BYRON EMERGENCY/ABNORMAL/CRITICAL SAFETY FUNCTION PROCEDURE WRITERS GUIDE

1.0 PURPOSE

The purpose of this guide is to ensure the utility of the Emergency, Abnormal, and Critical Safety Function procedures. Utility is defined by the NRC as usable, complete, accurate, convenient, readable, and acceptable to control room personnel.

2.0 REFERENCES

2.1 Westinghouse Owners Group Emergency Response Guidelines

2.2 NUREG - 0737

2.3 INPO 82-017 Emergency Operating Procedures Writing Guideline

2.4 NUREG 0799

2.5 NUREG 0899

3.0 SCOPE

This guide establishes requirements and provides guidance for the preparation and format of the Emergency, Abnormal, and Critical Safety Function procedures. This includes the following procedures.

a. Emergency Response Procedures

1). Emergency Operating Procedures (BEP)
2). Event Specific Subprocedure (BEP ES)
3). Emergency Contingency Actions (BCA)

b. Abnormal Procedures (BOA)

c. Critical Safety Functions

1). Status Tree's (BST)
2). Functional Restorations (BFR)

4.0 DEFINITION

4.1 Emergency Operating Procedures (BEP)

BEP's are a four procedure set that initiate operator action based upon either a reactor trip or safety injection. They diagnose and mitigate the immediate consequences of a LOCA, SGTR, (Steam Generator Tube Rupture) and LOSC (Loss of Secondary Coolant).

4.2 Event Specific Subprocedures (BEP ES)

If certain conditons are met or exceeded in the BEP's, the BEP ES will direct actions to accomplish the given objective or supply new actions based on observed conditions.

4.3 Emergency Contingency Actions (BCA)

BCA's are procedures provided due to a direct NRC requirement without regard to their combined failure probability. These include, ATWS, loss of all AC, SGTR contingencies, and others.

4.4 Abnormal Operating Procedures (BOA)

BOA's provide guidance to the operator when important parameters or systems are in jeopardy, but RPS or SI have not actuated.

4.5 Critical Safety Function Status Trees (BST)

The BST's are a set of six decision trees that evaluate the six critical safety functions to determine if the function is intact or being challenged. If challenged it will reference the restoration guideline for restoring the function.

4.6 Functional Restoration Procedures (BFR)

The BFR's direct operators action to recover/restore the degraded safety function dependent on which CSF is challenged and the extent of degradation.

4.7 Immediate Operator Action

Actions taken to stop the degradation of the condition and mitigate the consequence of the event. These actions must be taken immediately to prevent further degradation.

4.8 Subsequent Operator Action

Actions that the operator uses to take the plant to a normal stable or safe steady state condition. These actions form the major body of the procedures, and should follow the immediate actions without interruption.

5.0 PROCEDURE DEVELOPMENT

5.1 BEP, BEP-ES, BCA's, BST, BFR's

The above referenced procedures are to be generated in plant specific form using the Westinghouse Owner's Group (WOG) Generic Technical Guidelines.

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The generic WOG's will be modified to reflect specific Byron Plant considerations. Care will be taken not to deviate from the major flowpath. Changes made to the procedures will be documented for the convenience of On-Site Review, and be included in the basis document. In Addition any setpoint that requires off-site calculation will also be documented. Plant specific procedures will be verified and validated per the Byron Verification and Validation Guide.

5.2 BOA

These procedures will be rewritten to utilize the two column format, and will include some additional procedures to reflect the new BEP reorganization. These procedures will use the previous BOA's and Zion AOP's for guidance in their generation. Since the BEP's are not entered until a reactor trip occurs, these procedures will be designed to give guidance to the operator until a trip occurs, or until an orderly shutdown can be accomplished.

6.0 REQUIREMENTS

6.1 General Considerations

a. The following considerations will be utilized in development of the Emergency/Abnormal/CSF procedures.

1). High readability
2). Easily comprehendable
3). Easily learnable

b. Procedures developed for control room use will not include information useful for only training purposes. Explanatory information will be available for formal and independent training to provide a comprehensive background, and deeper understanding of the procedures. However, this information will not be included in the procedures. This will aid the operator to quickly discern the major flowpath of the procedure.

c. If several tasks must be performed concurrently, the concurrent tasks shall be consistent with normal plant manning.

6.2 Style

a. Word Usage

1). The simpler spelling will be used whenever a choice is indicated in the dictionary. Short words and commonly used words are recommended.

2). Nomenclature and acronyms used in operator training will be incorporated into the procedures.

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3). Use simple word order as much as possible: i.e.: subject, verb and object.

4). There will be only one main thought per sentence.

5). Use positive statements to address required actions (e.g., CLOSE the "Valve").

6). When addressing a concept, object or operation, be consistent in referring to it throughout the procedure (e.g., do not use unit, assembly, equipment and component interchangably).

7). When referring to equipment, control switches, instrumentation, etc., the nomenclature including acronyms and abbreviations as used on specific components in the plant shall be used.

8). Numbers will be arabic numerals, and will not be spelled out except when the number begins a sentence.

9). For familiar acronyms the use of the acronym is preferred rather than the complete title spelled out.

10). The following words will be used in accordance with their definition below.

a). Verify - confirm that an expected condition exits.
b). Check - note the condition of
c). Manually - operator action required at the main control board.
d). Locally - operator action required in the plant, usually at the specific equipment location.
e). Maintain - sustain or continue with at a relatively constant value, parameters or conditions as specified in the step.
f). Monitor - watch or observe a parameter at certain time intervals, that are either designated or determined by the operator.

11). When a high level step starts with verify, check, or maintain, the low level step should usually start with a noun in a broken sentence. The broken sentence will have the parameter and the expected response.

For example:

Check Pressurizer Level:

a). Pressurizer Level - GREATER THAN 25%

When a high level step starts with, establish, align, reset, block, unblock, determine, investigate, calculate, isolate, manually, locally, continue, initiate, adjust or evaluate, the low level step should usually start with a verb.

For example:

Establish Component Cooling to _ _ _ _ _ _ .

a). Open valve _ _ _ _
b). Start pump _ _ _ _.

12). Abbreviations, when used, will follow the approved station abbreviation list (BAP 1310T2).

13). The logic terms AND, OR, NOT, IF, IF NOT, WHEN and THEN are used to precisely describe a set of conditions or sequence of actions. When logic terms are used they will be underlined and capitalized for emphasis.

The use of AND and OR within the same action shall be avoided. The word AND shall not be used to join together more than three conditions. If more than three conditions need to be joined a list will be utilized.

When action steps are contingent upon certain conditions or combinations of conditions, the step shall begin with the words IF or WHEN followed by a description of the condition or conditions (the antecedent), a comma, the word THEN, followed by the action to be taken (the consequent). WHEN is used for an expected conditon. IF is used for an unexpected but possible condition.

b. Level of Detail

The level of detail required for the BOP's must not be so excessive, that readability and timely execution cannot be maintained. The level of detail desired is that which a newly trained and licensed operator would find adequate in emergency situations. For example, extremely familiary valves would be referenced, with only their valve number, e.g. "Place PCV 131 in manual." Valves with less operator familiarity would be referenced with both the valve number and name, e.g., "Open accumulator vent header isolation valve HCV 943."

c. Measurement - Units and Tolerance

1). Units or measurement for most engineering parameters will be expressed in units of the English Engineering System. These units will be conistent with the Instrument display on the main control board.

2). The high and low tolerance for various parameters may be presented where required for practical, a single parameter with the tolerance listed as a plus or minus must be avoided.

Example avoid: 2235 ± 15 psig

use: 2220 - 2250 psig

Tolerances given on parameters should be consistent with the associated instruments display. Therefore, do not use a tolerance of ± 3°F if the display is given in 20°F increments.

3). For numbers less than unity, the decimal point should be preceeded by a zero. For example 0.1.

d. Emphasis

1). Emphasis of necessary key words and phrases will be made readily visually recognizable by the use of an underline. For example, all logic words will be underlined. (IF, NOT, THEN). Additional emphasis may require the use of select capitalization.

e. Cautions and Notes

1). Cautions will be used to attract attention to essential and critical information and will usually address the following as applicable:

a). Specific nature of hazard
b). Specific location of source of hazard
c). Time considerations if applicable
d). Consequences of not heeding caution, if not obvious.

2). Notes will be used to deliver critical information only.

3). Cautions and notes will proceed the step to which they apply.

4). If a caution or note is general enough to apply to the majority of the procedure, then it should be placed in front of the first action statement.

(0828P)

5). Both cautions and notes will be centered on the page, splitting the dual column format, and will be outlined with asterisks.

6). Cautions will normally not contain action steps, or be used to deliver command data. Use of an action step in a caution will be used infrequently, and only as warranted by unusual circumstances.

f. Attachments

1). Attachments may be used as necessary to aid the operator in accomplishment of the goal of the procedure. These may include checklists, flowcharts, decision trees, tables, or foldouts, and appendices. Attachments are used when inclusion of the information in the procedure would cause unnecessary "clutter", and reader confusion.

2). Attachments will be numbered sequentially based on their order of appearance in the procedure.

g. Foldouts

1). Foldout pages contain information that should be monitored throughout the procedure. The foldout is contained in the back of the procedure and is "folded out" upon entry into the procedure.

h. Branching to Other Procedures

1). Most procedures may have "kick-outs", which direct the operator to go to another procedure as conditions require, or as a rediagnois directs. These procedure transitions are necessary to ensure proper operator response. To minimize confusion the words "Go to" will be used to direct the operator to leave one procedure and go to another. Therefore the operator will know to leave one step and not return until directed. The same mechanism will be used to direct movement to different steps in the same procedure.

6.3 Format for BEP, BEP-ES, BCA, BOA, BFR

a. Cover Page

1). The cover page is ideally a single page with the following information:

a). Procedure title
b). Procedure number

c). Procedure revision and date
d). Purpose - a brief statement of the goal(s) of the procedure.
e). Symptoms - a brief listing of symptoms associated with the emergency.

2). The following procedures utilize cover pages.

a). BEP-0
b). BCA's 1,2,3, future
c). All BCA's

b. Procedure

1). The Emergency Procedures shall consist of numbered action steps presented in a two-column, dual-level format.

2). The left-hand column shall show the desired actions and expected responses.

3). The right-hand column shall show contingency actions and transitions to other procedures for actions or responses not obtained in the left-hand column.

4). The actions in the left-hand column shall be presented in the dual-level format as follows:

a). High-level steps which present the required tasks (what to do), and
b). Low-level steps which present the actions necessary to accomplish the high-level step (how to do).

5). The high-level step shall be orator underlined type, and will be numbered with arabic numbers in sequential order.

6). The low-level steps shall be indented and designated by letters (a, b, c, etc.) when their sequence of performance is important. When the sequence is not important, the low-level step shall be preceded by a bullet. "A closed bullet" requires all steps to be completed in any order (õ). An "open bullet" preceeding multiple steps requires only the steps that apply to be completed in any order (o).

7). The procedure steps shall be arranged so that the user continues down the left-hand column for normal recovery.

8). Each high-level step should have a corresponding contingency action entry in the right-hand column if practical.

9). After completing a contingency action the user should return to the next numbered step in the left-hand column.

10). If a contingency action cannot be completed, the user should return to the next step in the left-hand column, unless instructions in the right-hand column specify otherwise.

11). To differentiate immediate actions steps from subsequent actions, the immediate action step numbers shall be boxed. (Immediate action steps are those which cannot be delayed).

12). Immediate actions should be limited to those required to accomplish the following:

a). Verify automatic actions.
b). Assure the reactor shutdown margin is adequate.
c). Establish core cooling.
d). Verify electrical power available.
e). Confirm no uncontrolled release in progress.

13). Supplemental/subsequent actions should be steps required to accomplish the following:

a). Diagnose and take the reactor to normal or steady state conditions.
b). Verify immediate actions.
c). Provide transition to appropriate procedure by specific symptom identification.

14). Automatic actions will be verified in the procedure body. This verification will be based on a technical priority. Only those automatic actions which have a direct effect on the procedure, or adverse consequence on the plant, will be verified.

15). Steps will be sequenced primarily according to technical necessity. Additional consideration will be given to control room organization, and layout, to prevent cumbersome operator movement. However, technical necessity will be the first consideration.

a). Non-Sequential Steps
Non-sequential steps are those which may be required to be performed at any point in the procedure (eg. "Isolate accumulator isolation valves below 1000 psi"). These non-sequential steps will usually use the logic terms WHEN, THEN. In some cases a reminder will be placed on the foldout sheet. In rare instances, a note or series of notes may be used.

b). Recurrent Step
Recurrent steps are those that require the operator to repeat a given action. The word monitor is used to key the operator to continuously watch a parameter. If the time frame is critical specific times are given. In other cases the frequency is left to operator discretion based on plant status.

c. Time Dependent Step

Time dependent steps are those that are required at some specified interval, usually simultaneously. When simultaneous steps are required, a note will be placed in front of the first step requiring the operator to read all steps first before performing them simultaneously.

d. Pages

1). Each page of a procedure shall include the following:

a). procedure title *
b). procedure number
c). page number
d). total number of pages
e). revision number
f). revision date

* Appendices will carry only the procedure number and appendix title in lieu of the procedure title.

2). Pages will be consecutively numbered from the cover page to the last page of the text. The last page of the text will be marked -END-.

3). The beginning of each procedure will have a tab on the outside edge of the page identifying the procedure for easy reference.

4). In order to facilitate place keeping, each page of the remote shutdown panel and control room copies will be laminated, so that a grease pencil can be used to mark off steps as they are completed.

e. Capitalization

1). Capitalize means capitalizing only the first letter of the word.

2). All caps means capitalizing the entire word.

3). Organizations, Institutions, Companies, and Associations shall be capitalized.

4). Titles of works and publications shall be capitalized.

5). Titles of staff positions and titles shall be capitalized.

6). Titles of plant systems will be all caps, RH, CV etc.

7). The procedure title, number and revision will be all narrator type caps.

8). The high level step will have each word capitalized in narrator type.

9). The low level step use normal sentence capitalization rules, except when needed for emphasis.

10). Alarm window engravings, switch, circuit breaker position, controller modes of operation, and valve positions will be all caps.

11). System component and device identifiers will be all caps, (e.g, 1CW001A.)

12). Logic words will be all caps and underlined. (IF, THEN, NOT, etc.).

13). CAUTION and NOTE headings will be all caps and underlined.

f. Punctuation

Punctuation should be used only as necessary to aid reading. Work order should be selected to require a minimum of punctation. When extensive punctuation is necessary for clarity, the sentence should be rewritten into ~~several~~ SEVERAL sentences.

g. Calculations

Certain steps in the WOG drafts require calculations to establish certain setpoints, or "pivot points" in the procedure. For example: "Enter value of pressurizer level @ no-load value with tolerances for uncertainty due to adverse containment environment." In this case and in numerous others, off-site assistance is required for the calculation. These will be documented individually, and forwarded to Engineering for completion. The operator will normally not be required to perform any manual calculations during execution of these procedures.

6.4 Procedure Numbering and Listing

a. Byron Emergency Procedures (BEP)

BEP-0 Reactor Trip or Safety Injection

BEP ES-0.1 Reactor Trip Recovery
BEP ES-0.2 Natural Circulation Cooldown
BEP ES-0.3 SI Termination Following Spurious Safety Injection

BEP-1 Loss of Reactor Coolant

BEP ES-1.1 SI Termination Following Loss of Reactor Coolant
BEP ES-1.2 Post-LOCA Cooldown and Depressurization
BEP ES-1.3 Transfer to Cold Leg Recirculation Following Loss of Reactor Coolant
BEP ES-1.4 Transfer to Hot Leg Recirculation

BEP-2 Loss of Secondary Coolant

BEP ES-2.1 SI Termination Following Loss of Secondary Coolant
BEP ES-2.2 Transfer to Cold Leg Recirculation Following Loss of Secondary Coolant

BEP-3 Steam Generator Tube Rupture

BEP ES-3.1 SI Termination Following Steam Generator Tube Rupture
BEP ES-3.2A SGTR Alternate Cooldown Using S/G Blowdown
BEP ES-3.2B SGTR Alternate Cooldown By Backfilling RCS
BEP ES-3.3 SGTR with Secondary Depressurization

b. Byron Contingency Actions (BCA)

BCA-1 Anticipated Transient Without SCRAM

BCA-2 Loss of All AC Power

BCA-2.1 Loss of All AC Power Recovery Without SI Required
BCA-2.2 Loss of All AC Power Recovery With SI Required

BCA-3 SGTR Contingencies

c. Byron Status Trees (BST)

BST-1 Subcriticality
BST-2 Core Cooling
BST-3 Integrity
BST-4 Heat Sink
BST-5 Containment
BST-6 Inventory

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d. Byron Functional Restorations (BFR)

BFR-S.1	Response to Nuclear Power Generation
BFR-S.2	Response to Loss of Core Shutdown
BFR-P.1	Response to Imminent Pressurized Thermal Shock Condition
EFR-P.2	Response to Anticipated Pressurized Thermal Shock Condition
BFR-C.1	Response to Inadequate Core Cooling
BFR-C.2	Response to Degraded Core Cooling
BFR-C.3	Response to Potential Loss of Core Cooling
BFR-C.4	Response to Saturated Core Cooling Conditions.
BFR-I.1	Response to Pressurizer Flooding
BFR-I.2	Response to Low System Inventory
BFR-I.3	Response to Voids in Reactor Vessel
BFR-H.1	Response to Loss of Secondary Heat Sink
BFR-H.2	Response to Steam Generator Over pressure
BFR-H.3	Response to Steam Generator High Level
BFR-H.4	Response to Steam Generator Low Level
BFR-H.5	Response to Loss of Steam Generator PORV's and Condenser Dump Valves
BFR-Z.1	Response to Containment Above Design Pressure
BFR-Z.2	Response to High Containment Sump Level
BFR-Z.3	Response to High Containment Radiation Level

e. Byron Operating Abnormals (BOA)

BOA ELEC-1	Loss of DC __11/__12
BOA ELEC-2	Loss of Instrument Bus
BOA INST-1	NI Malfunction
BOA INST-2	Operation with Failed Inst Channel
BOA PRI-1	Excessive Primary Leakage
BOA PRI-2	Emergency Boration
BOA PRI-3	Charging/Letdown Failure
BOA PRI-5	Control Room Inacessability
BOA PRI-6	CC Malfunction
BOA PRI-7	SX Malfunction
BOA PRI-8	O_2/H_2 Explosive Mixture
BOA RAD-1	Process Monitor Hi Activity
BOA RAD-2	Area Monitor Hi Radiaton

BOA RCP-1	RCP Seal Failure
BOA RCP-2	Loss of Seal Injection
BOA REFUEL-1	Fuel Handling Emergency
BOA REFUEL-2	Reactor Cavity Level Loss
BOA REFUEL-3	Spent Fuel Pool Level Loss
BOA REFUEL-4	Loss of RH During Refueling
BOA ROD-1	Uncontrolled Rod Motion
BOA ROD-2	Rods Fail to Move
BOA ROD-3	Stuck or Misaligned Rod
BOA ROD-4	Dropped Rod Recovery
BOA SEC-1	Condensate FW Malfuncton
BOA SEC-2	S/G High Conductivity
BOA SEC-3	Loss of Vacuum
BOA SEC-4	Turbine High Vib. Ecc. Diff Exp
BOA SEC-5	TGTMS Trouble
BOA SEC-6	Loss of Stator Water Flow
BOA SEC-7	Stator Water High Conductivity
BOA SEC-8	Generator Condition Monitor
BOA SEC-9	S.A.C. S/U During Abnormal Conditions
BOA SEC-10	WS System Malfunction
BOA SEC-11	High Temperature in AF Nozzle Piping
BOA ENV-1	High Wind
BOA ENV-2	Low Water

6.5 Typing Guide

a. General Typing Instructions:

For all the BEP, BCA, BFR and BOA's, the following general requirements must be followed:

1). Continuous feed, pre-printed border, 8 1/2 X 11 paper size must be used.

2). Courier, 10-pitch type style will be used for low level statements and within the context.

3). Narrator, 10-pitch type style will be used for the title head and high level statements.

4). Steps and substeps will be as follows:

Major step numbers will be narrator (without periods). Substeps and sub-substeps wil be 10-pitch courier. See figure 1 on pages 17 and 18 for example.

b. Page Arrangement:

1). See figure 1 on pages 17 and 18 for example.

c. Breaking of Steps:

Steps will not be split between pages unless the length of the step is such that it requires more than a full page in itself. In this case, a continuation statement at the bottom of the page will be required to alert operator of step continuation. If a step appears to go beyond the page length then that step must start the next page. All notes or cautions associated with a step will precede that step and will be on the same page as that step.

d. Breaking of Words:

Breaking of words shall be avoided to facilitate operator reading.

e. Operator Aids:

Aids include status trees, graphs, flow charts, tables and appendices.

- Status trees, graphs and flow charts

  1). Number, title and revision will use the same title block as the emergency procedure.

  2). Typing of number, title and revision will be in narrator. 10-pitch type style - upper case.

  3). The field must not violate specific page margins.

  4). Field should be of sufficient size to offer good readability.

  5). Grid lines of graphs must be at least 1/16 - inch apart; numbered grid lines should be bolder than unnumbered grid lines.

- Tables will be typed using the following rules:

  1). Type style and size must be the same as that for the rest of the procedure.

  2). The table number and title must be located above the table field and three line spaces below preceding text.

  3). A heading must be entered for each column and centered with the column; the first letter of words in the column headings should be capitalized.

4). Horizontal lines must be placed above and below the column headings; vertical lines, while desirable, are not necessary or required.

- Appendices will be typed using the following rules:

  1). Type style and size must be the same as that for the rest of the procedure.

  2). Continuous feed, pre-printed border, 8 1/2 X 11 paper size should be used.

  3). Title head will reference appendix letter.

f. Notes and Cautions:

All notes and cautions should be distinguishable from the rest of the text by using the following format:

- The applicable heading "NOTE" and "CAUTION" must be capitalized, centered, and placed 3 line spaces below the preceding text.

- The text of the note or caution must be block format, one line spaced. The note and caution text will be indented 23 spaces from the left-hand printed margin and begun 1 line spaces below the heading.

- The right-hand margin of the text of the note or caution must be 14 spaces to the left of the right-hand printed margin.

- NOTES AND CAUTIONS shall be further highlighted by a line of asterisks 2 spaces above the heading, 2 spaces below the last line of the text and bordered vertically on both right and left side by a line 2 spaces from text.

g. Use of Foldout Pages

When used, a foldout page is treated as a single page. It will follow the same format as a standard page except the width is different. The page must be folded so that a small margin exists between the fold and the right-hand edge of standard pages. This will reduce wear of the fold.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

1 EXAMPLE OF CAUTION AND NOTE:

****
* NOTE *
* IF RWST low level switchover has not *
* been reached, THEN return to step 13 *
* and wait for RWST low level switch- *
* over before continuing with *
* procedure. *
****

****
* CAUTION *
* ECCS RECIRCULATION FLOW TO RCS MUST *
* BE MAINTAINED AT ALL TIMES. *
****

2 EXAMPLE OF STEPS:

a. Verify locally all breakers on Bus _43 and _44 - OPEN.

b. Energize Bus _43 and _44 from ESF crosstie breakers.

1) Open 480 volt transformer HIGH side breakers at reactor panel.

2) Close 480 volt transformer HIGH side breakers at electrical distribution panel.

a) .....

b) .....

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
3	EXAMPLE OF OPEN BULLETS: a. Establish conditions for cross-tieing to a LIMITED power supply 1) Place the follcwing safe-guards equipment in PULL-TO-LOCK: ° Charging Pumps ° RH Pumps ° SI Pumps ° AF Motor-driven pump ° RCFC's (Hi and Lo) ° CS Pumps ° CC Pumps ° Control room refrigera-tion units.	
4	EXAMPLE OF CLOSED BULLETS: CHECK CST LEVEL: a. CST level - GREATER THAN 10%	a. Consider the following: • Crosstie unit CST's. • Initiate CST makeup from MUD's or Radwaste. • Reduce plant cooldown rate. • Prepare to isolate secondary side of three steam generators prior to reaching 0% CST level.