

SOFTWARE RELEASE NOTICE

1. SRN Number: PA-SRN-214		
2. Project Title: TSPA & Technical Integration Code		Project No. 20-01402-762
3. SRN Title: TPA Version 4.0 Beta		
4. Originator/Requestor: Bruce Mabrito		Date: 6/26/2000
5. Summary of Actions		
<input type="checkbox"/> Release of new software <input type="checkbox"/> Release of modified software: <input type="checkbox"/> Enhancements made <input type="checkbox"/> Corrections made. <input type="checkbox"/> Change of access software <input checked="" type="checkbox"/> Software Retirement		
6. Persons Authorized Access to Source Code		
Name	Read Only/Read-Write	Addition/Change/Delete
Sitakanta Mohanty	RW	
Ron Janetzke	RW	
Tim McCartin (NRC)	RW	
D. Esh (NRC)	RW	
7. Element Manager Approval: <i>Gordon Wilton</i> Date: <i>6/26/2000</i>		
8. Remarks: TPA Version 4.0 Beta Version is superseded by TPA Version 4.0.		

SOFTWARE RELEASE NOTICE

1. SRN Number: PA-SRN-214		
2. Project Title: TSPA & Technical Integration Code		Project No. 20-01402-762
3. SRN Title: TPA Version 4.0beta		
4. Originator/Requestor: Bruce Mabrito		Date: 02/15/00
5. Summary of Actions		
<input type="checkbox"/> Release of new software <input checked="" type="checkbox"/> Release of modified software: <input checked="" type="checkbox"/> Enhancements made <input checked="" type="checkbox"/> Corrections made <input type="checkbox"/> Change of access software <input type="checkbox"/> Software Retirement		
6. Persons Authorized Access		
Name	Read Only/Read-Write	Addition/Change/Delete
Sitakanta Mohanty	RW	
Ron Janetzke	RW	
Tim McCartin (NRC)	RW	
M. Rose Byrne (NRC)	RW	
7. Element Manager Approval: <i>Gordon Wittmayer</i>		Date: 2/15/2000
8. Remarks: An 8mm tape containing FORTRAN source code for the TPA Version 4.0beta code, and 1 data CD containing binary executable files for the PC/Windows NT platform were sent to NRC.		

SOFTWARE SUMMARY FORM

01. Summary Date: 02/15/00		02. Summary prepared by (Name and phone): Sitakanta Mohanty (210) 522-5185		03. Summary Action: Modified	
04. Software Date: 02/15/00		05. Short Title: TPA Version 4.0beta			
06. Software Title: TPA - System Performance Assessment Computer Code, Version 4.0beta				07. Internal Software ID: None	
08. Software Type: <input type="checkbox"/> Automated Data System <input checked="" type="checkbox"/> Computer Program <input type="checkbox"/> Subroutine/Module		09. Processing Mode: <input type="checkbox"/> Interactive <input checked="" type="checkbox"/> Batch <input type="checkbox"/> Combination		10. Application Area: a. General: <input type="checkbox"/> Scientific/Engineering <input type="checkbox"/> Auxiliary Analyses <input checked="" type="checkbox"/> Total System PA <input type="checkbox"/> Subsystem PA <input type="checkbox"/> Other b. Specific:	
11. Submitting Organization and Address: CNWRA/SwRI 6220 Culebra Road San Antonio, TX 78228			12. Technical Contact(s) and Phone: Sitakanta Mohanty (210) 522-5185		
13. Software Application: The TPA Code consists of the following modules: UZFLOW, NFENV, EBSREL, UZFT, SZFT, DCAGW, FAULTO, SEISMO, VOLCANO, ASHPLUMO, ASHRMVO, DCAGS, LHS, EXEC.					
14. Computer Platform: SUN Workstation PC		15. Computer Operating System: UNIX Windows NT		16. Programming Language(s): SUN FORTRAN 5.0 Lahey LF90 V4.5	
17. Number of Source Program Statements: Approx. 43000 lines w/o stand alone codes		18. Computer Memory Requirements: 74 Mb		19. Tape Drives: None	
20. Disk Units: N/A		21. Graphics: N/A			
22. Other Operational Requirements: Uses system environment variables: TPA_TEST and TPA_DATA.					
23. Software Availability: <input checked="" type="checkbox"/> Available <input type="checkbox"/> Limited <input type="checkbox"/> In-House ONLY			24. Documentation Availability: <input type="checkbox"/> Available <input type="checkbox"/> Preliminary <input checked="" type="checkbox"/> In-House ONLY		
25. Software Developer: <u>Ron Janigba</u> Date: <u>2-15-00</u>					

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CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

DESIGN VERIFICATION REPORT FOR CNWRA SOFTWARE: TPA 4.0 Beta.

1 of 4 pages

Date: 2/15/2000

Total System Performance Assessment (Scientific and Engineering Software) Version 4.0 Beta

NOTE: This version of the TPA Software contains changes from the previous version released. Software Change Reports (SCRs) have been utilized as the change documentation method and they are being retained in the N/A Version N/A folder.

Maintained in project files.

1. This Design Verification Report is prepared by (names of CNWRA software custodian and software developer): Ron Janetzke

Full Title of CNWRA scientific and engineering software: TPA Version 4.0 Beta
Demonstration work station: SUN E PC (Scratchy 1 & ALBY)
Operating System: Solaris, WIN NT

2. Software Requirements Description and any changes thereto follow QAP-002 requirements?

YES NO N/A

Nov. 30, 1999

Notes:

3. Software Development Plan (SDP) and any changes have been approved by the Element Manager?

YES NO N/A Developed, not signed

2/15/2000

2/15/2000

Notes:

User's manual for TPA 4.0 should be discussed.

4. Design and Development

Module-level testing is documented in either scientific notebooks or in Software Change Reports?

YES NO N/A Beta

Notes:

Testing will be documented on SCRs prior to Release of TPA 4.0.

5. Is the CNWRA scientific and engineering software developed in accordance with the conventions described in the SDP?

YES NO N/A

Notes:

6. Is the CNWRA software documented internally?
 YES NO N/A

Does the primary program header contain the following information?

A. Program title, Developed for (Customer), Office/Division/~~Date~~/Customer Contact/Telephone number, Software Developer, Telephone number, titles of Associated Documentation/Designator, and the Disclaimer Notice?
 YES NO N/A

B. Source code module header information provides Program Name, Client Name, Contract Reference, Revision number?
 YES NO N/A

Notes: *Reviewed file
= numrecip.f*

7. Software designed so that individual runs are uniquely identified by Date, Time, Name of software and version?
 YES NO N/A

8. The physical labeling on the software or the referenced list has Program Name/Title, Module/Name/Title, Module Revision, File Type (i.e. ASCII, OBJ, EXE), Recording Date and Operating System of the Supporting Hardware?
 YES NO N/A
Tar & EXE

9. Users' Manual

Is there a Users' Manual for the software?
YES NO N/A

If no, explain: *Due April 3, 2000*

Are there basic instructions for the use of the software?
YES NO N/A

Notes:

10. Acceptance Testing

Does the acceptance testing demonstrate whether or not requirements in the SRD have been fulfilled?

YES NO N/A

Notes:

Beta only

Has acceptance testing been conducted for each intended computer platform and operating system?

YES NO N/A

Notes:

Beta only

Have installation tests been performed on the target platform?

YES NO N/A

Notes:

PC & Unix

11. Configuration Control

Is the Software Summary Form completed and signed?

YES NO N/A

If no, explain:

12. Is a software technical description prepared, documenting the essential mathematical and numerical basis?

YES NO N/A

If no, explain:

will be part of User's Manual.

13. Is the source code available (or, is the executable code available in the case of commercial codes)?

YES NO N/A

14. Have all the script/make files and executable files been submitted to the Software Custodian?
 YES NO N/A

Notes:

Ron Jantke 2-15-00
CNWRA Software Code Developer Date

Randy Felch 2/15/2000
CNWRA Software Custodian Date

Attachments/

Original to: Software Folder
cc: CNWRA Software Developer
 Cognizant EM

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c Program Name:      TPA - Total-System Performance Assessment Code
c File Name:         %M%
c File Date:         %G%
c Release Version:   4.0beta
c
c Client Name:       USNRC
c                   U. S. Nuclear Regulatory Commission
c                   NRC Office of Nuclear Material Safety and Safeguards
c                   Division of Waste Management
c Contract Number:   NRC 02-97-009
c
c NRC Contact        Tim McCartin (301) 415-6681
c
c CNWRA Contact:    Sitakanta Mohanty (210) 522-5185
c                   Center for Nuclear Waste Regulatory Analyses
c                   San Antonio, Texas 78238-5166
c                   smohanty@swri.edu

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c Revisions:
c 3.1.1 includes SPCRs 101 through 205
c 3.1.2 includes SPCRs 206 through 224
c 3.1.3 includes SPCRs 225 through 227
c 3.1.4 includes SPCRs 228 through 231
c 3.2 includes SPCRs 232 through 252
c 3.2.1 3.2PCbeta port of 3.2 to PC running NT4
c 3.2.2 3.2PVMbeta mod of 3.2.1 to enable PVM
c 3.2.3 includes SCRs 260 through 271
c 3.3 includes SCRs 272 through 278
c      and includes SCRs 280 through 287
c 3.3a clean up comments and dead code.
c 3.3b New volcano model.
c 3.3c New snllhs stand alone code.
c 3.3d New samplehazardcurve random numbers.
c 3.3e Weld corrosion and radiolysis for fault.
c 3.3f Add 2 diffusion parameters for STFF.
c 3.3g Add time varying mass loading for ash.
c 3.3h Move invent data to burnup.dat file.
c 3.3i Add time dependent fow & fmult and
c      failure dependent water contact mode.
c 3.3j 8 subareas for EDA-II design.
c 3.3k Updated uzflow parameters.
c 3.3l Sampled tuff/alluv. I/F; new strmtube.dat
c 3.3m Time dependent nfenv time steps.
c 3.3n Precise repository outline and drift calc.
c 3.3o Integrate GENII code as Gentpa in dcagw.
c 4.0beta New gaussian routine for nfenv.f

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c Documentation:    Predecisional "Total-System Performance Assessment
c                   (TPA) Version 3.2 Code: Module Description and
c                   User's Guide", Center for Nuclear Waste Regulatory
c                   Analyses

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c NUREG-Series Designator: N/A
c
c
c

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c
c
c      D I S C L A I M E R
c
c

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c
c      "This computer code/material was prepared as an account of work
c performed by the Center for Nuclear Waste Regulatory Analyses (CNWRA)
c for the Division of Waste Management of the Nuclear Regulatory
c Commission (NRC), an independent agency of the United States

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c Government. Neither the developer(s) of the code nor any of their
c sponsors make any warranty, expressed or implied, or assume any legal
c liability or responsibility for the accuracy, completeness, or
c usefulness of any information, apparatus, product or process
c disclosed, or represent that its use would not infringe on privately-
c owned rights."

c "In no event unless required by applicable law will the sponsors
c or those who have written or modified this code, be liable for
c damages, including any lost profits, lost monies, or other special,
c incidental or consequential damages arising out of the use or
c inability to use the program (including but not limited to loss of
c data or data being rendered inaccurate or losses sustained by third
c parties or a failure of the program to operate with other programs),
c even if you have been advised of the possibility of such damages or
c for any claim by any other party."

c
c = = = = =

TPA 4.0 BETA

a tpa40beta/ 0 tape blocks
a tpa40beta/CLEANUP 3 tape blocks
a tpa40beta/array.f 57 tape blocks
a tpa40beta/ashplumo.f 37 tape blocks
a tpa40beta/ashrmovo.f 45 tape blocks
a tpa40beta/condxyzt.f 20 tape blocks
a tpa40beta/dcags.f 43 tape blocks
a tpa40beta/dcagw.f 190 tape blocks
a tpa40beta/ebsfail.f 67 tape blocks
a tpa40beta/ebsrel.f 100 tape blocks
a tpa40beta/exec.f 475 tape blocks
a tpa40beta/execa.i 4 tape blocks
a tpa40beta/execb.i 1 tape blocks
a tpa40beta/faulto.f 17 tape blocks
a tpa40beta/fileunit.f 12 tape blocks
a tpa40beta/findelev.f 11 tape blocks
a tpa40beta/invent.f 89 tape blocks
a tpa40beta/ia.f 61 tape blocks
a tpa40beta/ia.i 3 tape blocks
a tpa40beta/Makefile 2 tape blocks
a tpa40beta/max500yr.i 1 tape blocks
a tpa40beta/maxchain.i 1 tape blocks
a tpa40beta/maxnnucl.i 1 tape blocks
a tpa40beta/maxnsuba.i 1 tape blocks
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a tpa40beta/mv.f 23 tape blocks
a tpa40beta/nfenv.f 157 tape blocks
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a tpa40beta/reader2.i 1 tape blocks
a tpa40beta/reader3.i 1 tape blocks
a tpa40beta/reader4.i 1 tape blocks
a tpa40beta/driftsa.i 1 tape blocks
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a tpa40beta/seismo.f 79 tape blocks
a tpa40beta/stop.i 1 tape blocks
a tpa40beta/subarea.f 75 tape blocks
a tpa40beta/szft.f 148 tape blocks
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a tpa40beta/uzflow.f 103 tape blocks
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a tpa40beta/inventi.i 1 tape blocks
a tpa40beta/inventj.i 1 tape blocks
a tpa40beta/inventk.i 1 tape blocks

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a tpa40beta/codes/genii/Make.bat 4 tape blocks
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a tpa40beta/codes/genii/biocal.f 3 tape blocks
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a tpa40beta/samplerf.i 1 tape blocks
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a tpa40beta/samplerh.i 1 tape blocks
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a tpa40beta/data/ebsrel.def 9 tape blocks
a tpa40beta/data/rectedge.dat 5 tape blocks
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a tpa40beta/data/soildem.dat 965 tape blocks
a tpa40beta/data/elevdem.dat 589 tape blocks
a tpa40beta/data/g_s_cb_ad.dat 6 tape blocks
a tpa40beta/data/g_s_cb_ci.dat 5 tape blocks
a tpa40beta/data/g_s_pb_ad.dat 6 tape blocks
a tpa40beta/data/g_s_pb_ci.dat 5 tape blocks
a tpa40beta/data/tefkfi.inp 1473 tape blocks
a tpa40beta/data/tpanames.dbs 138 tape blocks
a tpa40beta/data/ebsfilt.def 2 tape blocks
a tpa40beta/data/drythick.dat 1 tape blocks
a tpa40beta/data/nuclides.dat 8 tape blocks
a tpa40beta/data/burnup.dat 6 tape blocks
a tpa40beta/data/wpflow.def 35 tape blocks
a tpa40beta/data/FILENAME.DAT 2 tape blocks
a tpa40beta/data/gbioacl.dat 13 tape blocks
a tpa40beta/data/gdefault.def 7 tape blocks
a tpa40beta/data/gdosinc2.dat 1 tape blocks
a tpa40beta/data/gftrans.def 14 tape blocks
a tpa40beta/data/ggamen.dat 30 tape blocks
a tpa40beta/data/ggenii.def 28 tape blocks
a tpa40beta/data/ggrdf.dat 11 tape blocks
a tpa40beta/data/gnewdf.dat 20 tape blocks
a tpa40beta/data/grmdlib.dat 26 tape blocks
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a tpa40beta/data/maidtbl.dat 16935 tape blocks
a tpa40beta/ccdf/ 0 tape blocks
a tpa40beta/ccdf/tccdf.f 46 tape blocks
a tpa40beta/ccdf/tccdf.i 1 tape blocks
a tpa40beta/ccdf/tccdf.inp 2 tape blocks
a tpa40beta/ccdf/Makefile 1 tape blocks
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Software Development Plan

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SOFTWARE DEVELOPMENT PLAN FOR TOTAL-SYSTEM PERFORMANCE ASSESSMENT VERSION 4.0 CODE

December 1999

This software development plan (SDP) describes the approach to be followed in implementing the code modifications, to be made to the Total-system Performance Assessment (TPA) Version 3.3 code, necessary to meet the design specifications for the TPA Version 4.0 code that are outlined in the Software Requirements Description (SRD) For TPA Version 4.0.

1.0 SCOPE

The scope of the software development effort is described in detail in the SRD. The work will be performed in both the executive side of the code and the process model side. The integration of the process models to the executive will be strengthened and will provide new and more appropriate information to the analyst. The process model development will be limited to the EBSREL, RELEASET, and SEISMO modules. On the executive side the problem setup procedure will become more flexible with changes to the input mechanism for specifying the repository design parameters and statistical sampling techniques.

2.0 BASELINE ITEMS

The products to be delivered from this software development project include: (i) a beta test version of the TPA Version 4.0 source code to be delivered to NRC on 1/31/00, (ii) a tested TPA Version 4.0 source code to be delivered to NRC on 4/3/00, (iii) an updated version of the input file *tpa.inp*, (iv) *make* files that create the TPA and process model executable files, (v) auxiliary data files for the *data/* subdirectory, and (vi) source code for the process models in the *codes/* subdirectory.

3.0 PROJECT MANAGEMENT

Software development project tasks, schedules, staff and provisions. For reducing associated risk are discussed in the section. The TPA Version 3.3 code will be used as the base line code from which all modifications discussed in the SRD will proceed.

3.1 Work Breakdown Structure

3.1.1 Task 1 (Mohanty, 10.5 days)

This task will make the following adjustments to the *tpa.inp* file:

- Include the radiolysis effects of H₂O₂ for passive corrosion rates and corrosion potentials via changes to the *tpa.inp* file.

- Add the drip shield failure time distribution function to the *tpa.inp* file.

- Modify input parameters in *tpa.inp* for SF dissolution models 1 and 2.

3.1.2 Task 2 (Codell, 5 days)

This task will make the following changes to LHS:

- Add two new distributions (logbeta and an integer distribution) to the LHS code.

3.1.3 Task 3 (Stothoff, ? Days)

This task will make the following changes to UZFLOW:

- Enhance the computation of the shallow infiltration above the repository in UZFLOW.

3.1.4 Task 4 (Green, 2.5 days)

This task will make the following changes to NFENV:

- Modify NFENV to provide additional flexibility to the reflux model to accommodate the new repository drift and canister spacing.

3.1.5 Task 5 (Mohanty, 10 days)

This task will make the following changes to FAILT:

- Add the calculation of weld corrosion rates to the *failt* process module.

3.1.6 Task 6 (R. Rice, 11.5 days)

This task will make the following changes to RELEASET and EBSREL:

- Modify EBSREL and the executive to identify the initial failures separately from corrosion failures.

- Change the F_{mult} and F_{ow} WP wetting parameters from sampled distribution to a time history of the parameters that is contained in an auxiliary data file.

- Modify RELEASET to permit the assignment of a water contact mode (bathtub or flow through) to each failure type.

3.1.7 Task 7 (McCartin/Janetzke, 7 days)

This task will make the following changes to UZFT, SZFT, and NEFTRAN:

- Modify UZFT, SZFT, and NEFTRAN to permit the user to activate calculations to account for colloid transport.
- Modify SZFT to permit the alluvium lengths for the stream tubes to be sampled.
- Modify SZFT to accept the diffusion rate and immobile phase porosity of the tuff from the *tpa.inp* file.

3.1.8 Task 8 (Smith/Janetzke, 18.5 days)

This task will make the following changes to EXEC:

- Modify the executive to permit the user to specify additional partially utilized subareas.
- Modify the executive to permit the transport of C-14 through the UZ and SZ.
- Modify the executive, DCAGW and DCAGS to permit the incorporation of the GENII-S code into the TPA system.

3.1.9 Task 9 (Hill/Weldy, 5.5 days)

This task will make the following changes to VOLCANO and ASHRMOVO:

- Modify the VOLCANO module to provide the number of WPS entrained in the conduit and the number impacted by magma flow in the drift based on external calculations.
- Modify ASHRMOVO to incorporate the use of a time history of mass loading?.

3.1.10 Task 10 (Janetzke, 4 days)

This task will make the following changes to SEISMO:

- Modify SEISMO to use a sample hazard curve generated by LHS rather than the internal random number generator.

3.1.11 Task 11

In Task 2 the TPA Version 4.0 code will be tested to ensure correctness of the screen output and the *.res files. This task will be completed by April 3, 2000. This will include corrections identified in the testing effort.

3.2 Schedules

The following schedules will be adopted in order to meet the task deliverables.

3.2.1 Tasks 1-10

- This group of tasks will be complete by January 31, 2000.

3.2.2 Task 11

- This task will be complete by April 3, 2000.

3.3 Staffing

In addition to PA staff who have been involved in the development of the TPA Version 3.3 code, completion of this software development project will require the use of consultants and SwRI personnel who are proficient in developing, implementing, and testing FORTRAN 77 code, specifically R. Rice, M. Muller and J. Marty Menchaca. For Tasks 1-5 and 7-9, key CNWRA and NRC technical staff members from appropriate KTIs will be required to produce the algorithms and data needed for modification to the process models. These KTI staff members will also participate in the final code testing to be completed under Task 11.

3.4 Risk Management

The primary risk associated with this project is failure to meet the April 3, 2000 deliverable date for Task 11. This task is dependent on the completion of Tasks 1-10. If Tasks 1-10 are not complete on January 31 then modifications not implemented will be deferred until a later version in order that the thorough testing in Task 11 may be completed on schedule. NRC will be informed at the time of delivery of Tasks 1-10 that a certain feature was not implemented to ensure that a working code could be delivered at the completion of Task 11.

4.0 DEVELOPMENT PROCEDURES

This section describes plans for developing the TPA Version 4.0 code

4.1 Hardware and Software resources

All code development will be done on Sun SPARC 10 and 20 workstations running SOLARIS 5.5.1, the Sun UltraSPARC 1 server running SOLARIS 5.6, and a Microsoft Windows compatible PC. The Sun FORTRAN 77 Version SC3.0.1 will be used on the UNIX platform and Lahey Fortran 90 (LF90) Version 4.5 will be used on the PC platform.

4.2 Software development Lifecycle

The project will consist of two phases. Phase 1 will be the development of Tasks 1-10 for

the TPA Version 4.0 code. Phase 2 will be the testing of the TPA Version 4.0 code.

4.3 Coding

All coding will be done in FORTRAN 77 with extensions to permit the use of long variable names. Coding style will be in accordance with that which has been historically used at the CNWRA and NRC for development of TPA codes.

4.4 Acceptance testing and Analysis

The results of the Task 11 testing will be appropriately recorded in scientific notebooks or software change requests (SCR).

5.0 CONFIGURATION MANAGEMENT PLAN

The official version of the working code will be placed under control of the Software Configuration Control System (SCCS) package available on the Sun workstation to ensure that coding conflicts do not arise during development. A copy of the final TPA Version 4.0 code will be provided to QA for configuration control.

5.1 Tools

In addition to the SCCS tool mentioned above, Unix utilities *diff*, *filemerge* and *make* will be used to perform the code manipulations required to maintain the official version of the working code.

5.2 Configuration Identification

The configuration identification will be assigned by the software custodian of the QA staff.

5.3 Configuration Procedures

All check-in or check-out activities on *scratchyl* will be performed by Ron Janetzke. The latest version of the files will be available in */export/home/janetzke/tpa/dev*. The standard SCR change request form will be used for all significant changes to the controlled source code.

6.0 REFERENCES

None.

7.0 APPENDICES

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None.

APPROVED:

Leslie Wilhoye
Signature of Element Manager

2/15/2000
Date