

EVALUATION OF EMERGENCY PROCEDURES

FOR

LA SALLE COUNTY NUCLEAR STATION

FOLLOW-UP REPORT

10 December 1980

Prepared for

**Nuclear Regulatory Commission
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INTRODUCTION

On 21 November 1980, the procedures listed in Table 1 were evaluated for the first time. A preliminary report was issued, but limited to factors visible only in the documents themselves.

TABLE 1

LA SALLE PROCEDURES EVALUATED BY XYZYX

NUMBER	TITLE	REVISION	ISSUED
LGA-01	Level Control	3	11-3-80
LGA-02	Shutdown	3	11-3-80
LGA-03	Containment Control	2	11-3-80
LGA-04	Level Restoration	2	11-3-80
LGA-05	RFV Flooding	3	11-3-80
LGP-3-2	Reactor Scram	1	6-23-80

On 29-30 November 1980, a site visit was made to cover factors visible in the work environment. The following kinds of things were evaluated in the control room and simulator:

- Nomenclature on panels, controls, and indicators
- Control panel markings
- Frequency of practice by operators
- Access to emergency procedures
- Control of emergency procedures
- Method of verifying operator actions
- Ability of operators to locate and identify key controls and indicators
- Ability of operators to function without assistance beyond the procedures

On the day of the site visit, an updated version of each procedure (in rough form) was made available. The purpose of this report is to complete the evaluation of the La Salle procedures, based on information provided by the site visit and the procedural updates.

This report is organized as follows. First, results are summarized in terms of limitations, conclusions, and recommendations. Then, the strengths and weaknesses of the procedures are pinpointed by means of the human factors checklist introduced in the preliminary report.

LIMITATIONS

The following limitations apply to the evaluation described here.

1. This evaluation does NOT address procedural completeness or accuracy. Evaluation of those properties requires knowledge of the object system not available to the present reviewers.
2. In identifying kinds of deficiencies, no effort was made to specify individual instances within kind, except to cite examples.
3. All deficiencies noted are considered to be correctable prior to active use of the procedures.

CONCLUSIONS

Inspection of the revised procedures, the control room, the simulator, and a LOCA exercise with a typical crew of operators led to the following conclusions:

1. Procedures

The updated procedures are slightly improved over those evaluated in the preliminary report. However, the improvement is not reflected equally in all categories. The distribution of improvement is summarized below by kind of deficiency within category.

a. Presentation Style

- (1) Deficiencies remedied in some places but not all: organization of data for multiple-variable decisions; placement of cautions; provision of worksheets.
- (2) Deficiencies not remedied anywhere: content of cautions and notes; contingency provisions; adequacy of charts and graphs; indicators of the need for more than one operator.

b. Level of Detail

No deficiencies remedied in this category.

c. Administrative Controls

- (1) Deficiencies remedied in some cases but not all; provisions for verification; procedure titles.
- (2) Deficiency not remedied anywhere; identification of final page in LCP-1-2.

2. Work and Training Environment

- a. Because the procedures are written at a very general level, the nomenclature used in the procedures rarely matches the placarding on controls and indicators.
- b. Ninte panels are utilized effectively in the control room to support the procedures. Following training, the operators are able to locate and identify all controls and indicators from memory. Therefore, locator cards are not needed in the procedures used beyond the training period.
- c. The training schedule calls for some form of re-qualification training every six weeks. However, operators are required to practice each emergency procedure only once per year. No data exist (pre or con) on the adequacy of this schedule. In the judgment of the reviewer, the frequency of operator practice is inadequate. This is especially true, given the lack of detailed information in the procedures and the heavy reliance on training and operator memory.
- d. Based on operator skills observed during the simulator exercise, the level of detail provided by the procedures was inadequate, even in non-stress situations. The negative effects of stress were not represented in the exercise.
- e. Operating procedures are an intrinsic part of the training program, wherein the participants do not yet know how the various control room transactions are accomplished. Trainees thus represent an important subset of the using population with respect to level of detail.

RECOMMENDATIONS

The following recommendations are presented in pursuit of effective emergency procedures at La Salle.

1. Revise the procedures to incorporate the kinds of provisions cited below.
 - a. On actions where decisions must be based on more than two variables, reorganize the copy so as to make it clearer. Consider making further use of the matrix approach used on Page 3 of LGA-04. In addition, consider the method modeled below.
 7. MONITOR RPV water level for ____ minutes.
If level is decreasing, go to Step ____.
If level has stabilized, go to Step ____.
If level is increasing, continue.
 - b. Remove all command statements from cautions and notes. Where operator actions are required, provide command steps. Be sure to place cautions and notes immediately before the applicable step(s).
 - c. Whenever a procedure requires the use of other documents, reference these documents in the appropriate step and provide a listing of all such documents up front.
 - d. Provide the operator with alternative actions to cope with all logical contingencies.
 - e. Provide graphs and charts where needed. Clearly reference these charts in the applicable steps.
 - f. Where applicable, reference worksheets (e.g., Long Term Trend Sheet) in the procedures and/or provide them as attachments.
 - g. Where necessary, indicate the need for more than one operator and provide directions for partitioning the work among them.
 - h. Express all actions at the step level, i.e., as direct command verbs against specific controls and indicators. Provide specific control positions and indicator values.

- i. Provide sign-off lines for every step and require the SCRE to verify each operator action.
 - j. Provide a method to help the SCRE track his way through the procedures.
 - k. Limit references to external procedures to situations where it would be inconvenient for the operator to have the entire referenced instruction reiterated.
1. Paginate LCP-3-2 per the method used in the other procedures evaluated. Place the two pages of Attachment A in their proper order.
 2. Revise either the applicable procedures or the hardware to assure that the nomenclature in the procedures matches that placarded on the control panels.
 3. Continue to keep the human engineering features of the control room up to date, so that operators will be furnished with locator cues external to the procedures.
 4. If possible, provide more frequent opportunities for operators to practice each emergency procedure.
 5. Provide detail-level information in the procedures, even where (at times) operators may appear not to need it. Such information is vital to training and to emergency situations where stress is experienced.

EVALUATION DETAILS

- Overview
- Human Factors Checklist
- Expansion of Negative Comments

EMERGENCY PROCEDURES HUMAN FACTORS CHECKLIST

Plant La Salle Procedure No. SGP P. 1 Title (p. 1)

Revision (p. 1) Review Date 11/29/73 Reviewer J. Englerhall & S. Rowe

OVERVIEW

	TOTAL	003	10	
		QUALITY	QUALITY	
I. PRESENTATION STYLE				
Document Items	10	two	eight	2, 4, 5, 6, 7, 9, 10, 11
Site Items	1	<u>zero</u>	<u>one</u>	10
Total Items	11	TWO	NINE	
II. LEVEL OF DETAIL				
Document Items	4	zero	four	1, 2, 3, 4
Site Items	4	<u>two</u>	<u>two</u>	5, 8
Total Items	8	Two	SIX	
III. ADMINISTRATIVE CONTROLS				
Document Items	8	five	three	2, 5, 11
Site Items	7	<u>six</u>	<u>one</u>	12
Total Items	15	ELEVEN	FOUR	
IV. OPERATIONAL TEST				
Document Items	0	zero	zero	
Site Items	4	<u>three</u>	<u>one</u>	4
Total Items	4	THREE	ONE	

COMPARISON FACTORS SUMMARY

1. PRESENTATION STYLE

NO SCORE

YES

COMMENT

- | | | |
|-----------------|---|------------|
| DOCUMENT | 1. Are approximately 50% or more of the instructions written in short, concise, identifiable steps (as opposed to paragraphs)? | yes |
| DOCUMENT | 2. Evaluate the complexity of the cited instructions by determining the average number of actions (verbs) called out or used. Base estimate on a sample of 30% of the steps or, if the sample size is less than 10, use all steps. Is the average number of actions per step 1.5 or less? | yes |
| DOCUMENT | 3. Where a decision must be made based on more than two variables, is the information organized to support the decision? | no |
| DOCUMENT | 4. If procedures apply to the performance of specific steps or portion of steps, are they always placed immediately ahead of the step(s) to which they apply? | no |
| DOCUMENT | 5. Are essential statements kept out of procedures and explanations? | no |
| DOCUMENT | 6. If equipment is operating outside the range specified by the procedure, is the operator told what action to take? | no |
| DOCUMENT | 7. Are graphs, charts, and tables adequate for readability and interpretation or extraction of values? | no |

EMERGENCY PROCEDURE HUMAN FACTORS CHECKLIST

1. PRESENTATION STYLE (continued)

INFO SOURCE	TYPE	COMMENT
DOCUMENT	0.	If worksheets are needed to facilitate some actions, are spaces provided for recording all data and processing them (performing additions, multiplications, etc.)? NO
DOCUMENT	9.	If more than one person is required to perform the procedure, is the procedure written to one "primary" user? That is, is it clear from the way that instructions are written that one person is responsible for coordinating the activity? NO
SITE	10.	Are references to external procedures limited to situations where it would be inconvenient for the operator to have the entire (referenced) instruction reiterated within this procedure? NO
DOCUMENT	11.	Are externally referenced procedures listed at the beginning of the procedure? NO

EMERGENCY PROCEDURE HUMAN FACTORS CHECKLIST

II. LEVEL OF TRAINING

OPERATOR

YES

COMMENT

- | | | |
|----------|--|-----|
| DOCUMENT | 1. Are actions expressed at the stop level? That is, are they driven by verbs (start, stop, etc.), adjectives (warning, specific) controls and indicators? | NO |
| DOCUMENT | 2. Where are ^{do} procedures require the use of specific ^{specific} positions given? | NO |
| DOCUMENT | 3. Where actions require the use of indicators, are specific values given? | NO |
| DOCUMENT | 4. Are control/indicator panel locations given? | NO |
| SITE | 5. Is the nomenclature used in the procedure identical to that displayed on the panels, controls, and indicators? | NO |
| SITE | 6. Are indicator values called out in the procedure expressed in the same units as are shown on the indicators? | YES |
| SITE | 7. Are all control panels properly marked to support this procedure? | YES |
| SITE | 8. Is every operator required to practice this procedure under simulated emergency conditions at least once per month? | NO |

EMERGENCY PROCEDURE HUMAN FACTORS CHECKLIST

III. ADMINISTRATIVE CONTROLS

INFO SOURCE	ITEM	COMMENT
SITE	1. Is an emergency procedure manual located in the control room and accessible by all operators?	yes
DOCUMENT	2. Is the title of the primary LOCA procedure referenced to an observable emergency condition?	NO
SITE	3. Are the LOCA procedures easily located within the manual?	yes
DOCUMENT	4. Does each page provide the following identification information? 4.1 Procedure number and/or title 4.2 Date of issue 4.3 Revision number 4.4 Page number	yes yes yes yes
DOCUMENT	5. Is the last page of the procedure clearly identifiable by marking: 0-0. Page _____ of _____ ; Final Page?	NO
SITE	6. Does the procedure have a unique and permanently assigned number? That is, if the procedure becomes deleted, will the number be re-tired rather than reassigned?	yes
SITE	7. If this is a temporary procedure, is it clearly marked with the expiration date?	N/A
SITE	8. Are personnel prevented from taking the LOCA procedures out of the control room?	yes
SITE	9. Are documents referenced by the LOCA procedures easily located in an emergency?	yes

EMERGENCY PROCEDURE HUMAN FACTORS CHECKLIST

III. ADMINISTRATIVE CONTROLS (continued)

INFO SOURCE	ITEM	COMMENT
DOCUMENT	10. Does the procedure provide for verification and signoff of actions?	yes
DOCUMENT	11. If yes, is <u>every</u> step signed off or initialed?	no
SITE	12. If yes, are the verifications predominantly performed by persons other than those performing the action?	no

General Procedure for Planning Operations

IV. OPERATIONAL TEST OF LOGA PROCEDURES (OPT)

Plan a walk-through of the LOGA procedure under simulated conditions of use. Observe the following procedures:

- a. Employ a leader operator selected from a group having the least experience at the plane involved.
- b. Employ a leader operator selected from a group having the least experience in that capacity.
- c. Formulate a plane situation known to represent LOGA conditions, but do not tell the LO or MO in advance that it is.
- d. Plan for the operator to verbalize each step.

Conduct the walk-through under close observation, while collecting answers to the questions listed below.

1. Can the procedure be performed in the sequence it is written? yes
2. Can the operator locate and identify all controls and indicators referred to in the instructions? yes
3. Where general rather than specific instructions are provided, can the operator explain in detail how to perform each general instruction? yes
4. Can the operator perform the procedure without obtaining additional information or assistance from persons or documents not specified by the procedure? no

COMMENTS

**EXPANSION OF NEGATIVE COMMENTS
ON LA SALLE EMERGENCY PROCEDURES**

I. PRESENTATION STYLE

- Item 3. Where a decision must be made based on more than two variables, the information is not always organized to support such a decision. See Steps 6 through 9 on Pages 3 to 4 of LGA-01 for an example of poorly organized decision information.
- Item 4. Cautions and notes should always be placed immediately ahead of the steps to which they apply. Any other location incurs the risk of their being read too early or too late for most effective use. In LGA-02, for example, several cautions are separated from the applicable steps by being placed at the bottom of the preceding page.
- Item 5. Cautions and notes should NEVER be used to deliver command data. Any intended action or decision should be numbered to indicate that the operator must do something. For a violation of this rule, see the example below from LGA-01, Page 1.
- Item 6. If equipment is operating outside the range specified by the procedure, the operator is not always told what action to take. "If" statements are seldom accompanied by corresponding "if not" statements. In some cases, (e.g., Step 6, Page 4 of LGA-02) the word "if" is omitted entirely.
- Item 7. Because all charts/graphs are missing from the procedures evaluated, it is impossible to judge their adequacy. These missing charts are poorly referenced in the applicable steps.
- Item 8. A "Long Term Trend Sheet" is being developed at the time of the site visit, but was not ready for review. This worksheet is not referenced in the procedures evaluated.
- Item 9. Although in some cases (e.g., LGA-03) several actions must be performed concurrently, there is no indication of how the work should best be partitioned or controlled.

- Item 10. References to external procedures are not limited to situations where it would be inconvenient for the operator to have the entire referenced instruction reiterated. An attempt to streamline the basic emergency procedures has resulted in procedures that provide only a skeletal framework of all the actions required; the operator must refer to other documents too frequently. Often, he must refer to several at the same time.
- Item 11. Externally referenced procedures are listed at the end of the procedure.

II. LEVEL OF DETAIL

- Item 1. Although most of the actions are driven by command verbs, some are expressed in the passive voice (e.g., "Procedure reduction may be augmented . . ."). Rarely are specific controls and indicators mentioned.
- Item 2. Where specific controls are mentioned, specific positions are generally given. However, as noted in Item 1 above, specific controls are often omitted.
- Item 3. Where specific indicators are mentioned, specific values are generally given. However, as noted in Item 1 above, specific indicators are rarely provided. The phrase "consistent with plant parameters" is used frequently; those parameters are not specified in the procedures.
- Item 4. Control/indicator panel locations are not provided.
- Item 5. Because the procedures evaluated are very general in nature, the nomenclature used rarely matches the specific placarding on the control panels. Even where specific controls are mentioned, the match is not always perfect (e.g., MSIV in the procedure is placarded MSLIV on the control panel). In addition, a typographical error in Step 2-a of LCA-03 (Page 2) resulted in further mismatch.
- Item 6. Operators are required to practice each emergency procedure only once per year.

III. ADMINISTRATIVE CONTROLS

- Item 2. The titles of the procedures evaluated reflect the purpose of the procedure rather than the entry conditions. This problem is ameliorated by the requirement that operators memorize the entry conditions.
- Item 5. In all the procedures evaluated except LGP-3-2, the final page is clearly identified via the page of method. In LGP-3-2, this method is not employed. Furthermore, the final two pages (Attachment A) are out of order and mismarked. This may be a reflection of inadequate editorial control.
- Item 11. Signoff lines are provided after most steps, but not all. This may be a reflection of inadequate editorial control.
- Item 12. Verifying operator actions is left to the SCRB. In the simulator exercised performed during the site visit, the signoff lines were rarely used.

IV. OPERATIONAL TEST

- Item 4. Because of the general nature of these procedures (see comments on Level of Detail, above), operator memory is relied on heavily for details on how to perform the actions. Should the operator's memory fail him in a stressful situation, procedures are available to provide the detailed "how to" information he needs. However, these detailed instructions are not referenced in the emergency procedures.