WPO 30791

Total # of pages in document includes
__8__ pages of preface material and
__82__ pages of text

Record of FEP Screening Work

FEP ID # GG-1 Radiolysis of Brine (2: 1 RA, 1 Calculational)
FEP ID # S-7 Gas Exsolution

The following package contains:

- Screening Argument for the above FEP (s)
- Technical Review Form (follows this cover page)
- N/A Completed Comment Forms for GG-1 (at back of document)
  (If no comments received fill in N/A)
- 1 Completed Comment Forms for S-7 (p. 24)
  (If no comments received fill in N/A)
- Response to Comments (follows Technical Review Form)

In total 1 pages of response(s) to comments are included in this records package.

This document represents implementation of:

- Technical comments presented during WIPP Project Management Review Sessions held September 8, 28,29 and open managerial review session.

Signed:
D.R. Anderson D. R. Anderson Dated 12/12/95
(6749 Department Management Approval) Signature

Lead Staff Michael Lord for Palmer Vaughn Dated 12/12/95
(6749) Signature
Division Number

Lead Staff Michael Lord Dated 12/12/95
(6749) Signature
Division Number

APS 12/15/95
SWCF-A: 1.1.6.3:PA:QA:TSK: GG1& S7
APS 12/15/95

FEP Title: RADIOLYSIS OF BRINE (Calculational)

FEP ID: GG-1

Reviewer Instructions
Check "Yes" for each item reviewed and found acceptable.
Check "No" for each item reviewed and found not acceptable.

1. Are the calculations applicable, correct, and adequate?

(YES) NO NA (for reasoned argument FEP's)

Comments (attach pages as needed)

2. Are the screening arguments derived from the calculations or arguments applicable, correct, and adequate?

(YES) NO

Comments (attach pages as needed)

3. Is the record package documenting the screening effort, complete? Use Criteria found in Appendix D of the FEP Plan Version 5.1.

(YES) NO

Comments (attach pages as needed)

Does the record packages contain sufficient information for an independent person with equivalent technical background to understand the work, evaluate the technical quality of the work, continue unfinished work, and/or reproduce the work and its primary results.

(YES) NO

Comments (attach pages as needed)

Report your assessment along with deficiencies if any and, if appropriate, make recommendations for addressing the deficiencies (attach pages as needed).

Signature of technical reviewer(s) and lead staff member indicates that the package reviewed was complete, accurate, and acceptable.

Technical Reviewer(s) (attach pages as needed)

Name (Print) M.G. MARIETTA Signature [signature] Date 10/15/95

Name (Print) Signature Date

Lead Staff

Palmer Vaughn Signature Palmer Vaughn Date 10/19/95

Name (Print)

Management Concurrence

Name (Print) Margaret Chu Signature [signature] Date 10/19/95

QA AES 12/15/95

SCWF-A:1.1.6.3:PA:~~NQ~~:TSK:GG-1 (FEP ID)

FEP Title: Radiolysis of Brine (RA)

FEP ID: GG-1

Reviewer Instructions
Check "Yes" for each item reviewed and found acceptable.
Check "No" for each item reviewed and found not acceptable.

1. Are the calculations applicable, correct, and adequate?

YES NO (NA) (for reasoned argument FEP's)

Comments (attach pages as needed)

2. Are the screening arguments derived from the calculations or arguments applicable, correct, and adequate?

(YES) NO

Comments (attach pages as needed)

3. Is the record package documenting the screening effort, complete? Use Criteria found in Appendix D of the FEP Plan Version 5.1.

YES NO

Comments (attach pages as needed)

NA

Does the record packages contain sufficient information for an independent person with equivalent technical background to understand the work, evaluate the technical quality of the work, continue unfinished work, and/or reproduce the work and its primary results.

(YES) NO

Comments (attach pages as needed)

Report your assessment along with deficiencies if any and, if appropriate, make recommendations for addressing the deficiencies (attach pages as needed).

Signature of technical reviewer(s) and lead staff member indicates that the package reviewed was complete, accurate, and acceptable.

Technical Reviewer(s) (attach pages as needed)

Name (Print)	Signature	Date
M. G. Marietta	M. G. Marietta	10/15/95
Name (Print)	Signature	Date

Lead Staff

Name (Print) DA GALSON Signature D.A. Galson Date 10/17/95

Management Concurrence

Name (Print) Margaret Chu Signature [signature] Date 10/19/95

QA ARS 12/15/95

SCWF-A:1.1.6.3:PA:~~NQ~~:TSK:GG-1 (FEP ID)

FEP Title: GAS EXSOLUTION

FEP ID: S-7

Reviewer Instructions *Check "Yes" for each item reviewed and found acceptable.* *Check "No" for each item reviewed and found not acceptable.*

1. Are the calculations applicable, correct, and adequate?

(YES) NO NA (for reasoned argument FEP's)

Comments (attach pages as needed)

2. Are the screening arguments derived from the calculations or arguments applicable, correct, and adequate?

(YES) NO

Comments (attach pages as needed)

3. Is the record package documenting the screening effort, complete? Use Criteria found in Appendix D of the FEP Plan Version 5.1.

(YES) NO

Comments (attach pages as needed)

Does the record packages contain sufficient information for an independent person with equivalent technical background to understand the work, evaluate the technical quality of the work, continue unfinished work, and/or reproduce the work and its primary results.

(YES) NO

Comments (attach pages as needed)

Report your assessment along with deficiencies if any and, if appropriate, make recommendations for addressing the deficiencies (attach pages as needed).

Signature of technical reviewer(s) and lead staff member indicates that the package reviewed was complete, accurate, and acceptable.

Technical Reviewer(s) (attach pages as needed)

Name (Print) M.G. MARIETTA Signature [signature] Date 10/15/95

Name (Print) Signature Date

Lead Staff

Michael Lord

Name (Print) Signature [signature] Date 10/17/95

Management Concurrence

Name (Print) Margaret Chu Signature [signature] Date 10/17/95

QA APS 12/15/95

SCWF-A:1.1.6.3:PA:~~NQ~~QA:TSK: S-7 (FEP ID)

RESPONSE TO COMMENT(s) FOR FEP S-7

Comment from Stephen Webb
(Commentor's name)

Response to Comment (1)

Comment acknowledged. 1) More detail of the dissolved gas model will be included. 2) Disagree with commentor concerning reference to DR4.

Signature Palmer Vaughn

Date 9/29/95

SWCF-A:1.1.6.3:PA:QA:TSK: S-7 (FEP ID#)

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FEPs Screening Analyses

GG-1: Radiolysis of Brine
S-7: Gas Exsolution

WBS No. 1.1.6.3

SWCF-A: 1.1.6.3:PA:QA:TSK: GG-1
SWCF-A: 1.1.6.3:PA:QA:TSK:S-7

Palmer Vaughn 10/10/95

Lead Staff: Palmer Vaughn (GG-1)
Mike Lord (S-7) Michael Lord 10/10/95
Sandia National Laboratories
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Table of Contents

This Records Package contains 82 pages.

SWCF-A: 1.1.6.3:PA:QA:TSK:GG1 and S7

Table of Contents (Cont'd)

PLAN OF WORK

A set of screening analyses have been performed to evaluate the sensitivity of the WIPP repository performance to the following FEPs:

1. FEP Screening Issue GG-1: Radiolysis of Brine
2. FEP Screening Issue S-7: Gas Exsolution

This document describes the process for conducting sidebar calculations. This work was planned, conducted, and documented in accordance with the FEP Management Plan titles "Features, Events, and Processes (FEP) and Assumption Screening: Procedural Aspects, Documentation QA" Revision 5.1, effective 5/11/1995.

Approved Planning Memos of Record

The approved Planning Memos of Record for each FEP issue are provided in the following pages.

GG-1:RADIOLYSIS OF BRINE
Planning Memo of Record

DATE: **June 12, 1995**

TO: **D. R. Anderson**

FROM: **L. Brush, D. Bennett** D. Bennett (by D.A. Galson)

SUBJECT: FEPs Screening Issue GG-1

STATEMENT OF SCREENING ISSUE

The production of gas in the WIPP disposal rooms will occur as a result of corrosion, microbial activity, and radiolysis. To date, radiolysis has not been included in the WIPP system model which comprises the Average Stoichiometry model for gas generation within the performance assessment code for brine and gas flow (BRAGFLO). Although corrosion and microbial activity have the greatest potential to produce gas, radiolysis of brine in the WIPP disposal rooms and of water in the waste will lead to further gas production. Disposal system performance may be adversely affected if radiolytic gas generation leads to significantly greater gas pressures which influence the permeability and porosity of the waste-filled regions, resist room closure, and/or cause fractures to be created or reopened in the disturbed rock zone or the interbeds within the Salado. This screening effort will, therefore, investigate the need for the inclusion of radiolytic gas generation within the Average Stoichiometry model.

APPROACH

Calculation Design

Calculations are planned to assess the magnitude of the influence of the radiolysis of brine and waste waters on system performance. The existing BRAGFLO model will be employed to determine releases with and without the inclusion of reactions simulating radiolytic gas generation. Calculated releases will be compared, with the expectation that radiolysis of brine and waste waters will be shown to be a relatively minor factor in determining radionuclide release. This result would allow exclusion of radiolytic gas generation from system modeling on grounds of low consequence.

S-7: GAS EXSOLUTION
Planning Memo of Record

DATE: **June 12, 1995**

TO: **D. R. Anderson**

FROM: **M. Lord** M.E.L.

SUBJECT: FEP Screening Issue S-7

STATEMENT OF SCREENING ISSUE

During the early time when the waste cavity is filling with brine, the dissolved gas may contribute an additional drive mechanism. As brine is drained from the near-waste formations and pressure declines within these formations, gas will be released from the brine with resulting higher pressures. This mechanism may enhance the flow of brine to the waste region. At later time when gas generation is the principal drive mechanism, gas will go into solution as the pressure increases. This will result in lower fluid pressures and altered fluid flow. The effect should be the retardation of fluid transport.

These effects and their importance on releases to the environment are at present unknown and need to be quantified.

APPROACH

Calculation Design

A two-phased computational procedure is proposed. The first phase is intended to be a 'shake-out' phase designed to 1) demonstrate that the dynamics of gas in solution are implemented properly, 2) investigate any numerical problems associated with dissolved gas, and 3) justify the physical reality of the dissolved gas treatment. Some preliminary sensitivity analysis and screening may occur in the first phase. The results including dissolved gas will be compared to the results without dissolved gas, and all other FEP conceptual models will be disabled with the exception of repository dip.

The second phase is intended to be the sensitivity analysis used as a basis for possible screening, assuming that screening has not been previously justified as a result of the phase one analysis. The relative importance of solution gas will be evaluated simultaneously with other FEP issues (including repository dip) to evaluate the possible coupling of the effect of dissolved gas to other FEP conceptual models. The phase two analysis will use results generated from a large Latin hypercube sampling that includes the uncertainties of multiple FEP issues, as well as parameter uncertainty. The E1, E1/E2, and Undisturbed scenarios will be evaluated.

SOFTWARE

The computer programs used in the FEPs screening analyses, along with their abbreviated software abstracts, are listed below. Complete software abstracts are available in the WIPP Records Center. These computer programs are classified as follows.

Pre-processors: GENMESH, MATSET, PRELHS, LHS, ICSET, PREBRAG, GENNET

Analysis codes: BRAGFLO, NUTS, PANEL

Post-processors: POSTLHS, ALGEBRACBD, POSTBRAG, SUMMARIZE, CCDFCALC, CCDFPLOT, BLOTCDB, SPLAT

Pointers to SWCF records containing documentation for computer codes: A copy of the Grade X code is available in the Records Center. Other codes have been archived by Department 6351-Computational Support, on the following pages: F95074, F95080, F95654, F95714, F95738, and F95081.

GENMESH (Version 6.04Z0, Version Date 01/27/92):

This program constructs BRAGFLO's Cartesian, rectangular two-dimensional finite-difference grid. In addition to establishing mesh connectivity and node coordinates, the program sets material regions, geometry flags for node or element boundary conditions, and element attributes associated with the cell size (e.g. elevations of elements).

MATSET (Version 8.0720, Version Date 02/01/94):

MATSET sets material names to specified regions in BRAGFLO's finite-difference grid (e.g., defined by GENMESH), sets material property values, and sets attribute values into computational data base files. Property and attribute values are obtained from the property Secondary Data Base (median values read from PROP.SDB).

PRELHS (Version 2.02Z0, Version Date 02/01/94):

The PRELHS translator is used to extract parameter distribution data from the secondary data base file, PROP.SDB, and sets up the L_atin H_ypercube S_ampler (LHS) program input file.

LHS (Version 2.31Z0, Version Date 08/13/93):

The purpose of the LHS program is to sample distributions of input parameters using Latin Hypercube Sampling. LHS permits correlations (restricted pairings) between parameters.

POSTLHS (Version 4.05Z0, Version Date 02/16/94):

The POSTLHS translator replicates PRECAMDAT Nv times where Nv is number of sample vectors generated by LHS and inserts one distinct sample vector of the varied parameters from the output of LHS into each replication of CAMDAT. Identical parameters previously inserted into PRECAMDAT by MATSET are overwritten by POSTLHS.

ICSET (Version 2.11Z0, Version Date 07/07/94):

Sets analysis array variables: history, global, nodal, and element variable values, at the first time step (NSTEP=1) in a cdb file. A cdb file was generated for each vector. Analysis array names and values are obtained from a user supplied input file.

ALGEBRACDB (Version 2.31Z0, Version Date 11/15/94):

ALGEBRACDB generates additional data (or removes unnecessary data) in CAMDAT by manipulating data already stored. With ALGEBRACDB, an analyst can generate pertinent data external to a program module by combining data already stored in the CAMDAT rather than modifying the program module and, thereby, invoking a new quality assessment of the module.

PREBRAG (Version 4.00Z0, Version Date 01/16/95):

PREBRAG creates an input file for the BRAGFLO code by translating data from CAMDAT.

BRAGFLO (Version 3.61Z0 Filename: BF2_Bragflo.for, Version Date 09/08/95)

BRAGFLO is the two-phase (brine and gas) finite-difference program used to examine fluid flow within the Waste Isolation Pilot Plant (WIPP) repository site and surrounding formations.

POSTBRAG (Version 3.03Z0, Version Date 06/22/94):

POSTBRAG places BRAGFLO output into CAMDAT. BRAGFLO output includes global mass balances (global variables) and any of 48 user-specified element variable distributions, including fluid pressures, phase saturations, Darcy velocities of each fluid phase in each (x,y,z) direction, interblock fluid flow rates of each fluid phase in each direction, reactant concentrations, physical properties (e.g., porosity and viscosity of each phase), and phase mass balances.

SUMMARIZE (Version 2.00Z0, Version Date 02/08/95):

SUMMARIZE is used to read specified variable values from multiple CAMDAT data bases (one for each vector). The data may be read from a single time or multiple times. Some simple processing (such as interpolation or integration) of the data may be done. The data is then written to an output file in a format that is specified.

NUTS (Version used for FEPs screening analyses is located in directory [fep.dataexec.bragex])

NUTS is finite-difference program that calculates the movement of radionuclides within the Waste Isolation Pilot Plant (WIPP) repository site. NUTS can be used to simulate the decay of multiple radioactive components during transport in three dimensions through fracture and matrix continua. Single-porosity, dual porosity, and dual-permeability simulations can be performed.

POSTNUTS (Version 1.00Z0, Version Date 02/09/95):

POSTNUTS formats NUTS output for CAMDAT. This postprocessor outputs radionuclide concentrations, radionuclide fluxes, and associated input variables which include flow velocities, fluid saturations, and porosities.

GENNET (Version 2.03Z0, Version Date 02/01/94):

GENNET constructs simple one-, two-, or three-dimensional networks using two-node elements from a user input file. In addition to establishing the mesh connectivity and node coordinates, the program sets: material regions, geometry flags for node or element boundary conditions, and cross-sectional areas of elements. All information is then stored in a computational data base file, ".CDB file".

PANEL (Version 3.40Z0, Version Date 03/07/95):

PANEL reads input properties from a CAMDAT file and computes the distribution of the nuclides in the panel (ie,in orginal waste form, in colloidal form, or in solution). Then, when the panel is breached and brine flow starts, it outputs the cumlative mass released of the nuclides and the cumlative flow of the brine.

CCDFCALC (Version 4.27Z0, Version Date 02/30/95):

CCDFCALC is used to calculate integrated release from CAMDAT files to be plotted by CCDFPLOT.
For each sample set and scenario, CCDFCALC accesses the appropriate CAMDAT file and integrates to find cumulative releases for each radionuclide. The cumulative releases are written to a transfer file used by CCDFPLOT.

CCDFPLOT (Version 4.19Z0, Version Date 02/30/95):

CCDFPLOT plots a complementary cumulative distribution function of total integrated releases.

BLOTCDB (Version 1.33Z0, Version Date 01/19/95):

The plotting support module, BLOTCDB, plots all intermediate and final results from all main modules. BLOTCDB directly reads CAMDAT and plots (1) the computational mesh with contoured analysis results, (2) grid distance versus any variable, and/or (3) any variable versus any other variable.

Source Listings

None

PLATFORM

The FEP screening calculations were performed on Digital Equipment Corporation (DEC) ALPHAs , which are member machines of the WIPP ALPHA Cluster. The operating system is Open VMS Version 1.5.

INPUT DATA SET

All material properties were obtained from the baseline database prop.sdb. See records package for DR2, DR3, DR6, DR7, and S7. The baseline data is the same data described in chapter 6 of the Draft 40 CFR 191 Compliance Certification Application (DCCA). Input data sets for the screening calculations were generated in step-wise fashion using GENMESH, MATSET, PRELHS, LHS, POSTLHS, ICSET, ALGEBRACDB, and PREBRAG. These codes are described in the foregoing SOFTWARE section. Corresponding input and output files are listed in a subsequent Input and Output section.

All data sets used in the FEPs calculations were based on the baseline data set. The baseline data set were comprised only of those data required to invoke the particular FEP in the differences between each FEP data set and calculations.

CALCULATIONS

List of Parameters Required, Including Units

See Table 1 in Appendix 1 for this information.

Rationale for Selection of Models used in Calculations

There are two primary reasons why the computer models BRAGFLO, NUTS, and PANEL are used in the screening analyses presented herein. First, these models are the only ones available with the capabilities to evaluate the complex processes associated with each FEP issue, particularly within a probabilistic framework. Second, these models are the models to be used in the Performance Assessment of the Waste Isolation Pilot Plant. Note that the overall objective of the screening analyses is to determine which FEPs need to be included in these models for the final compliance calculations.

Assumptions

The conceptualization of the repository/Salado/shaft is the same as that described in chapter 6 of the Draft CFR 191 Compliance Certification Application (DCCA).

Names of Analysts

J. Bean, J. Garner, M. Lord, R. MacKinnon, D. McArthur, J. Schreiber, A. Shinta, P. Vaughn

Dates Analysis Conducted

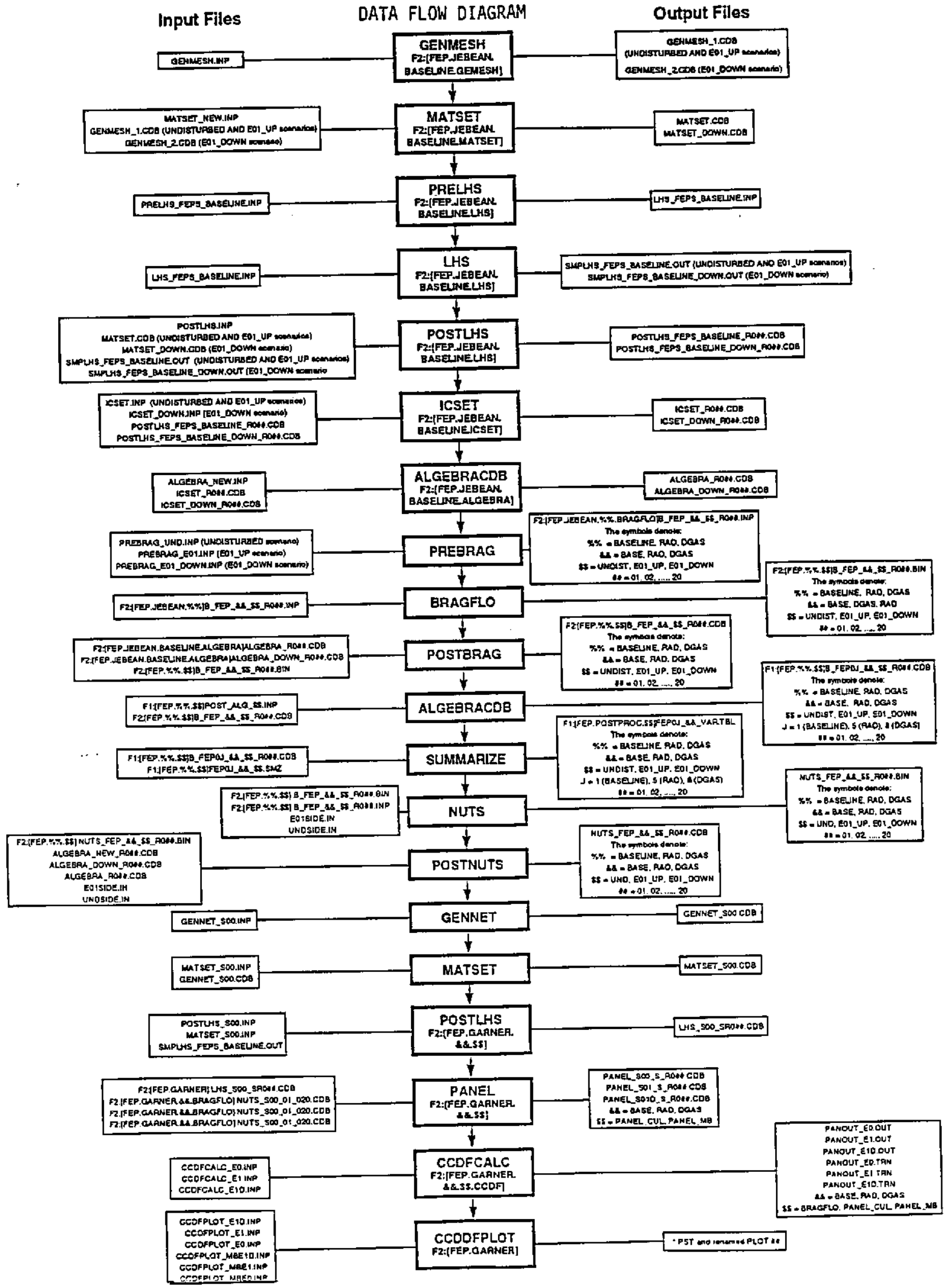
Calculations and analysis of results were conducted between June 21 and September 25, 1995.

Instructions from Lead Staff Member

Not applicable

Diagram of Data Flow Between Computer Codes

A listing of programs used in the FEPs screening analysis, the order they were implemented, and the data they receive and produce is provided in the subsequent section "List of Input and Output Files." Also, see data flow diagram included herein.


Input Files
DATA FLOW DIAGRAM
Output Files
GENMESH
F2:[FEP.JEBEAN.
BASELINE.GEMESH]
GENMESH.INP
GENMESH_1.CDB
(UNDISTURBED AND E01_UP scenarios)
GENMESH_2.CDB (E01_DOWN scenario)
MATSET
F2:[FEP.JEBEAN.
BASELINE.MATSET]
MATSET_NEW.INP
GENMESH_1.CDB (UNDISTURBED AND E01_UP scenarios)
GENMESH_2.CDB (E01_DOWN scenario)
MATSET.CDB
MATSET_DOWN.CDB
PRELHS
F2:[FEP.JEBEAN.
BASELINE.LHS]
PRELHS_FEPS_BASELINE.INP
LHS_FEPS_BASELINE.INP
LHS
F2:[FEP.JEBEAN.
BASELINE.LHS]
LHS_FEPS_BASELINE.INP
SMPLHS_FEPS_BASELINE.OUT (UNDISTURBED AND E01_UP scenarios)
SMPLHS_FEPS_BASELINE_DOWN.OUT (E01_DOWN scenario)
POSTLHS
F2:[FEP.JEBEAN.
BASELINE.LHS]
POSTLHS.INP
MATSET.CDB (UNDISTURBED AND E01_UP scenarios)
MATSET_DOWN.CDB (E01_DOWN scenario)
SMPLHS_FEPS_BASELINE.OUT (UNDISTURBED AND E01_UP scenarios)
SMPLHS_FEPS_BASELINE_DOWN.OUT (E01_DOWN scenario
POSTLHS_FEPS_BASELINE_R0##.CDB
POSTLHS_FEPS_BASELINE_DOWN_R0##.CDB
ICSET
F2:[FEP.JEBEAN.
BASELINE.ICSET]
ICSET.INP (UNDISTURBED AND E01_UP scenarios)
ICSET_DOWN.INP (E01_DOWN scenario)
POSTLHS_FEPS_BASELINE_R0##.CDB
POSTLHS_FEPS_BASELINE_DOWN_R0##.CDB
ICSET_R0##.CDB
ICSET_DOWN_R0##.CDB
ALGEBRACDB
F2:[FEP.JEBEAN.
BASELINE.ALGEBRA]
ALGEBRA_NEW.INP
ICSET_R0##.CDB
ICSET_DOWN_R0##.CDB
ALGEBRA_R0##.CDB
ALGEBRA_DOWN_R0##.CDB
PREBRAG
PREBRAG_UND.INP (UNDISTURBED scenario)
PREBRAG_E01.INP (E01_UP scenario)
PREBRAG_E01_DOWN.INP (E01_DOWN scenario)
F2:[FEP.JEBEAN.%%.BRAGFLO]B_FEP_&&_$$_R0##.INP
The symbols denote:
%% = BASELINE, RAD, DGAS
&& = BASE, RAD, DGAS
$$ = UNDIST, E01_UP, E01_DOWN
= 01, 02, ..., 20
BRAGFLO
F2:[FEP.JEBEAN.%%]B_FEP_&&_$$_R0##.INP
F2:[FEP.%%.$$]B_FEP_&&_$$_R0##.BIN
The symbols denote:
%% = BASELINE, RAD, DGAS
&& = BASE, DGAS, RAD
$$ = UNDIST, E01_UP, E01_DOWN
= 01, 02, ..., 20
POSTBRAG
F2:[FEP.JEBEAN.BASELINE.ALGEBRA]ALGEBRA_R0##.CDB
F2:[FEP.JEBEAN.BASELINE.ALGEBRA]ALGEBRA_DOWN_R0##.CDB
F2:[FEP.%%.$$]B_FEP_&&_$$_R0##.BIN
F2:[FEP.%%.$$]B_FEP_&&_$$_R0##.CDB
The symbols denote:
%% = BASELINE, RAD, DGAS
&& = BASE, RAD, DGAS
$$ = UNDIST, E01_UP, E01_DOWN
= 01, 02, ..., 20
ALGEBRACDB
F1:[FEP.%%.$$]POST_ALG_$$.INP
F2:[FEP.%%.$$]B_FEP_&&_$$_R0##.CDB
F1:[FEP.%%.$$]B_FEPOJ_&&_$$_R0##.CDB
The symbols denote:
%% = BASELINE, RAD, DGAS
&& = BASE, RAD, DGAS
$$ = UNDIST, E01_UP, E01_DOWN
J = 1 (BASELINE), 5 (RAD), 8 (DGAS)
= 01, 02, ..., 20
SUMMARIZE
F1:[FEP.%%.$$]B_FEPOJ_&&_$$_R0##.CDB
F1:[FEP.%%.$$]FEPOJ_&&_$$.SMZ
F1:[FEP.POSTPROC.$$]FEPOJ_&&_VAR.TBL
The symbols denote:
%% = BASELINE, RAD, DGAS
&& = BASE, RAD, DGAS
$$ = UNDIST, E01_UP, E01_DOWN
J = 1 (BASELINE), 5 (RAD), 8 (DGAS)
= 01, 02, ..., 20
NUTS
F2:[FEP.%%.$$] B_FEP_&&_$$_R0##.BIN
F2:[FEP.%%.$$] B_FEP_&&_$$_R0##.INP
E01SIDE.IN
UNDSIDE.IN
NUTS_FEP_&&_$$_R0##.BIN
The symbols denote:
%% = BASELINE, RAD, DGAS
&& = BASE, RAD, DGAS
$$ = UND, E01_UP, E01_DOWN
= 01, 02, ..., 20
POSTNUTS
F2:[FEP.%%.$$] NUTS_FEP_&&_$$_R0##.BIN
ALGEBRA_NEW_R0##.CDB
ALGEBRA_DOWN_R0##.CDB
ALGEBRA_R0##.CDB
E01SIDE.IN
UNDSIDE.IN
NUTS_FEP_&&_$$_R0##.CDB
The symbols denote:
%% = BASELINE, RAD, DGAS
&& = BASE, RAD, DGAS
$$ = UND, E01_UP, E01_DOWN
= 01, 02, ..., 20
GENNET
GENNET_S00.INP
GENNET_S00.CDB
MATSET
MATSET_S00.INP
GENNET_S00.CDB
MATSET_S00.CDB
POSTLHS
F2:[FEP.GARNER.
&&.$$]
POSTLHS_S00.INP
MATSET_S00.INP
SMPLHS_FEPS_BASELINE.OUT
LHS_S00_SR0##.CDB
PANEL
F2:[FEP.GARNER.
&&.$$]
F2:[FEP.GARNER]LHS_S00_SR0##.CDB
F2:[FEP.GARNER.&&.BRAGFLO]NUTS_S00_01_020.CDB
F2:[FEP.GARNER.&&.BRAGFLO]NUTS_S00_01_020.CDB
F2:[FEP.GARNER.&&.BRAGFLO]NUTS_S00_01_020.CDB
PANEL_S00_S_R0##.CDB
PANEL_S01_S_R0##.CDB
PANEL_S010_S_R0##.CDB
&& = BASE, RAD, DGAS
$$ = PANEL_CUL, PANEL_MB
CCDFCALC
F2:[FEP.GARNER.
&&.$$.CCDF]
CCDFCALC_E0.INP
CCDFCALC_E1.INP
CCDFCALC_E10.INP
PANOUT_E0.OUT
PANOUT_E1.OUT
PANOUT_E10.OUT
PANOUT_E0.TRN
PANOUT_E1.TRN
PANOUT_E10.TRN
&& = BASE, RAD, DGAS
$$ = BRAGFLO, PANEL_CUL, PANEL_MB
CCDDFPLOT
F2:[FEP.GARNER]
CCDFPLOT_E10.INP
CCDFPLOT_E1.INP
CCDFPLOT_E0.INP
CCDFPLOT_MBE10.INP
CCDFPLOT_MBE1.INP
CCDFPLOT_MBE0.INP
*.PST and renamed PLOT ##

Description of Scenarios

Two basic scenarios were considered in the screening analysis, undisturbed performance and disturbed performance. Both scenarios included a 1.0 degree formation dip downward to the south. Intrusion event E1 is considered in the disturbed scenario and consists of a borehole that penetrates the repository and pressurized brine in the underlying Castille Formation. Two variations of intrusion event E1 are examined, E1 Up-Dip and E1 Down-Dip. In the E1 Up-Dip event the intruded panel region is located on the up-dip (north) end of the repository, whereas in the E1 Down-Dip event the intruded panel region is located on the down-dip (south) end of the repository. These two E1 events permit evaluation of the possiblity of increased brine flow into the panel region due to higher brine saturations down-dip and the potential for subsequent impacts on contaminant migration.

An important objective of the screening analyses presented herein is to determine if any of the FEPs listed above have the potential to enhance contaminant migration to the accessible environment. The potential pathways of concern for groundwater flow and radionuclide transport in the undisturbed and disturbed systems are summarized below.

Potential contaminant migration pathways in the undisturbed system are:

- Head gradients between the waste-disposal panels and overlying strata may cause brine and radionuclide migration from the waste-disposal panels to the base of the shaft and upwards through the shaft to the Culebra and ground surface. Migration to the base of the shaft may occur directly through the panel seals and access drifts or through the DRZ and anhydrite interbeds (MB139, MB138, and interbeds A+B). Migration up the shaft occurs through the shaft-seal system. Radionuclide transport to the accessible environment may occur via lateral migration through the Culebra.

- Migration from the waste-disposal panels laterally through the anhydrite interbeds towards the accessible environment.

Flow along these pathways are driven by elevated gas pressures in the waste resulting from gas generation in the waste-disposal panels and by elevated (above hydrostatic) in-situ fluid pressures resulting from consolidation of the excavation and surrounding rock.

Potential migration pathways in the disturbed scenario are:

- Radionuclides may be brought to the ground surface during drilling as particulate material dissolved or entrained in drilling fluid due to cavings, cuttings, spallings, and blowout.

- Radionuclides that are dissolved in brine may reach the accessible environment following long-term groundwater transport up the borehole and shaft to the ground surface or laterally down a potentiometric gradient in the Culebra.

Contaminants transported as VOCs in the brine and gas phase are also an important consideration in the undisturbed scenario. The project position on gas-phase RCRA concerns is currently being evaluated. The assumption made in the present set of screening analyses is that the VOC source term has an insignificant impact on fluid flow and can be excluded from detailed consideration in the FEPs screening process. In addition, bounding calculations show that the VOC source term concentrations, when converted to soil concentrations, will not exceed RCRA soil-based limits for VOCs. If the project determines at a later time that an elevated gas-phase VOC source term is potentially important, the FEPs discussed herein may need to be reevaluated to assess their impact on gas-phase VOC transport. The assumption used for modeling heavy metal constituents is that their migration behavior is analogous to that of the long-lived radionuclides and therefore can be examined by direct comparison to the radionuclide results.

Performance Measures

Several key performance measures were used to evaluate the sensitivity of the primary migration pathways outlined above to each FEP, these measures include:

- Conditional complementary cumulative distribution functions (CCDFs) of normalized contaminated brine releases to the Culebra via human intrusion and shaft system as well as releases within the marker beds to the subsurface boundary of the accessible environment.

- Blowout related performance measures including volume averaged pressures and brine saturations in the waste disposal area at times 100, 1000, and 10000 years.

Model Geometry

Two geometries are used in the BRAGFLO screening calculations with three different sets of material properties, one set for undisturbed conditions and two sets for disturbed conditions. The geometries and material sets represent a three-dimensional system in a two-dimensional plane that cuts vertically through the repository. Side views of the geometry for the undisturbed, E1 Up-Dip, and E0 Down-Dip configurations and their respective material sets are given in Figures 1 - 3 in Appendix 1. The E1 Down-Dip geometry and material set is similar to the E1 Up-Dip configuration, except that the intruding borehole and waste panel locations are rotated 180 degrees about the centerline of the repository so that the intruded panel is on the down-dip side of the repository (to the left, south). Additional details on the model geometries are provided in the Draft Compliance Certification Application (DCCA), July Update, July 21,1995.

Boundary and Initial Conditions

Boundary and initial conditions in the undisturbed and disturbed scenarios are identical. Boundary conditions included no flow in the normal directions across all far-field boundaries except at the lateral boundaries of the Culebra and Magenta units, and at the ground surface. At the lateral boundaries of the Culebra an initial pressure of 0.852 MPa and a water saturation of 1.0 was held constant throughout the simulations. Similarly, the pressures and water saturations at the lateral boundaries of the Magenta were held fixed at 0.9 MPa and 1.0, respectively. At the ground surface, pressure was maintained at an atmospheric pressure of 1.01325 MPa. The water table was located at a depth of 59 meters below the ground surface.

As in the DCCA calculations, an initial simulation period and set of initial conditions were specified which account for the impact that the time period between excavation and sealing of the panels will have on fluid saturations and pressures in the formations surrounding the repository. This time period is modeled explicitly and is assumed to last 5 years beginning at time -5 years (the time of initial excavation). The initial conditions during this period are as follows.

- Except for the waste and excavated regions, the formations above the Salado, and the Castile formation, the pressure distribution at 5 yr before time zero is hydrostatic relative to the pore pressure of MB139. The brine pressure in MB139 is treated as an uncertain variable and is sampled from a range of 12 to 13 MPa.

- Pressure in the waste and excavated regions is set to atmospheric pressure at 5 yr before time zero.

- Except for the Culebra and Magenta units and the region above the water table, the pressure distribution in the Rustler formation at 5 yr before time zero is hydrostatic relative to the ground-water table.

- Water pressure in the Culebra at 5 yr before time zero is 0.852 MPa, and the far-field pressure is held at that value over the 10000 yr calculation.

- Water pressure in the Magenta at 5 yr before time zero is 0.90 MPa, and the far-field pressure is held at that value over the 10000 yr calculation.
- Water pressure in the region above the water table (upper 59 meter) is set to atmospheric pressure at 5 yr before time zero.
- Pressure in the Castile brine reservoir at 5 yr before time zero is 12.7 MPa.
- The initial brine saturation is 1.0 everyhere except in the waste and excavated regions (where brine saturation is 0.0), and in the region above the water table (where brine saturation is at residual equal to 0.20).
- Initial brine saturations within the disposal room, shaft, and experimental area are 0.028, 0.25, and 0.0.

Description of Calculations

During the initial conditions calculation, the permeability of the units overlying the Salado is set to zero to prevent water from flowing down the shaft during the waste emplacement period. In addition, the permeability of excavated regions is set to a high value (1.0×10^{-10} m^2) to represent cavities. Performance calculations begin at time zero (5 years after the initial calculation). At time zero, the pressure in the waste region is reset from its calculated value to atmospheric pressure. Brine saturations are reset within the disposal room, shaft, and experimental area to 0.028, 0.25, and 0.0, respectively. Initial brine saturation in the waste is treated as an uncertain variable and is reset to its sampled value, which ranges from 0.006 to 0.051 In all other excavated regions, the gas saturation is set to 1.0, and the pressure is reset to atmospheric pressure. Panel seals, backfill, and lower and upper shaft seals are also emplaced at time zero and these regions take on their corresponding permeabilities and porosities. Panel seals are assigned a high permeability of 1.0×10^{-12} m^2 to minimize their effectiveness. For the first 100 yrs, the upper shaft seal permeability is sampled from the seals permeability distribution curve and permeability of the lower seal is assumed to be 1.0×10^{-12} m^2. Calculations continue to time 100 yr, at which time the permeabilitites of the lower and upper shaft seals are reset so that the lower seal permeability is assigned sampled values from the upper seal permeability distribution and the upper seal permeability is set to 1.0×10^{-12} m^2. This treatment of seal permeabilities reflects that the short term component (upper seal) permeability increases with time and that the long-term component (lower seal) permeability decreases with time. In the undisturbed scenario, performance calculations continue unchanged to 10000 yr. In the human intrusion events, E1 Up-Dip and E1 Down-Dip, a borehole penetrates the repository and an underlying brine pocket at 1000 yr. Further details on property values of the various components can be found in Draft Compliance Certification Application, July Update, July 21, 1995.

BRAGFLO calculates the brine and gas flow fields in the disposal system. These flow fields are used in the computer code NUTS to estimate radionuclide releases to the accessible environment. NUTS uses the same model geometry as BRAGFLO and calculations are performed as follows. A tracer element is assumed to have an infinite inventory in each computational waste cell and a solubility of $1 Kg/m^3$. Tracer concentrations throughout the problem domain, exclusive of the waste region, are initially zero. Far-field boundary fluxes are maintained at zero. Decay and sorption processes are neglected. Using the brine flow velocities reported from BRAGFLO, NUTs calculates the transport of the tracer to the Culebra and subsurface boundary of the accessible environment. Since the tracer element has solubility of $1 Kg/m^3$, each Kg of contaminated brine reaching these locations is equivalent to $1\ m^3$ of repository brine.

The volumes of contaminated brine calculated by NUTs are used directly by the computer code PANEL to estimate the amounts of the various radionuclides (dissolved and colloidal) that are released to the Culebra and subsurface boundary. These estimates are based on the conservative assumption that the volumes of contaminated brine passing these locations flows directly through the disposal room and is transported instantaneously to the Culebra and subsurface boundary. Radionuclide decay and inventory solubility limits are accounted for in PANEL.

Table 1 in Appendix 1 summarizes the uncertain variables that were sampled in the screening calculations. The range and median values of the actual sampling are listed. A Latin hypercube sample of size of 20 was used to incorporate the effects of uncertainty. This sample size was selected as the best compromise between providing sufficient data for screening purposes versus schedule and resource constraints.

List of Input and Output Files

The programs used in the FEPs screening analysis are listed below in the order they were implemented. The input files listed under each program name are the files provided for program execution and the output files represent the resulting files. The directories are also noted. These directories and files have been archived on Tape Numbers F95256, F95283, F95074, F95080, F95654, F95714, F95738, and F95081and are placed on file in the WIPP Records Center.

The following symbolic notation is used to denote FEP files:

RAD: Screening Issue GG1
DGAS: Screening Issue S7
Base: Baseline Model

GENMESH:

Directory:	F2:[FEP.JEBEAN.BASELINE.GENMESH]
Input file:	GENMESH.INP
Output files:	GENMESH_1.CDB (UNDISTURBED AND E01_UP scenarios)
	GENMESH_2.CDB (E01_DOWN scenario)

MATSET:

Directory:	F2:[FEP.JEBEAN.BASELINE.MATSET]
Input files:	MATSET_NEW.INP
	GENMESH_1.CDB (UNDISTURBED AND E01_UP scenarios)
	GENMESH_2.CDB (E01_DOWN scenario)
Output files:	MATSET.CDB
	MATSET_DOWN.CDB

PRELHS:

Directory:	F2:[FEP.JEBEAN.BASELINE.LHS]
Input file:	PRELHS_FEPS_BASELINE.INP
Output file:	LHS_FEPS_BASELINE.INP

LHS:

Directory:	F2:[FEP.JEBEAN.BASELINE.LHS]
Input files:	LHS_FEPS_BASELINE.INP
Output file:	SMPLHS_FEPS_BASELINE.OUT (UNDISTURBED AND E01_UP scenarios)
	SMPLHS_FEPS_BASELINE_DOWN.OUT (E01_DOWN scenario)

POSTLHS:

Directory:	F2:[FEP.JEBEAN.BASELINE.LHS]
Input files:	POSTLHS.INP
	MATSET.CDB (UNDISTURBED AND E01_UP scenarios)

	MATSET_DOWN.CDB (E01_DOWN scenario)
	SMPLHS_FEPS_BASELINE.OUT (UNDISTURBED AND E01_UP scenarios)
	SMPLHS_FEPS_BASELINE_DOWN.OUT (E01_DOWN scenario)
Output files:	POSTLHS_FEPS_BASELINE_R0##.CDB
	POSTLHS_FEPS_BASELINE_DOWN_R0##.CDB

range from 01 to 20

ICSET:

Directory:	F2:[FEP.JEBEAN.BASELINE.ICSET]
Input file:	ICSET.INP (UNDISTURBED AND E01_UP scenarios)
	ICSET_DOWN.INP (E01_DOWN scenario)
	POSTLHS_FEPS_BASELINE_R0##.CDB
	POSTLHS_FEPS_BASELINE_DOWN_R0##.CDB
Output files:	ICSET_R0##.CDB
	ICSET_DOWN_R0##.CDB

range from 01 to 20

ALGEBRACDB:

Directory:	F2:[FEP.JEBEAN.BASELINE.ALGEBRA]
Input files:	ALGEBRA_NEW.INP
	ICSET_R0##.CDB
	ICSET_DOWN_R0##.CDB
Output files:	ALGEBRA_R0##.CDB
	ALGEBRA_DOWN_R0##.CDB

range from 01 to 20

PREBRAG:

Directory and	F2:[FEP.JEBEAN.BASELINE.PREBRAG]
Input files:	PREBRAG_UND.INP (UNDISTURBED scenario)
	PREBRAG_E01.INP (E01_UP scenario)
	PREBRAG_E01_DOWN.INP (E01_DOWN scenario)
Directories and	
Output files:	F2:[FEP.JEBEAN.%%.BRAGFLO]B_FEP_&&_$$_R0##.INP

The symbols denote:

%% = BASELINE, RAD, DGAS
&& = BASE, RAD, DGAS
$$ = UNDIST, E01_UP, E01_DOWN
= 01, 02, ..., 20

BRAGFLO:

Executable:	U1:[JDSCHRE.BRAGFLO.FEP]BF2_BRAGFLO.EXE
Input file:	F2:[FEP.JEBEAN.%%]B_FEP_&&_$$_R0##.INP
Output file:	F2:[FEP.%%.$$]B_FEP_&&_$$_R0##.BIN

The symbols denote:

%% = BASELINE, RAD, DGAS
&& = BASE, DGAS, RAD
$$ = UNDIST, E01_UP, E01_DOWN
= 01, 02, ..., 20

POSTBRAG:

Directories and
Input files: F2:[FEP.JEBEAN.BASELINE.ALGEBRA]ALGEBRA_R0##.CDB
F2:[FEP.JEBEAN.BASELINE.ALGEBRA]ALGEBRA_DOWN_R0##.CDB
F2:[FEP.%%.$$]B_FEP_&&_$$_R0##.BIN
Directories and
Output files: F2:[FEP.%%.$$]B_FEP_&&_$$_R0##.CDB

The symbols denote:
%% = BASELINE, RAD, DGAS
&& = BASE, RAD, DGAS
$$ = UNDIST, E01_UP, E01_DOWN
= 01, 02, ..., 20

ALGEBRACDB:

Directories and
Input files: F1:[FEP.%%.$$]POST_ALG_$$.INP
F2:[FEP.%%.$$]B_FEP_&&_$$_R0##.CDB
Directories and
Output files: F1:[FEP.%%.$$]B_FEP0J_&&_$$_R0##.CDB

The symbols denote:
%% = BASELINE, RAD, DGAS
&& = BASE, RAD, DGAS
$$ = UNDIST, E01_UP, E01_DOWN
J = 1 (BASELINE), 5 (RAD), 8 (DGAS)
= 01, 02, ..., 20

SUMMARIZE:

Directories and
Input files: F1:[FEP.%%.$$]B_FEP0J_&&_$$_R0##.CDB
F1:[FEP.%%.$$]FEP0J_&&_$$.SMZ
Directories and
Output files: F1:[FEP.POSTPROC.$$]FEP0J_&&_VAR.TBL

The symbols denote:
%% = BASELINE, RAD, DGAS
&& = BASE, RAD, DGAS
$$ = UNDIST, E01_UP, E01_DOWN
J = 1 (BASELINE), 5 (RAD), 8 (DGAS)
= 01, 02, ..., 20

NUTS:

Directory: F1:[FEP.AASHINT.SP.SIDEBAR.&&.$$]

Input Files:	F2:[FEP.%%.$$] B_FEP_&&_$$_R0##.BIN
	F2:[FEP.%%.$$] B_FEP_&&_$$_R0##.INP
	E01SIDE.IN
	UNDSIDE.IN
Output Files:	NUTS_FEP_&&_$$_R0##.BIN

The symbols denote:

%% = BASELINE, RAD, DGAS
&& = BASE, RAD, DGAS
$$ = UND, E01_UP, E01_DOWN
= 01, 02, ..., 20

POSTNUTS:

Directory:	F1:[FEP.AASHINT.SP.SIDEBAR.&&.$$]
Input Files:	F2:[FEP.%%.$$] NUTS_FEP_&&_$$_R0##.BIN
	ALGEBRA_NEW_R0##.CDB
	ALGEBRA_DOWN_R0##.CDB
	ALGEBRA_R0##.CDB
	E01SIDE.IN
	UNDSIDE.IN
Output Files:	NUTS_FEP_&&_$$_R0##.CDB

The symbols denote:

%% = BASELINE, RAD, DGAS
&& = BASE, RAD, DGAS
$$ = UND, E01_UP, E01_DOWN
= 01, 02, ..., 20

GENNET:

Directory:	F2:[FEP.GARNER]
Input file:	GENNET_S00.INP
Output file:	GENNET_S00.CDB

MATSET:

Directory:	F2:[FEP.GARNER]
Input file:	MATSET_S00.INP
	GENNET_S00.CDB
Output file:	MATSET_S00.CDB

POSTLHS:

Directory:	F2:[FEP.GARNER]
Input files:	POSTLHS_S00.INP
	MATSET_S00.INP
	SMPLHS_FEPS_BASELINE.OUT
Output:	LHS_S00_SR0##.CDB

range from 01 to 20

PANEL:

Directory: F2:[FEP.GARNER.&&.$$]
Input files: F2:[FEP.GARNER] LHS_S00_SR0##.CDB
F2:[FEP.GARNER.&&.BRAGFLO] NUTS_S00_01_020.CDB
F2:[FEP.GARNER.&&.BRAGFLO] NUTS_S00_01_020.CDB
F2:[FEP.GARNER.&&.BRAGFLO] NUTS_S00_01_020.CDB

Output Files: PANEL_S00_S_R0##.CDB
PANEL_S01_S_R0##.CDB
PANEL_S01D_S_R0##.CDB

&& = BASE, RAD, DGAS
$$ = PANEL_CUL, PANEL_MB
range from 01 to 20

CCDFCALC:

Directory: F2:[FEP.GARNER.&&.$$.CCDF]
Input files: CCDFCALC_E0.INP
CCDFCALC_E1.INP
CCDFCALC_E1D.INP

Output files: PANOUT_E0.OUT
PANOUT_E1.OUT
PANOUT_E1D.OUT
PANOUT_E0.TRN
PANOUT_E1.TRN
PANOUT_E1D.TRN

&& = BASE, RAD, DGAS
$$ = BRAGFLO, PANEL_CUL, PANEL_MB

CCDFPLOT:

Directory: F2:[FEP.GARNER]
Input files: CCDFPLOT_E1D.INP
CCDFPLOT_E1.INP
CCDFPLOT_E0.INP
CCDFPLOT_MBE1D.INP
CCDFPLOT_MBE1.INP
CCDFPLOT_MBE0.INP
Output files:
*.PST and renamed PLOT.##

The listing of directories and files used in the FEP screening analyses are given in Appendix 2. Plots, tables, and figure documenting results are presented in Appendix 1. All calculations undertaken in the screening analyses were successfully completed. Based on FEPs screening analyses of issues DR-2, DR-3, DR-6, DR-7, and S-6 (see Records Package for FEPS DR2, DR3, DR6, DR7, and S6), it can be concluded that the E1 Down-Dip configuration yields consistently larger predicted releases to the accessible environment than the E1 Up-Dip configuration. For this reason, E01 Up-Dip calculations were not performed for FEP issue S-7 (Gas Exsolution). In addition, the screening analyses of FEPs GG-1 and S-7 show that each FEP has insignificant impact on releases to the accessible environment. Therefore, the influence of synergism or interactions between multiple FEP issues on the sensitivity analysis will be small. For this reason, simulations examining multiple FEP issues were not performed.

GG-1: RADIOLYSIS OF BRINE
Summary Memo of Record

Date: October 10, 1995

To: D.R. Anderson

PV by MEL MEL

From: P. Vaughn, M. Lord, J. Garner, R. MacKinnon,

Subject: FEP Screening Issue GG-1

STATEMENT OF SCREENING DECISION

FEP Screening Issue GG-1 need not be included in future system-level performance assessment calculations.

STATEMENT OF SCREENING ISSUE

This screening effort evaluates the need for inclusion of radiolytic gas generation in future system-level performance assessment calculations. The production of gas in the WIPP disposal rooms will occur as a result of corrosion processes, microbial activity, and radiolysis. Although corrosion processes and microbial activity have the greatest potential to produce significant volumes of gas, radiolysis of brine in the disposal rooms and radiolysis of water in the waste will lead to additional gas production. Prior performance assessment calculations have not included this additional gas production. Disposal system performance may be adversely affected if radiolytic gas generation leads to significantly greater pressures. Significantly greater fluid pressures will influence the porosity of the waste-filled regions, inhibit room closure, and/or cause fractures to be created or reopened in the interbeds within the Salado. An associated screening issue is uncontrolled fluid flow to the surface (blowout) during an intrusion into the repository. The volume of uncontrolled releases to the surface due to cuttings, spalling, and blowout during drilling is influenced by the prevailing pressure, permeability, and saturation conditions in the disposal room at the time of intrusion.

APPROACH

A model was implemented in BRAGFLO to estimate disposal region radiolytic gas generation. This model accounts for the formation of H_2 and O_2 by radiolysis of H_2O according to the conservation equation:

$$\text{Energy} + 2H_2O \rightarrow 2H_2 + O_2$$

The energy required to separate water comes from ejected alpha particles. Alpha particles have energies of approximately 5 MEV and the approximate number of molecules of H_2O separated per EV is 1.25×10^{-2}. Therefore, each alpha decay particle splits approximately 6×10^4 molecules of water (Brush, 1993). Since gas generation is limited by the availability of H_2O, gas generation is limited by the quantity and distribution of brine in the waste resulting from initial brine saturation, brine flow into and out of the disposal region, and brine consumption due to corrosion and microbial action. Radiolysis of H_2O by 15 isotopes of thorium, plutonium, uranium, and Am241 was considered in the calculations. The formation O_2 gas during radiolysis was not included in the gas generation calculations. This treatment is based on the assumption that all of the produced oxygen will react with metal materials and other contents of the waste disposal region. Physical properties of all gas components in BRAGFLO correspond to those of H_2.

A series of BRAGFLO simulations were performed to assess the magnitude of the influence of the radiolysis of brine on contaminant migration to the accessible environment. Effects of all other FEP issues were disabled in the simulations. Two basic scenarios were considered in the screening analysis, undisturbed performance and disturbed performance. Both scenarios included a 1.0 degree formation dip downward to the south. Intrusion event E1 is considered in the disturbed scenario and consists of a borehole that penetrates the repository and pressurized brine in the underlying Castile Formation. Two variations of intrusion event E1 are examined, E1 Up-Dip and E1 Down-Dip. In the E1 Up-Dip event the modeled panel region is located on the up-dip (north) side of the borehole, whereas in the E1 Down-Dip event the modeled panel region is located on the down-dip side (south) of the borehole. These two E1 events permit evaluation of the possiblity of increased brine flow into the panel region down dip of the borehole and the potential for subsequent impacts on contaminant migration. To incorporate the effects of uncertainty in each case (E1 Up-Dip, E1 Down-Dip, and undisturbed), a Latin hypercube sample size of 20 was used resulting in a total of sixty simulations. To assess the sensitivity of system performance on gas generation by radiolysis, conditional complementary cumulative distribution functions (CCDFs) of normalized contaminated brine releases to the Culebra via human intrusion and shaft system, as well as releases to the subsurface boundary of the accessible environment, were constructed and compared to the corresponding baseline model CCDFs. These comparisons provide direct information about how the inclusion of radiolysis may influence repository performance. In addition, blowout related performance measures were examined and included volume averaged brine pressures, brine saturations, porosity, and permeability in the waste disposal area.

RESULTS AND DISCUSSION

CCDFs for releases to the Culebra and subsurface boundary of the accessible environment for E1 Up-Dip, E1 Down-Dip, and undisturbed cases are provided in Figure 4 in Appendix 1 of the records package entitled "FEPs Screening Analysis for FEPs GG-1 and S-7". Each figure compares CCDFs of normalized releases predicted by the baseline model and normalized releases predicted with radiolysis. Note that releases to the Culebra via the shaft and intrusion borehole are shown on the left side of the figure whereas releases to the subsurface boundary of the accessible environment are presented on the right side of the figure. In the E01-Down and E01-Up cases, the radiolysis curves for releases to the Culebra via the shaft and borehole are below and to the left of the baseline curves for their entire lengths. In the undisturbed case, the radiolysis and baseline CCDFs are essentially identical for their entire lengths. Releases to the accessible environment via the Marker Beds are on the right side of Figure 4. In the E01-Down case, the radiolysis CCDF coincides with the baseline CCDF for almost half of its length with the latter half located to the right of the baseline CCDF. Although in the E01-Down case the radiolysis model predicts higher releases to the subsurface boundary than the baseline model, the differences are not significant as indicated by the relative positions of the CCDFs. In the E01-Up case, the radiolysis and baseline CCDFs are again close to each other with the radiolysis CCDF located to the left of the baseline CCDF for the higher releases. In the undisturbed case, the radiolysis CCDF is above the baseline CCDF for only a short range of small releases, but is located to the left of the baseline CCDF for the larger releases. In summary, the CCDFs for releases to the Culebra and subsurface boundary of the accessible environment indicate that differences between predicted baseline and radiolysis releases are minor.

Blowout metrics including maximum, mean, medium, and minimum values of volume averaged brine pressures, brine saturations, porosity, and permeability in the waste region for undisturbed conditions at 100, 1000, and 10000 years are given in Table 3 of Appendix 1. Comparison of these table values with the baseline values given in Table 2 indicate that differences in brine pressures and saturations are minor for times of 100 and 1000 years. At 10000 years the radiolysis brine pressures tend to be higher with the difference between baseline and radiolysis maximum brine pressures being the only appreciable difference. These pressures exceed the regulatory limit of 15 MPa; pressures above this limit do not have to be considered for direct releases due to drilling activities. Therefore, baseline and radiolysis releases (for the maximum pressure tabulated) will be nearly equivalent since the differences between the other metrics (drivers) are insignificant. In addition, at other pressure values, mean and median brine saturations for radiolysis are to low to permit uncontrolled releases of appreciable brine due to blowout (See Records Package for FEP DR-4). In summary, the baseline model is conservative with respect to releases due to blowout, spallings, and cuttings.

It was noted above that the baseline and radiolysis maximum brine pressures at 10,000 years (see Table 2) are different. Blowout calculations were performed to determine if this difference impacted releases to the surface. CCDFs comparing brine releases due to blowout for the baseline and radiolysis models are shown in Figure 6. As shown, the baseline CCDF is above and to the right of the radiolysis CCDF for all releases. Therefore, the baseline model is conservative with respect to releases at 10,000 years.

Additional results comparing amounts of H_2 generated in the waste room due to radiolysis, biodegradation, and corrosion are presented in Figures 7-10. These results are based on conservative radionuclide solubilities. Additional analysis supporting the elimination of radiolytic gas generation from future system-level performance assessment calculations is provided in Appendix A.

BASIS FOR RECOMMENDED SCREENING DECISION

Results indicate that radiolysis does not significantly impact releases to the accessible environment. In addition, radiolysis does not significantly impact waste room conditions relevant uncontrolled release due to blowout, cuttings, and spalling. Therefore, radiolysis need not be included in system-level PA calculations.

S-7: GAS EXSOLUTION
Summary Memo of Record

DATE: October 10, 1995

TO: D. R. Anderson

MEL PV by MEL

FROM: M. Lord, P. Vaughn, R. MacKinnon

SUBJECT: FEP Screening Issue S-7

STATEMENT OF SCREENING DECISION

FEP Screening Issue S-7 need not be included in future system-level performance assessment calculations.

STATEMENT OF SCREENING ISSUE

This screening effort evaluates the need for including effects of dissolved gas in future system-level performance assessment calculations. During early time when the waste cavity is filling with brine, dissolved gas in brine may contribute an additional drive mechanism. As brine is drained from the near-waste formations and pressure declines within these formations, gas will be released from the brine resulting in potentially higher pressures. This mechanism may enhance the flow of brine to the waste region. At later time, when gas generation in the waste cavity is the principal drive mechanism, gas will go into solution as the pressure increases. This behavior will result in lower fluid pressures and altered fluid flow.

APPROACH

The baseline two-phase flow model in BRAGFLO does not account for dissolved gas in brine. To simulate the effects of dissolved gas on fluid flow, a model was implemented to permit gas exsolution and dissolution in brine according to Henry's Law. The treatment of dissolved gas in Bragflo is described in Appendix 3.

A series of BRAGFLO simulations were performed to determine if dissolved gas has the potential to enhance contaminant migration to the accessible environment. Effects of all other FEP issues were disabled in the simulations. Two basic scenarios were considered in the screening analysis, undisturbed performance and disturbed performance. Both scenarios included a 1.0 degree formation dip downward to the south. Intrusion event E1 is considered in the disturbed scenario and consists of a borehole that penetrates the repository and pressurized brine in the underlying Castile Formation. One variation of intrusion event E1 is examined, E1 Down-Dip. In the E1 Down-Dip event the intruded panel region is located on the down-dip (south) end of the repository. Based on FEPs screening analyses of issues DR-2, DR-3, DR-6, DR-7, and S-6, it can be concluded that the E1 Down-Dip configuration yields consistently larger predicted releases to the accessible environment than the E1 Up-Dip configuration. These larger releases are due to higher brine saturations down-dip of the borehole. For this reason, E1 Up-Dip calculations were not performed for this FEP issue. To incorporate the effects of uncertainty in each case (E1 Up-Dip, E1 Down-Dip, and undisturbed), a Latin hypercube sample size of 20 was used resulting in a total of sixty simulations. To assess the sensitivity of system performance on puddling, conditional complementary cumulative distribution functions (CCDFs) of normalized contaminated brine releases to the Culebra via human intrusion and shaft system, as well as releases to the *subsurface boundary of the accessible environment, were constructed* and compared to the corresponding baseline model CCDFs. In the baseline model calculations, the effects of all FEP issues are turned off. These comparisons provide direct information about how the inclusion of dissolved gas may influence repository performance. In addition, blowout, cuttings, and spalling performance measures are examined. Drivers for potential releases to the surface by these mechanisms are brine pressures, brine saturations, and permeability in the waste disposal area.

RESULTS AND DISCUSSION

CCDFs for releases to the Culebra and subsurface boundary of the accessible environment for E1 Up-Dip, E1 Down-Dip, and undisturbed cases are provided in Figure 5 of Appendix 1. Each figure compares CCDFs of normalized releases predicted by the baseline model and normalized releases predicted with gas exsolution. Note that releases to the Culebra via the shaft and intrusion borehole are shown on the left side of the figure, whereas releases to the subsurface boundary of the accessible environment are presented on the right side of the figure. In both cases (E1 Down-Dip and undisturbed), the gas exsolution curves for releases to the Culebra via the shaft and borehole are very close and consistently below and to the left of the baseline curves for all but a very narrow range of insignificant releases. Similarly, CCDFs for releases to the subsurface boundary via the Marker Beds show that the gas exsolution curvesare below and to the left of the baseline CCDFs for all but a very narrow range of insignificant releases. In summary, differences in releases between the baseline and gas exsolution results are minor with the baseline model predicting consistently higher releases.

Blowout, spalling, and cuttings metrics including maximum, mean, medium, and minimum values of volume averaged brine pressures, brine saturations, porosity, and permeability in the waste region for undisturbed conditions at 100, 1000, and 10000 years are given in Table 4 of Appendix 1. Comparison of these values with the baseline values given in Table 2 indicate that brine pressures are consistently higher in the baseline case. *All other metrics (drivers)* are nearly equal between the baseline and gas exsolution cases. In summary, the baseline case is sufficiently conservative with respect to releases due to blowout, spalling, and cuttings.

BASIS FOR RECOMMENDED SCREENING DECISION

Based on the CCDFs, the inclusion of gas exsolution in BRAGFLO results in overall lower computed releases to the accessible environment than the baseline case. In addition, gas exsolution has an insignificant effect on waste room conditions relevant to releases due to blowout, cuttings, and spalling. As a result, the baseline model is conservative in its approach of neglecting dissolved gas effects and gas exsolution can be eliminated from consideration in system-level PA calculations.

Certification and Training

The analysis team was identical on each FEP issue. The following individuals were reponsible for performing analyses:

J. Schreiber, P. Vaughn (Lead), J. Bean, J. Garner, M. Lord, R. MacKinnon, D. McArthur, and A. Shinta.

Technical reviewers were identical on each FEP and included:

Mel G. Marietta (6821) and Wendell Weart (6000).

Copies of certification of personnel qualifications for the above staff are on file in the SWCF. All staff were trained on QAPs prior to completion of the screening effort.

Correspondence

None

References

Bromberg, J.P. 1980. *Physical Chemistry*. Boston, MA: Allyn and Bacon, Inc. p. 215.

Brush, L.H. 1993. "Likely Gas Generation Reactions and Current Estimates of Gas Generation Rates for the Long Term WIPP Performance Assessment." Memorandum to M.S. Tierney. June 18, 1993. Albuquerque, NM: Sandia National Laboratories.

Butcher, B.M., T.W. Thompson, R.G. VanBurskirk, and N.C. Patti. 1991. *Mechanical Compaction of Waste Isolation Pilot Plant Simulated Waste*. SAND90-1206. Albuquerque, NM: Sandia National Laboratories.

Draft Compliance Certification Application." July Update, CAO Approval Draft, July 21, 1995. DRAFT-DOE/CAO-2056. (Note: Feb 10, 1995 most current draft in NWM Library.)

Records Package for FEPs DR2, DR3, DR6, DR7, and S6, October 1995. Albuquerque, NM: Sandia National Laboratories.

Records Package for FEP DR4. October 1995. Albuquerque, NM: Sandia National Laboratories.

Verifications and Assessments

No formal independent assessments were conducted; therefore, no Corrective Action Reports were generated.

The attached signature pages at the front of this document indicate the technical and lead staff signatures and dates of review for completeness and accuracy.

Comments follow.

Management, technical, editorial, and QA reviews of this records package were performed and comments were addressed to complete the records package as indicated by the signatures on the attached pages at the front of this document.

FEP Screening Comment Form
FEP ID# S-7
Author Stephen Webb, 6115
Date: September 27, 1995

I. Comment on Recommended Screening Decision for FEP S-7.

The gas exsolution model is not shown in either the Summary Memo of Record or the Records Package. Without knowing the model details, an evaluation of the results can not be made. I assume that the model changes made to BRAGFLO are verified in the code verification package since verification is excluded from the calculations records package. The screening decision makes reference to numerical values in FEP DR-4. Basing the acceptability of numerical values by comparison to DR-4 is not appropriate since DR-4 was only a scoping study, not an investigation into the complete parameter space.

II. Alternative Recommended FEP Screening Decision
(not to be more that a few sentences)

N/A

III. Rebuttal Arguments that Support Alternative FEP Screening Decision

N/A

Radiolysis of Brine

Qualitative screening argument for Side Effort GG-1

D.G. Bennett
D.A. Galson D.A. Galson

Galson Sciences Ltd.
10 October 1995

Recommended Screening Decision

Gas generation due to radiolysis of brine has been eliminated from performance assessment calculations for the WIPP on the basis of low consequence to the performance of the disposal system.

Screening Issue

Radiolysis of brine in the WIPP disposal rooms, and of water in the waste, will lead to the production of gases and may significantly affect the oxygen content of the rooms. This in turn will affect the prevailing chemical conditions and potentially the concentrations of radionuclides that may be mobilised in the brines.

Basis for Recommended Screening Decision

The overall reaction for the radiolysis of water in the waste and brine is:

$$H_2O = H_2 + {}^{1}/_{2}O_2 \qquad (1)$$

However, the production of intermediate oxygen-bearing species that may subsequently undergo reduction, such as H_2O_2, ClO_3^-, and ClO_4^- , will lead to reduced oxygen gas yields.

Reed et al. (1993) studied radiolytic gas generation during experiments lasting between 155 and 182 days. These experiments involved both synthetic brines similar to those sampled from the Salado at the WIPP repository horizon, and brines occurring in reservoirs in the Castile, as well as real brines sampled from the Salado in the repository workings. The brines were spiked with $^{239}Pu(VI)$ at concentrations between 6.9×10^{-9} and 3.4×10^{-4} M. During these relatively short-term experiments, hydrogen gas was observed as the product of radiolysis. Oxygen gas was not observed; this was attributed to the formation of intermediate oxygen-bearing species. However, given sufficient exposure to alpha-emission, oxygen production may reach 50% that of hydrogen.

An estimate of the maximum rate of gas generation due to the radiolysis of brine, R_{RAD} can be made by making the following assumptions:

- Gas production occurs following the reaction above, so that 1.5 moles of gas are generated for each mole of water consumed.
- Gas production occurs as a result of the alpha-decay of ^{239}Pu.
- ^{239}Pu concentrations in the disposal room brines are controlled by solubility equilibria.
- All of the dissolved plutonium is ^{239}Pu.

R_{RAD} is then given by;

$$R_{RAD} = \frac{1.5 \times 3.15 \times 10^7 C_{Pu} Sa_{Pu} G \overline{E}_{\alpha} V_B}{N_D N_A}$$

where,

R_{RAD}	is the rate of gas production (mol/drum/year),
C_{Pu}	is the maximum dissolved concentration of plutonium (M),
Sa_{Pu}	is the specific activity of ^{239}Pu (5.42×10^{11} Bq/mol),
$\overline{E}_{\alpha}$	is the average energy of α-particles emitted during ^{239}Pu decay (5.15×10^6 eV),
G	is the number of moles of molecules split per eV (eV^{-1}),
V_B	is the volume of brine in the disposal room (L),
N_D	is the number of CH drums in the disposal room (6800),
N_A	is the Avogadro constant (6.0×10^{23} mol^{-1}).

The maximum dissolved concentration of plutonium, C_{Pu}, has been taken as 5.5×10^{-4} M, as derived during estimation of the actinide source term for the WIPP (Trauth et al. 1992, p. 4-5). The value of G used in this calculation has been set at 1.4, the upper limit of the range of values observed (1.1 to 1.4) during experimental studies of the effects of radiation on WIPP brines (Reed et al. 1993). Estimates of the volume of brine that could potentially be present in the disposal rooms vary between 0 and 815000 L. For the purposes of this calculation, the upper limit of the range has been used. These parameter values lead to an estimate of the rate of gas production due to the radiolysis of brine of 2.02×10^{-1} mol/drum/year.

Gas production rates due to other processes that will occur in the WIPP are likely to be significantly greater than this. For example, under saturated conditions, microbial degradation of cellulosic waste is estimated to yield up to 5 moles/drum/year, and anoxic corrosion of steels under these conditions is estimated to yield up to 100 moles/drum/year. Under unsaturated conditions, gas production rates for these processes are expected to be up to 1 moles/drum/year and up to 0.06 moles/drum/year, respectively. Even if gas production by these processes were to be minimal and radiolytic gas production dominated gas generation, the effects would be of low consequence because of the low total volumes.

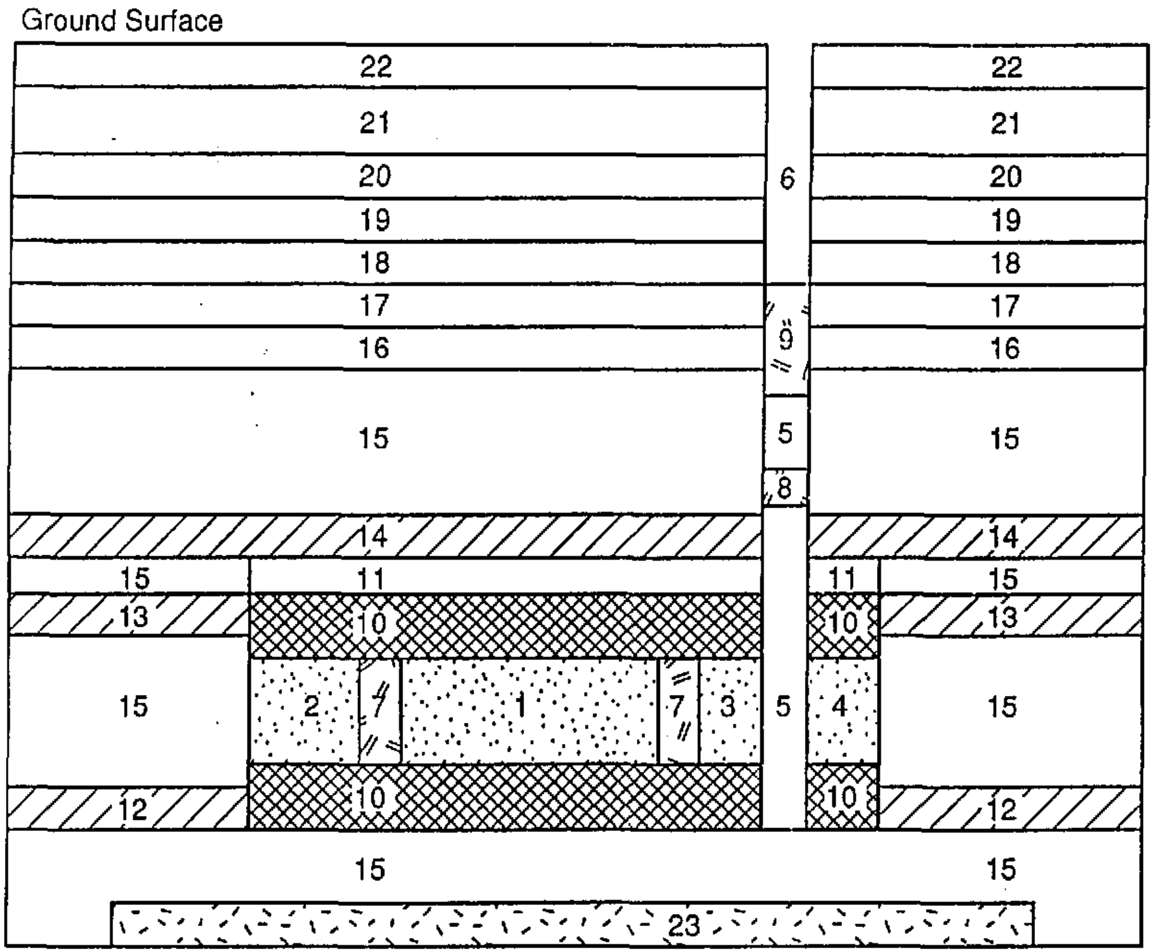
Therefore, considering the likely gas generation rates, the effects of the radiolysis of brine have been eliminated from performance assessment calculations on the basis of low consequence to the performance of the disposal system.

References

Reed, D.T., S. Okajima, L.H. Brush, and M.A.Molecke. 1993. "Radiolytically-Induced Gas Production in Plutonium Spiked WIPP Brine," *Scientific Basis for Nuclear Waste Management XVI, Materials Research Society Symposium Proceedings, Boston, MA, November 30 - December 4, 1992.* Eds. C.G. Interrante and R.T Pabalan. SAND92-7283C Pittsburgh, PA: Materials Research Society. Vol. 294, 431-438.

Trauth, K.M., S.C. Hora, R.P. Rechard, and D.R. Anderson. 1992. *The Use of Expert Judgment to Quantify Uncertainty in Solubility and Sorption Parameters for Waste Isolation Pilot Plant Performance Assessment.* SAND92-0479. Albuquerque, NM: Sandia National Laboratories,

APPENDIX 1



1 Equivalent Panel
2 Remaining Panels
3 Backfill Region
4 Experimental Region
5 Lower Shaft
6 Upper Shaft
7 Panel Seals
8 Lower Shaft Seal
9 Upper Shaft Seal
10 Disturbed Rock Zone
11 Transition Zone
12 MB 139
13 Anhydrite Layers A & B
14 MB 139
15 Intact Halite
16 Unnamed
17 Culebra
18 Tamarisk
19 Magenta
20 Forty Niner
21 Dewey Lake Red Beds
22 Santa Rose
23 Castile Brine Pocket

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Figure 1. North-south vertical cross-section of model domain for the undisturbed scenario.

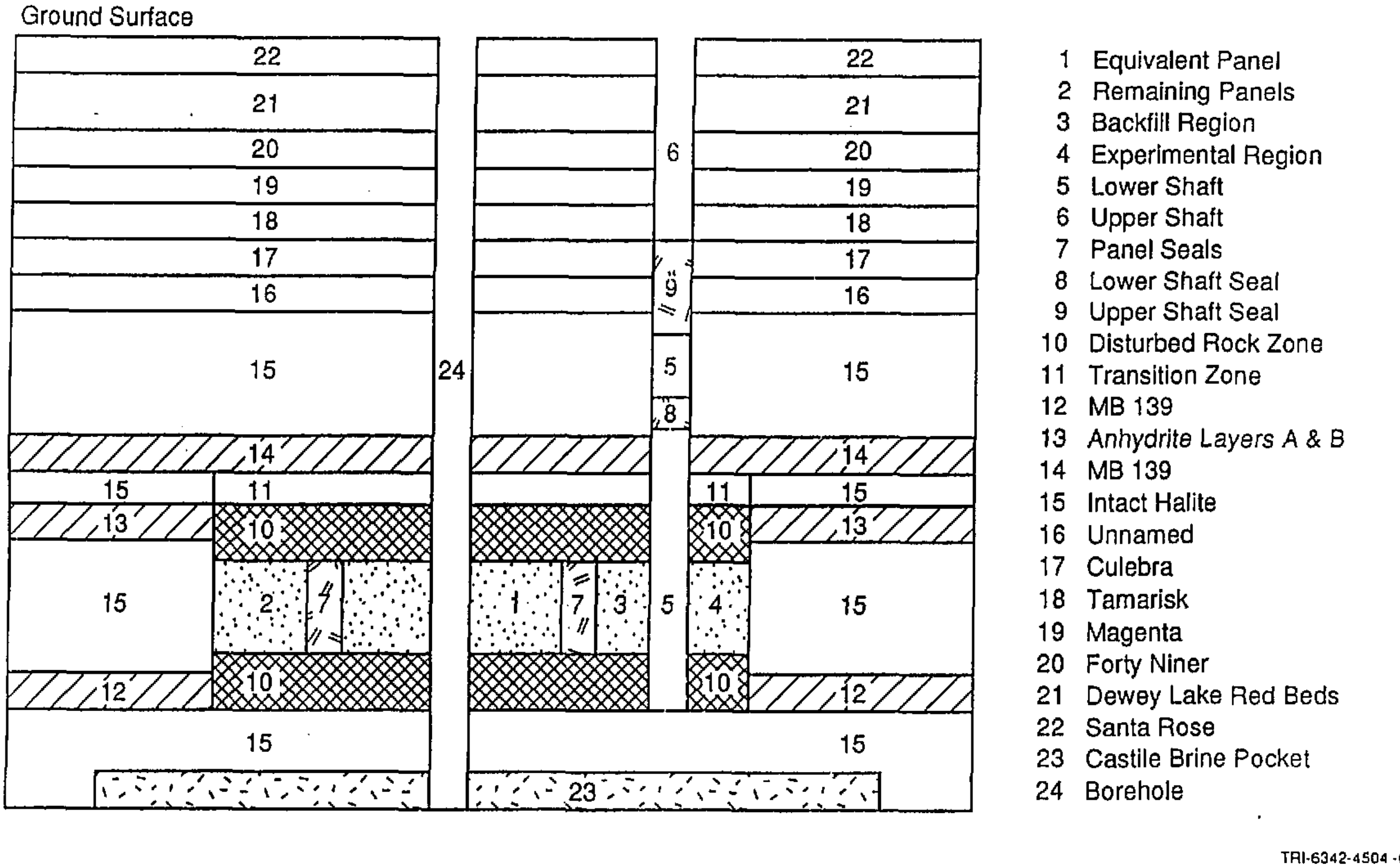

Figure 2. North-south vertical cross-section of model domain for the E01-Up intrusion scenario

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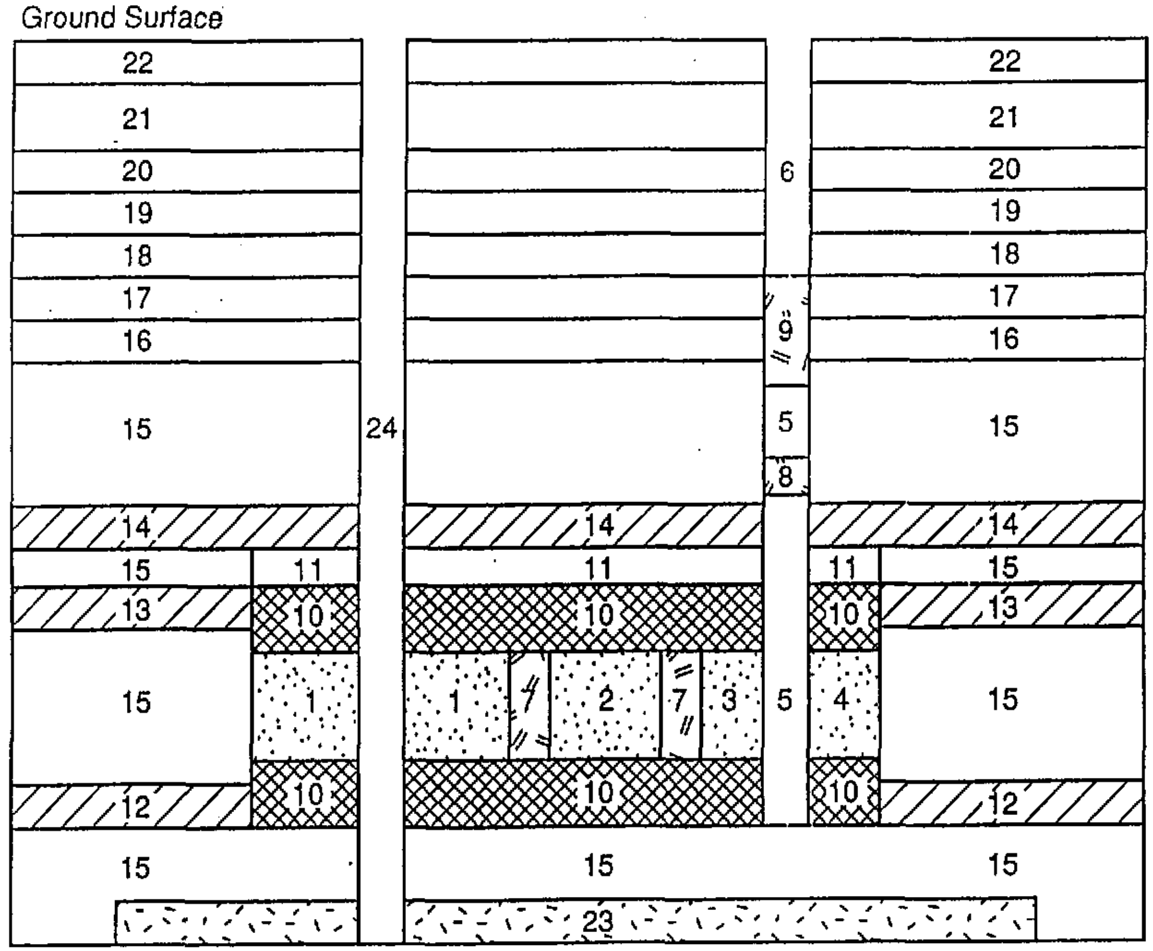

1 Equivalent Panel
2 Remaining Panels
3 Backfill Region
4 Experimental Region
5 Lower Shaft
6 Upper Shaft
7 Panel Seals
8 Lower Shaft Seal
9 Upper Shaft Seal
10 Disturbed Rock Zone
11 Transition Zone
12 MB 139
13 Anhydrite Layers A & B
14 MB 139
15 Intact Halite
16 Unnamed
17 Culebra
18 Tamarisk
19 Magenta
20 Forty Niner
21 Dewey Lake Red Beds
22 Santa Rose
23 Castile Brine Pocket
24 Borehole

TRI-6342-4503-0

Figure 3. North-south vertical cross-section of model domain for the E01-Down intrusion scenario

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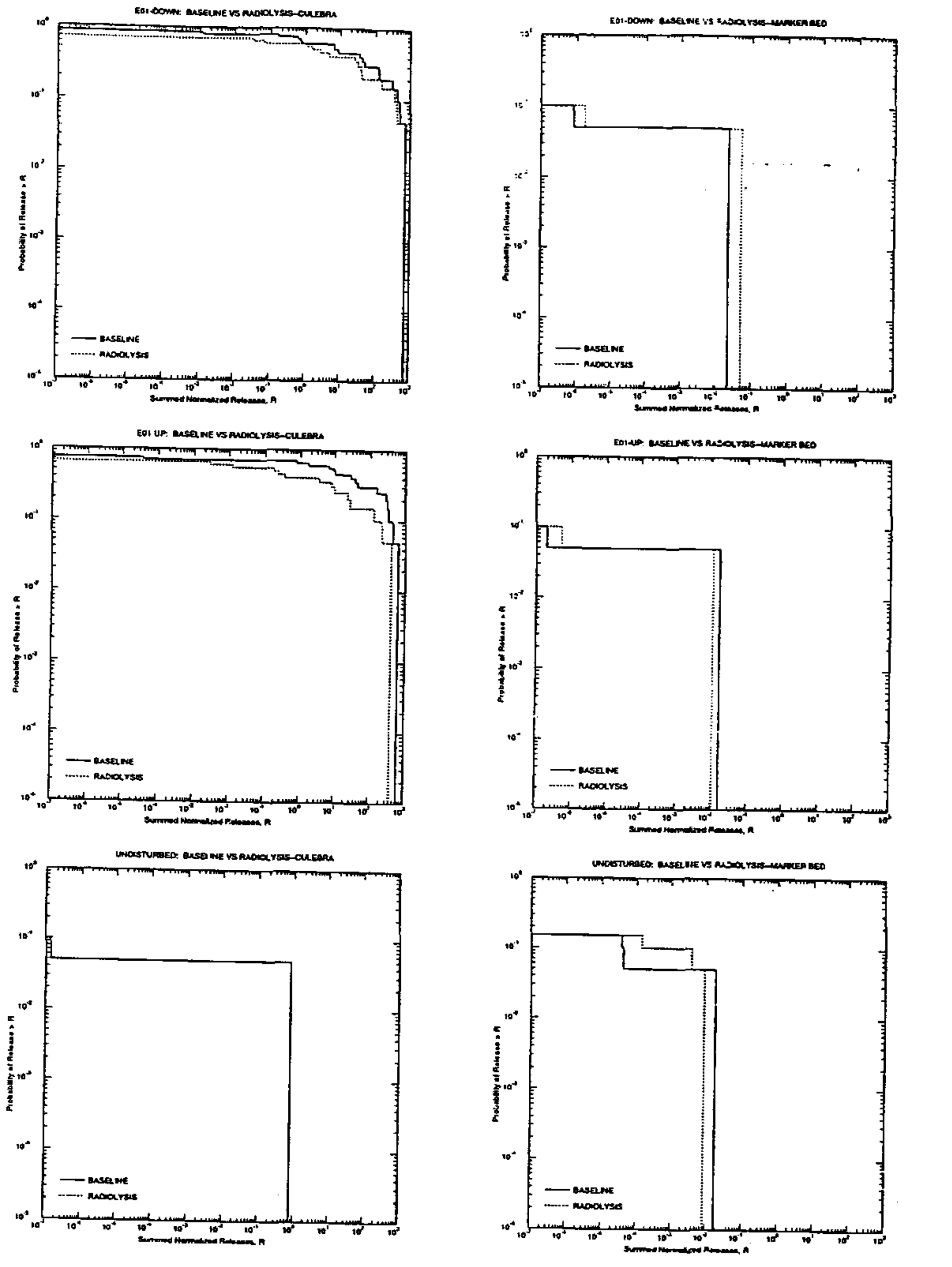

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Figure 4. CCDFs for releases to the Culebra and subsurface boundary of the accessible environment (Baseline vs Radiolysis).

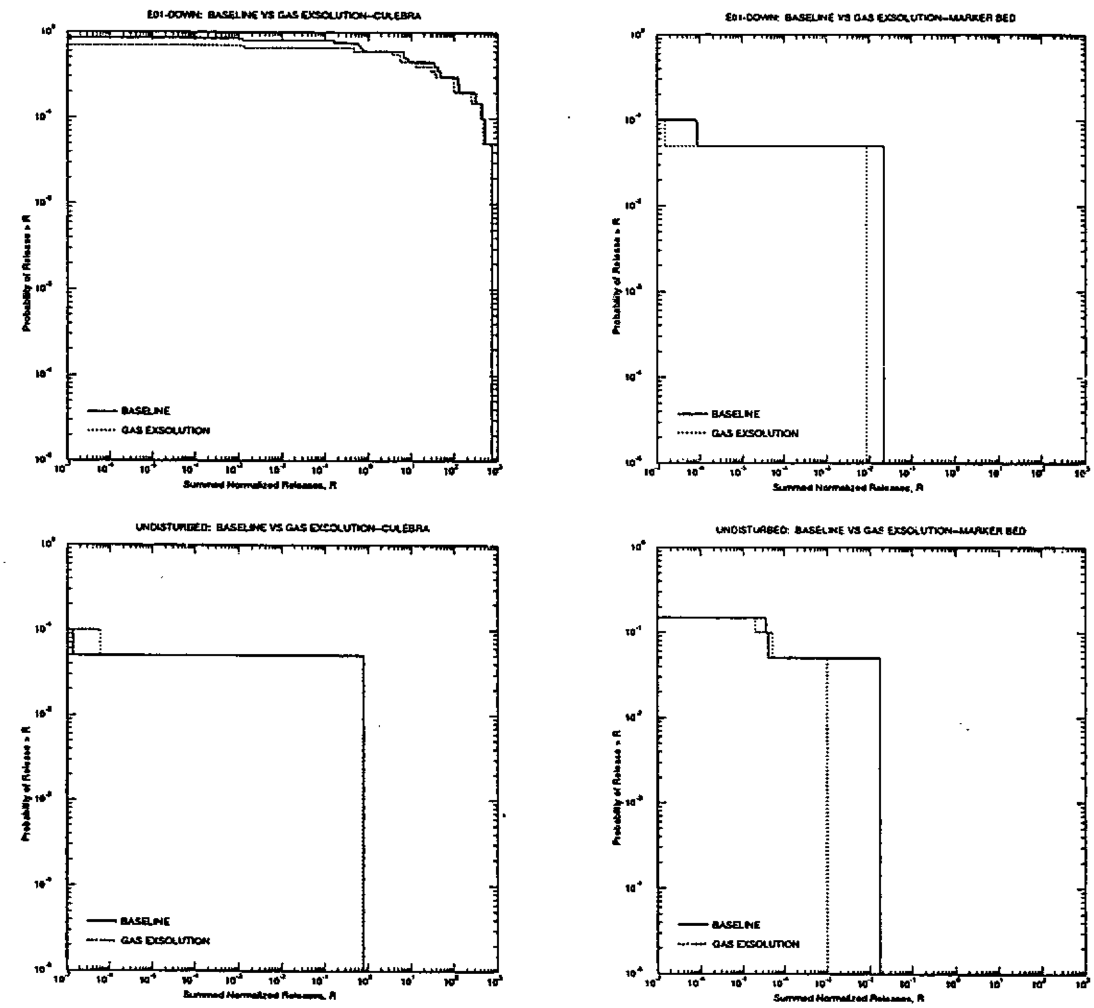

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Figure 5. CCDFs for releases to the Culebra and subsurface boundary of the accessible environment (Baseline vs Gas Exsolution).

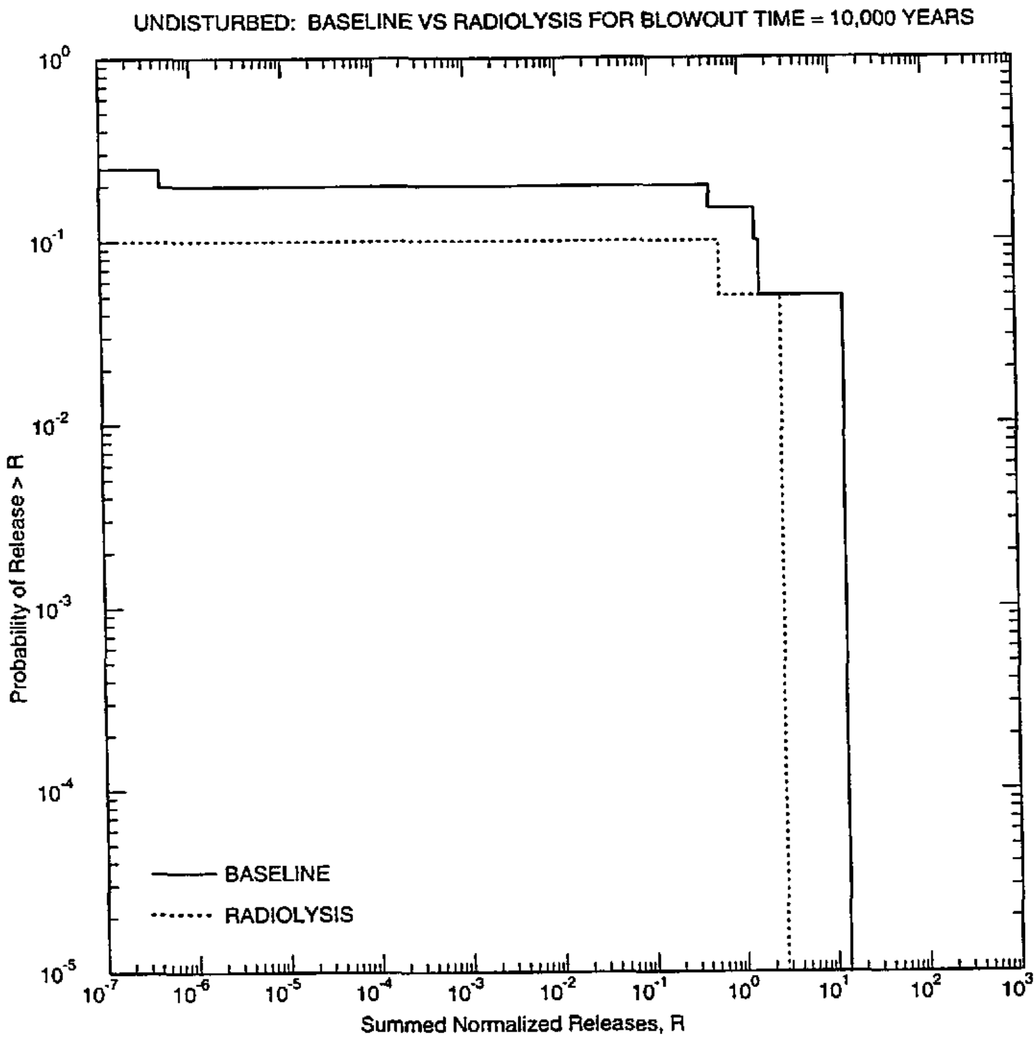

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Figure 6. CCDFs for releases due to Blowout (Baseline vs Radiolysis).

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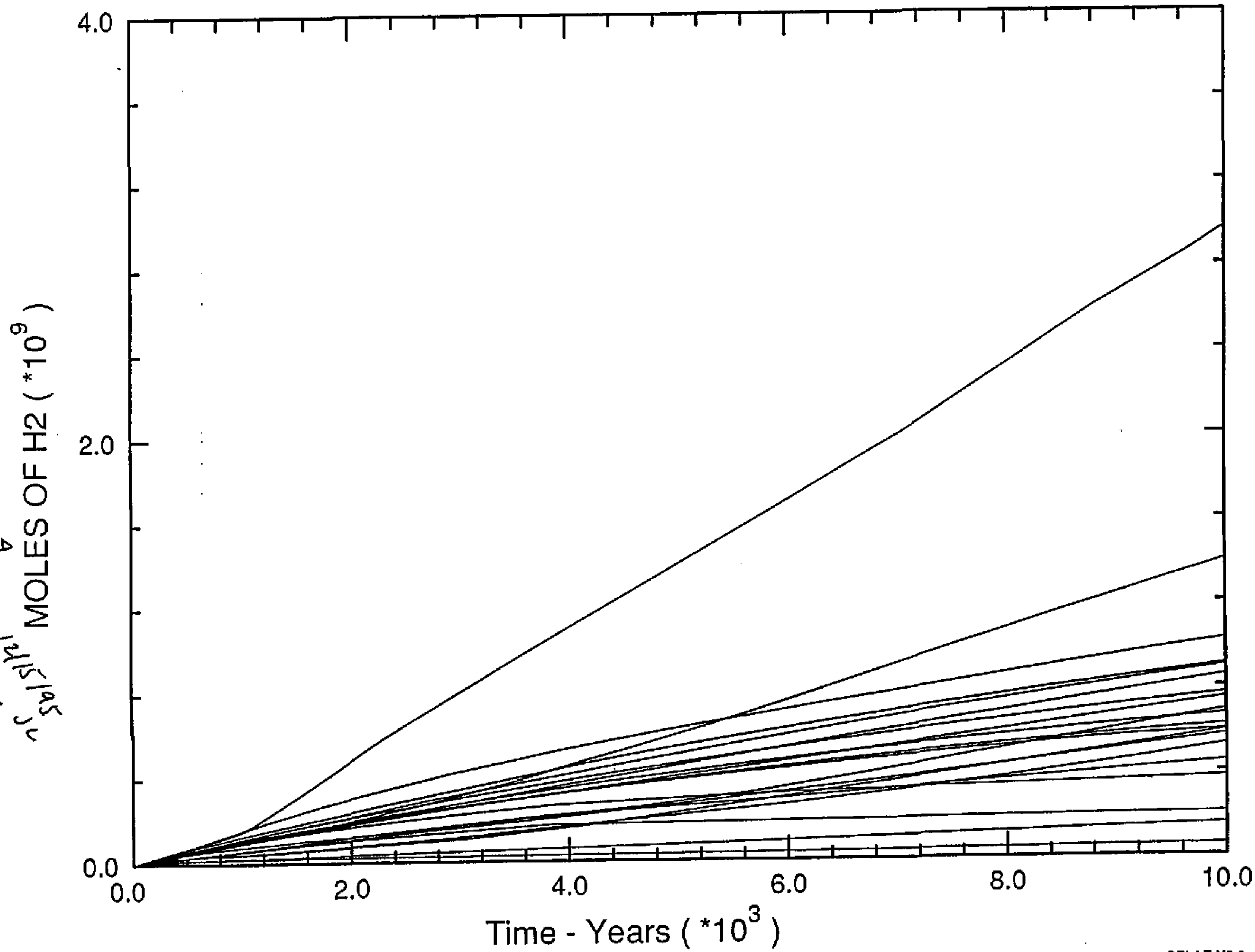
FIGURE 7. MOLES OF H2 GENERATED DUE TO RADIOLYSIS



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F1:[FEP.RAD.UNDIST]SPLAT_H2.INP;7

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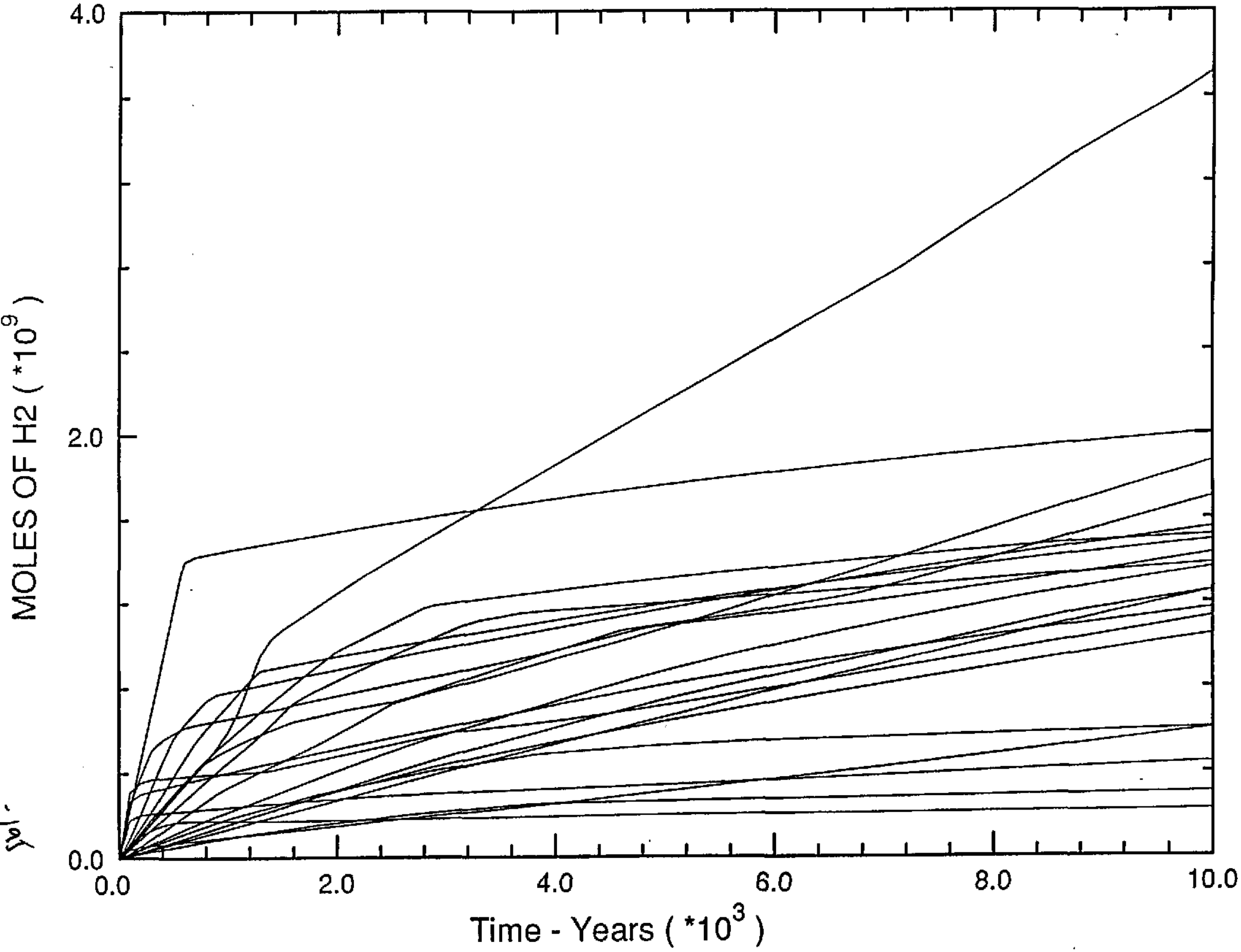
FIGURE 8. MOLES OF H2 GENERATED DUE TO CORROSION AND BIODEGRADATION



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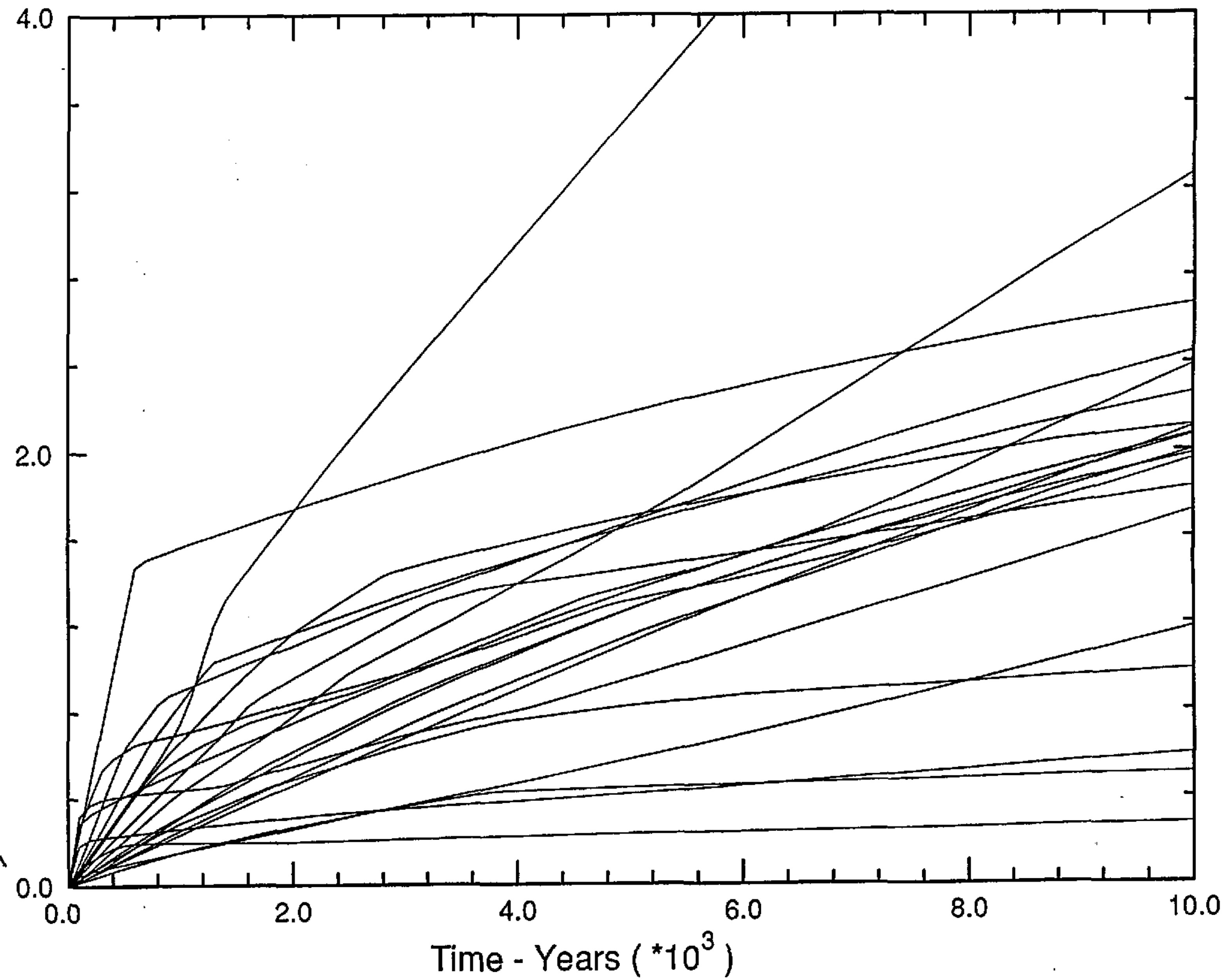
F1:[FEP.RAD.UNDIST]SPLAT_H2B.INP;4

SPLAT X2.0 09/28/95 14:02:15

FIGURE 9. MOLES OF H2 DUE TO RADIOLYSIS, CORROSION, AND BIODEGRADATION



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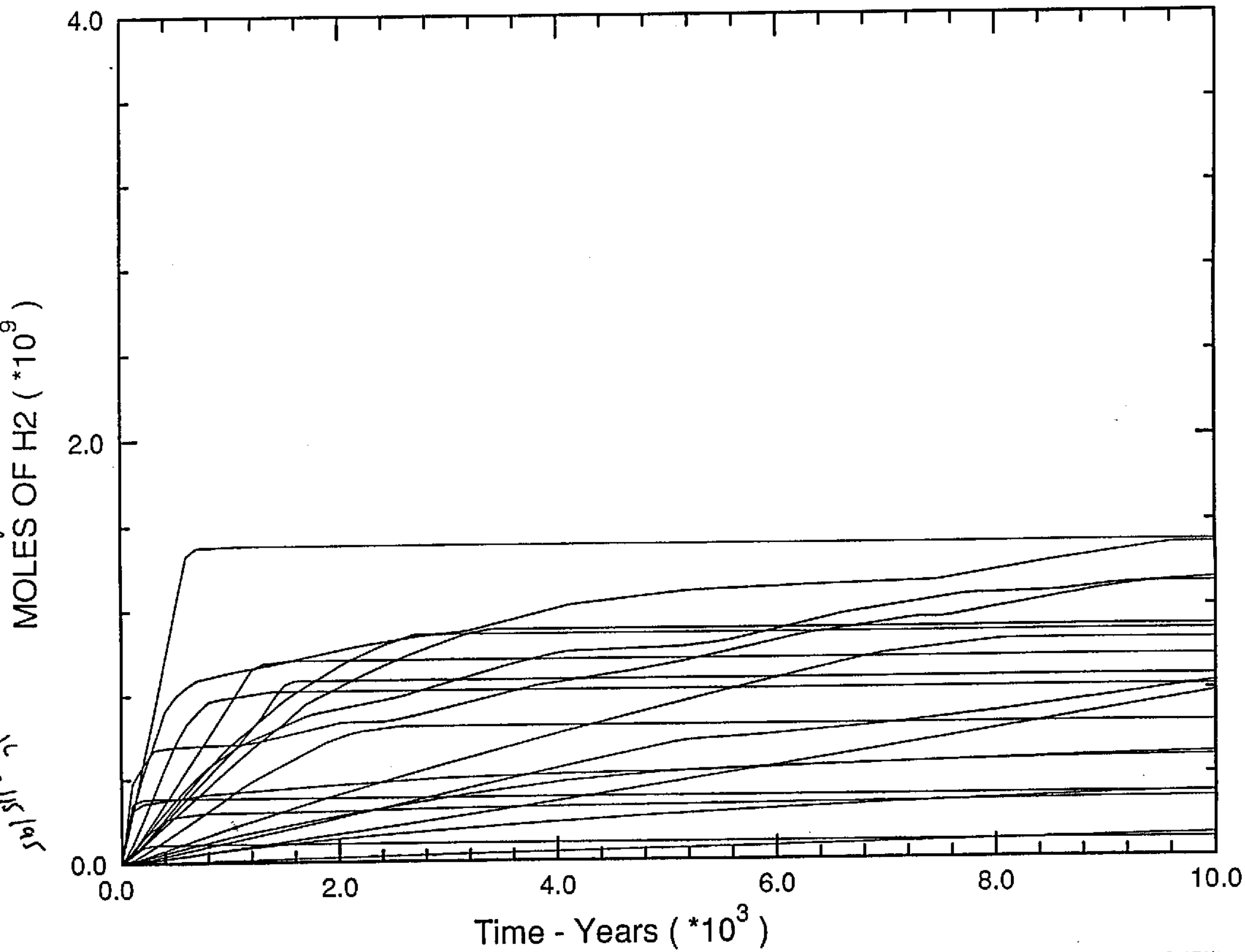
F1:[FEP.RAD.UNDIST]SPLAT_H2C.INP;5

SPLAT X2.0 09/28/95 14:55:25

FIGURE 10. MOLES OF H2 GENERATED (BASELINE MODEL)



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F1:[FEP.BASELINE.UNDIST]SPLAT_H2C.INP;4

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Table 1. Sampled Parameters

Parameter (Variable Name) (Dimensions)	Material	Distribution	Actual Range	Actual Median
Log of x-direction permeability (PERMX_LOG) (log(m2))	Halite	Constructed	3.799883	-21.09494
	MB139	Constructed	5.529356	-18.78408
	Shaft_US1	Constructed	2.946171	-17.02151
	BoreholeNormal		2.636367	-12.49108
Porosity (POROSITY) (Dimensionless)	Halite	Constructed	0.027027	0.010380
	MB139	Constructed	0.069465	0.018577
Log of specific storage (SP_S_LOG) (log(m-1))	Halite	Constructed	1.823131	-6.034230
	MB139	Constructed	1.890774	-5.992161
Relative Permeability Model (RELP_MOD) (Dimensionless)	Halite	Constructed	3.000000	4.000000
	Waste Area	Constructed	3.000000	4.000000
Residual Brine Saturation (SAT_RBRN) (Dimensionless)	Halite	Uniform	0.574155	0.302751
	MB139	Constructed	0.499165	0.194686
	Waste Area	Uniform	0.372923	0.199534
Residual Gas Saturation (SAT_RGAS) (Dimensionless)	Halite	Uniform	0.383115	0.199356
	MB139	Constructed	0.319945	0.164978
	Waste Area	Uniform	0.3884864	0.199738
Pore size distribution parameter (PORE_DIS) (Dimensionless)	Halite	Constructed	9.767002	0.726102
	MB139	Constructed	9.180162	0.922575
	Waste Area	Constructed	9.095209	0.769556
Threshold Pressure (PTHRESH) (MPa)	Halite	Constructed	0.9643E+8	9036895.0
	MB139	Constructed	3.665728	-7.926188
Pressure (PRESSURE) (MPa)	MB139	Uniform	981014.0	0.1248E+8
Puddling Saturation (SAT_PUD) (Dimensionless)	Waste Area	Uniform	0.664240	0.439542
Wicking Saturation (SAT_WICK) (Dimensionless)	Waste Area	Uniform	0.928796	0.495629

-A QA 12/15/95 JL

Table 1 Cont'd

Microbial Stoichiometry (STOIMIC) (Dimensionless)	Waste Area	Uniform	1.529712	0.843751
Corrosion Stoichiometry (STOICOR) (Dimensionless)	Waste Area	Uniform	0.9517006	0.493922
Humid Corrosion Gas Generation Rate (GRATCORH) (mol/m2-s)	Waste Area	Constructed	0.30988E-9	0.95958E-11
Inundated Corrosion Gas Generation Rate (GRATCORI) (mol/m2-s)	Waste Area	Constructed	0.591798E-6	0.119664E-7
Humid Microbial Gas Generation Rate (GRATMICH) (mol/kg-s)	Waste Areaa	Constructed	0.302275E-8	0.339431E-9
Inundated Microbial Gas Generation Rate (GRATMICI) (mol/kg-s)	Waste Area	Constructed	0.154756E-7	0.369955E-8
Initial Brine Saturation (SAT_IBRN)	Waste Area	Uniform	0.454750E-1	0.279499E-1
Fracture Pressure (FRAC_PR)	Waste Area	Uniform	0.9603366	0.4893045
Passivation Switch (PASSIDX) (Dimensionless)	Waste Area	Constructed	1.0000000	0.50000000
Log (Solubility of Aqueous Radionuclides in Oxidation State III) (OXYSTAT3) (log (mol/L))	Waste Area	Constructed	8.477690	-6.582510
Log (Solubility of Aqueous Radionuclides in Oxidation State IV) (OXYSTAT4) (log (mol/L))	Waste Area	Constructed	4.731806	-6.976091

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Table 1 Cont'd

Log (Solubility of Aqueous Radionuclides in Oxidation State V) (OXYSTAT5) (log (mol/L))	Waste Area	Constructed	8.866982	-4.882648
Log (Solubility of Aqueous Radionuclides in Oxidation State VI) (OXYSTAT6) (log (mol/L))	Waste Area	Constructed	9.587173	-3.950130
Oxidation State Distribution Parameter (SOL1IDX) (DIMENSIONLESS)	Waste Area	Random	0.9747659	0.4977925
Oxidation State Distribution Parameter (SOL2IDX) (DIMENSIONLESS)	Waste Area	Random	0.9202215	0.5066518
Oxidation State Distribution Parameter (SOL3IDX) (DIMENSIONLESS)	Waste Area	Random	0.9844602	0.4970062
Oxidation State Distribution Parameter (SOL4IDX) (DIMENSIONLESS)	Waste Area	Random	0.9417638	0.5013523

Table 2. Performance Measures for Blowout, Spalling, and Cuttings (Baseline Model Results)

TIME = 0.100000E+03

	BRINE PRESSURE (Mpa)	BRINE SATURATION	POROSITY	PERMEABILITY (m^2)
MIN	0.646341E+06	0.164512E-00	0.129134E+00	0.558470E-11
MAX	0.781343E+07	0.328766E+00	0.300751E+00	0.558470E-11
MEAN	0.261626E+07	0.159652E+00	0.182226E+00	0.558470E-11
MED	0.197089E+07	0.175252E+00	0.163546E+00	0.558470E-11

TIME = 0.100000E+04

MIN	0.405960E+07	0.144595E-03	0.753411E-01	0.558470E-11
MAX	0.213275E+08	0.829489E+00	0.260317E+00	0.558470E-11
MEAN	0.993771E+07	0.223267E+00	0.114298E+00	0.558470E-11
MED	0.841570E+07	0.185228E+00	0.986526E-01	0.558470E-11

TIME = 0.100000E+05

MIN	0.596549E+07	0.162282E-03	0.831857E-01	0.558470E-11
MAX	0.177650E+08	0.891300E+00	0.259204E+00	0.558470E-11
MEAN	0.904791E+07	0.295925E+00	0.115752E+00	0.558470E-11
MED	0.686144E+07	0.224458E+00	0.106594E+00	0.558470E-11

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Table 3. Performance Measures For Blowout, Spalling, and Cuttings (Radiolysis Model Results)

TIME = 0.100000E+03 years

	BRINE PRESSURE (Mpa)	BRINE SATURATION	POROSITY	PERMEABILITY (m^2)
MIN	0.872038E+06	0.160421E-01	0.134322E+00	0.558470E-11
MAX	0.793133E+07	0.306094E+00	0.300751E+00	0.558470E-11
MEAN	0.295773E+07	0.147644E+00	0.191641E+00	0.558470E-11
MED	0.224451E+07	0.162401E+00	0.171171E+00	0.558470E-11

TIME = 0.100000E+04 years

MIN	0.614292E+07	0.736760E-05	0.857483E-01	0.558470E-11
MAX	0.212381E+08	0.876010E+00	0.270104E+00	0.558470E-11
MEAN	0.110687E+08	0.193949E+00	0.122223E+00	0.558470E-11
MED	0.988744E+07	0.178975E+00	0.107433E+00	0.558470E-11

TIME = 0.100000E+05 years

MIN	0.612985E+07	0.799972E-07	0.839650E-01	0.558470E-11
MAX	0.211370E+08	0.891299E+00	0.270071E+00	0.558470E-11
MEAN	0.101330E+08	0.147083E+00	0.117256E+00	0.558470E-11
MED	0.789789E+07	0.768956E-01	0.101605E+00	0.558470E-11

Table 4. Performance Measures For Blowout, Spalling, and Cuttings (Gas Exsolution Model Results)

TIME = 0.100000E+03 years

	BRINE PRESSURE (Mpa)	BRINE SATURATION	POROSITY	PERMEABILITY (m^2)
MIN	0.623238E+06	0.161922E-01	0.128635E+00	0.558470E-11
MAX	0.773898E+07	0.329942E+00	0.300751E+00	0.558470E-11
MEAN	0.258056E+07	0.154919E+00	0.181337E+00	0.558470E-11
MED	0.193918E+07	0.173379E+00	0.162942E+00	0.558470E-11

TIME = 0.100000E+04 years

MIN	0.197624E+07	0.956873E-05	0.646636E-01	0.558470E-11
MAX	0.210255E+08	0.412832E+00	0.258960E+00	0.558470E-11
MEAN	0.970278E+07	0.198533E+00	0.112481E+00	0.558470E-11
MED	0.809752E+07	0.179574E+00	0.975377E-01	0.558470E-11

TIME = 0.100000E+05 years

MIN	0.571118E+07	0.180534E-03	0.819800E-01	0.558470E-11
MAX	0.172035E+08	0.891735E+00	0.257772E+00	0.558470E-11
MEAN	0.856382E+07	0.304707E+00	0.114075E+00	0.558470E-11
MED	0.675711E+07	0.240683E+00	0.971745E-01	0.558470E-11

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APPENDIX 2

The following list details the directories and files used in the FEPs screening analyses.

Directory F2:[FEP.JEBEAN.BASELINE.GENMESH]

BLOT.ADOBE_1;2 BLOT.PST;1 GENMESH.INP;6 GENMESH_1.CDB;2
GENMESH_2.CDB;2 GENMESH_2.CDB;1 GENMESH_2.INP;5 MESH_1.ADB;1

Directory F2:[FEP.JEBEAN.BASELINE.MATSET]

BATCH.COM;8 BATCH.COM;7 BATCH_DOWN.COM;1 MATSET.CDB;3
MATSET.DBG;2 MATSET.DBG;1 MATSET_DOWN.CDB;2 MATSET_NEW.INP;10

Directory F2:[FEP.JEBEAN.BASELINE.LHS]

BATCH.COM;8 BATCH_DOWN.COM;2 BATCH_DOWN.COM;1 JUNK.DIF;1
JUNK.JOU;1 LHS.COM;1 LHS_FEPS_BASELINE.INP;5
LHS_FEPS_BASELINE.INP;4 LHS_FEPS_BASELINE.INP;2
POSTLHS.INP;2 POSTLHS_FEPS_BASELINE_DOWN_R001.CDB;2
POSTLHS_FEPS_BASELINE_DOWN_R002.CDB;2
POSTLHS_FEPS_BASELINE_DOWN_R003.CDB;2
POSTLHS_FEPS_BASELINE_DOWN_R004.CDB;2
POSTLHS_FEPS_BASELINE_DOWN_R005.CDB;2
POSTLHS_FEPS_BASELINE_DOWN_R006.CDB;2
POSTLHS_FEPS_BASELINE_DOWN_R007.CDB;2
POSTLHS_FEPS_BASELINE_DOWN_R008.CDB;2
POSTLHS_FEPS_BASELINE_DOWN_R009.CDB;2
POSTLHS_FEPS_BASELINE_DOWN_R010.CDB;2
POSTLHS_FEPS_BASELINE_DOWN_R011.CDB;2
POSTLHS_FEPS_BASELINE_DOWN_R012.CDB;2
POSTLHS_FEPS_BASELINE_DOWN_R013.CDB;2
POSTLHS_FEPS_BASELINE_DOWN_R014.CDB;2
POSTLHS_FEPS_BASELINE_DOWN_R015.CDB;2
POSTLHS_FEPS_BASELINE_DOWN_R016.CDB;2
POSTLHS_FEPS_BASELINE_DOWN_R017.CDB;2
POSTLHS_FEPS_BASELINE_DOWN_R018.CDB;2
POSTLHS_FEPS_BASELINE_DOWN_R019.CDB;2
POSTLHS_FEPS_BASELINE_DOWN_R020.CDB;2 POSTLHS_FEPS_BASELINE_R001.CDB;1
POSTLHS_FEPS_BASELINE_R002.CDB;1 POSTLHS_FEPS_BASELINE_R003.CDB;1
POSTLHS_FEPS_BASELINE_R004.CDB;1 POSTLHS_FEPS_BASELINE_R005.CDB;1
POSTLHS_FEPS_BASELINE_R006.CDB;1 POSTLHS_FEPS_BASELINE_R007.CDB;1
POSTLHS_FEPS_BASELINE_R008.CDB;1 POSTLHS_FEPS_BASELINE_R009.CDB;1
POSTLHS_FEPS_BASELINE_R010.CDB;1 POSTLHS_FEPS_BASELINE_R011.CDB;1
POSTLHS_FEPS_BASELINE_R012.CDB;1 POSTLHS_FEPS_BASELINE_R013.CDB;1
POSTLHS_FEPS_BASELINE_R014.CDB;1 POSTLHS_FEPS_BASELINE_R015.CDB;1
POSTLHS_FEPS_BASELINE_R016.CDB;1 POSTLHS_FEPS_BASELINE_R017.CDB;1
POSTLHS_FEPS_BASELINE_R018.CDB;1 POSTLHS_FEPS_BASELINE_R019.CDB;1
POSTLHS_FEPS_BASELINE_R020.CDB;1 PRELHS_FEPS_BASELINE.INP;4
SMPLHS_FEPS_BASELINE.OUT;2 SMPLHS_FEPS_BASELINE.OUT;1
SMPLHS_FEPS_BASELINE_DOWN.OUT;2 SMPLHS_FEPS_BASELINE_DOWN.OUT;1

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Directory F2:[FEP.JEBEAN.BASELINE.ICSET]

BATCH.COM;11 BATCH1.COM;3 BATCH_DOWN.COM;2 BATCH_DOWN.COM;1
ICSET.DBG;1 ICSET.INP;17 ICSET_DOWN.INP;1
ICSET_DOWN_R001.CDB;1 ICSET_DOWN_R002.CDB;1
ICSET_DOWN_R003.CDB;1 ICSET_DOWN_R004.CDB;1
ICSET_DOWN_R005.CDB;1 ICSET_DOWN_R006.CDB;1
ICSET_DOWN_R007.CDB;1 ICSET_DOWN_R008.CDB;1
ICSET_DOWN_R009.CDB;1 ICSET_DOWN_R010.CDB;1
ICSET_DOWN_R011.CDB;1 ICSET_DOWN_R012.CDB;1
ICSET_DOWN_R013.CDB;1 ICSET_DOWN_R014.CDB;1
ICSET_DOWN_R015.CDB;1 ICSET_DOWN_R016.CDB;1
ICSET_DOWN_R017.CDB;1 ICSET_DOWN_R018.CDB;1
ICSET_DOWN_R019.CDB;1 ICSET_DOWN_R020.CDB;1
ICSET_MED.CDB;1 ICSET_R001.CDB;1 ICSET_R002.CDB;1 ICSET_R003.CDB;1
ICSET_R004.CDB;1 ICSET_R005.CDB;1 ICSET_R006.CDB;1 ICSET_R007.CDB;1
ICSET_R008.CDB;1 ICSET_R009.CDB;1 ICSET_R010.CDB;1 ICSET_R011.CDB;1
ICSET_R012.CDB;1 ICSET_R013.CDB;1 ICSET_R014.CDB;1 ICSET_R015.CDB;1
ICSET_R016.CDB;1 ICSET_R017.CDB;1 ICSET_R018.CDB;1 ICSET_R019.CDB;1
ICSET_R020.CDB;1

Directory F2:[FEP.JEBEAN.BASELINE.ALGEBRA]

ALGEBRA_DOWN.INP;1 ALGEBRA_DOWN_R001.CDB;1
ALGEBRA_DOWN_R002.CDB;1 ALGEBRA_DOWN_R003.CDB;1
ALGEBRA_DOWN_R004.CDB;1 ALGEBRA_DOWN_R005.CDB;1
ALGEBRA_DOWN_R006.CDB;1 ALGEBRA_DOWN_R007.CDB;1
ALGEBRA_DOWN_R008.CDB;1 ALGEBRA_DOWN_R009.CDB;1
ALGEBRA_DOWN_R010.CDB;1 ALGEBRA_DOWN_R011.CDB;1
ALGEBRA_DOWN_R012.CDB;1 ALGEBRA_DOWN_R013.CDB;1
ALGEBRA_DOWN_R014.CDB;1 ALGEBRA_DOWN_R015.CDB;1
ALGEBRA_DOWN_R016.CDB;1 ALGEBRA_DOWN_R017.CDB;1
ALGEBRA_DOWN_R018.CDB;1 ALGEBRA_DOWN_R019.CDB;1
ALGEBRA_DOWN_R020.CDB;1 ALGEBRA_MED.CDB;1 ALGEBRA_NEW.INP;24
ALGEBRA_NODIP.INP;1 ALGEBRA_R001.CDB;1 ALGEBRA_R002.CDB;1
ALGEBRA_R003.CDB;1
ALGEBRA_R004.CDB;1 ALGEBRA_R005.CDB;1 ALGEBRA_R006.CDB;1
ALGEBRA_R007.CDB;1
ALGEBRA_R008.CDB;1 ALGEBRA_R009.CDB;1 ALGEBRA_R010.CDB;1
ALGEBRA_R011.CDB;1
ALGEBRA_R012.CDB;1 ALGEBRA_R013.CDB;1 ALGEBRA_R014.CDB;1
ALGEBRA_R015.CDB;1
ALGEBRA_R016.CDB;1 ALGEBRA_R017.CDB;1 ALGEBRA_R018.CDB;1
ALGEBRA_R019.CDB;1
ALGEBRA_R020.CDB;1 BATCH.COM;4 BATCH1.COM;2 BATCH_DOWN.COM;2

Directory F2:[FEP.JEBEAN]

BASELINE.DIR;1 DGAS.DIR;1 DRZ.DIR;1 MCS.DIR;1
MISC.DIR;1 POSTALG.DIR;1 PUD.DIR;1 PVGULICK.DIR;1
RAD.DIR;1 VPC.DIR;1 VTPC.DIR;1 WICK.DIR;1

Directory F2:[FEP.JEBEAN.RAD]

BRAGFLO.DIR;1 NEW.DIR;1 PREBRAG.DIR;1

Directory F2:[FEP.JEBEAN.RAD.BRAGFLO]

BATCH2.INP;2 BATCH3.INP;2 BRAGFLO.INP;2 BRAGFLO.INP;1
B_FEP_RAD_E01_DOWN_R001.INP;4 B_FEP_RAD_E01_DOWN_R002.INP;1
B_FEP_RAD_E01_DOWN_R003.INP;1 B_FEP_RAD_E01_DOWN_R004.INP;1
B_FEP_RAD_E01_DOWN_R005.INP;1 B_FEP_RAD_E01_DOWN_R006.INP;1
B_FEP_RAD_E01_DOWN_R007.INP;1 B_FEP_RAD_E01_DOWN_R008.INP;1
B_FEP_RAD_E01_DOWN_R009.INP;1 B_FEP_RAD_E01_DOWN_R010.INP;1
B_FEP_RAD_E01_DOWN_R011.INP;1 B_FEP_RAD_E01_DOWN_R012.INP;1
B_FEP_RAD_E01_DOWN_R013.INP;1 B_FEP_RAD_E01_DOWN_R014.INP;1
B_FEP_RAD_E01_DOWN_R015.INP;1 B_FEP_RAD_E01_DOWN_R016.INP;1
B_FEP_RAD_E01_DOWN_R017.INP;1 B_FEP_RAD_E01_DOWN_R018.INP;1
B_FEP_RAD_E01_DOWN_R019.INP;1 B_FEP_RAD_E01_DOWN_R020.INP;1
B_FEP_RAD_E01_UP_R001.INP;3 B_FEP_RAD_E01_UP_R002.INP;3
B_FEP_RAD_E01_UP_R003.INP;3 B_FEP_RAD_E01_UP_R004.INP;3
B_FEP_RAD_E01_UP_R005.INP;3 B_FEP_RAD_E01_UP_R006.INP;3
B_FEP_RAD_E01_UP_R007.INP;3 B_FEP_RAD_E01_UP_R008.INP;3
B_FEP_RAD_E01_UP_R009.INP;3 B_FEP_RAD_E01_UP_R010.INP;3
B_FEP_RAD_E01_UP_R011.INP;3 B_FEP_RAD_E01_UP_R012.INP;3
B_FEP_RAD_E01_UP_R013.INP;3 B_FEP_RAD_E01_UP_R014.INP;3
B_FEP_RAD_E01_UP_R015.INP;3 B_FEP_RAD_E01_UP_R016.INP;3
B_FEP_RAD_E01_UP_R017.INP;3 B_FEP_RAD_E01_UP_R018.INP;3
B_FEP_RAD_E01_UP_R019.INP;3 B_FEP_RAD_E01_UP_R020.INP;3
B_FEP_RAD_UND_R001.INP;12 B_FEP_RAD_UND_R002.INP;4
B_FEP_RAD_UND_R003.INP;4 B_FEP_RAD_UND_R004.INP;4
B_FEP_RAD_UND_R005.INP;4 B_FEP_RAD_UND_R006.INP;2
B_FEP_RAD_UND_R007.INP;2 B_FEP_RAD_UND_R008.INP;2
B_FEP_RAD_UND_R009.INP;4 B_FEP_RAD_UND_R010.INP;2
B_FEP_RAD_UND_R011.INP;1 B_FEP_RAD_UND_R012.INP;1
B_FEP_RAD_UND_R013.INP;1 B_FEP_RAD_UND_R014.INP;1
B_FEP_RAD_UND_R015.INP;1 B_FEP_RAD_UND_R016.INP;2
B_FEP_RAD_UND_R017.INP;2 B_FEP_RAD_UND_R018.INP;3
B_FEP_RAD_UND_R019.INP;2 B_FEP_RAD_UND_R020.INP;2
PREBRAG_E01.INP;1 PREBRAG_E01_DOWN.INP;6
PREBRAG_E01_UP.INP;2 PREBRAG_R001.DBG;3 PREBRAG_R001.DBG;2
PREBRAG_R001.DBG;1 PREBRAG_UND.INP;70

Directory F2:[FEP.JEBEAN.RAD.NEW]

BRAGFLO.DIR;1 PREBRAG.DIR;1

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Directory F2:[FEP.JEBEAN.RAD.NEW.BRAGFLO]

B_FEP_RAD_E01_DOWN_R001.INP;1 B_FEP_RAD_E01_DOWN_R002.INP;1
B_FEP_RAD_E01_DOWN_R003.INP;1 B_FEP_RAD_E01_DOWN_R004.INP;1
B_FEP_RAD_E01_DOWN_R005.INP;1 B_FEP_RAD_E01_DOWN_R006.INP;1
B_FEP_RAD_E01_DOWN_R007.INP;1 B_FEP_RAD_E01_DOWN_R008.INP;1
B_FEP_RAD_E01_DOWN_R009.INP;1 B_FEP_RAD_E01_DOWN_R010.INP;1
B_FEP_RAD_E01_DOWN_R011.INP;1 B_FEP_RAD_E01_DOWN_R012.INP;1
B_FEP_RAD_E01_DOWN_R013.INP;1 B_FEP_RAD_E01_DOWN_R014.INP;1
B_FEP_RAD_E01_DOWN_R015.INP;1 B_FEP_RAD_E01_DOWN_R016.INP;1
B_FEP_RAD_E01_DOWN_R017.INP;1 B_FEP_RAD_E01_DOWN_R018.INP;1
B_FEP_RAD_E01_DOWN_R019.INP;1 B_FEP_RAD_E01_DOWN_R020.INP;1
B_FEP_RAD_E01_UP_R001.INP;1 B_FEP_RAD_E01_UP_R002.INP;1
B_FEP_RAD_E01_UP_R003.INP;1 B_FEP_RAD_E01_UP_R004.INP;1
B_FEP_RAD_E01_UP_R005.INP;1 B_FEP_RAD_E01_UP_R006.INP;1
B_FEP_RAD_E01_UP_R007.INP;1 B_FEP_RAD_E01_UP_R008.INP;1
B_FEP_RAD_E01_UP_R009.INP;1 B_FEP_RAD_E01_UP_R010.INP;1
B_FEP_RAD_E01_UP_R011.INP;1 B_FEP_RAD_E01_UP_R012.INP;1
B_FEP_RAD_E01_UP_R013.INP;1 B_FEP_RAD_E01_UP_R014.INP;1
B_FEP_RAD_E01_UP_R015.INP;1 B_FEP_RAD_E01_UP_R016.INP;1
B_FEP_RAD_E01_UP_R017.INP;1 B_FEP_RAD_E01_UP_R018.INP;1
B_FEP_RAD_E01_UP_R019.INP;1 B_FEP_RAD_E01_UP_R020.INP;1
B_FEP_RAD_UND_R001.INP;1 B_FEP_RAD_UND_R002.INP;1
B_FEP_RAD_UND_R003.INP;1 B_FEP_RAD_UND_R004.INP;1
B_FEP_RAD_UND_R005.INP;1 B_FEP_RAD_UND_R006.INP;1
B_FEP_RAD_UND_R007.INP;1 B_FEP_RAD_UND_R008.INP;1
B_FEP_RAD_UND_R009.INP;1 B_FEP_RAD_UND_R010.INP;1
B_FEP_RAD_UND_R011.INP;1 B_FEP_RAD_UND_R012.INP;1
B_FEP_RAD_UND_R013.INP;1 B_FEP_RAD_UND_R014.INP;1
B_FEP_RAD_UND_R015.INP;1 B_FEP_RAD_UND_R016.INP;1
B_FEP_RAD_UND_R017.INP;1 B_FEP_RAD_UND_R018.INP;1
B_FEP_RAD_UND_R019.INP;1 B_FEP_RAD_UND_R020.INP;1
PREBRAG_DOWN_R001.DBG;1 PREBRAG_DOWN_R002.DBG;1
PREBRAG_DOWN_R003.DBG;1 PREBRAG_DOWN_R004.DBG;1
PREBRAG_DOWN_R005.DBG;1 PREBRAG_DOWN_R006.DBG;1
PREBRAG_DOWN_R007.DBG;1 PREBRAG_DOWN_R008.DBG;1
PREBRAG_DOWN_R009.DBG;1 PREBRAG_DOWN_R010.DBG;1
PREBRAG_DOWN_R011.DBG;1 PREBRAG_DOWN_R012.DBG;1
PREBRAG_DOWN_R013.DBG;1 PREBRAG_DOWN_R014.DBG;1
PREBRAG_DOWN_R015.DBG;1 PREBRAG_DOWN_R016.DBG;1
PREBRAG_DOWN_R017.DBG;1 PREBRAG_DOWN_R018.DBG;1
PREBRAG_DOWN_R019.DBG;1 PREBRAG_DOWN_R020.DBG;1
PREBRAG_UND_R001.DBG;1 PREBRAG_UND_R002.DBG;1
PREBRAG_UND_R003.DBG;1 PREBRAG_UND_R004.DBG;1
PREBRAG_UND_R005.DBG;1 PREBRAG_UND_R006.DBG;1
PREBRAG_UND_R007.DBG;1 PREBRAG_UND_R008.DBG;1
PREBRAG_UND_R009.DBG;1 PREBRAG_UND_R010.DBG;1
PREBRAG_UND_R011.DBG;1 PREBRAG_UND_R012.DBG;1
PREBRAG_UND_R013.DBG;1 PREBRAG_UND_R014.DBG;1
PREBRAG_UND_R015.DBG;1 PREBRAG_UND_R016.DBG;1
PREBRAG_UND_R017.DBG;1 PREBRAG_UND_R018.DBG;1
PREBRAG_UND_R019.DBG;1 PREBRAG_UND_R020.DBG;1
PREBRAG_UP_R001.DBG;1 PREBRAG_UP_R002.DBG;1

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PREBRAG_UP_R003.DBG;1 PREBRAG_UP_R004.DBG;1
PREBRAG_UP_R005.DBG;1 PREBRAG_UP_R006.DBG;1
PREBRAG_UP_R007.DBG;1 PREBRAG_UP_R008.DBG;1
PREBRAG_UP_R009.DBG;1 PREBRAG_UP_R010.DBG;1
PREBRAG_UP_R011.DBG;1 PREBRAG_UP_R012.DBG;1
PREBRAG_UP_R013.DBG;1 PREBRAG_UP_R014.DBG;1
PREBRAG_UP_R015.DBG;1 PREBRAG_UP_R016.DBG;1
PREBRAG_UP_R017.DBG;1 PREBRAG_UP_R018.DBG;1
PREBRAG_UP_R019.DBG;1 PREBRAG_UP_R020.DBG;1

Directory F2:[FEP.JEBEAN.RAD.NEW.PREBRAG]

BATCH.COM;2 BATCH1.COM;2 BATCH1.COM;1 MACRO.MAC;10
PREBRAG_E01_DOWN.INP;9 PREBRAG_E01_DOWN.INP;8
PREBRAG_E01_DOWN.INP;7 PREBRAG_E01_UP.INP;5
PREBRAG_E01_UP.INP;4 PREBRAG_E01_UP.INP;3
PREBRAG_UND.INP;74 PREBRAG_UND.INP;73 PREBRAG_UND.INP;72

Directory F2:[FEP.JEBEAN.RAD.PREBRAG]

BATCH1.COM;26 BATCH1.COM;25 BATCH1.COM;24 BATCH1.COM;23
BATCH1.COM;22 BATCH1.COM;21 BATCH1INP.COM;9
BATCH1INP_DOWN.COM;4 BATCH1INP_UP.COM;2 BATCH2.INP;2
BATCH2INP.COM;4 BATCH2INP_DOWN.COM;3 BATCH2INP_UP.COM;2
BATCH3.INP;2 BATCH3INP.COM;4 BATCH4INP.COM;4 BATCHINP.COM;5
BATCHINP_1.COM;2 BATCHINP_9.COM;1 BATCH_DOWN.COM;2 BRAGFLO.INP;2
CAMDAT1.CDB;1 E01_DOWN.DIF;5 FOR008.DAT;2 FOR008.DAT;1
MACRO.MAC;8 MACRO.MAC;7 MACRO.MAC;6 MED.COM;1
MEDIAN.DIR;1 PREBRAG.EXE;57 PREBRAG_E01.INP;1
PREBRAG_E01_DOWN.INP;6 PREBRAG_E01_UP.INP;2
PREBRAG_E01_UP.TMP;2 PREBRAG_UND.INP;72 PREBRAG_UND.INP;71
TEST.INP;1 TEST_E01_UP.INP;1

Directory F2:[FEP.JEBEAN.DGAS]

BRAGFLO.DIR;1 PREBRAG.DIR;1

Directory F2:[FEP.JEBEAN.DGAS.BRAGFLO]

B_FEP_DGAS_E01_DOWN_R001.INP;1 B_FEP_DGAS_E01_DOWN_R002.INP;1
B_FEP_DGAS_E01_DOWN_R003.INP;1 B_FEP_DGAS_E01_DOWN_R004.INP;1
B_FEP_DGAS_E01_DOWN_R005.INP;1 B_FEP_DGAS_E01_DOWN_R006.INP;1
B_FEP_DGAS_E01_DOWN_R007.INP;1 B_FEP_DGAS_E01_DOWN_R008.INP;1
B_FEP_DGAS_E01_DOWN_R009.INP;1 B_FEP_DGAS_E01_DOWN_R010.INP;1
B_FEP_DGAS_E01_DOWN_R011.INP;1 B_FEP_DGAS_E01_DOWN_R012.INP;1
B_FEP_DGAS_E01_DOWN_R013.INP;1 B_FEP_DGAS_E01_DOWN_R014.INP;1
B_FEP_DGAS_E01_DOWN_R015.INP;1 B_FEP_DGAS_E01_DOWN_R016.INP;1
B_FEP_DGAS_E01_DOWN_R017.INP;1 B_FEP_DGAS_E01_DOWN_R018.INP;1
B_FEP_DGAS_E01_DOWN_R019.INP;1 B_FEP_DGAS_E01_DOWN_R020.INP;1

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B_FEP_DGAS_E01_UP_R001.INP;1 B_FEP_DGAS_E01_UP_R002.INP;1
B_FEP_DGAS_E01_UP_R003.INP;1 B_FEP_DGAS_E01_UP_R004.INP;1
B_FEP_DGAS_E01_UP_R005.INP;1 B_FEP_DGAS_E01_UP_R006.INP;1
B_FEP_DGAS_E01_UP_R007.INP;1 B_FEP_DGAS_E01_UP_R008.INP;1
B_FEP_DGAS_E01_UP_R009.INP;1 B_FEP_DGAS_E01_UP_R010.INP;1
B_FEP_DGAS_E01_UP_R011.INP;1 B_FEP_DGAS_E01_UP_R012.INP;1
B_FEP_DGAS_E01_UP_R013.INP;1 B_FEP_DGAS_E01_UP_R014.INP;1
B_FEP_DGAS_E01_UP_R015.INP;1 B_FEP_DGAS_E01_UP_R016.INP;1
B_FEP_DGAS_E01_UP_R017.INP;1 B_FEP_DGAS_E01_UP_R018.INP;1
B_FEP_DGAS_E01_UP_R019.INP;1 B_FEP_DGAS_E01_UP_R020.INP;1
B_FEP_DGAS_UND_R001.INP;1 B_FEP_DGAS_UND_R002.INP;1
B_FEP_DGAS_UND_R003.INP;1 B_FEP_DGAS_UND_R004.INP;1
B_FEP_DGAS_UND_R005.INP;1 B_FEP_DGAS_UND_R006.INP;1
B_FEP_DGAS_UND_R007.INP;1 B_FEP_DGAS_UND_R008.INP;1
B_FEP_DGAS_UND_R009.INP;1 B_FEP_DGAS_UND_R010.INP;1
B_FEP_DGAS_UND_R011.INP;1 B_FEP_DGAS_UND_R012.INP;1
B_FEP_DGAS_UND_R013.INP;1 B_FEP_DGAS_UND_R014.INP;1
B_FEP_DGAS_UND_R015.INP;1 B_FEP_DGAS_UND_R016.INP;1
B_FEP_DGAS_UND_R017.INP;1 B_FEP_DGAS_UND_R018.INP;1
B_FEP_DGAS_UND_R019.INP;1 B_FEP_DGAS_UND_R020.INP;1
XD.FOR;2 XD.FOR;1

Directory F2:[FEP.JEBEAN.DGAS.PREBRAG]

BATCH1.COM;3 BATCH1_E01.COM;2 BATCH1_E01.COM;1
BATCH_E01_DOWN.COM;2 BATCH_E01_UP.COM;2 BATCH_UND.COM;1
MACRO.MAC;3 MACRO.MAC;2 MACRO.MAC;1
PREBRAG_E01_DOWN.INP;8 PREBRAG_E01_DOWN.INP;7
PREBRAG_E01_DOWN.INP;6 PREBRAG_E01_UP.INP;2
PREBRAG_E01_UP.INP;1 PREBRAG_UND.INP;74 PREBRAG_UND.INP;73

Directory F2:[FEP.JEBEAN.BASELINE.PREBRAG]

BATCH1.COM;14 BATCH1.COM;13 BATCH1.COM;12 BATCH_DOWN.COM;2
BRAGFLO_DAN.INP;2 PREBRAG.DBG;3 PREBRAG.DBG;2 PREBRAG.DBG;1
PREBRAG_E01.INP;1 PREBRAG_E01_DOWN.INP;5 PREBRAG_UND.INP;69
PREBRAG_UND_DOWN.INP;2

Directory F2:[FEP.JEBEAN.BASELINE.ALGEBRA]

ALGEBRA_DOWN.INP;1 ALGEBRA_DOWN_R001.CDB;1
ALGEBRA_DOWN_R002.CDB;1 ALGEBRA_DOWN_R003.CDB;1
ALGEBRA_DOWN_R004.CDB;1 ALGEBRA_DOWN_R005.CDB;1
ALGEBRA_DOWN_R006.CDB;1 ALGEBRA_DOWN_R007.CDB;1
ALGEBRA_DOWN_R008.CDB;1 ALGEBRA_DOWN_R009.CDB;1
ALGEBRA_DOWN_R010.CDB;1 ALGEBRA_DOWN_R011.CDB;1

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ALGEBRA_DOWN_R012.CDB;1 ALGEBRA_DOWN_R013.CDB;1
ALGEBRA_DOWN_R014.CDB;1 ALGEBRA_DOWN_R015.CDB;1
ALGEBRA_DOWN_R016.CDB;1 ALGEBRA_DOWN_R017.CDB;1
ALGEBRA_DOWN_R018.CDB;1 ALGEBRA_DOWN_R019.CDB;1
ALGEBRA_DOWN_R020.CDB;1 ALGEBRA_MED.CDB;1 ALGEBRA_NEW.INP;24
ALGEBRA_NODIP.INP;1 ALGEBRA_R001.CDB;1 ALGEBRA_R002.CDB;1
ALGEBRA_R003.CDB;1
ALGEBRA_R004.CDB;1 ALGEBRA_R005.CDB;1 ALGEBRA_R006.CDB;1
ALGEBRA_R007.CDB;1
ALGEBRA_R008.CDB;1 ALGEBRA_R009.CDB;1 ALGEBRA_R010.CDB;1
ALGEBRA_R011.CDB;1
ALGEBRA_R012.CDB;1 ALGEBRA_R013.CDB;1 ALGEBRA_R014.CDB;1
ALGEBRA_R015.CDB;1
ALGEBRA_R016.CDB;1 ALGEBRA_R017.CDB;1 ALGEBRA_R018.CDB;1
ALGEBRA_R019.CDB;1
ALGEBRA_R020.CDB;1 BATCH.COM;4 BATCH1.COM;2 BATCH_DOWN.COM;2

Directory F2:[FEP.BASELINE.UNDIST]

3DX.INP;9 BATCH1.COM;2 BATCH1BO.COM;1 BATCH2.COM;2
BATCH3.COM;2 BATCH4.COM;2 BLOT.PST;6 BO.SMZ;9
BOAV.OUT;3 BOAVG.EXE;14 BOAVG.FOR;21 BOAVG.OBJ;14
BO_100.SMZ;2 BO_100.TBL;1 BO_1000.SMZ;2 BO_1000.TBL;1
BO_10000.SMZ;2 BO_10000.TBL;1 BO_UND.OUT;8
B_FEP_BASE_UND_R001.BIN;1 B_FEP_BASE_UND_R001.CDB;1
B_FEP_BASE_UND_R002.BIN;1 B_FEP_BASE_UND_R002.CDB;1
B_FEP_BASE_UND_R003.BIN;1 B_FEP_BASE_UND_R003.CDB;1
B_FEP_BASE_UND_R004.BIN;1 B_FEP_BASE_UND_R004.CDB;1
B_FEP_BASE_UND_R005.BIN;1 B_FEP_BASE_UND_R005.CDB;1
B_FEP_BASE_UND_R006.BIN;1 B_FEP_BASE_UND_R006.CDB;1
B_FEP_BASE_UND_R007.BIN;3 B_FEP_BASE_UND_R007.CDB;1
B_FEP_BASE_UND_R008.BIN;1 B_FEP_BASE_UND_R008.CDB;1
B_FEP_BASE_UND_R009.BIN;1 B_FEP_BASE_UND_R009.CDB;1
B_FEP_BASE_UND_R010.BIN;1 B_FEP_BASE_UND_R010.CDB;1
B_FEP_BASE_UND_R010_PB.CDB;1 B_FEP_BASE_UND_R011.BIN;1
B_FEP_BASE_UND_R011.CDB;1 B_FEP_BASE_UND_R012.BIN;1
B_FEP_BASE_UND_R012.CDB;1 B_FEP_BASE_UND_R013.BIN;1
B_FEP_BASE_UND_R013.CDB;1 B_FEP_BASE_UND_R014.BIN;1
B_FEP_BASE_UND_R014.CDB;1 B_FEP_BASE_UND_R015.BIN;1
B_FEP_BASE_UND_R015.CDB;1 B_FEP_BASE_UND_R016.BIN;1
B_FEP_BASE_UND_R016.CDB;1 B_FEP_BASE_UND_R017.BIN;1
B_FEP_BASE_UND_R017.CDB;1 B_FEP_BASE_UND_R018.BIN;1
B_FEP_BASE_UND_R018.CDB;1 B_FEP_BASE_UND_R019.BIN;1
B_FEP_BASE_UND_R019.CDB;1 B_FEP_BASE_UND_R020.BIN;1
B_FEP_BASE_UND_R020.CDB;1 FEP01_BASE_UND1_BO.SMZ;7
FEP01_BASE_UND2_BO.SMZ;1 FEP01_BASE_UND_BO.COM;3
FEP01_PRESBRIN_UND.TBL;4 FEP01_PRESBRIN_UND_R001.TBL;2

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FEP01_PRESBRIN_UND_R002.TBL;2 FEP01_PRESBRIN_UND_R003.TBL;2
FEP01_PRESBRIN_UND_R004.TBL;2 FEP01_PRESBRIN_UND_R005.TBL;2
FEP01_PRESBRIN_UND_R006.TBL;2 FEP01_PRESBRIN_UND_R007.TBL;2
FEP01_PRESBRIN_UND_R008.TBL;2 FEP01_PRESBRIN_UND_R009.TBL;2
FEP01_PRESBRIN_UND_R010.TBL;2 FEP01_PRESBRIN_UND_R011.TBL;2
FEP01_PRESBRIN_UND_R012.TBL;2 FEP01_PRESBRIN_UND_R013.TBL;2
FEP01_PRESBRIN_UND_R014.TBL;2 FEP01_PRESBRIN_UND_R015.TBL;2
FEP01_PRESBRIN_UND_R016.TBL;2 FEP01_PRESBRIN_UND_R017.TBL;2
FEP01_PRESBRIN_UND_R018.TBL;2 FEP01_PRESBRIN_UND_R019.TBL;2
FEP01_PRESBRIN_UND_R020.TBL;2 FOR002.DAT;8 GRAPH.PST;9
MACRO.MAC;2 POST_ALG_UND_BO.INP;3 READ_SUM.EXE;2
READ_SUM.FOR;65 READ_SUM.OBJ;2 SPLAT.INP;3 SPLAT.INP;2
SPLAT_BO.INP;3 SPLAT_BO_POR.INP;7 SPLAT_TEST.INP;3 SUM.DAT;2

Directory F2:[FEP.BASELINE.E01_UP]

BATCH1E.COM;2 BATCH1E.LOG;1 BATCH2E.COM;2 BATCH2E.LOG;1
BATCH3E.COM;2 BATCH3E.LOG;1 BATCH4E.COM;2 BATCH4E.LOG;1
BLOT.PST;1 B_FEP_BASE_E01_UP_R001.BIN;1
B_FEP_BASE_E01_UP_R001.CDB;1 B_FEP_BASE_E01_UP_R002.BIN;1
B_FEP_BASE_E01_UP_R002.CDB;1 B_FEP_BASE_E01_UP_R003.BIN;1
B_FEP_BASE_E01_UP_R003.CDB;1 B_FEP_BASE_E01_UP_R004.BIN;1
B_FEP_BASE_E01_UP_R004.CDB;1 B_FEP_BASE_E01_UP_R005.BIN;1
B_FEP_BASE_E01_UP_R005.CDB;1 B_FEP_BASE_E01_UP_R006.BIN;1
B_FEP_BASE_E01_UP_R006.CDB;1 B_FEP_BASE_E01_UP_R007.BIN;1
B_FEP_BASE_E01_UP_R007.CDB;1 B_FEP_BASE_E01_UP_R008.BIN;1
B_FEP_BASE_E01_UP_R008.CDB;1 B_FEP_BASE_E01_UP_R009.BIN;1
B_FEP_BASE_E01_UP_R009.CDB;1 B_FEP_BASE_E01_UP_R010.BIN;1
B_FEP_BASE_E01_UP_R010.CDB;1 B_FEP_BASE_E01_UP_R011.BIN;1
B_FEP_BASE_E01_UP_R011.CDB;1 B_FEP_BASE_E01_UP_R012.BIN;1
B_FEP_BASE_E01_UP_R012.CDB;1 B_FEP_BASE_E01_UP_R013.BIN;1
B_FEP_BASE_E01_UP_R013.CDB;1 B_FEP_BASE_E01_UP_R014.BIN;1
B_FEP_BASE_E01_UP_R014.CDB;1 B_FEP_BASE_E01_UP_R015.BIN;1
B_FEP_BASE_E01_UP_R015.CDB;1 B_FEP_BASE_E01_UP_R016.BIN;1
B_FEP_BASE_E01_UP_R016.CDB;1 B_FEP_BASE_E01_UP_R017.BIN;1
B_FEP_BASE_E01_UP_R017.CDB;1 B_FEP_BASE_E01_UP_R018.BIN;1
B_FEP_BASE_E01_UP_R018.CDB;1 B_FEP_BASE_E01_UP_R019.BIN;1
B_FEP_BASE_E01_UP_R019.CDB;1 B_FEP_BASE_E01_UP_R020.BIN;1
B_FEP_BASE_E01_UP_R020.CDB;1 READ_SUM.EXE;1 READ_SUM.FOR;65
READ_SUM.OBJ;1 SUM.DAT;3

Directory F2:[FEP.BASELINE.E01_DOWN]

BATCH_11_15.COM;6 BATCH_11_15.LOG;1 BATCH_16_20.COM;6 BATCH_16_20.LOG;1
BATCH_1_5.COM;12 BATCH_1_5.LOG;1 BATCH_6_10.COM;6 BATCH_6_10.LOG;1
B_FEP_BASE_E01_DOWN_R001.BIN;1 B_FEP_BASE_E01_DOWN_R001.CDB;1
B_FEP_BASE_E01_DOWN_R002.BIN;1 B_FEP_BASE_E01_DOWN_R002.CDB;1
B_FEP_BASE_E01_DOWN_R003.BIN;1 B_FEP_BASE_E01_DOWN_R003.CDB;1
B_FEP_BASE_E01_DOWN_R004.BIN;1 B_FEP_BASE_E01_DOWN_R004.CDB;1
B_FEP_BASE_E01_DOWN_R005.BIN;1 B_FEP_BASE_E01_DOWN_R005.CDB;1
B_FEP_BASE_E01_DOWN_R006.BIN;1 B_FEP_BASE_E01_DOWN_R006.CDB;1
B_FEP_BASE_E01_DOWN_R007.BIN;2 B_FEP_BASE_E01_DOWN_R007.CDB;1
B_FEP_BASE_E01_DOWN_R008.BIN;1 B_FEP_BASE_E01_DOWN_R008.CDB;1
B_FEP_BASE_E01_DOWN_R009.BIN;1 B_FEP_BASE_E01_DOWN_R009.CDB;1
B_FEP_BASE_E01_DOWN_R010.BIN;1 B_FEP_BASE_E01_DOWN_R010.CDB;1
B_FEP_BASE_E01_DOWN_R011.BIN;1 B_FEP_BASE_E01_DOWN_R011.CDB;1
B_FEP_BASE_E01_DOWN_R012.BIN;1 B_FEP_BASE_E01_DOWN_R012.CDB;1
B_FEP_BASE_E01_DOWN_R013.BIN;1 B_FEP_BASE_E01_DOWN_R013.CDB;1
B_FEP_BASE_E01_DOWN_R014.BIN;1 B_FEP_BASE_E01_DOWN_R014.CDB;1
B_FEP_BASE_E01_DOWN_R015.BIN;1 B_FEP_BASE_E01_DOWN_R015.CDB;1
B_FEP_BASE_E01_DOWN_R016.BIN;1 B_FEP_BASE_E01_DOWN_R016.CDB;1
B_FEP_BASE_E01_DOWN_R017.BIN;1 B_FEP_BASE_E01_DOWN_R017.CDB;1
B_FEP_BASE_E01_DOWN_R018.BIN;1 B_FEP_BASE_E01_DOWN_R018.CDB;1
B_FEP_BASE_E01_DOWN_R019.BIN;1 B_FEP_BASE_E01_DOWN_R019.CDB;1
B_FEP_BASE_E01_DOWN_R020.BIN;1 B_FEP_BASE_E01_DOWN_R020.CDB;1
B_FEP_MCS_E01_DOWN_R009.INP;2 JDSCHRE.DIR;1 READ_SUM.EXE;2
READ_SUM.FOR;68 READ_SUM.OBJ;2 SUM.DAT;3

Directory F2:[FEP.DGAS]

E01_DOWN.DIR;1 E01_UP.DIR;1 UNDIST.DIR;1

Directory F2:[FEP.DGAS.UNDIST]

BATCH_10_11.COM;5 BATCH_12_13.COM;2 BATCH_14.COM;3 BATCH_14_15.COM;2
BATCH_16_17.COM;2 BATCH_18_19.COM;2 BATCH_19.COM;2 BATCH_1_5.COM;3
BATCH_20.COM;2 BATCH_5.COM;1 BATCH_6.COM;7 BATCH_7.COM;5
BATCH_8.COM;2 BATCH_8_9.COM;5 BATCH_9.COM;9
B_FEP_DGAS_UND_R001.BIN;1 B_FEP_DGAS_UND_R001.INP;1
B_FEP_DGAS_UND_R002.BIN;1 B_FEP_DGAS_UND_R002.INP;1
B_FEP_DGAS_UND_R003.BIN;1 B_FEP_DGAS_UND_R003.INP;1
B_FEP_DGAS_UND_R004.BIN;1 B_FEP_DGAS_UND_R004.INP;1
B_FEP_DGAS_UND_R005.BIN;1 B_FEP_DGAS_UND_R005.INP;2
B_FEP_DGAS_UND_R006.BIN;2 B_FEP_DGAS_UND_R006.INP;2
B_FEP_DGAS_UND_R007.BIN;1 B_FEP_DGAS_UND_R007.INP;2
B_FEP_DGAS_UND_R008.BIN;2 B_FEP_DGAS_UND_R008.INP;2
B_FEP_DGAS_UND_R009.BIN;22 B_FEP_DGAS_UND_R009.INP;23
B_FEP_DGAS_UND_R009.RIN;2 B_FEP_DGAS_UND_R009C.BIN;1
B_FEP_DGAS_UND_R010.BIN;1 B_FEP_DGAS_UND_R010.INP;1
B_FEP_DGAS_UND_R011.BIN;1 B_FEP_DGAS_UND_R011.INP;1

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B_FEP_DGAS_UND_R012.BIN;1 B_FEP_DGAS_UND_R012.INP;1
B_FEP_DGAS_UND_R013.BIN;1 B_FEP_DGAS_UND_R013.INP;1
B_FEP_DGAS_UND_R014.BIN;3 B_FEP_DGAS_UND_R014.INP;3
B_FEP_DGAS_UND_R015.BIN;1 B_FEP_DGAS_UND_R015.INP;1
B_FEP_DGAS_UND_R016.BIN;1 B_FEP_DGAS_UND_R016.INP;1
B_FEP_DGAS_UND_R017.BIN;1 B_FEP_DGAS_UND_R017.INP;1
B_FEP_DGAS_UND_R018.BIN;1 B_FEP_DGAS_UND_R018.INP;1
B_FEP_DGAS_UND_R019.BIN;2 B_FEP_DGAS_UND_R019.INP;2
B_FEP_DGAS_UND_R020.BIN;1 B_FEP_DGAS_UND_R020.INP;1
READ_SUM.EXE;2 READ_SUM.FOR;67 READ_SUM.OBJ;2 SUM.DAT;19

Directory F2:[FEP.DGAS.E01_DOWN]

BATCH_1.COM;2 BATCH_10.COM;2 BATCH_11.COM;2 BATCH_11_15.COM;3
BATCH_12.COM;2 BATCH_12.COM;1 BATCH_12_13.COM;2 BATCH_14.COM;2
BATCH_15_16.COM;2 BATCH_16_20.COM;3 BATCH_17_18.COM;2 BATCH_19.COM;2
BATCH_1_4.COM;2 BATCH_1_5.COM;5 BATCH_20.COM;2 BATCH_2_4.COM;2
BATCH_5.COM;2 BATCH_6.COM;2 BATCH_6_10.COM;2 BATCH_7.COM;2
BATCH_8.COM;2 BATCH_9.COM;3 B_FEP_DGAS_E01_DOWN_R001.BIN;1
B_FEP_DGAS_E01_DOWN_R001.INP;1 B_FEP_DGAS_E01_DOWN_R002.BIN;1
B_FEP_DGAS_E01_DOWN_R002.INP;1 B_FEP_DGAS_E01_DOWN_R003.BIN;1
B_FEP_DGAS_E01_DOWN_R003.INP;1 B_FEP_DGAS_E01_DOWN_R004.BIN;1
B_FEP_DGAS_E01_DOWN_R004.INP;1 B_FEP_DGAS_E01_DOWN_R005.BIN;1
B_FEP_DGAS_E01_DOWN_R005.INP;2 B_FEP_DGAS_E01_DOWN_R006.BIN;11
B_FEP_DGAS_E01_DOWN_R006.INP;12 B_FEP_DGAS_E01_DOWN_R007.BIN;1
B_FEP_DGAS_E01_DOWN_R007.INP;2 B_FEP_DGAS_E01_DOWN_R008.BIN;1
B_FEP_DGAS_E01_DOWN_R008.INP;2 B_FEP_DGAS_E01_DOWN_R009.BIN;11
B_FEP_DGAS_E01_DOWN_R009.BIN;10 B_FEP_DGAS_E01_DOWN_R009.INP;1
B_FEP_DGAS_E01_DOWN_R009.RIN;1 B_FEP_DGAS_E01_DOWN_R009A.BIN;1
B_FEP_DGAS_E01_DOWN_R009A.INP;1 B_FEP_DGAS_E01_DOWN_R009B.BIN;1
B_FEP_DGAS_E01_DOWN_R009B.INP;1 B_FEP_DGAS_E01_DOWN_R010.BIN;1
B_FEP_DGAS_E01_DOWN_R010.INP;1 B_FEP_DGAS_E01_DOWN_R011.BIN;1
B_FEP_DGAS_E01_DOWN_R011.INP;2 B_FEP_DGAS_E01_DOWN_R012.BIN;3
B_FEP_DGAS_E01_DOWN_R012.BIN;2 B_FEP_DGAS_E01_DOWN_R012.INP;1
B_FEP_DGAS_E01_DOWN_R013.BIN;1 B_FEP_DGAS_E01_DOWN_R013.INP;1
B_FEP_DGAS_E01_DOWN_R014.BIN;3 B_FEP_DGAS_E01_DOWN_R014.INP;5
B_FEP_DGAS_E01_DOWN_R015.BIN;1 B_FEP_DGAS_E01_DOWN_R015.INP;1
B_FEP_DGAS_E01_DOWN_R016.BIN;1 B_FEP_DGAS_E01_DOWN_R016.INP;1
B_FEP_DGAS_E01_DOWN_R017.BIN;1 B_FEP_DGAS_E01_DOWN_R017.INP;1
B_FEP_DGAS_E01_DOWN_R018.BIN;1 B_FEP_DGAS_E01_DOWN_R018.INP;1
B_FEP_DGAS_E01_DOWN_R019.BIN;5 B_FEP_DGAS_E01_DOWN_R019.INP;5
B_FEP_DGAS_E01_DOWN_R020.BIN;1 B_FEP_DGAS_E01_DOWN_R020.INP;1
READ_SUM.EXE;1 READ_SUM.FOR;66 READ_SUM.OBJ;1 SUM.DAT;22
SUM.DAT;21

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Directory F2:[FEP.RAD.UNDIST]

ALGEBRA_R001.CDB;2 ALGEBRA_R002.CDB;2 ALGEBRA_R003.CDB;2
ALGEBRA_R004.CDB;2
ALGEBRA_R005.CDB;2 ALGEBRA_R006.CDB;2 ALGEBRA_R007.CDB;2
ALGEBRA_R008.CDB;2
ALGEBRA_R009.CDB;2 ALGEBRA_R010.CDB;2 ALGEBRA_R011.CDB;2
ALGEBRA_R012.CDB;2
ALGEBRA_R013.CDB;2 ALGEBRA_R014.CDB;2 ALGEBRA_R015.CDB;2
ALGEBRA_R016.CDB;2
ALGEBRA_R017.CDB;2 ALGEBRA_R018.CDB;2 ALGEBRA_R019.CDB;2
ALGEBRA_R020.CDB;2
BATCH.COM;1 BATCHECHO.COM;5 BATCH_10.COM;4 BATCH_10_11.COM;4
BATCH_11.COM;2 BATCH_11_12.COM;1 BATCH_12_15.COM;4 BATCH_16_20.COM;4
BATCH_1_4.COM;3 BATCH_1_5.COM;3 BATCH_5.COM;4 BATCH_6.COM;4
BATCH_6_10.COM;2 BATCH_6_20.COM;2 BATCH_7.COM;6 BATCH_8.COM;2
BATCH_8_10.COM;1 BATCH_8_9.COM;3 BATCH_9.COM;2 BATCH_9_10.COM;2
BLOT.PST;4 BOAVG.EXE;14 BOAVG.FOR;20
B_FEP05_RAD_UND_BO_R001.CDB;2 B_FEP05_RAD_UND_BO_R002.CDB;2
B_FEP05_RAD_UND_BO_R003.CDB;2 B_FEP05_RAD_UND_BO_R004.CDB;2
B_FEP05_RAD_UND_BO_R005.CDB;2 B_FEP05_RAD_UND_BO_R006.CDB;2
B_FEP05_RAD_UND_BO_R007.CDB;2 B_FEP05_RAD_UND_BO_R008.CDB;2
B_FEP05_RAD_UND_BO_R009.CDB;2 B_FEP05_RAD_UND_BO_R010.CDB;2
B_FEP05_RAD_UND_BO_R011.CDB;2 B_FEP05_RAD_UND_BO_R012.CDB;2
B_FEP05_RAD_UND_BO_R013.CDB;2 B_FEP05_RAD_UND_BO_R014.CDB;2
B_FEP05_RAD_UND_BO_R015.CDB;2 B_FEP05_RAD_UND_BO_R016.CDB;2
B_FEP05_RAD_UND_BO_R017.CDB;2 B_FEP05_RAD_UND_BO_R018.CDB;2
B_FEP05_RAD_UND_BO_R019.CDB;2 B_FEP05_RAD_UND_BO_R020.CDB;2
B_FEP_RAD_UND_R001.BIN;1 B_FEP_RAD_UND_R001.CDB;2
B_FEP_RAD_UND_R001.INP;1 B_FEP_RAD_UND_R002.BIN;1
B_FEP_RAD_UND_R002.CDB;1 B_FEP_RAD_UND_R002.INP;1
B_FEP_RAD_UND_R003.BIN;1 B_FEP_RAD_UND_R003.CDB;2
B_FEP_RAD_UND_R003.INP;1 B_FEP_RAD_UND_R004.BIN;1
B_FEP_RAD_UND_R004.CDB;1 B_FEP_RAD_UND_R004.INP;1
B_FEP_RAD_UND_R005.BIN;2 B_FEP_RAD_UND_R005.CDB;1
B_FEP_RAD_UND_R005.INP;2 B_FEP_RAD_UND_R005.ROT;1
B_FEP_RAD_UND_R006.BIN;2 B_FEP_RAD_UND_R006.CDB;1
B_FEP_RAD_UND_R006.INP;1 B_FEP_RAD_UND_R007.BIN;2
B_FEP_RAD_UND_R007.CDB;1 B_FEP_RAD_UND_R007.INP;2
B_FEP_RAD_UND_R007.ROT;1 B_FEP_RAD_UND_R008.BIN;1
B_FEP_RAD_UND_R008.CDB;1 B_FEP_RAD_UND_R008.INP;1
B_FEP_RAD_UND_R009.BIN;3 B_FEP_RAD_UND_R009.CDB;1
B_FEP_RAD_UND_R009.INP;3 B_FEP_RAD_UND_R010.BIN;2
B_FEP_RAD_UND_R010.CDB;1 B_FEP_RAD_UND_R010.INP;2
B_FEP_RAD_UND_R010.ROT;1 B_FEP_RAD_UND_R011.BIN;2
B_FEP_RAD_UND_R011.CDB;1 B_FEP_RAD_UND_R011.INP;2
B_FEP_RAD_UND_R011.ROT;1 B_FEP_RAD_UND_R012.BIN;2
B_FEP_RAD_UND_R012.CDB;1 B_FEP_RAD_UND_R012.INP;1

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B_FEP_RAD_UND_R013.BIN;1 B_FEP_RAD_UND_R013.CDB;1
B_FEP_RAD_UND_R013.INP;1 B_FEP_RAD_UND_R014.BIN;1
B_FEP_RAD_UND_R014.CDB;1 B_FEP_RAD_UND_R014.INP;1
B_FEP_RAD_UND_R015.BIN;1 B_FEP_RAD_UND_R015.CDB;1
B_FEP_RAD_UND_R015.INP;1 B_FEP_RAD_UND_R016.BIN;1
B_FEP_RAD_UND_R016.CDB;1 B_FEP_RAD_UND_R016.INP;1
B_FEP_RAD_UND_R017.BIN;1 B_FEP_RAD_UND_R017.CDB;1
B_FEP_RAD_UND_R017.INP;1 B_FEP_RAD_UND_R018.BIN;1
B_FEP_RAD_UND_R018.CDB;1 B_FEP_RAD_UND_R018.INP;1
B_FEP_RAD_UND_R019.BIN;1 B_FEP_RAD_UND_R019.CDB;1
B_FEP_RAD_UND_R019.INP;1 B_FEP_RAD_UND_R020.BIN;1
B_FEP_RAD_UND_R020.CDB;1 B_FEP_RAD_UND_R020.INP;1
FOR002.DAT;1 MACRO.MAC;1 READ_SUM.EXE;2 READ_SUM.FOR;64
READ_SUM.OBJ;2 SPLAT_BO_POR.INP;17 SUBMIT_16_20.COM;2 SUBMIT_1_5.COM;2
SUBMIT_6_10.COM;3 SUM.DAT;14

Directory F2:[FEP.RAD.E01_UP]

B001.DIF;1 BATCHCDB_11_20.COM;6 BATCHCDB_1_10.COM;8
BATCH_10.COM;2 BATCH_11_12.COM;1 BATCH_11_15.COM;2 BATCH_12_15.COM;4
BATCH_14.COM;2 BATCH_14_20.COM;2 BATCH_15.COM;3 BATCH_16_20.COM;1
BATCH_1_5.COM;4 BATCH_1_6.COM;2 BATCH_6.COM;2 BATCH_6_10.COM;3
BATCH_7.COM;2 BATCH_8_10.COM;2 BATCH_9.COM;2
B_FEP_RAD_E01_UP_R001.BIN;2 B_FEP_RAD_E01_UP_R001.INP;1
B_FEP_RAD_E01_UP_R002.BIN;2 B_FEP_RAD_E01_UP_R002.INP;1
B_FEP_RAD_E01_UP_R003.BIN;2 B_FEP_RAD_E01_UP_R003.INP;1
B_FEP_RAD_E01_UP_R004.BIN;2 B_FEP_RAD_E01_UP_R004.INP;1
B_FEP_RAD_E01_UP_R005.BIN;2 B_FEP_RAD_E01_UP_R005.INP;1
B_FEP_RAD_E01_UP_R006.BIN;3 B_FEP_RAD_E01_UP_R006.INP;1
B_FEP_RAD_E01_UP_R007.BIN;1 B_FEP_RAD_E01_UP_R007.INP;1
B_FEP_RAD_E01_UP_R008.BIN;1 B_FEP_RAD_E01_UP_R008.INP;1
B_FEP_RAD_E01_UP_R009.BIN;2 B_FEP_RAD_E01_UP_R009.INP;2
B_FEP_RAD_E01_UP_R010.BIN;1 B_FEP_RAD_E01_UP_R010.INP;1
B_FEP_RAD_E01_UP_R011.BIN;1 B_FEP_RAD_E01_UP_R011.INP;1
B_FEP_RAD_E01_UP_R012.BIN;1 B_FEP_RAD_E01_UP_R012.INP;1
B_FEP_RAD_E01_UP_R013.BIN;1 B_FEP_RAD_E01_UP_R013.INP;1
B_FEP_RAD_E01_UP_R014.BIN;5 B_FEP_RAD_E01_UP_R014.INP;3
B_FEP_RAD_E01_UP_R015.BIN;1 B_FEP_RAD_E01_UP_R015.INP;1
B_FEP_RAD_E01_UP_R016.BIN;1 B_FEP_RAD_E01_UP_R016.INP;1
B_FEP_RAD_E01_UP_R017.BIN;1 B_FEP_RAD_E01_UP_R017.INP;1
B_FEP_RAD_E01_UP_R018.BIN;1 B_FEP_RAD_E01_UP_R018.INP;1
B_FEP_RAD_E01_UP_R019.BIN;1 B_FEP_RAD_E01_UP_R019.INP;1
B_FEP_RAD_E01_UP_R020.BIN;1 B_FEP_RAD_E01_UP_R020.INP;1
MACRO.MAC;2 READ_SUM.EXE;1 READ_SUM.FOR;64 READ_SUM.OBJ;1
SUM.DAT;7

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Directory F2:[FEP.RAD.E01_DOWN]

B1.EXE;56 BATCHCDB_11_20.COM;9
BATCHCDB_11_20.LOG;1 BATCHCDB_1_10.COM;11
BATCHCDB_1_10.LOG;2 BATCH_10.COM;2 BATCH_11.COM;2 BATCH_11_12.COM;1
BATCH_11_15.COM;3 BATCH_12_15.COM;4 BATCH_14.COM;3 BATCH_14_20.COM;2
BATCH_15.COM;3 BATCH_16_20.COM;2 BATCH_1_5.COM;5 BATCH_1_6.COM;2
BATCH_5.COM;3 BATCH_6.COM;2 BATCH_6_10.COM;4 BATCH_7.COM;2
BATCH_8_10.COM;2 BATCH_9.COM;2 B_FEP_RAD_E01_DOWN_R001.BIN;1
B_FEP_RAD_E01_DOWN_R001.INP;1 B_FEP_RAD_E01_DOWN_R002.BIN;1
B_FEP_RAD_E01_DOWN_R002.INP;1 B_FEP_RAD_E01_DOWN_R003.BIN;1
B_FEP_RAD_E01_DOWN_R003.INP;1 B_FEP_RAD_E01_DOWN_R004.BIN;1
B_FEP_RAD_E01_DOWN_R004.INP;1 B_FEP_RAD_E01_DOWN_R005.BIN;2
B_FEP_RAD_E01_DOWN_R005.INP;2 B_FEP_RAD_E01_DOWN_R006.BIN;1
B_FEP_RAD_E01_DOWN_R006.INP;1 B_FEP_RAD_E01_DOWN_R007.BIN;2
B_FEP_RAD_E01_DOWN_R007.INP;2 B_FEP_RAD_E01_DOWN_R008.BIN;1
B_FEP_RAD_E01_DOWN_R008.INP;1 B_FEP_RAD_E01_DOWN_R009.BIN;2
B_FEP_RAD_E01_DOWN_R009.INP;2 B_FEP_RAD_E01_DOWN_R010.BIN;1
B_FEP_RAD_E01_DOWN_R010.INP;1 B_FEP_RAD_E01_DOWN_R011.BIN;2
B_FEP_RAD_E01_DOWN_R011.INP;2 B_FEP_RAD_E01_DOWN_R012.BIN;1
B_FEP_RAD_E01_DOWN_R012.INP;1 B_FEP_RAD_E01_DOWN_R013.BIN;1
B_FEP_RAD_E01_DOWN_R013.INP;1 B_FEP_RAD_E01_DOWN_R014.BIN;3
B_FEP_RAD_E01_DOWN_R014.INP;2 B_FEP_RAD_E01_DOWN_R015.BIN;1
B_FEP_RAD_E01_DOWN_R015.INP;1 B_FEP_RAD_E01_DOWN_R016.BIN;1
B_FEP_RAD_E01_DOWN_R016.INP;1 B_FEP_RAD_E01_DOWN_R017.BIN;1
B_FEP_RAD_E01_DOWN_R017.INP;1 B_FEP_RAD_E01_DOWN_R018.BIN;1
B_FEP_RAD_E01_DOWN_R018.INP;1 B_FEP_RAD_E01_DOWN_R019.BIN;1
B_FEP_RAD_E01_DOWN_R019.INP;1 B_FEP_RAD_E01_DOWN_R020.BIN;1
B_FEP_RAD_E01_DOWN_R020.INP;1 MACRO.MAC;1 RAD.DIF;1
READ_SUM.EXE;3 READ_SUM.FOR;65 READ_SUM.OBJ;3 SUM.DAT;9

Directory F1:[FEP.AASHINT.SP.SIDEBAR]

BASE.DIR;1 DGAS.DIR;1 DRZ.DIR;1 MCS.DIR;1
PUD.DIR;1 RAD.DIR;1 VPC.DIR;1 WICK.DIR;1

Directory F1:[FEP.AASHINT.SP.SIDEBAR.BASE.UND]

NUTSSP2F.EXE;11 NUTSSP2F.FOR;12 NUTSSP2F.OBJ;4
NUTS_FEP_BASE_UND_R001.CDB;1 NUTS_FEP_BASE_UND_R002.CDB;1
NUTS_FEP_BASE_UND_R003.CDB;1 NUTS_FEP_BASE_UND_R004.CDB;1
NUTS_FEP_BASE_UND_R005.CDB;1 NUTS_FEP_BASE_UND_R006.CDB;1
NUTS_FEP_BASE_UND_R007.CDB;1 NUTS_FEP_BASE_UND_R008.CDB;1
NUTS_FEP_BASE_UND_R009.CDB;1 NUTS_FEP_BASE_UND_R010.CDB;1
NUTS_FEP_BASE_UND_R011.CDB;1 NUTS_FEP_BASE_UND_R012.CDB;1
NUTS_FEP_BASE_UND_R013.CDB;1 NUTS_FEP_BASE_UND_R014.CDB;1
NUTS_FEP_BASE_UND_R015.CDB;1 NUTS_FEP_BASE_UND_R016.CDB;1
NUTS_FEP_BASE_UND_R017.CDB;1 NUTS_FEP_BASE_UND_R018.CDB;1
NUTS_FEP_BASE_UND_R019.CDB;1 NUTS_FEP_BASE_UND_R020.CDB;1
PARAM.INC;5 POST.COM;6 POSTR7.COM;2 R7.COM;4
UNDSIDE.COM;6 UNDSIDE.IN;2 VAXTIME.FOR;1 VAXTIME.OBJ;1

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Directory F1:[FEP.AASHINT.SP.SIDEBAR.BASE.E01_UP]

E01SIDE.COM;3 E01SIDE.IN;2 NUTSSP2F.EXE;11 NUTSSP2F.FOR;12
NUTSSP2F.OBJ;4 NUTS_FEP_BASE_E01_R001.CDB;1
NUTS_FEP_BASE_E01_R002.CDB;1 NUTS_FEP_BASE_E01_R003.CDB;1
NUTS_FEP_BASE_E01_R004.CDB;1 NUTS_FEP_BASE_E01_R005.CDB;1
NUTS_FEP_BASE_E01_R006.CDB;1 NUTS_FEP_BASE_E01_R007.CDB;1
NUTS_FEP_BASE_E01_R008.CDB;1 NUTS_FEP_BASE_E01_R009.CDB;1
NUTS_FEP_BASE_E01_R010.CDB;1 NUTS_FEP_BASE_E01_R011.CDB;1
NUTS_FEP_BASE_E01_R012.CDB;1 NUTS_FEP_BASE_E01_R013.CDB;1
NUTS_FEP_BASE_E01_R014.CDB;1 NUTS_FEP_BASE_E01_R015.CDB;1
NUTS_FEP_BASE_E01_R016.CDB;1 NUTS_FEP_BASE_E01_R017.CDB;1
NUTS_FEP_BASE_E01_R018.CDB;1 NUTS_FEP_BASE_E01_R019.CDB;1
NUTS_FEP_BASE_E01_R020.CDB;1 PARAM.INC;5 POST.COM;8
POST5-7.COM;2 R5-7.COM;2 VAXTIME.FOR;1 VAXTIME.OBJ;1

Directory F1:[FEP.AASHINT.SP.SIDEBAR.BASE.E01_DOWN]

E01SIDE.COM;7 E01SIDE.IN;3 NUTSSP2F.EXE;11 NUTSSP2F.FOR;12
NUTS_FEP_BASE_E01_DOWN_R001.CDB;1 NUTS_FEP_BASE_E01_DOWN_R002.CDB;1
NUTS_FEP_BASE_E01_DOWN_R003.CDB;1 NUTS_FEP_BASE_E01_DOWN_R004.CDB;1
NUTS_FEP_BASE_E01_DOWN_R005.CDB;1 NUTS_FEP_BASE_E01_DOWN_R006.CDB;1
NUTS_FEP_BASE_E01_DOWN_R007.CDB;1 NUTS_FEP_BASE_E01_DOWN_R008.CDB;1
NUTS_FEP_BASE_E01_DOWN_R009.CDB;1 NUTS_FEP_BASE_E01_DOWN_R010.CDB;1
NUTS_FEP_BASE_E01_DOWN_R011.CDB;1 NUTS_FEP_BASE_E01_DOWN_R012.CDB;1
NUTS_FEP_BASE_E01_DOWN_R013.CDB;1 NUTS_FEP_BASE_E01_DOWN_R014.CDB;1
NUTS_FEP_BASE_E01_DOWN_R015.CDB;1 NUTS_FEP_BASE_E01_DOWN_R016.CDB;1
NUTS_FEP_BASE_E01_DOWN_R017.CDB;1 NUTS_FEP_BASE_E01_DOWN_R018.CDB;1
NUTS_FEP_BASE_E01_DOWN_R019.CDB;1 NUTS_FEP_BASE_E01_DOWN_R020.CDB;1
PARAM.INC;5 POST.COM;9 POST5-7.COM;2 TEMP.COM;3
VAXTIME.FOR;1

Directory F1:[FEP.AASHINT.SP.SIDEBAR.DGAS]

E01_DOWN.DIR;1 UND.DIR;1

Directory F1:[FEP.AASHINT.SP.SIDEBAR.DGAS.UND]

BRAGTEST.DAT;21 FOR009.DAT;1 NUTS.OUT;21 NUTS.OUT;20
NUTS.OUT;19 NUTS.OUT;18 NUTS.OUT;17 NUTS.OUT;16
NUTS.OUT;15 NUTS.OUT;14 NUTS.OUT;13 NUTS.OUT;12
NUTS.OUT;11 NUTS.OUT;10 NUTS.OUT;9 NUTS.OUT;8
NUTS.OUT;7 NUTS.OUT;6 NUTS.OUT;5 NUTS.OUT;4
NUTS.OUT;3 NUTS.OUT;2 NUTS.OUT;1 NUTSSP2F.EXE;11
NUTS_FEP_DGAS_UND_R001.BIN;1 NUTS_FEP_DGAS_UND_R001.CDB;2
NUTS_FEP_DGAS_UND_R001.CDB;1 NUTS_FEP_DGAS_UND_R002.BIN;1
NUTS_FEP_DGAS_UND_R002.CDB;1 NUTS_FEP_DGAS_UND_R003.BIN;1
NUTS_FEP_DGAS_UND_R003.CDB;1 NUTS_FEP_DGAS_UND_R004.BIN;1
NUTS_FEP_DGAS_UND_R004.CDB;1 NUTS_FEP_DGAS_UND_R005.BIN;1

NUTS_FEP_DGAS_UND_R005.CDB;1 NUTS_FEP_DGAS_UND_R006.BIN;1
NUTS_FEP_DGAS_UND_R006.CDB;1 NUTS_FEP_DGAS_UND_R007.BIN;1
NUTS_FEP_DGAS_UND_R007.CDB;1 NUTS_FEP_DGAS_UND_R008.BIN;1
NUTS_FEP_DGAS_UND_R008.CDB;1 NUTS_FEP_DGAS_UND_R009.BIN;1
NUTS_FEP_DGAS_UND_R009.CDB;1 NUTS_FEP_DGAS_UND_R010.BIN;1
NUTS_FEP_DGAS_UND_R010.CDB;1 NUTS_FEP_DGAS_UND_R011.BIN;1
NUTS_FEP_DGAS_UND_R011.CDB;1 NUTS_FEP_DGAS_UND_R012.BIN;1
NUTS_FEP_DGAS_UND_R012.CDB;1 NUTS_FEP_DGAS_UND_R013.BIN;1
NUTS_FEP_DGAS_UND_R013.CDB;1 NUTS_FEP_DGAS_UND_R014.BIN;1
NUTS_FEP_DGAS_UND_R014.CDB;1 NUTS_FEP_DGAS_UND_R015.BIN;1
NUTS_FEP_DGAS_UND_R015.CDB;1 NUTS_FEP_DGAS_UND_R016.BIN;2
NUTS_FEP_DGAS_UND_R016.CDB;1 NUTS_FEP_DGAS_UND_R017.BIN;1
NUTS_FEP_DGAS_UND_R017.CDB;1 NUTS_FEP_DGAS_UND_R018.BIN;1
NUTS_FEP_DGAS_UND_R018.CDB;1 NUTS_FEP_DGAS_UND_R019.BIN;1
NUTS_FEP_DGAS_UND_R019.CDB;1 NUTS_FEP_DGAS_UND_R020.BIN;1
NUTS_FEP_DGAS_UND_R020.CDB;1 POST.COM;13 TEMP.COM;1
UNDSIDE.COM;12 UNDSIDE.IN;1

Directory F1:[FEP.AASHINT.SP.SIDEBAR.DGAS.E01_DOWN]

BATCH.COM;3 BATCH.LOG;3 BRAGTEST.DAT;22 E01SIDE.COM;2
E01SIDE.IN;2 NUTS.OUT;20 NUTS.OUT;19 NUTSSP2F.EXE;11
NUTS_FEP_DGAS_E01_DOWN_R001.CDB;1 NUTS_FEP_DGAS_E01_DOWN_R002.CDB;1
NUTS_FEP_DGAS_E01_DOWN_R003.CDB;1 NUTS_FEP_DGAS_E01_DOWN_R004.CDB;1
NUTS_FEP_DGAS_E01_DOWN_R005.CDB;1 NUTS_FEP_DGAS_E01_DOWN_R006.CDB;1
NUTS_FEP_DGAS_E01_DOWN_R007.CDB;1 NUTS_FEP_DGAS_E01_DOWN_R008.CDB;1
NUTS_FEP_DGAS_E01_DOWN_R009.CDB;1 NUTS_FEP_DGAS_E01_DOWN_R010.CDB;1
NUTS_FEP_DGAS_E01_DOWN_R011.CDB;1 NUTS_FEP_DGAS_E01_DOWN_R012.BIN;1
NUTS_FEP_DGAS_E01_DOWN_R012.CDB;1 NUTS_FEP_DGAS_E01_DOWN_R013.CDB;1
NUTS_FEP_DGAS_E01_DOWN_R014.CDB;1 NUTS_FEP_DGAS_E01_DOWN_R015.CDB;1
NUTS_FEP_DGAS_E01_DOWN_R016.CDB;1 NUTS_FEP_DGAS_E01_DOWN_R017.CDB;1
NUTS_FEP_DGAS_E01_DOWN_R018.CDB;1 NUTS_FEP_DGAS_E01_DOWN_R019.CDB;1
NUTS_FEP_DGAS_E01_DOWN_R020.CDB;1 POST.COM;20 POST9.COM;2
TEMP.COM;2 V9.COM;2

Directory F1:[FEP.AASHINT.SP.SIDEBAR.RAD]

E01_DOWN.DIR;1 E01_UP.DIR;1 READ.ME;2 READ.ME;1
UND.DIR;1

Directory F1:[FEP.AASHINT.SP.SIDEBAR.RAD.UND]

BRAGTEST.DAT;4 NUTS.OUT;24 NUTS.OUT;23 NUTS.OUT;22
NUTS.OUT;21 NUTS.OUT;20 NUTSSP2F.EXE;11 NUTSSP2F.FOR;12
NUTS_FEP_RAD_UND_R001.BIN;2 NUTS_FEP_RAD_UND_R001.CDB;1
NUTS_FEP_RAD_UND_R002.BIN;1 NUTS_FEP_RAD_UND_R002.CDB;1
NUTS_FEP_RAD_UND_R003.BIN;1 NUTS_FEP_RAD_UND_R003.CDB;1
NUTS_FEP_RAD_UND_R004.BIN;1 NUTS_FEP_RAD_UND_R004.CDB;1
NUTS_FEP_RAD_UND_R005.BIN;2 NUTS_FEP_RAD_UND_R005.CDB;2

NUTS_FEP_RAD_UND_R005.CDB;1 NUTS_FEP_RAD_UND_R006.BIN;1
NUTS_FEP_RAD_UND_R006.CDB;1 NUTS_FEP_RAD_UND_R007.BIN;2
NUTS_FEP_RAD_UND_R007.CDB;2 NUTS_FEP_RAD_UND_R007.CDB;1
NUTS_FEP_RAD_UND_R008.BIN;1 NUTS_FEP_RAD_UND_R008.CDB;1
NUTS_FEP_RAD_UND_R009.BIN;1 NUTS_FEP_RAD_UND_R009.CDB;1
NUTS_FEP_RAD_UND_R010.BIN;2 NUTS_FEP_RAD_UND_R010.CDB;2
NUTS_FEP_RAD_UND_R010.CDB;1 NUTS_FEP_RAD_UND_R011.BIN;2
NUTS_FEP_RAD_UND_R011.CDB;2 NUTS_FEP_RAD_UND_R011.CDB;1
NUTS_FEP_RAD_UND_R012.BIN;1 NUTS_FEP_RAD_UND_R012.CDB;1
NUTS_FEP_RAD_UND_R013.BIN;1 NUTS_FEP_RAD_UND_R013.CDB;1
NUTS_FEP_RAD_UND_R014.BIN;1 NUTS_FEP_RAD_UND_R014.CDB;1
NUTS_FEP_RAD_UND_R015.BIN;1 NUTS_FEP_RAD_UND_R015.CDB;1
NUTS_FEP_RAD_UND_R016.BIN;1 NUTS_FEP_RAD_UND_R016.CDB;1
NUTS_FEP_RAD_UND_R017.BIN;1 NUTS_FEP_RAD_UND_R017.CDB;1
NUTS_FEP_RAD_UND_R018.BIN;1 NUTS_FEP_RAD_UND_R018.CDB;1
NUTS_FEP_RAD_UND_R019.BIN;1 NUTS_FEP_RAD_UND_R019.CDB;1
NUTS_FEP_RAD_UND_R020.BIN;1 NUTS_FEP_RAD_UND_R020.CDB;1
PARAM.INC;5 POST.COM;12 UNDSIDE.COM;11 UNDSIDE.IN;1
V571011.COM;2 VAXTIME.FOR;1

Directory F1:[FEP.AASHINT.SP.SIDEBAR.RAD.E01_UP]

ALI.IN;1 BRAGTEST.DAT;1 E01SIDE.COM;9 E01SIDE.IN;1
NUTS.OUT;20 NUTS.OUT;19 NUTS.OUT;18 NUTS.OUT;17
NUTS.OUT;16 NUTS.OUT;15 NUTS.OUT;14 NUTS.OUT;13
NUTS.OUT;12 NUTS.OUT;11 NUTS.OUT;10 NUTS.OUT;9
NUTS.OUT;8 NUTS.OUT;7 NUTSSP2F.EXE;11 NUTSSP2F.FOR;12
NUTS_FEP_RAD_E01_UP_R001.BIN;1 NUTS_FEP_RAD_E01_UP_R001.CDB;1
NUTS_FEP_RAD_E01_UP_R002.BIN;1 NUTS_FEP_RAD_E01_UP_R002.CDB;1
NUTS_FEP_RAD_E01_UP_R003.BIN;1 NUTS_FEP_RAD_E01_UP_R003.CDB;1
NUTS_FEP_RAD_E01_UP_R004.BIN;1 NUTS_FEP_RAD_E01_UP_R004.CDB;1
NUTS_FEP_RAD_E01_UP_R005.BIN;1 NUTS_FEP_RAD_E01_UP_R005.CDB;1
NUTS_FEP_RAD_E01_UP_R006.BIN;1 NUTS_FEP_RAD_E01_UP_R006.CDB;1
NUTS_FEP_RAD_E01_UP_R007.BIN;1 NUTS_FEP_RAD_E01_UP_R007.CDB;1
NUTS_FEP_RAD_E01_UP_R008.BIN;1 NUTS_FEP_RAD_E01_UP_R008.CDB;1
NUTS_FEP_RAD_E01_UP_R009.BIN;1 NUTS_FEP_RAD_E01_UP_R009.CDB;1
NUTS_FEP_RAD_E01_UP_R010.BIN;1 NUTS_FEP_RAD_E01_UP_R010.CDB;1
NUTS_FEP_RAD_E01_UP_R011.BIN;1 NUTS_FEP_RAD_E01_UP_R011.CDB;1
NUTS_FEP_RAD_E01_UP_R012.BIN;1 NUTS_FEP_RAD_E01_UP_R012.CDB;1
NUTS_FEP_RAD_E01_UP_R013.BIN;1 NUTS_FEP_RAD_E01_UP_R013.CDB;1
NUTS_FEP_RAD_E01_UP_R014.BIN;2 NUTS_FEP_RAD_E01_UP_R014.CDB;1
NUTS_FEP_RAD_E01_UP_R015.BIN;1 NUTS_FEP_RAD_E01_UP_R015.CDB;1
NUTS_FEP_RAD_E01_UP_R016.BIN;1 NUTS_FEP_RAD_E01_UP_R016.CDB;1
NUTS_FEP_RAD_E01_UP_R017.BIN;1 NUTS_FEP_RAD_E01_UP_R017.CDB;1
NUTS_FEP_RAD_E01_UP_R018.BIN;1 NUTS_FEP_RAD_E01_UP_R018.CDB;1
NUTS_FEP_RAD_E01_UP_R019.BIN;1 NUTS_FEP_RAD_E01_UP_R019.CDB;1
NUTS_FEP_RAD_E01_UP_R020.BIN;1 NUTS_FEP_RAD_E01_UP_R020.CDB;1
PARAM.INC;5 POST.COM;16 POST1-7.COM;1 POST11UP.COM;1
POST58910.COM;2 R11UP.COM;1 R9UP.COM;1 V14.COM;2
V58910.COM;1 VAXTIME.FOR;1

Directory F1:[FEP.AASHINT.SP.SIDEBAR.RAD.E01_DOWN]

BRAGTEST.DAT;10 E01SIDE.COM;10 E01SIDE.IN;1 E5UP.COM;1
E6UP.COM;1 FOR010.DAT;1 NUTS.OUT;23 NUTS.OUT;22
NUTS.OUT;21 NUTS.OUT;20 NUTSSP2F.EXE;11 NUTSSP2F.FOR;12
NUTS_FEP_RAD_E01_DOWN_R001.BIN;1 NUTS_FEP_RAD_E01_DOWN_R001.CDB;1
NUTS_FEP_RAD_E01_DOWN_R002.BIN;1 NUTS_FEP_RAD_E01_DOWN_R002.CDB;1
NUTS_FEP_RAD_E01_DOWN_R003.BIN;1 NUTS_FEP_RAD_E01_DOWN_R003.CDB;1
NUTS_FEP_RAD_E01_DOWN_R004.BIN;1 NUTS_FEP_RAD_E01_DOWN_R004.CDB;1
NUTS_FEP_RAD_E01_DOWN_R005.BIN;2 NUTS_FEP_RAD_E01_DOWN_R005.CDB;2
NUTS_FEP_RAD_E01_DOWN_R005.CDB;1 NUTS_FEP_RAD_E01_DOWN_R006.BIN;1
NUTS_FEP_RAD_E01_DOWN_R006.CDB;1 NUTS_FEP_RAD_E01_DOWN_R007.BIN;2
NUTS_FEP_RAD_E01_DOWN_R007.CDB;2 NUTS_FEP_RAD_E01_DOWN_R007.CDB;1
NUTS_FEP_RAD_E01_DOWN_R008.BIN;1 NUTS_FEP_RAD_E01_DOWN_R008.CDB;1
NUTS_FEP_RAD_E01_DOWN_R009.BIN;1 NUTS_FEP_RAD_E01_DOWN_R009.CDB;1
NUTS_FEP_RAD_E01_DOWN_R010.BIN;1 NUTS_FEP_RAD_E01_DOWN_R010.CDB;1
NUTS_FEP_RAD_E01_DOWN_R011.BIN;2 NUTS_FEP_RAD_E01_DOWN_R011.CDB;2
NUTS_FEP_RAD_E01_DOWN_R011.CDB;1 NUTS_FEP_RAD_E01_DOWN_R012.BIN;1
NUTS_FEP_RAD_E01_DOWN_R012.CDB;1 NUTS_FEP_RAD_E01_DOWN_R013.BIN;1
NUTS_FEP_RAD_E01_DOWN_R013.CDB;1 NUTS_FEP_RAD_E01_DOWN_R014.BIN;1
NUTS_FEP_RAD_E01_DOWN_R014.CDB;1 NUTS_FEP_RAD_E01_DOWN_R015.BIN;1
NUTS_FEP_RAD_E01_DOWN_R015.CDB;1 NUTS_FEP_RAD_E01_DOWN_R016.BIN;1
NUTS_FEP_RAD_E01_DOWN_R016.CDB;1 NUTS_FEP_RAD_E01_DOWN_R017.BIN;1
NUTS_FEP_RAD_E01_DOWN_R017.CDB;1 NUTS_FEP_RAD_E01_DOWN_R018.BIN;1
NUTS_FEP_RAD_E01_DOWN_R018.CDB;1 NUTS_FEP_RAD_E01_DOWN_R019.BIN;1
NUTS_FEP_RAD_E01_DOWN_R019.CDB;1 NUTS_FEP_RAD_E01_DOWN_R020.BIN;1
NUTS_FEP_RAD_E01_DOWN_R020.CDB;1 PARAM.INC;5 POST.COM;18
POST578910.COM;2 POST6.COM;1 R11UP.COM;1 R5.COM;1
TEMP.COM;3 TEMP1.COM;2 V14.COM;2 V15TO20.COM;2
V5711.COM;2 V578910.COM;1 VAXTIME.FOR;1

Directory F2:[FEP.GARNER]

ALGEBRA.INP;1 BASE.DIR;1 BLOW.DIR;1 CCDFPLOT.COM;4
CCDFPLOT.COM;3 CCDFPLOT.COM;2 CCDFPLOT.COM;1 CCDFPLOT.OUT;1
CCDFPLOT.PST;4 CCDFPLOT.PST;3 CCDFPLOT.PST;2 CCDFPLOT.PST;1
CCDFPLOT_E0.INP;8 CCDFPLOT_E0.INP;7 CCDFPLOT_E0.INP;6 CCDFPLOT_E0.INP;5
CCDFPLOT_E0.INP;4 CCDFPLOT_E0.INP;3 CCDFPLOT_E0.INP;2 CCDFPLOT_E0.INP;1
CCDFPLOT_E1.INP;7 CCDFPLOT_E1.INP;6 CCDFPLOT_E1.INP;5 CCDFPLOT_E1.INP;4
CCDFPLOT_E1.INP;3 CCDFPLOT_E1.INP;2 CCDFPLOT_E1.INP;1 CCDFPLOT_E1D.INP;8
CCDFPLOT_E1D.INP;7 CCDFPLOT_E1D.INP;6 CCDFPLOT_E1D.INP;5 CCDFPLOT_E1D.INP;4
CCDFPLOT_E1D.INP;3 CCDFPLOT_E1D.INP;2 CCDFPLOT_E1D.INP;1 CCDFPLOT_MBC.COM;1
CCDFPLOT_MBE0.INP;8 CCDFPLOT_MBE0.INP;7 CCDFPLOT_MBE0.INP;6
CCDFPLOT_MBE0.INP;5
CCDFPLOT_MBE0.INP;4 CCDFPLOT_MBE0.INP;3 CCDFPLOT_MBE0.INP;2
CCDFPLOT_MBE0.INP;1

CCDFPLOT_MBE0C.INP;7 CCDFPLOT_MBE0C.INP;1
CCDFPLOT_MBE1.INP;8 CCDFPLOT_MBE1.INP;7 CCDFPLOT_MBE1.INP;6
CCDFPLOT_MBE1.INP;5
CCDFPLOT_MBE1.INP;4 CCDFPLOT_MBE1.INP;3 CCDFPLOT_MBE1.INP;2
CCDFPLOT_MBE1.INP;1
CCDFPLOT_MBE1C.INP;7 CCDFPLOT_MBE1C.INP;1
CCDFPLOT_MBE1D.INP;8 CCDFPLOT_MBE1D.INP;7
CCDFPLOT_MBE1D.INP;6 CCDFPLOT_MBE1D.INP;5
CCDFPLOT_MBE1D.INP;4 CCDFPLOT_MBE1D.INP;3
CCDFPLOT_MBE1D.INP;2 CCDFPLOT_MBE1D.INP;1
CCDFPLOT_MBE1DC.INP;7 CCDFPLOT_MBE1DC.INP;1
DGAS.DIR;1 DRZ.DIR;1 GENNET_S00.CDB;1 GENNET_S00.INP;1
LHS_S00_S_R001.CDB;1 LHS_S00_S_R002.CDB;1
LHS_S00_S_R003.CDB;1 LHS_S00_S_R004.CDB;1
LHS_S00_S_R005.CDB;1 LHS_S00_S_R006.CDB;1
LHS_S00_S_R007.CDB;1 LHS_S00_S_R008.CDB;1
LHS_S00_S_R009.CDB;1 LHS_S00_S_R010.CDB;1
LHS_S00_S_R011.CDB;1 LHS_S00_S_R012.CDB;1
LHS_S00_S_R013.CDB;1 LHS_S00_S_R014.CDB;1
LHS_S00_S_R015.CDB;1 LHS_S00_S_R016.CDB;1
LHS_S00_S_R017.CDB;1 LHS_S00_S_R018.CDB;1
LHS_S00_S_R019.CDB;1 LHS_S00_S_R020.CDB;1
MATSET_S00.CDB;1 MATSET_S00.INP;1 MCS.DIR;1 PLOT.N1;1
PLOT.N10;1 PLOT.N2;1 PLOT.N3;1 PLOT.N4;1
PLOT.N5;1 PLOT.N6;1 PLOT.N7;1 PLOT.N8;1
PLOT.N9;1 POSTLHS_S00.INP;1 PUD.DIR;1 RAD.DIR;1
SCENARIO_00.LOG;1 SECO.DIR;1 VPC.DIR;1 WICK.DIR;1

Directory F2:[FEP.GARNER.DGAS]

BRAGFLO.DIR;1 PANEL_CUL.DIR;1 PANEL_MB.DIR;1

Directory F2:[FEP.GARNER.DGAS.BRAGFLO]

ALGEBRA.INP;1 ALG_DOWN.INP;1 ALG_E1.COM;5 ALG_E1D.COM;6
ALG_E1D.COM;5 ALG_UND.COM;6 ALG_UND.COM;5 ALG_UND.COM;4
DIAG.DIR;1 JUNK.COM;4 JUNK.COM;3 JUNK.COM;2
JUNK.COM;1 NUTS_E1.DAT;3 NUTS_S00_01_001.CDB;1
NUTS_S00_01_002.CDB;1 NUTS_S00_01_003.CDB;1
NUTS_S00_01_004.CDB;1 NUTS_S00_01_005.CDB;1
NUTS_S00_01_006.CDB;1 NUTS_S00_01_007.CDB;1
NUTS_S00_01_008.CDB;1 NUTS_S00_01_009.CDB;1
NUTS_S00_01_010.CDB;1 NUTS_S00_01_011.CDB;1
NUTS_S00_01_012.CDB;1 NUTS_S00_01_013.CDB;1
NUTS_S00_01_014.CDB;1 NUTS_S00_01_015.CDB;1
NUTS_S00_01_016.CDB;1 NUTS_S00_01_017.CDB;1
NUTS_S00_01_018.CDB;1 NUTS_S00_01_019.CDB;1

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NUTS_S00_01_020.CDB;1 NUTS_S01D_01_001.CDB;1
NUTS_S01D_01_002.CDB;1 NUTS_S01D_01_003.CDB;1
NUTS_S01D_01_004.CDB;1 NUTS_S01D_01_005.CDB;1
NUTS_S01D_01_006.CDB;1 NUTS_S01D_01_007.CDB;1
NUTS_S01D_01_008.CDB;1 NUTS_S01D_01_009.CDB;1
NUTS_S01D_01_010.CDB;1 NUTS_S01D_01_011.CDB;1
NUTS_S01D_01_012.CDB;1 NUTS_S01D_01_013.CDB;1
NUTS_S01D_01_014.CDB;1 NUTS_S01D_01_015.CDB;1
NUTS_S01D_01_016.CDB;1 NUTS_S01D_01_017.CDB;1
NUTS_S01D_01_018.CDB;1 NUTS_S01D_01_019.CDB;1
NUTS_S01D_01_020.CDB;1 NUTS_UND.DAT;3 SPLAT.INP;1
SUMM.INP;1 SUMM2.INP;4 SUMM2.LOG;4 SUMM2_E1.INP;1
SUMM2_ERROR.LOG;4 SUMMARIZE.INP;1

Directory F2:[FEP.GARNER.DGAS.PANEL_CUL]

BATCHA0.COM;2 BATCHA1.COM;2 BATCHA1D.COM;2 BATCHALL.COM;2
BATCHE0.COM;2 BATCHE1.COM;2 BATCHE1D.COM;2 CCDF.DIR;1
JUNK.COM;6 JUNK.COM;5 JUNK.COM;4
PANEL_S00_S_R001.CDB;2 PANEL_S00_S_R001.DBG;1
PANEL_S00_S_R002.CDB;2 PANEL_S00_S_R002.DBG;1
PANEL_S00_S_R003.CDB;2 PANEL_S00_S_R003.DBG;1
PANEL_S00_S_R004.CDB;2 PANEL_S00_S_R004.DBG;1
PANEL_S00_S_R005.CDB;2 PANEL_S00_S_R005.DBG;1
PANEL_S00_S_R006.CDB;2 PANEL_S00_S_R006.DBG;1
PANEL_S00_S_R007.CDB;2 PANEL_S00_S_R007.DBG;1
PANEL_S00_S_R008.CDB;2 PANEL_S00_S_R008.DBG;1
PANEL_S00_S_R009.CDB;2 PANEL_S00_S_R009.DBG;1
PANEL_S00_S_R010.CDB;2 PANEL_S00_S_R010.DBG;1
PANEL_S00_S_R011.CDB;2 PANEL_S00_S_R011.DBG;1
PANEL_S00_S_R012.CDB;2 PANEL_S00_S_R012.DBG;1
PANEL_S00_S_R013.CDB;2 PANEL_S00_S_R013.DBG;1
PANEL_S00_S_R014.CDB;2 PANEL_S00_S_R014.DBG;1
PANEL_S00_S_R015.CDB;2 PANEL_S00_S_R015.DBG;1
PANEL_S00_S_R016.CDB;2 PANEL_S00_S_R016.DBG;1
PANEL_S00_S_R017.CDB;2 PANEL_S00_S_R017.DBG;1
PANEL_S00_S_R018.CDB;2 PANEL_S00_S_R018.DBG;1
PANEL_S00_S_R019.CDB;2 PANEL_S00_S_R019.DBG;1
PANEL_S00_S_R020.CDB;2 PANEL_S00_S_R020.DBG;1
PANEL_S01D_S_R001.CDB;2 PANEL_S01D_S_R001.DBG;1
PANEL_S01D_S_R002.CDB;2 PANEL_S01D_S_R002.DBG;1
PANEL_S01D_S_R003.CDB;2 PANEL_S01D_S_R003.DBG;1
PANEL_S01D_S_R004.CDB;2 PANEL_S01D_S_R004.DBG;1
PANEL_S01D_S_R005.CDB;2 PANEL_S01D_S_R005.DBG;1
PANEL_S01D_S_R006.CDB;2 PANEL_S01D_S_R006.DBG;1
PANEL_S01D_S_R007.CDB;2 PANEL_S01D_S_R007.DBG;1
PANEL_S01D_S_R008.CDB;2 PANEL_S01D_S_R008.DBG;1

PANEL_S01D_S_R009.CDB;2 PANEL_S01D_S_R009.DBG;1
PANEL_S01D_S_R010.CDB;2 PANEL_S01D_S_R010.DBG;1
PANEL_S01D_S_R011.CDB;2 PANEL_S01D_S_R011.DBG;1
PANEL_S01D_S_R012.CDB;2 PANEL_S01D_S_R012.DBG;1
PANEL_S01D_S_R013.CDB;2 PANEL_S01D_S_R013.DBG;1
PANEL_S01D_S_R014.CDB;2 PANEL_S01D_S_R014.DBG;1
PANEL_S01D_S_R015.CDB;2 PANEL_S01D_S_R015.DBG;1
PANEL_S01D_S_R016.CDB;2 PANEL_S01D_S_R016.DBG;1
PANEL_S01D_S_R017.CDB;2 PANEL_S01D_S_R017.DBG;1
PANEL_S01D_S_R018.CDB;2 PANEL_S01D_S_R018.DBG;1
PANEL_S01D_S_R019.CDB;2 PANEL_S01D_S_R019.DBG;1
PANEL_S01D_S_R020.CDB;2 PANEL_S01D_S_R020.DBG;1

Directory F2:[FEP.GARNER.DGAS.PANEL_MB]

BATCHA0.COM;2 BATCHA1.COM;2 BATCHA1D.COM;2 BATCHALL.COM;2
BATCHE0.COM;2 BATCHE1.COM;2 BATCHE1D.COM;2 CCDF.DIR;1
JUNK.COM;6 PANEL_S00_S_R001.CDB;2
PANEL_S00_S_R001.DBG;1 PANEL_S00_S_R002.CDB;2
PANEL_S00_S_R002.DBG;1 PANEL_S00_S_R003.CDB;2
PANEL_S00_S_R003.DBG;1 PANEL_S00_S_R004.CDB;2
PANEL_S00_S_R004.DBG;1 PANEL_S00_S_R005.CDB;2
PANEL_S00_S_R005.DBG;1 PANEL_S00_S_R006.CDB;2
PANEL_S00_S_R006.DBG;1 PANEL_S00_S_R007.CDB;2
PANEL_S00_S_R007.DBG;1 PANEL_S00_S_R008.CDB;2
PANEL_S00_S_R008.DBG;1 PANEL_S00_S_R009.CDB;2
PANEL_S00_S_R009.DBG;1 PANEL_S00_S_R010.CDB;2
PANEL_S00_S_R010.DBG;1 PANEL_S00_S_R011.CDB;2
PANEL_S00_S_R011.DBG;1 PANEL_S00_S_R012.CDB;2
PANEL_S00_S_R012.DBG;1 PANEL_S00_S_R013.CDB;2
PANEL_S00_S_R013.DBG;1 PANEL_S00_S_R014.CDB;2
PANEL_S00_S_R014.DBG;1 PANEL_S00_S_R015.CDB;2
PANEL_S00_S_R015.DBG;1 PANEL_S00_S_R016.CDB;2
PANEL_S00_S_R016.DBG;1 PANEL_S00_S_R017.CDB;2
PANEL_S00_S_R017.DBG;1 PANEL_S00_S_R018.CDB;2
PANEL_S00_S_R018.DBG;1 PANEL_S00_S_R019.CDB;2
PANEL_S00_S_R019.DBG;1 PANEL_S00_S_R020.CDB;2
PANEL_S00_S_R020.DBG;1 PANEL_S01D_S_R001.CDB;2
PANEL_S01D_S_R001.DBG;1 PANEL_S01D_S_R002.CDB;2
PANEL_S01D_S_R002.DBG;1 PANEL_S01D_S_R003.CDB;2
PANEL_S01D_S_R003.DBG;1 PANEL_S01D_S_R004.CDB;2
PANEL_S01D_S_R004.DBG;1 PANEL_S01D_S_R005.CDB;2
PANEL_S01D_S_R005.DBG;1 PANEL_S01D_S_R006.CDB;2
PANEL_S01D_S_R006.DBG;1 PANEL_S01D_S_R007.CDB;2
PANEL_S01D_S_R007.DBG;1 PANEL_S01D_S_R008.CDB;2
PANEL_S01D_S_R008.DBG;1 PANEL_S01D_S_R009.CDB;2
PANEL_S01D_S_R009.DBG;1 PANEL_S01D_S_R010.CDB;2
PANEL_S01D_S_R010.DBG;1 PANEL_S01D_S_R011.CDB;2

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PANEL_S01D_S_R011.DBG;1
PANEL_S01D_S_R012.DBG;1
PANEL_S01D_S_R013.DBG;1
PANEL_S01D_S_R014.DBG;1
PANEL_S01D_S_R015.DBG;1
PANEL_S01D_S_R016.DBG;1
PANEL_S01D_S_R017.DBG;1
PANEL_S01D_S_R018.DBG;1
PANEL_S01D_S_R019.DBG;1
PANEL_S01D_S_R020.DBG;1
PANEL_S01D_S_R012.CDB;2
PANEL_S01D_S_R013.CDB;2
PANEL_S01D_S_R014.CDB;2
PANEL_S01D_S_R015.CDB;2
PANEL_S01D_S_R016.CDB;2
PANEL_S01D_S_R017.CDB;2
PANEL_S01D_S_R018.CDB;2
PANEL_S01D_S_R019.CDB;2
PANEL_S01D_S_R020.CDB;2

Directory F2:[FEP.GARNER.RAD]

BRAGFLO.DIR;1 PANEL_CUL.DIR;1 PANEL_MB.DIR;1

Directory F2:[FEP.GARNER.RAD.BRAGFLO]

ALGEBRA.INP;1 ALG_DOWN.INP;1 ALG_E1.COM;5 ALG_E1.COM;4
ALG_E1.COM;3 ALG_E1D.COM;5 ALG_E1D.COM;4 ALG_E1D.COM;3
ALG_UND.COM;4 ALG_UND.COM;3 ALG_UND.COM;2 DIAG.DIR;1
NUTS_E1.DAT;3 NUTS_S00_01_001.CDB;1
NUTS_S00_01_002.CDB;1 NUTS_S00_01_003.CDB;1
NUTS_S00_01_004.CDB;1 NUTS_S00_01_005.CDB;1
NUTS_S00_01_006.CDB;1 NUTS_S00_01_007.CDB;1
NUTS_S00_01_008.CDB;1 NUTS_S00_01_009.CDB;1
NUTS_S00_01_010.CDB;1 NUTS_S00_01_011.CDB;1
NUTS_S00_01_012.CDB;1 NUTS_S00_01_013.CDB;1
NUTS_S00_01_014.CDB;1 NUTS_S00_01_015.CDB;1
NUTS_S00_01_016.CDB;1 NUTS_S00_01_017.CDB;1
NUTS_S00_01_018.CDB;1 NUTS_S00_01_019.CDB;1
NUTS_S00_01_020.CDB;1 NUTS_S01D_01_001.CDB;1
NUTS_S01D_01_002.CDB;1 NUTS_S01D_01_003.CDB;1
NUTS_S01D_01_004.CDB;1 NUTS_S01D_01_005.CDB;1
NUTS_S01D_01_006.CDB;1 NUTS_S01D_01_007.CDB;1
NUTS_S01D_01_008.CDB;1 NUTS_S01D_01_009.CDB;1
NUTS_S01D_01_010.CDB;1 NUTS_S01D_01_011.CDB;1
NUTS_S01D_01_012.CDB;1 NUTS_S01D_01_013.CDB;1
NUTS_S01D_01_014.CDB;1 NUTS_S01D_01_015.CDB;1
NUTS_S01D_01_016.CDB;1 NUTS_S01D_01_017.CDB;1
NUTS_S01D_01_018.CDB;1 NUTS_S01D_01_019.CDB;1
NUTS_S01D_01_020.CDB;1 NUTS_S01_01_001.CDB;1
NUTS_S01_01_002.CDB;1 NUTS_S01_01_003.CDB;1
NUTS_S01_01_004.CDB;1 NUTS_S01_01_005.CDB;1
NUTS_S01_01_006.CDB;1 NUTS_S01_01_007.CDB;1

NUTS_S01_01_008.CDB;1 NUTS_S01_01_009.CDB;1
NUTS_S01_01_010.CDB;1 NUTS_S01_01_011.CDB;1
NUTS_S01_01_012.CDB;1 NUTS_S01_01_013.CDB;1
NUTS_S01_01_014.CDB;1 NUTS_S01_01_015.CDB;1
NUTS_S01_01_016.CDB;1 NUTS_S01_01_017.CDB;1
NUTS_S01_01_018.CDB;1 NUTS_S01_01_019.CDB;1
NUTS_S01_01_020.CDB;1 NUTS_UND.DAT;3 SPLAT.INP;1
SUMM.INP;1 SUMM2.INP;4 SUMM2.LOG;4 SUMM2_E1.INP;1
SUMM2_ERROR.LOG;4 SUMMARIZE.INP;1

Directory F2:[FEP.GARNER.RAD.PANEL_CUL]

BATCHA0.COM;1 BATCHA1.COM;1 BATCHA1D.COM;1 BATCHALL.COM;1
BATCHE0.COM;1 BATCHE1.COM;1 BATCHE1D.COM;1 CCDF.DIR;1
PANEL_S00_S_R001.CDB;2 PANEL_S00_S_R001.DBG;1
PANEL_S00_S_R002.CDB;2 PANEL_S00_S_R002.DBG;1
PANEL_S00_S_R003.CDB;2 PANEL_S00_S_R003.DBG;1
PANEL_S00_S_R004.CDB;2 PANEL_S00_S_R004.DBG;1
PANEL_S00_S_R005.CDB;2 PANEL_S00_S_R005.DBG;1
PANEL_S00_S_R006.CDB;2 PANEL_S00_S_R006.DBG;1
PANEL_S00_S_R007.CDB;2 PANEL_S00_S_R007.DBG;1
PANEL_S00_S_R008.CDB;2 PANEL_S00_S_R008.DBG;1
PANEL_S00_S_R009.CDB;2 PANEL_S00_S_R009.DBG;1
PANEL_S00_S_R010.CDB;2 PANEL_S00_S_R010.DBG;1
PANEL_S00_S_R011.CDB;2 PANEL_S00_S_R011.DBG;1
PANEL_S00_S_R012.CDB;2 PANEL_S00_S_R012.DBG;1
PANEL_S00_S_R013.CDB;2 PANEL_S00_S_R013.DBG;1
PANEL_S00_S_R014.CDB;2 PANEL_S00_S_R014.DBG;1
PANEL_S00_S_R015.CDB;2 PANEL_S00_S_R015.DBG;1
PANEL_S00_S_R016.CDB;2 PANEL_S00_S_R016.DBG;1
PANEL_S00_S_R017.CDB;2 PANEL_S00_S_R017.DBG;1
PANEL_S00_S_R018.CDB;2 PANEL_S00_S_R018.DBG;1
PANEL_S00_S_R019.CDB;2 PANEL_S00_S_R019.DBG;1
PANEL_S00_S_R020.CDB;2 PANEL_S00_S_R020.DBG;1
PANEL_S01D_S_R001.CDB;2 PANEL_S01D_S_R001.DBG;1
PANEL_S01D_S_R002.CDB;2 PANEL_S01D_S_R002.DBG;1
PANEL_S01D_S_R003.CDB;2 PANEL_S01D_S_R003.DBG;1
PANEL_S01D_S_R004.CDB;2 PANEL_S01D_S_R004.DBG;1
PANEL_S01D_S_R005.CDB;2 PANEL_S01D_S_R005.DBG;1
PANEL_S01D_S_R006.CDB;2 PANEL_S01D_S_R006.DBG;1
PANEL_S01D_S_R007.CDB;2 PANEL_S01D_S_R007.DBG;1
PANEL_S01D_S_R008.CDB;2 PANEL_S01D_S_R008.DBG;1
PANEL_S01D_S_R009.CDB;2 PANEL_S01D_S_R009.DBG;1
PANEL_S01D_S_R010.CDB;2 PANEL_S01D_S_R010.DBG;1
PANEL_S01D_S_R011.CDB;2 PANEL_S01D_S_R011.DBG;1
PANEL_S01D_S_R012.CDB;2 PANEL_S01D_S_R012.DBG;1
PANEL_S01D_S_R013.CDB;2 PANEL_S01D_S_R013.DBG;1

PANEL_S01D_S_R014.CDB;2	PANEL_S01D_S_R014.DBG;1
PANEL_S01D_S_R015.CDB;2	PANEL_S01D_S_R015.DBG;1
PANEL_S01D_S_R016.CDB;2	PANEL_S01D_S_R016.DBG;1
PANEL_S01D_S_R017.CDB;2	PANEL_S01D_S_R017.DBG;1
PANEL_S01D_S_R018.CDB;2	PANEL_S01D_S_R018.DBG;1
PANEL_S01D_S_R019.CDB;2	PANEL_S01D_S_R019.DBG;1
PANEL_S01D_S_R020.CDB;2	PANEL_S01D_S_R020.DBG;1
PANEL_S01_S_R001.CDB;2	PANEL_S01_S_R001.DBG;1
PANEL_S01_S_R002.CDB;2	PANEL_S01_S_R002.DBG;1
PANEL_S01_S_R003.CDB;2	PANEL_S01_S_R003.DBG;1
PANEL_S01_S_R004.CDB;2	PANEL_S01_S_R004.DBG;1
PANEL_S01_S_R005.CDB;2	PANEL_S01_S_R005.DBG;1
PANEL_S01_S_R006.CDB;2	PANEL_S01_S_R006.DBG;1
PANEL_S01_S_R007.CDB;2	PANEL_S01_S_R007.DBG;1
PANEL_S01_S_R008.CDB;2	PANEL_S01_S_R008.DBG;1
PANEL_S01_S_R009.CDB;2	PANEL_S01_S_R009.DBG;1
PANEL_S01_S_R010.CDB;2	PANEL_S01_S_R010.DBG;1
PANEL_S01_S_R011.CDB;2	PANEL_S01_S_R011.DBG;1
PANEL_S01_S_R012.CDB;2	PANEL_S01_S_R012.DBG;1
PANEL_S01_S_R013.CDB;2	PANEL_S01_S_R013.DBG;1
PANEL_S01_S_R014.CDB;2	PANEL_S01_S_R014.DBG;1
PANEL_S01_S_R015.CDB;2	PANEL_S01_S_R015.DBG;1
PANEL_S01_S_R016.CDB;2	PANEL_S01_S_R016.DBG;1
PANEL_S01_S_R017.CDB;2	PANEL_S01_S_R017.DBG;1
PANEL_S01_S_R018.CDB;2	PANEL_S01_S_R018.DBG;1
PANEL_S01_S_R019.CDB;2	PANEL_S01_S_R019.DBG;1
PANEL_S01_S_R020.CDB;2	PANEL_S01_S_R020.DBG;1

Directory F2:[FEP.GARNER.RAD.PANEL_MB]

BATCHA0.COM;1	BATCHA1.COM;1	BATCHA1D.COM;1	BATCHALL.COM;1
BATCHE0.COM;1	BATCHE1.COM;1	BATCHE1D.COM;1	CCDF.DIR;1

PANEL_S00_S_R001.CDB;2	PANEL_S00_S_R001.DBG;1
PANEL_S00_S_R002.CDB;2	PANEL_S00_S_R002.DBG;1
PANEL_S00_S_R003.CDB;2	PANEL_S00_S_R003.DBG;1
PANEL_S00_S_R004.CDB;2	PANEL_S00_S_R004.DBG;1
PANEL_S00_S_R005.CDB;2	PANEL_S00_S_R005.DBG;1
PANEL_S00_S_R006.CDB;2	PANEL_S00_S_R006.DBG;1
PANEL_S00_S_R007.CDB;2	PANEL_S00_S_R007.DBG;1
PANEL_S00_S_R008.CDB;2	PANEL_S00_S_R008.DBG;1
PANEL_S00_S_R009.CDB;2	PANEL_S00_S_R009.DBG;1
PANEL_S00_S_R010.CDB;2	PANEL_S00_S_R010.DBG;1
PANEL_S00_S_R011.CDB;2	PANEL_S00_S_R011.DBG;1
PANEL_S00_S_R012.CDB;2	PANEL_S00_S_R012.DBG;1
PANEL_S00_S_R013.CDB;2	PANEL_S00_S_R013.DBG;1
PANEL_S00_S_R014.CDB;2	PANEL_S00_S_R014.DBG;1
PANEL_S00_S_R015.CDB;2	PANEL_S00_S_R015.DBG;1

PANEL_S00_S_R016.CDB;2	PANEL_S00_S_R016.DBG;1
PANEL_S00_S_R017.CDB;2	PANEL_S00_S_R017.DBG;1
PANEL_S00_S_R018.CDB;2	PANEL_S00_S_R018.DBG;1
PANEL_S00_S_R019.CDB;2	PANEL_S00_S_R019.DBG;1
PANEL_S00_S_R020.CDB;2	PANEL_S00_S_R020.DBG;1
PANEL_S01D_S_R001.CDB;2	PANEL_S01D_S_R001.DBG;1
PANEL_S01D_S_R002.CDB;2	PANEL_S01D_S_R002.DBG;1
PANEL_S01D_S_R003.CDB;2	PANEL_S01D_S_R003.DBG;1
PANEL_S01D_S_R004.CDB;2	PANEL_S01D_S_R004.DBG;1
PANEL_S01D_S_R005.CDB;2	PANEL_S01D_S_R005.DBG;1
PANEL_S01D_S_R006.CDB;2	PANEL_S01D_S_R006.DBG;1
PANEL_S01D_S_R007.CDB;2	PANEL_S01D_S_R007.DBG;1
PANEL_S01D_S_R008.CDB;2	PANEL_S01D_S_R008.DBG;1
PANEL_S01D_S_R009.CDB;2	PANEL_S01D_S_R009.DBG;1
PANEL_S01D_S_R010.CDB;2	PANEL_S01D_S_R010.DBG;1
PANEL_S01D_S_R011.CDB;2	PANEL_S01D_S_R011.DBG;1
PANEL_S01D_S_R012.CDB;2	PANEL_S01D_S_R012.DBG;1
PANEL_S01D_S_R013.CDB;2	PANEL_S01D_S_R013.DBG;1
PANEL_S01D_S_R014.CDB;2	PANEL_S01D_S_R014.DBG;1
PANEL_S01D_S_R015.CDB;2	PANEL_S01D_S_R015.DBG;1
PANEL_S01D_S_R016.CDB;2	PANEL_S01D_S_R016.DBG;1
PANEL_S01D_S_R017.CDB;2	PANEL_S01D_S_R017.DBG;1
PANEL_S01D_S_R018.CDB;2	PANEL_S01D_S_R018.DBG;1
PANEL_S01D_S_R019.CDB;2	PANEL_S01D_S_R019.DBG;1
PANEL_S01D_S_R020.CDB;2	PANEL_S01D_S_R020.DBG;1
PANEL_S01_S_R001.CDB;2	PANEL_S01_S_R001.DBG;1
PANEL_S01_S_R002.CDB;2	PANEL_S01_S_R002.DBG;1
PANEL_S01_S_R003.CDB;2	PANEL_S01_S_R003.DBG;1
PANEL_S01_S_R004.CDB;2	PANEL_S01_S_R004.DBG;1
PANEL_S01_S_R005.CDB;2	PANEL_S01_S_R005.DBG;1
PANEL_S01_S_R006.CDB;2	PANEL_S01_S_R006.DBG;1
PANEL_S01_S_R007.CDB;2	PANEL_S01_S_R007.DBG;1
PANEL_S01_S_R008.CDB;2	PANEL_S01_S_R008.DBG;1
PANEL_S01_S_R009.CDB;2	PANEL_S01_S_R009.DBG;1
PANEL_S01_S_R010.CDB;2	PANEL_S01_S_R010.DBG;1
PANEL_S01_S_R011.CDB;2	PANEL_S01_S_R011.DBG;1
PANEL_S01_S_R012.CDB;2	PANEL_S01_S_R012.DBG;1
PANEL_S01_S_R013.CDB;2	PANEL_S01_S_R013.DBG;1
PANEL_S01_S_R014.CDB;2	PANEL_S01_S_R014.DBG;1
PANEL_S01_S_R015.CDB;2	PANEL_S01_S_R015.DBG;1
PANEL_S01_S_R016.CDB;2	PANEL_S01_S_R016.DBG;1
PANEL_S01_S_R017.CDB;2	PANEL_S01_S_R017.DBG;1
PANEL_S01_S_R018.CDB;2	PANEL_S01_S_R018.DBG;1
PANEL_S01_S_R019.CDB;2	PANEL_S01_S_R019.DBG;1
PANEL_S01_S_R020.CDB;2	PANEL_S01_S_R020.DBG;1

Directory F1:[FEP]

AASHINT.DIR;1 BASELINE.DIR;1 BRAGFLO_181.DIR;1 DGAS.DIR;1
DMS_BLOWOUT.DIR;1 DMS_WATERFLOOD.DIR;1 DRZ.DIR;1
MCS.DIR;1 POSTPROC.DIR;1 PUD.DIR;1 PVAUGHN.DIR;1
RAD.DIR;1 SCATTER.DIR;1 VPC.DIR;1 WICK.DIR;1

Directory F1:[FEP.BASELINE]

E01_DOWN.DIR;1 E01_UP.DIR;1 UNDIST.DIR;1

Directory F1:[FEP.BASELINE.UNDIST]

BLOT.CMD;36 BLOT.PST;5 BLOTMBR001.PST;1 BLOTMBR001A.PST;1
BLOTMBR002.PST;1 BLOTMBR002A.PST;1 BLOTMBR003.PST;1 BLOTMBR003A.PST;1
BLOTMBR004.PST;1 BLOTMBR004A.PST;1 BLOTMBR005.PST;1 BLOTMBR005A.PST;1
BLOTMBR006.PST;1 BLOTMBR007.PST;1 BLOTMBR008.PST;1 BLOTMBR009.PST;1
BLOTMBR010.PST;1 BLOTMBR011.PST;1 BLOTMBR012.PST;1 BLOTMBR013.PST;1
BLOTMBR014.PST;1 BLOTMBR015.PST;1 BLOTMBR016.PST;1 BLOTMBR017.PST;1
BLOTMBR018.PST;1 BLOTMBR019.PST;1 BLOTMBR020.PST;1
FEP01_BASE_UND.COM;2 FEP01_BASE_UND.SMZ;6
FEP01_BASE_UND1.SMZ;2 FEP01_BASE_UND10.SMZ;6
FEP01_BASE_UND11.SMZ;1 FEP01_BASE_UND12.SMZ;2
FEP01_BASE_UND1_BO.SMZ;2 FEP01_BASE_UND2.SMZ;1
FEP01_BASE_UND3.SMZ;4 FEP01_BASE_UND4.SMZ;2
FEP01_BASE_UND5.SMZ;2 FEP01_BASE_UND6.SMZ;2
FEP01_BASE_UND7.SMZ;2 FEP01_BASE_UND8.SMZ;2
FEP01_BASE_UND9.SMZ;2 FEP01_BASE_UND_BO.COM;2
FEP01_BASE_UND_GAS.COM;3 FEP01_BMGANABC_UND.TBL;1
FEP01_BMGMB38C_UND.TBL;2 FEP01_BMGMB39C_UND.TBL;1
FEP01_BRNANABC_UND.TBL;2 FEP01_BRNMB38C_UND.TBL;1
FEP01_BRNMB39C_UND.TBL;1 FEP01_BRNSHUPC_UND.TBL;1
FEP01_GASANABC_UND.TBL;1 FEP01_GASMB38C_UND.TBL;1
FEP01_GASMB39C_UND.TBL;1 FEP01_GASSHUPC_UND.TBL;6
FEP01_MXGASMOL_UND.TBL;2 GASSHUPC.TBL;8 MXSG_ANHABR.PST;1
PA_GAS_FEP_BASE_UND.COM;6 PA_GAS_FEP_BASE_UND_01.COM;2
POST_ALG_GAS.INP;5 POST_ALG_GAS_UND.INP;10 POST_ALG_UND.INP;2
POST_ALG_UND_BO.INP;2 READTBL.EXE;6 READTBL.OBJ;6
READ_SUM.FOR;65 READ_TBL.EXE;4 READ_TBL.FOR;12 READ_TBL.OBJ;4
SATGAS_ANHABR.PST;1 SPLOT.INP;9 SPLOTMB.INP;1 SPLOTMBR010.PST;1
SPLOTMB_MXGS.INP;1 SPLOTMB_SATGAS.INP;2
SPLOTMB_SATGAS_R003.PST;1 SPLOTMB_SATGAS_R005.PST;1
SPLOTMB_SATGAS_R006.PST;1 SPLOTMB_SATGAS_R007.PST;1
SPLOTMB_SATGAS_R009.PST;1 SPLOTMB_SATGAS_R011.PST;1
TEST.OUT;7 TEST1.SMZ;11

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Directory F1:[FEP.BASELINE.E01_UP]

ALGEBRA_R001.CDB;1 ALGEBRA_R002.CDB;1 ALGEBRA_R003.CDB;1
ALGEBRA_R004.CDB;1
ALGEBRA_R005.CDB;1 ALGEBRA_R006.CDB;1 ALGEBRA_R007.CDB;1
ALGEBRA_R008.CDB;1
ALGEBRA_R009.CDB;1 ALGEBRA_R010.CDB;1 ALGEBRA_R011.CDB;1
ALGEBRA_R012.CDB;1
ALGEBRA_R013.CDB;1 ALGEBRA_R014.CDB;1 ALGEBRA_R015.CDB;1
ALGEBRA_R016.CDB;1
ALGEBRA_R017.CDB;1 ALGEBRA_R018.CDB;1 ALGEBRA_R019.CDB;1
ALGEBRA_R020.CDB;1
FEP01_BASE_E01_UP.COM;1 FEP01_BASE_E01_UP10.SMZ;2
FEP01_BASE_E01_UP11.SMZ;2 FEP01_BASE_E01_UP12.SMZ;2
FEP01_BASE_E01_UP13.LOG;1 FEP01_BASE_E01_UP13.SMZ;2
FEP01_BASE_E01_UP13.SMZ;1 FEP01_BASE_E01_UP13_ERROR.LOG;1
FEP01_BASE_E01_UP14.LOG;1 FEP01_BASE_E01_UP14.SMZ;2
FEP01_BASE_E01_UP14.SMZ;1 FEP01_BASE_E01_UP14_ERROR.LOG;1
FEP01_BASE_E01_UP2.SMZ;2 FEP01_BASE_E01_UP9.SMZ;2
FEP01_BRNANABC_E01_UP.TBL;1 FEP01_BRNBHUPC_E01_UP.TBL;1
FEP01_BRNMB38C_E01_UP.TBL;1 FEP01_BRNMB39C_E01_UP.TBL;1
FEP01_BRNSHUPC_E01_UP.TBL;1 FEP01_GASBHUPC_E01_UP.TBL;1
FEP01_MXGASMOL_E01_UP.TBL;1 POST_ALG_E01_UP.INP;1

Directory F1:[FEP.BASELINE.E01_DOWN]

ALGEBRA_DOWN_R001.CDB;1 ALGEBRA_DOWN_R002.CDB;1
ALGEBRA_DOWN_R003.CDB;1 ALGEBRA_DOWN_R004.CDB;1
ALGEBRA_DOWN_R005.CDB;1 ALGEBRA_DOWN_R006.CDB;1
ALGEBRA_DOWN_R007.CDB;1 ALGEBRA_DOWN_R008.CDB;1
ALGEBRA_DOWN_R009.CDB;1 ALGEBRA_DOWN_R010.CDB;1
ALGEBRA_DOWN_R011.CDB;1 ALGEBRA_DOWN_R012.CDB;1
ALGEBRA_DOWN_R013.CDB;1 ALGEBRA_DOWN_R014.CDB;1
ALGEBRA_DOWN_R015.CDB;1 ALGEBRA_DOWN_R016.CDB;1
ALGEBRA_DOWN_R017.CDB;1 ALGEBRA_DOWN_R018.CDB;1
ALGEBRA_DOWN_R019.CDB;1 ALGEBRA_DOWN_R020.CDB;1
BATCHCDB_10.COM;2 BATCHCDB_11_20.COM;6
BATCHCDB_11_20.COM;5 BATCHCDB_11_20.COM;4
BATCHCDB_11_20.COM;3 BATCHCDB_19_20.COM;3
BATCHCDB_19_20.COM;2 BATCHCDB_19_20.COM;1
BATCHCDB_1_10.COM;6 BATCHCDB_1_10.COM;5 BATCHCDB_8_10.COM;4
BATCHCDB_8_10.COM;3
BATCHCDB_8_10.COM;2 BATCHCDB_9_10.COM;3 BATCHCDB_9_10.COM;2
BATCHCDB_9_10.COM;1
FEP01_BASE_E01_DOWN.COM;2 FEP01_BASE_E01_DOWN.COM;1
FEP01_BASE_E01_DOWN.SMZ;1 FEP01_BASE_E01_DOWN10.SMZ;2
FEP01_BASE_E01_DOWN10.SMZ;1 FEP01_BASE_E01_DOWN11.SMZ;2
FEP01_BASE_E01_DOWN11.SMZ;1 FEP01_BASE_E01_DOWN12.SMZ;2
FEP01_BASE_E01_DOWN12.SMZ;1 FEP01_BASE_E01_DOWN13.SMZ;2

FEP01_BASE_E01_DOWN13.SMZ;1 FEP01_BASE_E01_DOWN14.SMZ;2
FEP01_BASE_E01_DOWN14.SMZ;1 FEP01_BASE_E01_DOWN2.SMZ;2
FEP01_BASE_E01_DOWN2.SMZ;1 FEP01_BASE_E01_DOWN9.SMZ;2
FEP01_BASE_E01_DOWN9.SMZ;1 FEP01_BASE_E01_DOWN_10_20.COM;2
FEP01_BASE_E01_DOWN_10_20.COM;1 FEP01_BASE_E01_DOWN_19_20.COM;2
FEP01_BASE_E01_DOWN_19_20.COM;1 FEP01_BASE_E01_DOWN_8_20.COM;2
FEP01_BASE_E01_DOWN_8_20.COM;1 FEP01_BRNANABC_E01_DOWN.TBL;1
FEP01_BRNBHUPC_E01_DOWN.TBL;1 FEP01_BRNMB38C_E01_DOWN.TBL;1
FEP01_BRNMB39C_E01_DOWN.TBL;1 FEP01_BRNSHUPC_E01_DOWN.TBL;1
FEP01_GASBHUPC_E01_DOWN.TBL;1 FEP01_MXGASMOL_E01_DOWN.TBL;1
POST_ALG_E01_DOWN.INP;1

Directory F1:[FEP.DGAS]

E01_UP.DIR;1 UNDIST.DIR;1

Directory F1:[FEP.DGAS.UNDIST]

ALGEBRA_R001.CDB;1 ALGEBRA_R002.CDB;1 ALGEBRA_R003.CDB;1
ALGEBRA_R004.CDB;1
ALGEBRA_R005.CDB;1 ALGEBRA_R006.CDB;1 ALGEBRA_R007.CDB;1
ALGEBRA_R008.CDB;1
ALGEBRA_R009.CDB;1 ALGEBRA_R010.CDB;1 ALGEBRA_R011.CDB;1
ALGEBRA_R012.CDB;1
ALGEBRA_R013.CDB;1 ALGEBRA_R014.CDB;1 ALGEBRA_R015.CDB;1
ALGEBRA_R016.CDB;1
ALGEBRA_R017.CDB;1 ALGEBRA_R018.CDB;1 ALGEBRA_R019.CDB;1
ALGEBRA_R020.CDB;1
BATCHCDB_11_20.COM;7 BATCHCDB_11_20.COM;6
BATCHCDB_14_20.COM;2 BATCHCDB_14_20.COM;1
BATCHCDB_17_20.COM;2 BATCHCDB_17_20.COM;1
BATCHCDB_1_10.COM;9 BATCHCDB_1_10.COM;8 BATCHCDB_7.COM;2
BATCHCDB_7.COM;1
BATCHCDB_7_10.COM;2 BATCHCDB_7_10.COM;1 BATCHCDB_8_10.COM;1 BOAVG.EXE;15
BOAVG.EXE;14 BO_100.LOG;1 BO_100.SMZ;11 BO_100.TBL;1
BO_1000.LOG;1 BO_1000.SMZ;9 BO_1000.TBL;1 BO_10000.LOG;1
BO_10000.SMZ;9 BO_10000.TBL;1 BO_10000_ERROR.LOG;1
BO_1000_ERROR.LOG;1 BO_100_ERROR.LOG;1 BO_UND.OUT;1
B_FEP08_DGAS_UND_BO_R001.CDB;1 B_FEP08_DGAS_UND_BO_R002.CDB;1
B_FEP08_DGAS_UND_BO_R003.CDB;1 B_FEP08_DGAS_UND_BO_R004.CDB;1
B_FEP08_DGAS_UND_BO_R005.CDB;1 B_FEP08_DGAS_UND_BO_R006.CDB;1
B_FEP08_DGAS_UND_BO_R007.CDB;1 B_FEP08_DGAS_UND_BO_R008.CDB;1
B_FEP08_DGAS_UND_BO_R009.CDB;1 B_FEP08_DGAS_UND_BO_R010.CDB;1
B_FEP08_DGAS_UND_BO_R011.CDB;1 B_FEP08_DGAS_UND_BO_R012.CDB;1
B_FEP08_DGAS_UND_BO_R013.CDB;1 B_FEP08_DGAS_UND_BO_R014.CDB;1
B_FEP08_DGAS_UND_BO_R015.CDB;1 B_FEP08_DGAS_UND_BO_R016.CDB;1
B_FEP08_DGAS_UND_BO_R017.CDB;1 B_FEP08_DGAS_UND_BO_R018.CDB;1
B_FEP08_DGAS_UND_BO_R019.CDB;1 B_FEP08_DGAS_UND_BO_R020.CDB;1

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B_FEP_DGAS_UND_R001.CDB;1 B_FEP_DGAS_UND_R002.CDB;1
B_FEP_DGAS_UND_R003.CDB;1 B_FEP_DGAS_UND_R004.CDB;1
B_FEP_DGAS_UND_R005.CDB;1 B_FEP_DGAS_UND_R006.CDB;1
B_FEP_DGAS_UND_R007.CDB;3 B_FEP_DGAS_UND_R007.CDB;2
B_FEP_DGAS_UND_R007.CDB;1 B_FEP_DGAS_UND_R008.CDB;1
B_FEP_DGAS_UND_R009.CDB;1 B_FEP_DGAS_UND_R010.CDB;1
B_FEP_DGAS_UND_R011.CDB;1 B_FEP_DGAS_UND_R012.CDB;1
B_FEP_DGAS_UND_R013.CDB;1 B_FEP_DGAS_UND_R014.CDB;1
B_FEP_DGAS_UND_R015.CDB;1 B_FEP_DGAS_UND_R016.CDB;1
B_FEP_DGAS_UND_R017.CDB;2 B_FEP_DGAS_UND_R017.CDB;1
B_FEP_DGAS_UND_R018.CDB;1 B_FEP_DGAS_UND_R019.CDB;1
B_FEP_DGAS_UND_R020.CDB;1 FEP05_RAD_UND_BO.COM;2
FEP08_DGAS_UND_BO.COM;2 FEP08_DGAS_UND_BO.COM;1
POST_ALG_UND_BO.INP;3 R007CDB.DBG;1

Directory F1:[FEP.DGAS.E01_UP]

BATCH.COM;1 BATCHECHO.COM;3 BATCH_10.COM;2 BATCH_11.COM;2
BATCH_11_15.COM;2 BATCH_14.COM;2 BATCH_16_20.COM;2 BATCH_19.COM;2
BATCH_1_5.COM;4 BATCH_5.COM;2 BATCH_6.COM;2 BATCH_6_10.COM;1
BATCH_7.COM;2 BATCH_8.COM;2 BATCH_9.COM;2
B_FEP_DGAS_E01_UP_R001.BIN;1 B_FEP_DGAS_E01_UP_R001.INP;1
B_FEP_DGAS_E01_UP_R002.BIN;1 B_FEP_DGAS_E01_UP_R002.INP;1
B_FEP_DGAS_E01_UP_R003.BIN;1 B_FEP_DGAS_E01_UP_R003.INP;1
B_FEP_DGAS_E01_UP_R004.BIN;1 B_FEP_DGAS_E01_UP_R004.INP;1
B_FEP_DGAS_E01_UP_R005.BIN;2 B_FEP_DGAS_E01_UP_R005.INP;2
B_FEP_DGAS_E01_UP_R006.BIN;5 B_FEP_DGAS_E01_UP_R006.INP;4
B_FEP_DGAS_E01_UP_R007.BIN;2 B_FEP_DGAS_E01_UP_R007.INP;2
B_FEP_DGAS_E01_UP_R008.BIN;2 B_FEP_DGAS_E01_UP_R008.INP;3
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B_FEP_DGAS_E01_UP_R015.INP;1 B_FEP_DGAS_E01_UP_R016.BIN;1
B_FEP_DGAS_E01_UP_R016.INP;1 B_FEP_DGAS_E01_UP_R017.BIN;1
B_FEP_DGAS_E01_UP_R017.INP;1 B_FEP_DGAS_E01_UP_R018.BIN;1
B_FEP_DGAS_E01_UP_R018.INP;1 B_FEP_DGAS_E01_UP_R019.BIN;2
B_FEP_DGAS_E01_UP_R019.INP;2 B_FEP_DGAS_E01_UP_R019.SUM;1
B_FEP_DGAS_E01_UP_R020.BIN;1 B_FEP_DGAS_E01_UP_R020.INP;1
JUNK.DIF;1 MACRO.MAC;2 READ_SUM.EXE;2 READ_SUM.FOR;65
READ_SUM.OBJ;2 SUM.DAT;9

Directory F1:[FEP.RAD.UNDIST]

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BATCHCDB_11_20.COM;5 BATCHCDB_11_20.COM;4
BATCHCDB_1_10.COM;8 BATCHCDB_1_10.COM;7 BATCHCDB_1_10.COM;6
BATCHCDB_3.COM;2
BATCHCDB_3.COM;1 BATCH_1.COM;2 BATCH_1.COM;1
BATCH_5_7_10_11.COM;2 BATCH_5_7_10_11.COM;1
BATCH_9.COM;2 BATCH_9.COM;1 BLOT.PST;3 BLOT.PST;2
BLOT.PST;1 BOAVG.EXE;14 BO_100.SMZ;9 BO_100.TBL;4
BO_1000.SMZ;7 BO_1000.TBL;2 BO_10000.SMZ;7 BO_10000.TBL;2
BO_UND.OUT;3 BO_UND.OUT;2 BO_UND.OUT;1
FEP02_DRZ_UND1_BO.SMZ;3 FEP05_RAD_UND.COM;2
FEP05_RAD_UND_7.COM;2 FEP05_RAD_UND_7.COM;1
FEP05_RAD_UND_BO.COM;3 FEP05_RAD_UND_BO.COM;2
FEP05_RAD_UND_BO.COM;1 FEP05_RAD_UND_BO_11_20.COM;2
FEP05_RAD_UND_BO_11_20.COM;1 FEP05_RAD_UND_BO_5_7_10_11.COM;2
FEP05_RAD_UND_BO_5_7_10_11.COM;1 POST_ALG_UND.INP;2
POST_ALG_UND_BO.INP;3 SUBMIT_11_15.COM;3 SUBMIT_11_15.COM;2
SUBMIT_16_20.COM;2 SUBMIT_1_5.COM;2 SUBMIT_1_5.COM;1 SUBMIT_6_10.COM;3
SUBMIT_6_10.COM;2

Directory F1:[FEP.RAD.E01_UP]

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ALGEBRA_R004.CDB;1
ALGEBRA_R005.CDB;1 ALGEBRA_R006.CDB;1 ALGEBRA_R007.CDB;1
ALGEBRA_R008.CDB;1
ALGEBRA_R009.CDB;1 ALGEBRA_R010.CDB;1 ALGEBRA_R011.CDB;1
ALGEBRA_R012.CDB;1
ALGEBRA_R013.CDB;1 ALGEBRA_R014.CDB;1 ALGEBRA_R015.CDB;1
ALGEBRA_R016.CDB;1
ALGEBRA_R017.CDB;1 ALGEBRA_R018.CDB;1 ALGEBRA_R019.CDB;1
ALGEBRA_R020.CDB;1
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BATCHCDB_RAD_E01_UP_11_20.COM;4 BATCHCDB_RAD_E01_UP_1_10.COM;4
BATCH_10.COM;2 BATCH_11_15.COM;8 BATCH_16_20.COM;8 BATCH_1_5.COM;14
BATCH_5.COM;3 BATCH_6_10.COM;11 BATCH_7_10.COM;2 BATCH_8.COM;2
BATCH_9.COM;2 B_FEP_RAD_E01_UP_R001.CDB;1
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B_FEP_RAD_E01_UP_R006.CDB;1 B_FEP_RAD_E01_UP_R007.CDB;1
B_FEP_RAD_E01_UP_R008.CDB;1 B_FEP_RAD_E01_UP_R009.CDB;1
B_FEP_RAD_E01_UP_R010.CDB;1 FEP03_MCS_E01_UP.SMZ;1
FEP03_MCS_E01_UP9.SMZ;1 FEP04_PUD_E01_UP10.SMZ;1
FEP04_PUD_E01_UP11.SMZ;1 FEP04_PUD_E01_UP12.SMZ;1
FEP04_PUD_E01_UP13.SMZ;1 FEP04_PUD_E01_UP14.SMZ;1
FEP04_PUD_E01_UP2.SMZ;1 FEP05_BRNANABC_E01_UP.TBL;1
FEP05_BRNBHUPC_E01_UP.TBL;2 FEP05_BRNMB38C_E01_UP.TBL;1
FEP05_BRNMB39C_E01_UP.TBL;1 FEP05_BRNSHUPC_E01_UP.TBL;1
FEP05_GASBHUPC_E01_UP.TBL;1 FEP05_MXGASMOL_E01_UP.TBL;2

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FEP05_RAD_E01_UP.COM;2 FEP05_RAD_E01_UP10.SMZ;2
FEP05_RAD_E01_UP11.SMZ;2 FEP05_RAD_E01_UP12.SMZ;2
FEP05_RAD_E01_UP13.SMZ;3 FEP05_RAD_E01_UP14.SMZ;2
FEP05_RAD_E01_UP2.SMZ;3 FEP05_RAD_E01_UP9.SMZ;2
JUNK.DIF;1 POST_ALG_E01_UP.INP;1 SUBMIT_11_15.COM;3
SUBMIT_16_20.COM;3 SUBMIT_1_5.COM;2 SUBMIT_6_10.COM;3

Directory F1:[FEP.RAD.E01_DOWN]

ALGEBRA_DOWN_R001.CDB;1 ALGEBRA_DOWN_R002.CDB;1
ALGEBRA_DOWN_R003.CDB;1 ALGEBRA_DOWN_R004.CDB;1
ALGEBRA_DOWN_R005.CDB;1 ALGEBRA_DOWN_R006.CDB;1
ALGEBRA_DOWN_R007.CDB;1 ALGEBRA_DOWN_R008.CDB;1
ALGEBRA_DOWN_R009.CDB;1 ALGEBRA_DOWN_R010.CDB;1
ALGEBRA_DOWN_R011.CDB;1 ALGEBRA_DOWN_R012.CDB;1
ALGEBRA_DOWN_R013.CDB;1 ALGEBRA_DOWN_R014.CDB;1
ALGEBRA_DOWN_R015.CDB;1 ALGEBRA_DOWN_R016.CDB;1
ALGEBRA_DOWN_R017.CDB;1 ALGEBRA_DOWN_R018.CDB;1
ALGEBRA_DOWN_R019.CDB;1 ALGEBRA_DOWN_R020.CDB;1
BATCHCDB_11_20.COM;6 BATCHCDB_1_10.COM;8
BATCHCDB_RAD_E01_DOWN_1.COM;2 BATCHCDB_RAD_E01_DOWN_1.COM;1
BATCHCDB_RAD_E01_DOWN_11_20.COM;3 BATCHCDB_RAD_E01_DOWN_11_20.COM;2
BATCHCDB_RAD_E01_DOWN_1_10.COM;3 BATCHCDB_RAD_E01_DOWN_1_10.COM;2
BATCH_11_15.COM;10 BATCH_16_20.COM;10 BATCH_1_5.COM;17 BATCH_5.COM;2
BATCH_6_10.COM;13 B_FEP_RAD_E01_DOWN_R001.INP;4
B_FEP_RAD_E01_DOWN_R001T.INP;1 B_FEP_RAD_E01_DOWN_R002.INP;1
B_FEP_RAD_E01_DOWN_R003.INP;1 B_FEP_RAD_E01_DOWN_R004.INP;1
B_FEP_RAD_E01_DOWN_R005.INP;1 B_FEP_RAD_E01_DOWN_R006.INP;1
B_FEP_RAD_E01_DOWN_R007.INP;1 B_FEP_RAD_E01_DOWN_R008.INP;1
B_FEP_RAD_E01_DOWN_R009.INP;1 B_FEP_RAD_E01_DOWN_R010.INP;1
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B_FEP_RAD_E01_DOWN_R017.INP;1 B_FEP_RAD_E01_DOWN_R018.INP;1
B_FEP_RAD_E01_DOWN_R019.INP;1 B_FEP_RAD_E01_DOWN_R020.INP;1
FEP05_BRNANABC_E01_DOWN.TBL;1 FEP05_BRNBHUPC_E01_DOWN.TBL;1
FEP05_BRNMB38C_E01_DOWN.TBL;1 FEP05_BRNMB39C_E01_DOWN.TBL;1
FEP05_BRNSHUPC_E01_DOWN.TBL;1 FEP05_GASBHUPC_E01_DOWN.TBL;1
FEP05_MXGASMOL_E01_DOWN.TBL;1 FEP05_RAD_E01_DOWN.COM;3
FEP05_RAD_E01_DOWN.COM;2 FEP05_RAD_E01_DOWN.COM;1
FEP05_RAD_E01_DOWN10.SMZ;3 FEP05_RAD_E01_DOWN11.SMZ;2
FEP05_RAD_E01_DOWN12.SMZ;2 FEP05_RAD_E01_DOWN13.SMZ;2
FEP05_RAD_E01_DOWN14.SMZ;2 FEP05_RAD_E01_DOWN2.SMZ;7
FEP05_RAD_E01_DOWN9.SMZ;2 FEP05_RAD_E01_DOWN_1.COM;2
FEP05_RAD_E01_DOWN_1.COM;1 POST_ALG_E01_DOWN.INP;1
READ_SUM.EXE;2 READ_SUM.FOR;64 READ_SUM.OBJ;2 SUBMIT_11_15.COM;4
SUBMIT_16_20.COM;4 SUBMIT_1_5.COM;3 SUBMIT_6_10.COM;4 SUM.DAT;4

Directory F2:[FEP.DGASVAR]

BF2_BRAGFLO.EXE;5 SP4.COM;1 SP4.INP;9 SP4.OUT;1
SP4NDG.COM;2 SP4NDG.INP;6 SP4NDG.OUT;1 SP4NDG_B.DAT;4
SP4NDG_P.CMD;5 SP4NDG_SG.CMD;4 SP4_B.DAT;4 SP4_MF.CMD;23
SP4_P.CMD;12 SP4_SG.CMD;5 T2.EXE;24 TOUGH2.INP;32
TOUGH2.OUT;6

APPENDIX 3

TREATMENT OF DISSOLVED GAS

The treatment of dissolved gas in the liquid phase is modeled by Henry's law (Bromberg, 1980) which relates the fraction of gas in the liquid phase to the gas pressure as

$$X_g = P_g/H$$

where

X_g = mole fraction of gas in the liquid phase
P_g = gas pressure [Pa]
H = Henry's constant [Pa]

Without solution gas BRAGFLO solves over a time step for gas saturation, S_g and brine pressure, P_b. These two variables together with constitutive equations allow all other model parameters to be computed. Solution gas introduces problems in BRAGFLO when a grid block goes from two phase liquid/gas to single phase liquid. For the single phase liquid case the gas mass fraction in the liquid phase can not be computed. When a free gas phase is present (two phase conditions) the dissolved gas mass fraction can be computed from the primary variables gas saturation and brine pressure.

Modification of the BRAGFLO code retains time step solution for gas saturation and brine pressure within a grid block when two phase conditions exist. For single phase conditions the primary variables solved for are the partial pressure of the dissolved gas, P_A, and the brine pressure, P_b. BRAGFLO uses the single phase set of solution variables when the gas saturation is less than or equal to zero ($Sg<0$). BRAGFLO switches from single phase liquid to two phase liquid/gas when the dissolved gas pressure exceeds the total gas pressure ($P_A>P_g$).

In order to verify the treatment of dissolved gas within BRAGFLO, a problem was simulated with BRAGFLO and TOUGH28W codes and the results are compared. The code TOUGH28W is the WIPP version of the TOUGH code. This version was used since it included the various Brooks-Corey characteristic curve models. The problem represents the drainage from a high pressure water saturated region to a low pressure gas saturated region. This is representative of the early time response in the WIPP site. Consider a horizontal one-dimensional reservoir with two grid blocks. The geometry is such that each grid block has unit dimension of 1 meter in each coordinate direction. The first grid block is initially at 1.0E+5 Pa pressure and gas saturation 1.0. The second grid block is at 1.0E+6 Pa pressure and gas saturation of 0.00001. A small amount of free gas in the second grid block allows TOUGH28W to initialize the gas mass fraction from Henry's law. Initially the water is saturated with gas at the mass fraction determined by Henry's law. The liquid is pure water with zero salt content. In BRAGFLO the gas is nitrogen while in TOUGH28W the gas is air. In order for Henry's law to predict the same mass fractions, the Henry's constants were proportioned by the molecular weights of nitrogen and air. Thus TOUGH28W uses a Henry's constant of 1.0E-10 Pa and BRAGFLO uses a value of 0.96731E-10 Pa. Actual TOUGH28W Henry's constant has input value the reciprocal of that used in BRAGFLO. The TOUGH28W Henry's constant was 1.0E+10 Pa. Formation properties are

permeability = 1.0E-14 m^2
porosity = 0.5
rock compressibility = 0.0
capillary pressure = 0.0

Relative permeabilities are given by Brooks-Corey with $\lambda = 0.7$ and residual water and gas saturation zero.

Some differences between the BRAGFLO and TOUGH28W codes exit which can not be accounted for in the input data. Fluid properties are represented differently in BRAGFLO and TOUGH28W. BRAGFLO uses a constant brine compressibility to compute brine density while TOUGH28W uses an equation of state for brine density. It was estimated from TOUGH28W brine density data that the equivalent brine compressibility to use in BRAGFLO was 4.45E-10 [1/Pa]. TOUGH28W uses an ideal gas equation of state and BRAGFLO uses Soave-Redlich-Kwong equation of state for gas density. Fluid viscosity in TOUGH28W are pressure dependent while BRAGFLO maintains constant water and gas viscosity. BRAGFLO used brine viscosity of 0.85E-3 Pa-s and gas viscosity of 8.92E-6 Pa-s. These values were chosen as representative of the values used in TOUGH28W throughout the pressure range. The two codes also implement a different averaging of the interblock flow which will contribute to differences in the transport of the fluids.

Qualitative behavior will have brine drain from the high pressure grid block to the low pressure grid block. As the pressure decreases in the second grid block solution gas will be released and the gas mass fraction in the second grid block will decrease. With free gas in the high pressure grid block, gas will be transported as both free gas and dissolved gas. Similarly the pressure and gas mass fraction will increase in the first or low pressure grid block. Asymptotically in time the pressures and mass fractions in the two blocks should equilibrate. The simulation was run to 1.0E+6 seconds at which time steady state conditions were obtained. Pressure, gas mass fraction and gas saturations were reported at 1.0E+n, n=1,2,3,4,5,6.

Comparison of the BRAGFLO/TOUGH28W results show pressures in figure 1, gas mass fractions in figure 2 and gas saturations in figure 3. The agreement between the BRAGFLO and TOUGH28W results are excellent.

This problem was also run with BRAGFLO without solution gas. Comparison of the BRAGFLO results with and without solution gas shows pressures in figure 4 and gas saturations in figure 5. Since no solution gas is available for release to free gas in the high pressure grid block, the pressure in this grid block decreases more rapidly in time. Without solution gas a much smaller volume of brine is transported in order to obtain pressure equilibration. Therefore, the gas saturation in the first grid block remains near a value of 1.0, while with solution gas a larger brine volume is transported with resulting lower gas saturation.

The results from this problem demonstrate that the dissolved gas model is properly implemented.

References:

Bromberg, J.P., "Physical Chemistry", Allyn and Bacon, Inc., 1980, p. 215.

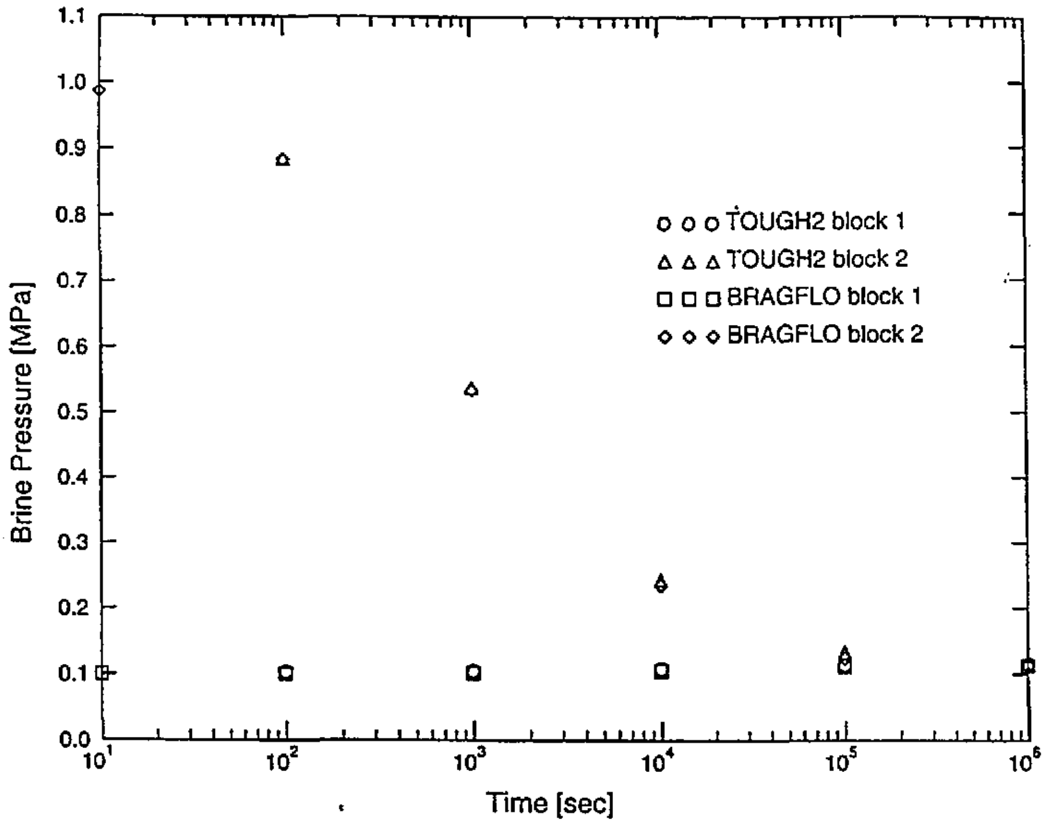

Figure 1: BRAGFLO and TOUGH2 Pressures Comparison

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SPLAT X2.0 10/11/95 16:15:16

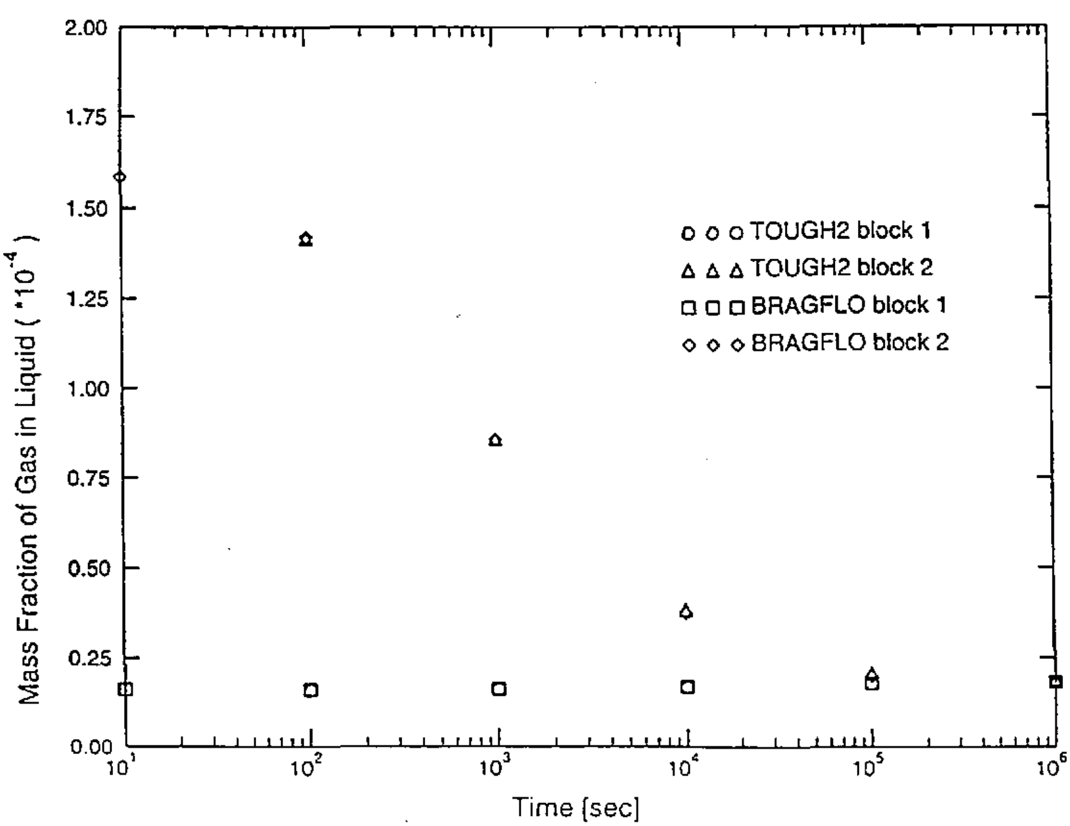

Figure 2: BRAGFLO and TOUGH2 Mass Fraction Comparison

U1:[MELORD.DISGAS]SP4_MF.CMD;23

SPLAT X2.0 10/11/95 16:20:00

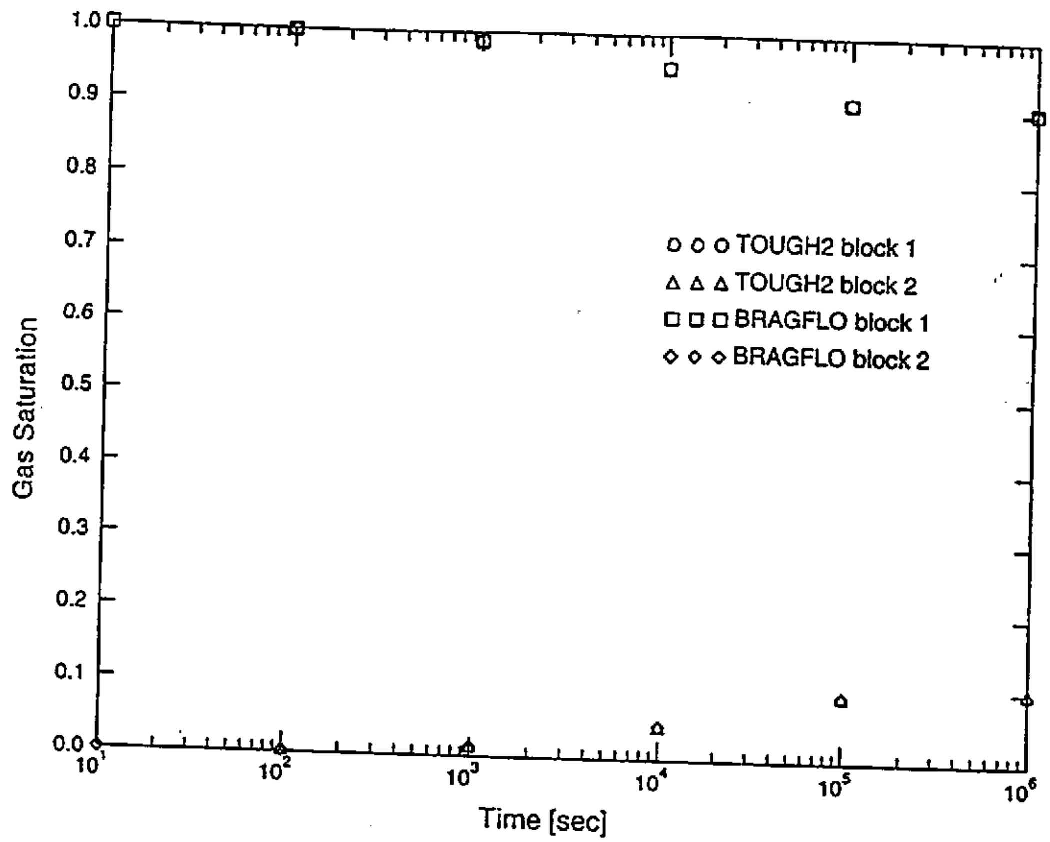

Figure 3: BRAGFLO and TOUGH2 Saturation Comparison

U1:[MELORO.DISGAS]SP4_SG.CMD;5

SPLAT X2.0 10/11/95 16:20:21

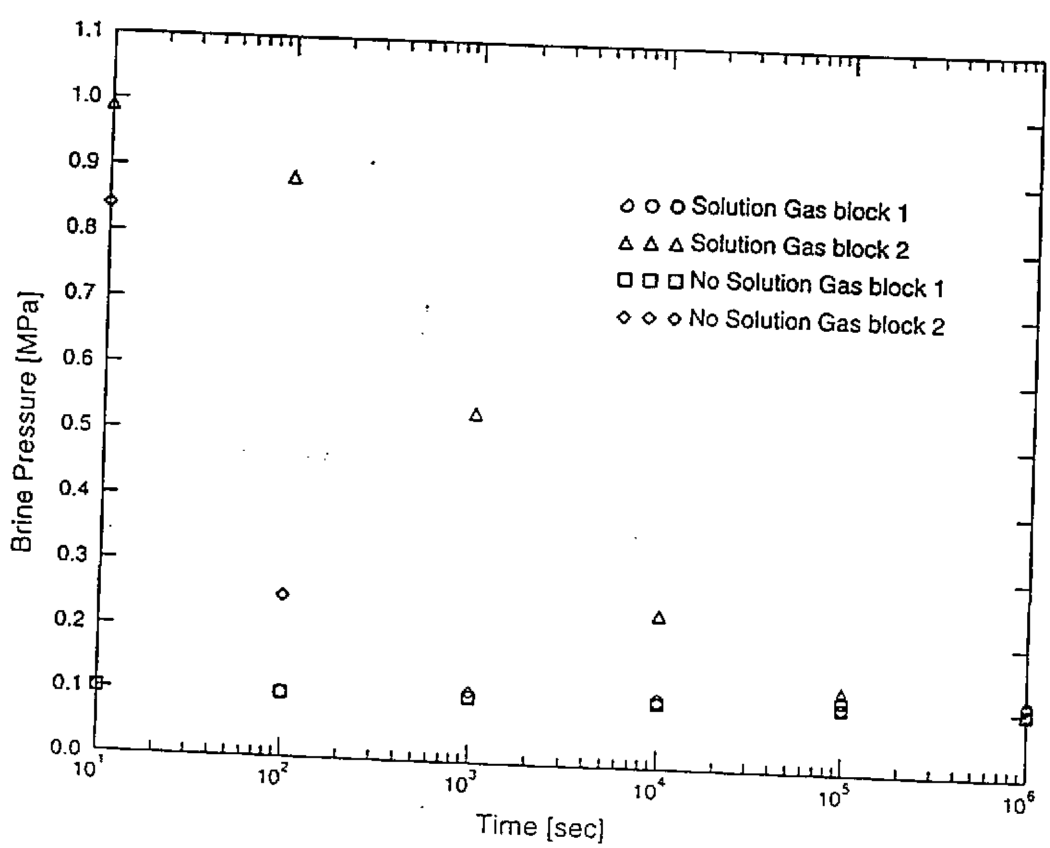

Figure 4: BRAGFLO Pressure Comparison With and Without Solution Gas

U1:[MELORO.DISGAS]SP4NOG_P.CMD;5

SWCF:1.1.6.3:PA:NG:TSK: GG1 and S7

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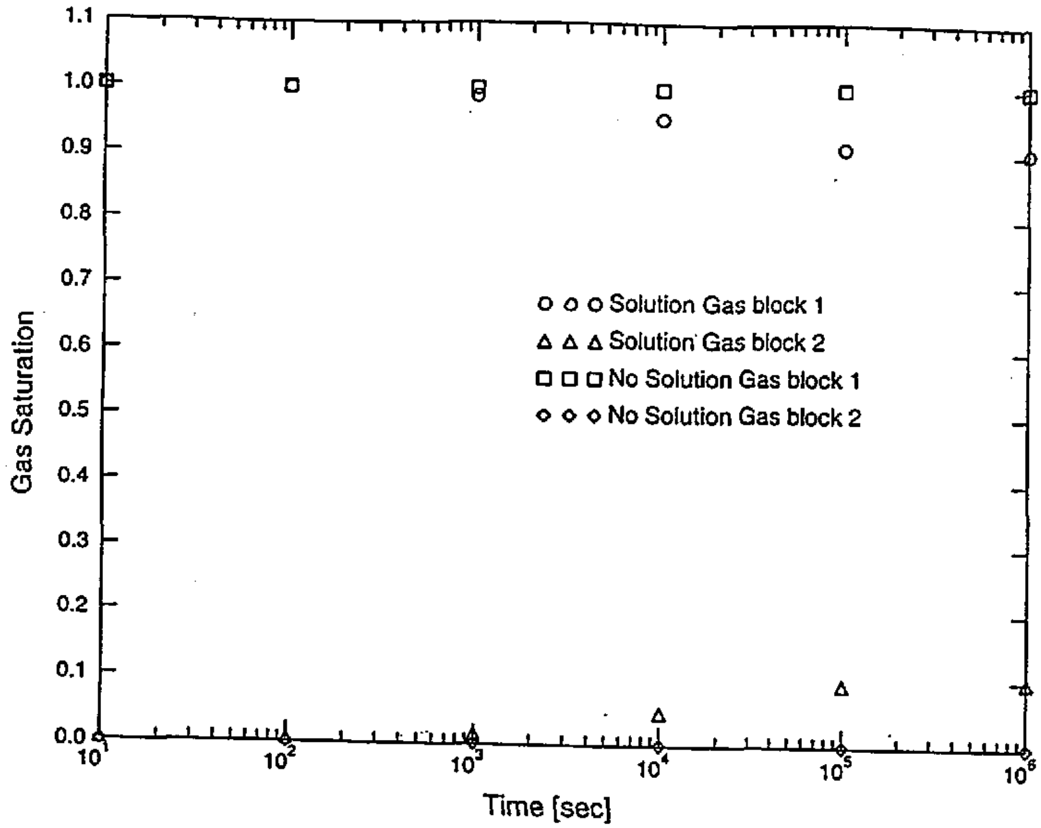

Figure 5: BRAGFLO Gas Saturation Comparison With and Without Solution Gas

U1:[MELORD.DISGAS]SP4NOG_SG.CMD;4

SPLAT X2.0 10/11/95 16:23:05

SWCF-A:1.1.6.3:PA:QA:TSK: GG1 and S7