Department of Energy
Office of Civilian Radioactive Waste Management
Yucca Mountain Site Characterization Office
P.O. Box 30307
North Las Vegas, NV 89036-0307

QA: N/A

AUG 20 2001

OVERNIGHT MAIL

C. William Reamer, Chief
High-Level Waste Branch
Division of Waste Management
Office of Nuclear Materials Safety
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U.S. Nuclear Regulatory Commission
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TRANSMITTAL OF WASTE PACKAGE DEGRADATION (WAPDEG) SOURCE CODE VERSION 4.0 – SOFTWARE TRACKING NUMBER STN: 10000-4.0-00

This letter transmits a copy of the approved and qualified WAPDEG Version 4.0 source code and identification of differences between WAPDEG Version 4.0 and the version of the WAPDEG code used for the Total System Performance Assessment-Site Recommendation (TSPA-SR). The source code and the difference list are provided to the U.S. Nuclear Regulatory Commission (NRC) to fulfill the request of David W. Esh of your staff.

Please note the WAPDEG Version 4.0 includes a known defect that has been detected, evaluated, and documented for any impact to previous and current results. The defect in the WAPDEG code is failure to initiate inside-out corrosion properly for single barrier waste packages. For waste packages with two or more barriers, WAPDEG models inside-out corrosion properly. Previous and current results made use of a waste package modeled with two barriers. The defect does not impact previous or current results. Results available to date verify this conclusion.

Due to the specialized technical nature of the enclosures, we are providing a copy to the NRC only. Please direct any questions concerning this letter or requests for copies of the enclosures to Timothy C. Gunter at (702) 794-1343.

Stephan Brocoum
Assistant Manager, Office of
Licensing and Regulatory Compliance

OL&RC:TCG-1567

Enclosures:
1. CD on WAPDEG Version 4.0
2. Differences Between WAPDEG Revision 4.0
and the WAPDEG Version Used for TSPA-SR

YMP-5

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OL&RC Library
Records Processing Center =
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QA:NA

ENCLOSURE 2

Differences Between WAPDEG Version 4.0 and the WAPDEG Version Used for TSPA-SR

Differences Between WAPDEG Version 4.0 and the WAPDEG Version Used for TSPA-SR

The majority of the files which make up both WAPDEG versions are identical (see the difference file wapdeg-q-unq-diff.txt on the accompanying CD). All of the differences between the two WAPDEG versions are related to the size of statically allocated arrays used during simulation. One should keep in mind that WAPDEG is used as a stochastic simulator. This implies that although the results from one single simulation may differ between the two versions, the results from a set of simulations will be similar. It is in this manner that the WAPDEG results are used and on that basis that the differences between the versions were determined to have no impact.

Difference in modStatTypes.f

WAPDEG Version 4.0	TSPA-SR REV 00 WAPDEG	Explanation of Impact
c for a CDF is 249 data pairs. The maximum size for a c poisson distribution is also 249 pairs (500 values).	c for a CDF is 201 data pairs (403 values). The maximum size for a c poisson distribution is also 201 pairs (404 values).	These are comment lines and have no effect on the resulting code. The text for the qualified code is correct.

Differences in modWapdegTypes.f

WAPDEG Version 4.0	TSPA-SR REV 00 WAPDEG	Explanation of Impact
NumberWPs = 10000	NumberWPs = 2000	This parameter determines the number of drip shield/waste package pairs which are possible to simulate. The TSPA-SR REV 00 analyses used 400 drip shield/waste package pairs which is within the capabilities of either code. This difference has no impact on the TSPA-SR REV 00 model or model results.
PatchCount = 1500	PatchCount = 1002	This parameter determines the number of patches per drip shield and per waste package which are possible to simulate. The TSPA-SR REV 00 analyses used 500 drip shield and 1,000 waste package patches which is within the capabilities of either code. This difference has no impact on the TSPA-SR REV 00 model or model results.
ExposSegments = 15	ExposSegments = 14	This parameter determines the number of thermal hydrology/exposure condition time histories which are possible to use during a WAPDEG simulation. The TSPA-SR REV 00 analyses used 14 thermal hydrology/exposure condition time histories which is within the capabilities of either code. This difference has no impact on the TSPA-SR REV 00 model or model results.
ExposTimes = 150	ExposTimes = 100	This parameter determines the number of lines (individual times) in the individual thermal hydrology/exposure condition time histories which are possible to use during a WAPDEG simulation. The TSPA-SR REV 00 analyses used no more than 98 lines in an individual thermal hydrology/exposure condition time history which is within the capabilities of either code. This difference has no impact on the TSPA-SR REV 00 model or model results.

WAPDEG Version 4.0	TSPA-SR REV 00 WAPDEG	Explanation of Impact
DripSequences = 10	DripSequences = 2	This parameter determines the number of drip sequences which are possible to use during a WAPDEG simulation. A drip sequence is composed of different water types and the time ranges (phases) over which they apply. The TSPA-SR REV 00 analyses used one drip sequence which is within the capabilities of either code. This difference has no impact on the TSPA-SR REV 00 model or model results.
DripPhases = 5	DripPhases = 3	This parameter determines the number of phases (time ranges) per drip sequence which are possible to use during a WAPDEG simulation. The TSPA-SR REV 00 analyses used three phases which is within the capabilities of either code. This difference has no impact on the TSPA-SR REV 00 model or model results.
AllConds = 5	AllConds = 3	This parameter determines the number of distinct water types which are possible to use during a WAPDEG simulation. The TSPA-SR REV 00 analyses used three water types which is within the capabilities of either code. This difference has no impact on the TSPA-SR REV 00 model or model results.
CrodeModels = 15	CrodeModels = 13	This parameter determines the number of distinct corrosion models which are possible to use during a WAPDEG simulation. The TSPA-SR REV 00 analyses used 12 corrosion models which is within the capabilities of either code. This difference has no impact on the TSPA-SR REV 00 model or model results.
CrodeVars = 8	CrodeVars = 9	This parameter determines the number of corrosion variables which are possible to use during a WAPDEG simulation. The TSPA-SR REV 00 analyses used three corrosion variables which is within the capabilities of either code. This difference has no impact on the TSPA-SR REV 00 model or model results.
WCBarriers = 4	WCBarriers = 2	This parameter determines the number of waste package barriers which are possible to use during a WAPDEG simulation. The TSPA-SR REV 00 analyses used two corrosion variables which is within the capabilities of either code. This difference has no impact on the TSPA-SR REV 00 model or model results.
GenThreshDataSets = 5	GenThreshDataSets = 1	This parameter determines the number of general corrosion threshold data sets which are possible to use during a WAPDEG simulation. The TSPA-SR REV 00 analyses used one general corrosion threshold data set which is within the capabilities of either code. This difference has no impact on the TSPA-SR REV 00 model or model results.
PitThreshDataSets = 5	PitThreshDataSets = 1	This parameter determines the number of localized corrosion (pit) threshold data sets which are possible to use during a WAPDEG simulation. The TSPA-SR REV 00 analyses used one localized corrosion threshold data set which is within the capabilities of either code. This difference has no impact on the TSPA-SR REV 00 model or model results.
EventsPossible = 20	EventsPossible = 17	This parameter determines the number of events which are possible to use during a WAPDEG simulation. The TSPA-SR REV 00 analyses used 15 events which is within the capabilities of either code. This difference has no impact on the TSPA-SR REV 00 model or model results.
ConstsPerEvent = 9	ConstsPerEvent = 7	This parameter determines the number of constants per event which are possible to use during a WAPDEG simulation. The TSPA-SR REV 00 analyses

WAPDEG Version 4.0	TSPA-SR REV 00 WAPDEG	Explanation of Impact
		used at most seven constants per event which is within the capabilities of either code. This difference has no impact on the TSPA-SR REV 00 model or model results.
VarsPerEvent = 10	VarsPerEvent = 8	This parameter determines the number of variables per event which are possible to use during a WAPDEG simulation. The TSPA-SR REV 00 analyses used at most eight variables per event which is within the capabilities of either code. This difference has no impact on the TSPA-SR REV 00 model or model results.
PitsPerPatch = 20	PitsPerPatch = 10	This parameter determines the number of localized corrosion sites (pits) per patch which are possible to use during a WAPDEG simulation. The TSPA-SR REV 00 analyses used at most 10 localized corrosion sites per patch which is within the capabilities of either code. This difference has no impact on the TSPA-SR REV 00 model or model results.
StrCracksPerPatch = 20	StrCracksPerPatch = 4	This parameter determines the number of manufacturing defects per patch which are possible to use during a WAPDEG simulation. The TSPA-SR REV 00 analyses used at most four manufacturing defects per patch which is within the capabilities of either code. This difference has no impact on the TSPA-SR REV 00 model or model results.
LocalPerPatch = 20	LocalPerPatch = 17	This parameter determines the number of cracks (both incipient cracks and manufacturing defects) per patch which are possible to use during a WAPDEG simulation. The TSPA-SR REV 00 analyses used at most seventeen cracks per patch which is within the capabilities of either code. This difference has no impact on the TSPA-SR REV 00 model or model results.

Label Information:

WAPDEG V4.0
Source, dll, Readme, Diff File
STN: 10000-4.0-00
SMN: 10000-PC-4.0-00

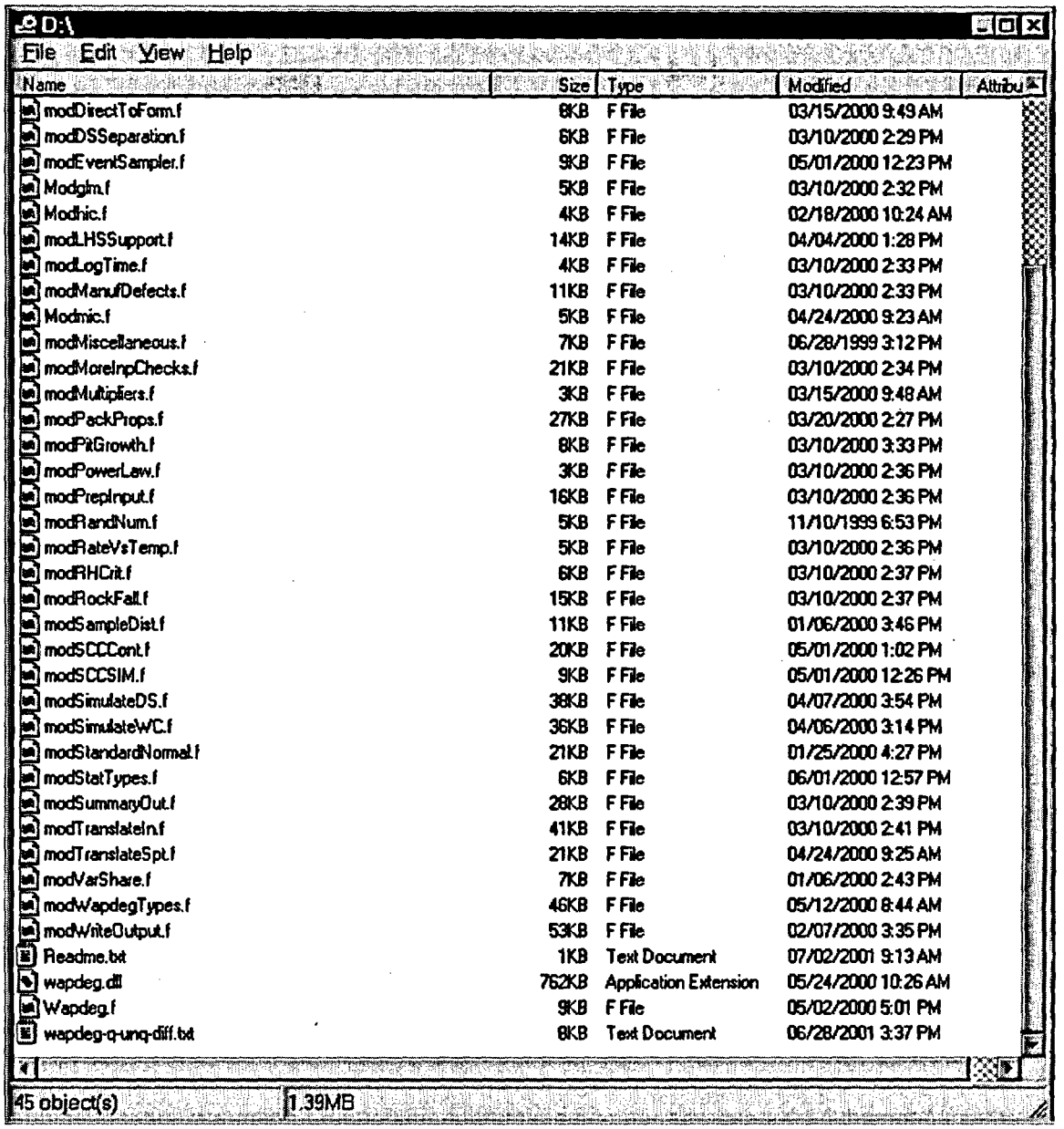
Key Contact: SCM Manager 702-295-3831

Baselined: 10/05/00
CD Created: 06/28/01

NRC COPY

CD Contents:

CD contains 45 files totaling 1.39 Mb of disk space. Screen capture of disk contents follows on 2 pages.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Modgim.f 5KB F File 03/10/2000 2:32 PM
Modhic.f 4KB F File 02/18/2000 10:24 AM
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modSCCSIM.f 9KB F File 05/01/2000 12:26 PM
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modWriteOutput.f 53KB F File 02/07/2000 3:35 PM
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wapdeg.dll 762KB Application Extension 05/24/2000 10:26 AM
Wapdeg.f 9KB F File 05/02/2000 5:01 PM
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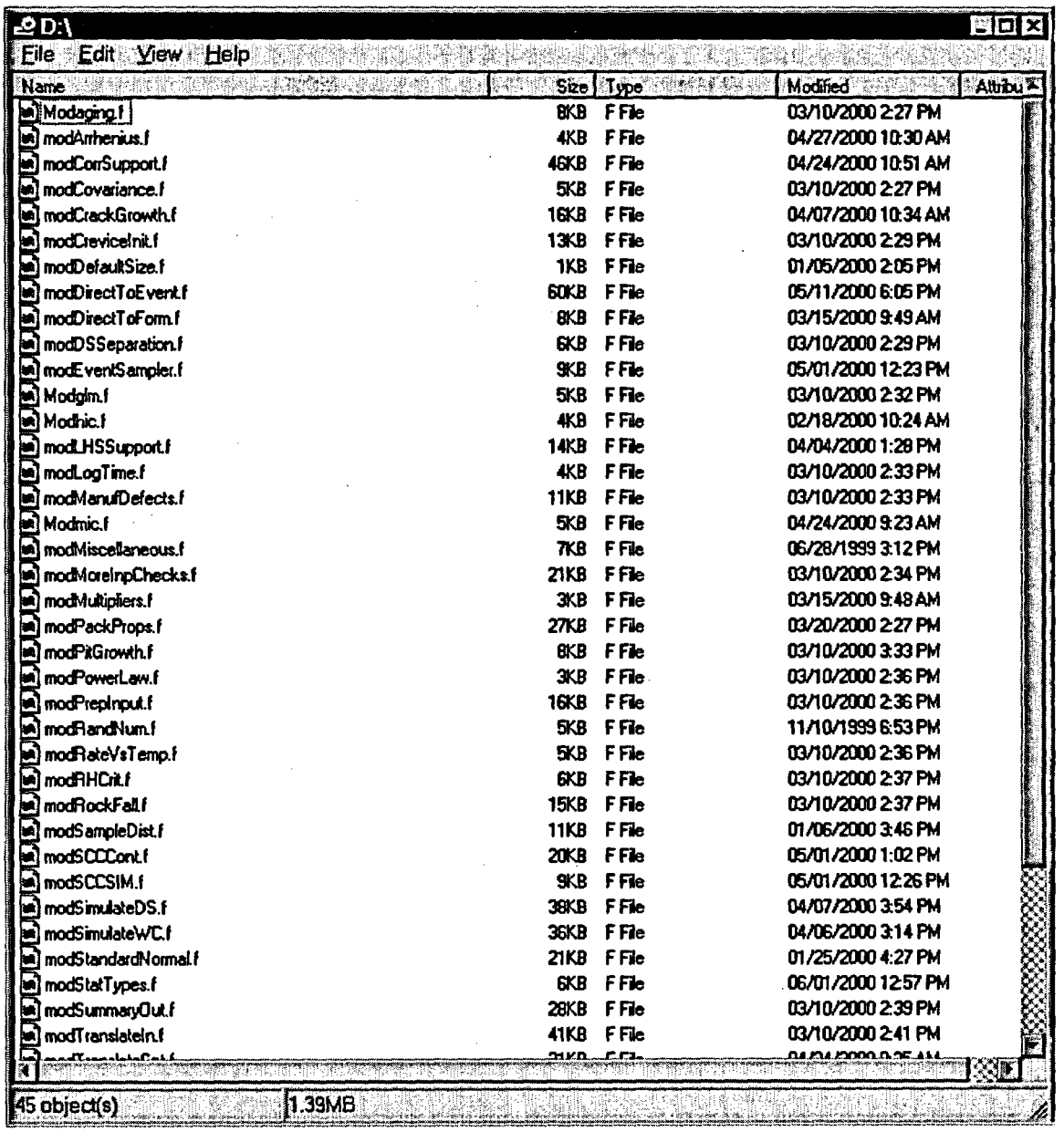
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modArrhenius.f 4KB F File 04/27/2000 10:30 AM
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modCovariance.f 5KB F File 03/10/2000 2:27 PM
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