to an Illinois EPA or USEPA request for records during the course of a source inspection.

11a. The Permittee shall submit an Annual Emissions Statement to the Agency by May 1st of each year. This report shall include the fuel oil consumption by the large diesel generators, the small diesel generators and the boilers. If there has been no exceedance during the prior year, the Annual Emissions Statement shall include a statement to that effect.

b. If there is an exceedance of the requirements of this permit as determined by the records required by this permit, the Permittee shall submit a report to the Agency's Compliance Section in Springfield, Illinois within 30 days after the exceedance. The report shall include the emissions released in accordance with the recordkeeping requirements, a copy of the relevant records, and a description of the exceedance and efforts to reduce emissions and future occurrences.

12. Two (2) copies of required reports and notifications concerning equipment operation or repairs, performance testing or a continuous monitoring system shall be sent to.

Illinois Environmental Protection Agency
Division of Air Pollution Control
Compliance Section (#40)
P.O. Box 19276
Springfield, Illinois 62794-9276

Telephone: 217/782-5811 Facsimile: 217/782-6348

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and one (1) copy shall be sent to the Illinois EPA's regional office at the following address unless otherwise indicated:

Illinois Environmental Protection Agency
Division of Air Pollution Control
9511 West Harrison
Des Plaines, Illinois 60016

Telephone: 847/294-4000 Facsimile: 847/294-4018

If you have any questions concerning this permit, please call Youra Benofamil at 217/782-2113.

Donald E. Sutton/ca

Donald E. Sutton, P. E.
Manager, Permit Section
Division of Air Pollution Control

DES:YB:psj

cc: Region 1
IEPA, FOS, CMU
Lotus Notes

Attachment A

This attachment provides a summary of the maximum emissions from the source operating in compliance with the requirements of this federally enforceable permit. In preparing this summary, the Agency used the annual operating scenario that results in maximum emissions from this source This is handling 2,242,000 gallons of distillate fuel oil. The resulting maximum emissions are below the levels, e g , 100 tons per year of NOx at which this source would be considered a major source for purposes of the Clean Air Act Permit Program. Actual emissions from this source will be less than predicted in this summary to the extent that less material is handled, and control measures are more effective than required in this permit.

1. Emissions from the five large diesel generators.

Pollutant	Emission Rate (Lb/mmBtu)	Fuel Usage (Gal/Yr)	Emissions (Ton/Yr)
NO_x	3.20	240,000	53.80
CO	0.85	240,000	14 50
SO_2	1.01 * 0.28=0 2828	240,000	4.83
VOM	0.09	240,000	1.54
PM	0 0697	240,000	1.19

2. Emissions from small diesel generators:

Pollutant	Emission Rate (Lb/mmBtu)	Fuel Usage (Gal/Yr)	Emissions (Ton/Yr)
NO_x	4.41	72,000	22.20
CO	0.95	72,000	4.87
SO_2	0.29	72,000	1.48
VOM	0.36	72,000	1.84
PM	0.31	72,000	1.60

3. Emissions from the three boilers.

Pollutant	Emission Rate (Lb/1000 Gal)	Fuel Usage (Gal/Yr)	Emissions (Ton/Yr)
NO_x	20.0	1,930,000	19.00
CO	5.0	1,930,000	4.82
SO_2	39.76	1,930,000	38.37
VOM	0.34	1,930,000	0.33
PM	2.0	1,930,000	1.93

4 Emissions from the 48 cooling tower cells:

Pollutant	Emission Rate For Drift Loss	Flow Rate (Gallon/Min)	Emissions (Tons/Year)
PM_{10}	0.008%	17,750	67.20

YB psj

STATE OF ILLINOIS
ENVIRONMENTAL PROTECTION AGENCY
DIVISION OF AIR POLLUTION CONTROL
P O. BOX 19506
SPRINGFIELD, ILLINOIS 62794-9506

STANDARD CONDITIONS
FOR
OPERATING PERMITS

May, 1993

The Illinois Environmental Protection Act (Illinois Revised Statutes, Chapter 111-1/2, Section 1039) grants the Environmental Protection Agency authority to impose conditions on permits which it issues.

The following conditions are applicable unless superseded by special permit condition(s).

1. The issuance of this permit does not release the Permittee from compliance with state and federal regulations which are part of the Illinois State Implementation Plan, as well as with other applicable statues and regulations of the United States or the State of Illinois or with applicable local laws, ordinances and regulations

2. The Illinois EPA has issued this permit based upon the information submitted by the Permittee in the permit application. Any misinformation, false statement or misrepresentation in the application shall be ground for revocation under 35 Ill. Adm. Code 201.166.

3. a. The Permittee shall not authorize, cause, direct or allow any modification, as defined in 35 Ill. Adm. Code 201.102, of equipment, operations or practices which are reflected in the permit application as submitted unless a new application or request for revision of the existing permit is filed with the Illinois EPA and unless a new permit or revision of the existing permit(s) is issued for such modification.

   b. This permit only covers emission sources and control equipment while physically present at the indicated plant location(s). Unless the permit specifically provides for equipment relocation, this permit is void for an item of equipment on the day it is removed from the permitted location(s) or if all equipment is removed, notwithstanding the expiration date specified on the permit.

4. The Permittee shall allow any duly authorized agent of the Illinois EPA, upon the presentation of credentials, at reasonable times:

   a. To enter the Permittee's property where actual or potential effluent, emission or noise sources are located or where any activity is to be conducted pursuant to this permit;

   b. To have access to and to copy any records required to be kept under the terms and conditions of this permit,

   c. To inspect, including during any hours of operation of equipment constructed or operated under this permit, such equipment and any equipment required to be kept, used, operated, calibrated and maintained under this permit;

   d. To obtain and remove samples of any discharge or emission of pollutants; and

   e. To enter and utilize any photographic, recording, testing, monitoring or other equipment for the purpose of preserving, testing, monitoring or recording any activity, discharge or emission authorized by this permit.

5. The issuance of this permit:

   a. Shall not be considered as in any manner affecting the title of the premises upon which the permitted facilities are located;

IL 532-0224
APC 161 Rev. March, 2001

090-005

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CHEMISTR BUILDING #

Directory
Environmental Protection Agency
Bureau of Air

September 1, 1992

For assistance in preparing a permit application, contact the Permit Section:

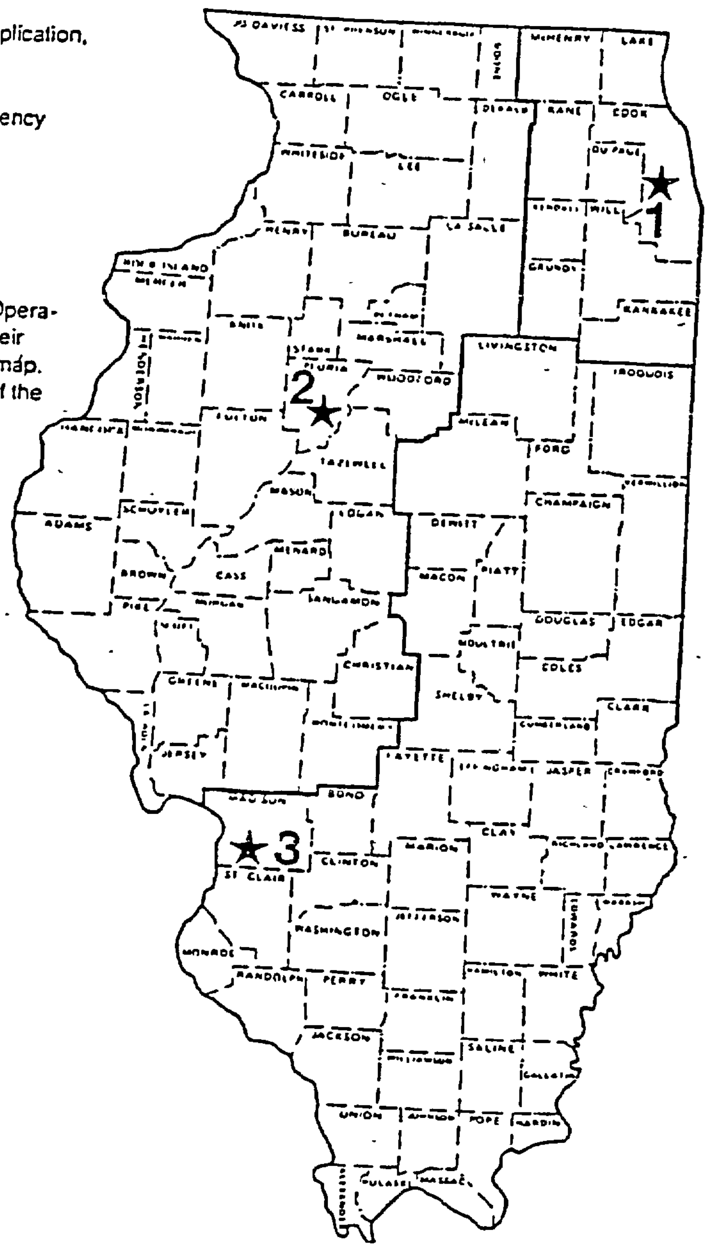
Illinois Environmental Protection Agency
Division of Air Pollution Control
Permit Section
2200 Churchill Road
Springfield, Illinois 62706
217/782-2113

Or contact a regional office of the Field Operations Section. The regional offices and their areas of responsibility are shown on the map. The addresses and telephone numbers of the regional offices are as follows.

ILLINOIS EPA
REGION 1
BUREAU OF AIR, FOS
9511 WEST HARRISON
DES PLAINES, IL 60016
847-294-4000

Illinois EPA
Region 2
5415 North University
Peoria, Illinois 61614
309/693-5461

Illinois EPA
Region 3
2009 Mall Street
Collinsville, Illinois 62234
618/346-5120



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