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   <u>Control Component</u>

4.3.1 Manage and control engineering interface activities with computation-
       al 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.   <u>Level 1</u> - 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.   <u>Level 2</u> - 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 quali-
          fied, 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, hierarchal 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 require-
ments 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   Users 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.

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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SUBJECT: ENGINEERING COMPUTER PROGRAM STATUS   SD-002

GE Nuclear Energy *Engineering Computer Program Status*

References:
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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