



**SUBJECT: ENGINEERING COMPUTER PROGRAMS**

**1.0 PURPOSE**

- 1.1 The purpose of this EOP is to define requirements for the control of computer programs defined as Engineering Computer Programs.

**2.0 GENERAL AND APPLICATION**

- 2.1 Computer programs developed or used by GE Nuclear Energy (GE-NE) personnel to produce design calculations, design bases, design data, or other data that affect the design, licensing, reliability, or operation of a product line are required to comply with GE-NE requirements, industry codes and standards, and regulatory requirements.
- 2.2 Computer programs (excluding Job Control Language) are defined as Engineering Computer Programs (ECP) when they meet all the criteria that follow:
- a. Are in a compiled form that is executed on computer equipment administered by GE-NE Computations Section, or by external computations service bureaus, or at the GE-NE Hybrid Computer Facility, or on microcomputer equipment or interactive graphics hardware systems.
  - b. Used to perform design computations or to perform evaluations of experiments.
  - c. Executed repeatedly.
  - d. Have a useful life of more than six months.
  - e. Have been accepted as ECPs by the Control Component.
- These criteria apply regardless of the simplicity or complexity of a program.
- 2.3 Design Record File documentation guidelines are contained in Appendix A.

+ Indicates change

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- + 2.4 Computer Software that is not controlled as an ECP can be used for design applications only if the results of each application are independently verified in accordance with EOP 42-6.00. If that verification involves comparison of the software with alternate calculations or data, those comparisons shall be performed on the same compiled executable file of the software as used for the design applications. Usage of such software shall be indicated in the verification package.
- 3.0 DEFINITION OF RESPONSIBLE INDIVIDUAL OR ORGANIZATION
  - 3.1 The following defines the responsible individual or organization for activities established in Section 4.0 of this EOP.
    - 3.1.1 Control Component - Component assigned responsibility for control of computer methods.
    - 3.1.2 Design and Development Components - Components applying ECP to design and development tasks.
    - 3.1.3 Responsible Component - Component responsible for development of specific ECP.  
  
Responsible Engineer - Person assigned responsibility for ECP.
- 4.0 PROCEDURE AND RESPONSIBILITIES
  - 4.1 Responsible Component
    - 4.1.1 Assign a Responsible Engineer for the ECP.
    - + 4.1.2 Prepare and implement the Software Management Plan for development of the ECP. Assure that impacts on other ECPs (upstream and downstream) are appropriately addressed in the Software Management Plan.
    - 4.1.3 Select the chairperson of the Level 1 Design Review Team to review the Software Management Plan and the Hardware/Software System Specification (H/SSS), in accordance with EOP 40-7.00. Manage the closure of all open items prior to requesting approval of Level 1 status. Assure that the primary user organization is represented on the Design Review Team.
    - 4.1.4 Select the chairperson of the Level 2 Design Review Team to perform a technical review of the completed ECP in accordance with EOP 40-7.00 for the purpose of final independent verification. Manage the closure of all open items prior to requesting approval of Level 2 status.

## 4.2 Responsible Engineer

- 4.2.1 Name the ECP using a generic five-character alpha-numeric family identification and a two-digit suffix commencing with 01 to indicate the ECP version number, and an optional character defined by the Control Component to identify the computer system used.
- 4.2.2 Provide ECP technical content, development, implementation of approved changes, documentation, and maintenance, which includes:
- a. Generating and maintaining the ECP Design Record File (DRF), in accordance with EOP 42-10.00, including the documentation requirements of Paragraphs 4.3.5.a and 4.3.5.b.
  - b. Developing the program.
  - c. Programming or directing programming and debugging.
  - d. Submitting the ECP source program and compilation to the computer Program Library for those ECPs stored and maintained by GE-NE Computations Section.
  - e. Coordinating the Level 2 Design Review presentation of the ECP to provide a basis for verification.
  - f. Specifying, for all ECPs not covered by Paragraph 4.2.2.d. above, the method to be used to confirm that no changes occur in the ECP after Level 2 is assigned. Presenting this method as part of the Level 2 Design Review. (The method to be used may be administrative control of the ECP software or execution and comparison of output from previously defined test cases.)
  - g. Assuring that at the time Level 2 status is authorized, material properties, which are encoded into the ECP or which are identified as critical input values for the qualification process of the ECP, are documented for inclusion in the DRF as being either:
    - (1) Compliant with the BWR Fuel or Plant Materials Properties Handbook, or
    - (2) Authorized for noncompliant use. Requires a letter of justification. Authorized by the ECP Control Component and the Section Manager or Business Segment Manager (NSPD) responsible for the BWR Fuel or Plant Materials Properties Handbook, or

- (3) Not applicable to the BWR Fuel or Plant Materials Properties Handbook.
- h. Requesting DRF microfilming within six (6) weeks of assignment of Level 2 status. After return of the DRF from microfilming, maintaining possession of a copy of the DRF until Level 4 status is assigned. Opening supplements to the DRF as required for permanent retention of post-Level 2 documentation.
- i. Documenting all ECP problems (errors, discrepancies and maintenance changes) in approved ECPs at Level 2, 2R, 3 or 4. Required documentation includes description of the problem and corrective action to be taken, including any necessary revisions of the User's Manual and other ECP documentation of 4.3.5a and 4.3.5b. Classify identified errors as:
- Type A: Having impact on calculated numerical results, or
- Type B: No impact on calculated numerical results
- Reporting Type A problems to all GE-NE ECP User Design and Development Component managers for evaluations of the impact of the problem on prior and current applications. Include in the ECP DRF the identified lists of DRFs requiring evaluation for Type-A problem impact, as provided by all ECP User Design and Development Component managers. Report Type-B problems to all ECP user component managers for information only. Report Type-A and Type-B problems to assigned business interfaces for consideration of customer notification.
- j. Submitting, for Control Component approval, problems and proposed corrective action (see Paragraph 4.2.2.i) within 30 days after determining that a problem exists. All ECP problem corrections shall remain compatible with input files used with the uncorrected version.
- k. Documenting ECP changes authorized by the Control Component. Implementing a separate DRF Supplement for each problem correction change to an ECP version. Submitting the DRF supplement for microfilming within six (6) weeks of assignment of Level 2 status for the problem correction.
- l. Notifying recipients of the problem report (see Paragraph 4.2.2.i) when corrective action is completed.

4.3 Control Component

- 4.3.1 Manage and control engineering interface activities with computational services.
- 4.3.2 Provide consultation on the management of interfaces with non-GE-NE computation service bureaus.
- 4.3.3 Assure ECP quality by:
  - a. Negotiating the basis for control of the Computer Program Library by functional components providing digital computation services.
  - b. Reviewing and concurring with procedures for ECPs controlled under Paragraph 4.2.2.f.
- 4.3.4 Approve Design Review Chairperson for Level 1 and Level 2 Design Reviews.
- 4.3.5 Approve ECP status levels as follows:
  - a. Level 1 - ECPs approved for development. Documentation includes a Design Record File in accordance with EOP 42-10.00, which must include:
    - (1) ECP Abstract, Form SD-001
    - (2) ECP Status, Form SD-002
    - (3) Software Management Plan
    - (4) Hardware/Software System Specification
    - (5) Level 1 Design Review Report
  - b. Level 2 - Approved Production Programs are ECPs that are verified and documented for design applications or for all technical activities used in developing design related information. The ECP program is stored in the controlled Computer Program Library, or as approved at the Level 2 Design Review, per Paragraph 4.2.2.f. ECP documentation includes the requirements of Paragraph 4.2.2.g, Paragraph 4.3.5.a, the Users Manual and any of the following documents that were not exempted by the Software Management Plan:

- (1) Software Requirements Description
- (2) Software Design Description
- + (3) Software Test Plan and Test Report
- (4) Independent Design Verification Packet
- (5) Program Source Listing
- c. Level 2R - Restricted Approved Production Programs are ECPs that do not satisfy all requirements for Level 2, but which may be applied to design tasks for a limited time with Control Component approval.
- d. Level 3 - Archive Programs are ECPs approved for design use, but which are no longer the most recent approved version.
- e. Level 4 - Historical programs are ECPs that are inactive and not currently authorized for design tasks. Engineering Computer Programs are removed from use within 30 days of assignment of Level 4 status.
- f. Level 1 and 4 ECPs are not authorized for design applications. However, the program contents may be used for design calculations if:
  - (1) The program is referred to by the ECP name with an appended suffix, - (Level 1) or - (Level 4), to identify the uncontrolled status, e.g. PANAC10V - (Level 1).
  - + (2) Results of the calculation are independently verified in accordance with Paragraph 2.4.
- 4.3.6 Approve changes to ECPs including:
  - a. Reassignment of ECP status levels.
  - b. ECP problem corrections.
- 4.3.7 Maintain the control file of all computer programs classified as ECPs, including original abstract (SD-001), Status (SD-002), Hardware/Software System Specification and Material Properties (see Paragraph 4.2.2.g).
- 4.3.8 Issue revision-controlled identification numbers for H/SSS, and retain original copies of H/SSS documents.

4.4 Design and Development Components

- 4.4.1 GE-NE components that apply approved ECPs to design and development activities are responsible for documenting both verification of inputs and confirmation that the utilization is within the application range of the ECP.
- 4.4.2 Confirm, for each application of an ECP not covered by Paragraph 4.2.2.d that the ECP has not changed since it was originally qualified, verified, and assigned Level 2 status. Confirmation shall utilize the same method presented at the Level 2 Design Review, per Paragraph 4.2.2.f.
- 4.4.3 Document and report to the Responsible Engineer, ECP technical usage problems, including potential errors.
- 4.4.4 Document to the Responsible Engineer, new or revised ECP features and technical requirements needed for design applications.
- 4.4.5 Identify all DRFs that require evaluation for impact because of Type A ECP errors. Within 30 days of the error report (see Paragraph 4.2.2.i), provide the ECP Responsible Engineer with the list of DRFs to be evaluated.

5.0 RESPONSIBILITY FOR COUNSELING

For counsel on matters pertaining to this EOP, refer to the EOP Counsel Matrix in EOP 15-1.00.

6.0 REFERENCES

EOP 40-7.00	Design Reviews
EOP 42-6.00	Independent Design Verification
EOP 42-10.00	Design Record Files



## APPENDIX A

## GUIDELINES FOR DRF DOCUMENTATION

A1 DRF DOCUMENTATION

Guidelines for the documentation requirements of Paragraphs 4.3.5.a and 4.3.5.b are summarized below.

+ A1.1 Software Management Plan (SMP)

The SMP includes the definition of scope, tasks, and schedules. For new versions of ECPs developed under previous versions of this EOP, the SMP defines the extent to which the ECP documentation requirements of Paragraph 4.3.5.b are to be retrofitted to the unchanged portion of the ECP. For ECPs or portions of ECPs developed by an organization external to GE-NE, the SMP defines the extent to which the ECP documentation requirements of Paragraph 4.3.5.b are to be generated for externally developed software. Plans for maintaining compatibility with other ECPs (upstream and downstream) should be addressed, as appropriate. Normally, the documentation described in Paragraphs A1.1 through A1.8 will not be formally issued as Corporate documents but will be descriptive material contained in the ECP DRF. In cases where the Responsible Component deems issued documentation to be necessary, the SMP will define that information to be contained in issued documents.

A1.2 Hardware/Software System Specification (H/SSS)

A specific ECP is a part of an overall hardware/software system. The H/SSS defines all of the functions that the system is to perform, all hardware and software elements of the system, and the performance and testing requirements associated with these functions and elements. For the subject ECP, these definitions shall specifically include the objectives and broad functions to be performed, any significant physical modeling assumptions, the inputs and outputs, and any special interface testing requirements or other constraints. A revision- controlled identification number for the H/SSS will be assigned by the Control Component. Verification of adequacy for the original H/SSS is provided by the ECP Level 1 review. Any revisions to the H/SSS subsequent to the ECP Level 1 review require the concurrence and approval of the Control Component.



A1.3 Software Requirements Description (SRD)

The SRD provides more detail on what the ECP must do. The SRD includes the technical basis description which defines the technical assumptions and mathematical formulation of the ECP, validation requirements, and a description of the overall inputs, outputs, and other constraints on the software embodied in the ECP. The SRD shall define the BWR Fuel or Plant Materials Properties Handbook section or other sources from which the encoded material properties will be obtained.

A1.4 Software Design Description (SDD)

The SDD defines how the software is designed to satisfy the H/SSS and SRD requirements. The SDD provides a summary description of the planned software design. This can include definitions of the software modules, hierarchical charts, data flows and logic flows as appropriate for effective development and maintenance. Data base and file structure definitions may also be included. Where special test provisions will be necessary, these should be identified in the SDD.

+ A1.5 Software Test Plan and Test Report (STPTR)

The STPTR describes the overall test approach and the results. The STPTR provides the detailed description of the software tests, including unit, integration, and system tests required to assure that the coding and associated software data library satisfy all requirements defined in the H/SSS and SRD. This description can be issued separately as a test plan document. The STPTR documents the results of these software tests, with the results included directly or referenced in the STPTR.

A1.6 Independent Design Verification Packet (IDVP)

The IDVP is the collection of all documentation of independent design verification. This packet always includes the Level 2 Design Review Report addressed in Paragraph 4.1.4 and will include, when available, comparison of results with experimental data or results from alternate methods and user testing.

A1.7 Code Listing

A documented source listing of the completed software. For problem corrections, the source header can include a brief description of the changes and reference to a software problem notification document.

**A1.8    User's Manual**

The User's Manual provides a summary description of the ECP functions and restrictions; an application statement consistent with the Abstract; a detailed description of the ECP input and output; a list of the ECP error messages and definitions for those messages not adequately described within the ECP; and a sample test problem. The User's Manual shall be approved by the Responsible Component manager.

Engineering Operating Procedure

Employees Only  
EOP 40-3.00  
Supplement A

SUBJECT: ENGINEERING COMPUTER PROGRAM ABSTRACT

SD-001



GE Nuclear Energy Engineering Computer Program Abstract

Reference  
EOP 40-3.00

RESPONSIBLE ENGINEER		ENGINEERING COMPUTER PROGRAM NAME	
		Design Record File Number	Abstract
Name	Component		Date Rev. No.
APPLICATION STATEMENT			

PROGRAM DESCRIPTION	
Inputs	Outputs
Documentation	
Computer Requirements	

Prepared By:

The Engineer responsible for the technical content of the ECP completes this form, and signs and dates attesting to the accuracy of the information.

Signature

Printed Name

Date

SD-001 (3/91)

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# Engineering Operating Procedure

**Employees Only**  
EOP 40-3.00  
Supplement B

SUBJECT: ENGINEERING COMPUTER PROGRAM STATUS

SD-002



**GE Nuclear Energy** Engineering Computer Program Status

Reference:  
EOP 40-3.00

RESPONSIBLE ENGINEER		ENGINEERING COMPUTER PROGRAM NAME	
		✓	
		Design Record File Number	Authorizing Document and Number
Name _____ Component _____		✓	✓

LEVEL 1 PLANNED LEVEL 2 DESIGN REVIEW DATE ✓

✓✓

Control Component	Title	Date

LEVEL 2R COMPUTATIONS SECTION LIBRARY IMPLEMENTATION

Select Name: \_\_\_\_\_ Date: \_\_\_\_\_

Expiration Date: \_\_\_\_\_

✓✓

Control Component	Title	Date

LEVEL 2 COMPUTATIONS SECTION LIBRARY IMPLEMENTATION

Select Name: \_\_\_\_\_ Date: \_\_\_\_\_

✓✓

Control Component	Title	Date

LEVEL 3 COMPUTATIONS SECTION LIBRARY IMPLEMENTATION

Select Name: \_\_\_\_\_ Date: \_\_\_\_\_

✓✓

Control Component	Title	Date

LEVEL 4

*Complete all information on this form as follows:*

- ✓ Responsible Engineer Completes
- ✓✓ Control Component Completes

✓✓

Control Component	Title	Date

SD-002 (10/92)

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