NUREG-1612

Status Report: Reactor Vessel Integrity Database

U.S. Nuclear Regulatory Commission

Office of Nuclear Reactor Regulation

C.J. Fairbanks, A.D. Lee, J. Medoff, J.R. Strosnider, K. R. Wichman, B. J. Elliot

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ABSTRACT

The U.S. Nuclear Regulatory Commission (NRC) developed the Reactor Vessel Integrity Database (RVID) following the staff's review of licensee responses to Generic Letter (GL) 92-01, Revision 1 (Ref. 1). The database summarizes the properties of the reactor pressure vessel (RPV) beltline materials for each operating commercial nuclear power plant.

The RVID contains four tables for each plant: (1) background information table, (2) chemistry data table, (3) upper-shelf energy table, and (4) pressure-temperature limits or pressurized thermal shock table. References and notes follow each table documenting the source(s) of data and presenting supplemental information. Additionally, the RVID has "sort" and "data search" capabilities. The user can select a desired grouping of plants and then specify information categories to search and list.

The design of the RVID consolidates the industry's RPV data in a convenient and accessible manner. Some of the data categories contain data inputs of docketed" information; other data categories contain computed numerical values, which may or may not be docketed. The programming logic used for calculations in the RVID follows the methodology in Regulatory Guide (RG) 1.99, Revision 2 (Ref. 2).

For the Palisades RPV, the data and information contained in the RVID, Version 1.1, are current through April 12, 1995; the data and information for the RPVs of all other operating commercial nuclear power plants are current through December 31, 1994. The staff will update the RVID periodically to reflect the latest information available. Information contained in the industry's responses to the closeout letters to GL 92-01, Revision 1, and in the industry's responses to GL 92-01, Revision 1, Supplement 1 (Ref. 3), are not necessarily reflected in this version, but will appear in a future version of the RVID.

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APPENDICES

ABBREVIATIONS

B&W	Babcock and Wilcox Company
BAW	topical report designation issued by the Babcock and Wilcox Company
BWR	boiling water reactor
CE	Combustion Engineering Company
CF	chemistry factor
CFR	*Code of Federal Regulations*
EMA	equivalent margins analysis
EOL	expiration of license
EPRI	Electric Power Research Institute
f	neutron fluence (E > 1 MeV)
GE	General Electric Company
GE-NE	topical report designation issued by the General Electric Company
GL	generic letter
ID	inner diameter
IRT_{NDT}	initial RT_{NDT} value — the reference temperature for unirradiated materials
MTEB	old abbreviation — Materials and Chemical Engineering Branch, Division of Engineering, NRR
NEI	Nuclear Energy Institute
NRC	U.S. Nuclear Regulatory Commission
NRR	Office of Nuclear Reactor Regulation
NSSS	nuclear steam supply system
OD	outer diameter
P-T	pressure-temperature
PTS	pressurized thermal shock
PWR	pressurized water reactor
QA	quality assurance
RAI	request for additional information
RG	Regulatory Guide
RPV	reactor pressure vessel
RT_{NDT}	reference temperature relative to the nil ductility transition
RT_{PTS}	reference temperature for purposes of assessing pressurized thermal shock at expiration of licensee
ΔRT_{NDT}	mean value of the adjustment in the RT_{NDT} value as a result of neutron irradiation of the beltline material
RVID	Reactor Vessel Integrity Database
USE	upper shelf energy
W	Westinghouse Corporation
WCAP	topical report designation by the Westinghouse Corporation
1/4 T	location at one-quarter of the reactor vessel wall thickness as measured relative to the inner vessel wall surface

1 INTRODUCTION

The U.S. Nuclear Regulatory Commission (NRC) developed the Reactor Vessel Integrity Database (RVID) following the staff's review of licensee responses to Generic Letter (GL) 92-01, Revision 1 (Ref. 1). The database summarizes the properties of the reactor vessel beltline materials for each operating commercial nuclear power plant.

The design of the RVID consolidates the industry's RPV data in a convenient and accessible manner. Some of the data categories contain data inputs of "docketed" information; other data categories contain computed numerical values, which may or may not be docketed.

The RVID contains four tables for each plant:

(1) background information table

(2) chemistry data table

(3) upper-shelf energy table

(4) pressure-temperature (P-T) limits or pressurized thermal shock (PTS) table.

References and notes following each table document the source(s) of data and provide supplemental information. Additionally, the RVID includes "sort" and "data search" capabilities. Users can select a desired grouping of plants (e.g., all plants) or can limit the search to either pressurized-water reactors (PWRs), boiling-water reactors (BWRs), specific owners groups, or selected individual plants, and then specify up to 10 information categories to search and list.

The staff revised the RVID and expanded the User's Manual as a result of its assessment of the RVID, Version 1.1, and comments from the database users. In June 1996, the staff issued the RVID, Version 1.1, Revision 1, on the World Wide Web. The Web site for the RVID, Version 1.1, Revision 1, is http://www.nrc.gov/NRR/adw1/rvid.htm. To access the Homepage, one must have an Internet account and a Web browser such as Mosaic[1], Lynx[2], or Netscape[3].

The staff issued Administrative Letter 95-03, Revision 1, "Availability of the Reactor Vessel Integrity Database," on July 10, 1996 (Ref. 4), to inform the industry of the RVID, Version 1.1, Revision 1.

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1. Mosaic is a trademark of Mosaic Communications.

2. Lynx is a trademark of Lynx Real-Time Systems, Inc.

3. Netscape is a trademark of the Netscape Communications Corporation.

2 BACKGROUND

2.1 Staff Review Process for GL 92-01, Revision 1

The U.S. Nuclear Regulatory Commission (NRC) issued Generic Letter (GL) 92-01, Revision 1 (Ref. 1), to obtain information needed to assess licensee compliance with requirements and commitments regarding reactor pressure vessel (RPV) integrity. The staff issued GL 92-01, Revision 1, in response to concerns that arose as a result of the staff's review of the vessel integrity assessments for the Yankee Rowe RPV.

The staff compiled data from the responses to GL 92-01, Revision 1, in the RVID computerized database. Based on review of the data in the database and plant-specific reviews, the staff concluded that licensees may not have considered all the relevant data in their RPV assessments. Therefore, the staff, issued Supplement 1 to GL 92-01, Revision 1 (Ref. 3), in May 1995. The supplement required that all addressees identify, collect, and analyze the impact of any new data pertinent to the structural integrity of their RPVs relative to the requirements of 10 CFR 50.60 (Ref. 5), 10 CFR 50.61 (Ref. 6), and Appendices G and H to 10 CFR Part 50 (Refs. 7 and 8), as well as any potential impact on low temperature overpressure protection (LTOP) limits or pressure-temperature (P-T) limits.

All licensees have responded to GL 92-01, Revision 1, Supplement 1. Some licensees have provided additional data that were not provided in their initial response to the GL. However, in regard to GL 92-01, Revision 1, Supplement 1, no licensee has yet to identify any significant RPV integrity issue. Most licensees have indicated that they are participating in the owners group activities that will determine whether new information is available. The industry is coordinating the owners group activities through the Nuclear Energy Institute (NEI). The Boiling Water Reactor Vessel and Internals Project (BWRVIP) is coordinating activities for boiling-water reactors (BWRs). The Combustion Engineering Owners Group (CEOG) and Babcock and Wilcox Owners Group (B&WOG) have instituted programs to resolve the issue concerning weld chemistry variability.

2.2 Software and Database Objectives

The staff created the RVID to use as a tool for assisting the staff in its evaluations of domestic RPVs. The staff designed the RVID in a manner that enabled consolidation of materials property data and information in a convenient and accessible manner. Additionally, the staff designed the RVID to provide a simplified means through which information important to evaluating RPV integrity could be disseminated to the public and industry.

The staff's objective for the software design was to present the information in an efficient "user-friendly" manner. Therefore, the staff designed the database's screens in "Windows-type" formats and summarized the plant-specific information into four tables for each plant. The staff added "sort" and "query" capabilities to enable the user to select a customized set of information categories from the data and information categories contained in the four tables.

Since the RVID was developed as a relational database, the staff selected FoxPro[4] as the programming language for the database. FoxPro was selected in order to minimize run times. The calculated values in the database were coded according to the methodologies of Regulatory Guide 1.99, Revision 2 (Ref. 2).

The following system requirements (configuration) are needed in order to operate the RVID:

- 386 personal computer (486 preferred)
- DOS Version 5.0 or above
- 6 to 8 megabytes RAM
- color monitor (preferred)
- mouse (preferred)
- files = 99
- buffers = 20

The staff recommends use of a 486 personal computer in order to reduce run times. The staff also recommends use of a color monitor and a mouse so that the user may take advantage of the color-based, "Windows-type" format and mouse-driven menu

4. FoxPro is a trademark of the Microsoft Corporation.

functions. In addition, the staff recommends that users consult with their resident computer experts to adjust any files or buffers in the database. Use of a computer setup that is less sophisticated than the minimum recommended configuration listed above may result in error messages (for example, "Too many files are open" and "Too many memory variables") during access to the database. The file and buffer configurations set up the available space in which FoxPro may work. If not enough space is available, the system may "crash" (fail) during access to the database. The file and buffer configurations for the operating system are designated in the config.sys file. The staff recommends that users consult with their resident computer experts for assistance if they are not familiar with the features of this file.

The staff included "help" features throughout the design of the RVID in order to make the database more user friendly. A user who has difficulty navigating or understanding the system, may turn to the help features for assistance. The RVID User's Manual accompanies the diskettes to provide additional detailed information regarding the system. The User's Manual also appears (in a re-edited form) in Appendix A to this report.

3 DEVELOPMENT AND DESIGN OF SUMMARY TABLES

3.1 Source Documents

The data and information inputted into the RVID were provided by licensees as part of their RPV integrity evaluations. The staff used the following documents as sources of information and data for development of the Reactor Vessel Integrity Database (RVID) tables:

- licensee responses to Generic Letter (GL) 92-01, Revision 1 (Ref. 1)
- licensee responses to staff requests for additional information (RAIs)
- documents referenced in licensee responses to GL 92-01, Revision 1
- surveillance capsule reports
- pressure-temperature (P-T) limits submittals
- pressurized thermal shock (PTS) submittals

Except for data and information regarding the Palisades RPV, the data and information contained in the RVID, Version 1.1, are reflective of "docketed" information through December 31, 1994. The data and information for the Palisades RPV are current through April 12, 1995. The staff reviewed the data and information regarding the Palisades RPV during the development of the RVID, Version 1.1. The staff summarized its evaluation of the PTS assessment for the Palisades RPV in a letter to the licensee, dated April 12, 1995 (Ref. 9).

3.2 Table Formats

The staff designed the format of the RVID to contain four tables for each plant:

(1) a background information table

(2) a chemistry data table

(3) an upper-shelf energy (USE) table

(4) a P-T limits table (boiling-water reactors, BWRs) or a PTS table (pressurized-water reactors, PWRs).

The summary reports are presented as tables; each beltline material is identified in one column, and various information categories are identified in other columns. References and notes follow each table to document the original sources of data and to provide supplemental information not incorporated into the tables. An example of each of the tables appears in Appendix B to this report.

3.2.1 P-T Limits Summary Table (BWRs) or PTS Summary Table (PWRs)

Each BWR has a P-T limits table; each PWR has a PTS table. Information headings for these tables are as follows:

Column 1: **Plant Name** contains the name of the plant, date of expiration of license (EOL), and docket number.

Column 2: **Beltline Identification** provides the plant-specific beltline material identification, which generally consists of a component description, location, and number.

Column 3: **Heat Identification Number** identifies the heat number of the beltline material. The following items represent possible suffixes that may be used in conjunction with or in lieu of the Heat Number Identifications for RPV beltline materials:

(S) — when this suffix is used after a heat number for a specified beltline weld material, the suffix indicates that a single wire was used in the single arc welding (SAW) process.

(T) — when this suffix is used after a heat number for a specified beltline weld material, the suffix indicates that a tandem wire was used in the SAW process.

NA/W-A — when this suffix is used in lieu of a heat number the suffix indicates that a corresponding heat number was not available for the plant specific beltline weld material specified in Column 2 of the Summary File. In the event that more than one weld did not have an available heat number for a given plant, these would be identified as NA/W-B, NA/W-C, etc.

NA/PL-A — when this suffix is used in lieu of a heat number, the suffix indicates that a corresponding heat number was not available for the plant specific beltline plate material specified in Column 2 of the Summary File. In the event that more than one plate did not have an available heat number for a given plant, these would be identified as NA/PL-B, NA/PL-C, etc.

NA/F-A — when this suffix is used in lieu of a heat number, the suffix indicates that a corresponding heat number was not available for the plant-specific beltline forging material specified in Column 2 of the Summary File. In the event that more than one forging did not have an available heat number for a given plant, these would be identified as NA/F-B, NA/F-C, etc.

Column 4: **RT_{PTS} @ EOL** provides the reference temperature as adjusted for the effects of neutron irradiation at the EOL. This adjusted reference value temperature is equivalent to the sum of the initial RT_{NDT} value, margin value, and ΔRT_{NDT} value at EOL.

Column 5: **ID Neutron Fluence @ EOL** is the neutron fluence value at the inner diameter (ID) of the reactor vessel at EOL. This value is either cited directly or calculated by applying the neutron fluence of the one-quarter thickness (1/4 T) location, as reported in the licensee's most recent submittal for the beltline material, to the neutron fluence attenuation equation in Regulatory Guide (RG) 1.99, Revision 2 (Ref. 2). All entries are given in units of 10^{19} n/cm^2.

Column 6: **IRT_{NDT}** is the initial RT_{NDT} of the unirradiated material as defined in ASME Code Section III, paragraph NB-2331, or from alternative methodologies, in accordance with Branch Technical Position MTEB 5-2 in Standard Review Plan Section 5.3.2 (Ref. 10).

Column 7: **Method of Determining IRT_{NDT}** is the method of determining the initial reference temperature. The following methods provide the possible inputs to this column:

B&W Generic indicates the initial reference temperature is the generic value for all Linde 80 welds fabricated by Babcock and Wilcox, excluding material heat number 72105.

Generic indicates that the initial reference temperature is the generic value for Linde 0091, Linde 1092, Linde 124, and ARCOS B-5 welds fabricated by Combustion Engineering.

MTEB 5-2 indicates that the initial reference temperature is a value determined using the methodology in Branch Technical Position MTEB 5-2 in Standard Review Plan Section 5.3.2.

NRC Generic indicates that the initial reference temperature is a bounding generic value for heat number 72105 welds fabricated by Babcock & Wilcox.

Plant Specific indicates that the initial reference temperature value was determined from tests on material removed from the same material heat as was the identified beltline material.

Column 8: **ΔRT_{NDT} @ EOL** is the mean value of the adjustment in reference temperature caused by irradiation. ΔRT_{NDT} is calculated in accordance with the PTS rule as follows: $\Delta RT_{NDT} = (CF)*f^{(0.28 - 0.10*\log f)}$, where CF is the chemistry factor and f (in units of 10E19 n/cm^2) is the neutron fluence of the beltline material projected at EOL.

Column 9: **Fluence Factor @ EOL** is calculated as follows: fluence factor at EOL = $f^{(0.28 - 0.10*\log f)}$ where f (in units of 10E19 n/cm^2) is the neutron fluence of the beltline material projected at EOL.

Column 10: **Chemistry Factor** is the chemistry factor for irradiated reference temperature evaluation.

Column 11: **Method of Determining CF** is the method of determining the chemistry factor. The following methods provide the possible inputs to this column:

Table indicates that the chemistry factor was determined using the best-estimate chemistry values (copper and nickel) and the tables in RG 1.99, Revision 2.

Calculated indicates that the chemistry factor was determined using the plant-specific surveillance data.

Override indicates that the chemistry factor was determined using a methodology approved by the NRC.

Column 12: **Margin** is a numerical quantity added to cover uncertainties in the values of initial RT_{NDT}, copper and nickel measurements, fluence, and the calculational procedures involved in determining RT_{NDT}. The margin is calculated according to the methodology of RG 1.99, Revision 2. According to the RG, the Margin = $2*(\sigma_i^2 + \sigma_\Delta^2)^{0.5}$. [5,6]

Column 13: **Method of Determining Margin** is the method of determining the margin value. The following methods provide the possible inputs to this column:

Table indicates that the margin term was calculated using a standard deviation for the increase in reference temperature of 15.6 °C (28 °F) for welds and 9.4 °C (17 °F) for base metal.

Surv. Capsule indicates that the margin term was calculated using a standard deviation for the increase in reference temperature of 7.8 °C (14 °F) for welds and 4.7 °C (8.5 °F) for base metal.

Column 14: **Cu%** provides the copper content, cited directly from the licensee's value, except when more than one value was reported (in which case the staff used the average value).

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5. Here σ_i is the standard deviation for the initial RT_{NDT}. If a measured value of initial RT_{NDT} for the material in question is available, σ_i is to be estimated from the precision of the test method. If not, and generic mean values for that class of material are used, σ_i is the standard deviation obtained from the set of data used to establish the mean.

6. The standard deviation for ΔRT_{NDT}, σ_Δ, is 15.6°C (28°F) for welds and 9.4°C (17°F) for base metal, except that σ_Δ need not exceed 0.50 times the mean value of ΔRT_{NDT}. If two or more sets of credible surveillance data are available and are used to establish the ΔRT_{NDT}, the values for σ_Δ may be cut in half.

Column 15: **Ni%** provides the nickel content, cited directly from the licensee's value, except when more than one value was reported (in which case the staff used the average value).

The following represent columns in the Summary File for PTS/P-T Limits whose numerical or text values are entered directly from a source document:

Column 1: Plant Name

Column 2: Beltline Identification

Column 3: Heat No. Identification

Column 5: ID Neutron Fluence @ EOL

Column 6: IRT_{NDT}

Column 7: Method of Determining IRT_{NDT}

Column 9: Chemistry Factor, in the case of an Override

Column 11: Method of Determining Chemistry Factor

Column 12: Margin—inputs of σ_i and

Column 13: Method of Determining Margin

Column 14: Cu% (the average value is listed if more than one value is reported)

Column 15: Ni% (the average value is listed if more than one value is reported).

The following columns represent columns in the Summary File for PTS/P-T Limits whose numerical data have been obtained by using the calculational methodology of RG 1.99, Revision 2:

Column 4: RT_{PTS} @ EOL

Column 8: ΔRT_{NDT} @ EOL

Column 9: Fluence Factor @ EOL

Column 10: Chemistry Factor

Column 12: Margin—calculated from the inputs of σ_i and σ_Δ.

3.2.2 Upper-shelf Energy (USE) Summary Table

Information headings for the USE Summary Tables include:

Column 1: **Plant Name** contains the name of the plant, date of EOL, and docket number.

Column 2: **Beltline Identification** provides the plant-specific beltline material identification, which generally consists of a component description, location, and number.

Column 3: **Heat Number Identification** identifies the heat number of the beltline material. A number of suffixes may accompany or be used in lieu of the heat number identifications in this column. Refer to the suffixes described under the informational heading for Column 3 in Section 3.2.1 of this Chapter.

Column 4: **Material Type** provides the material type for each plate, forging or weld.

Column 5: **USE @ EOL @ 1/4 T** is the calculated upper-shelf energy value (in ft-lb) at EOL as determined for the one-quarter thickness location of the RPV.

Column 6: **1/4 T Neutron Fluence @ EOL** is the neutron fluence value at EOL for one-quarter thickness location of the RPV. This value is either cited directly or calculated by applying the ID neutron fluence, as reported in the licensee's most recent submittal for the beltline material, to the neutron fluence attenuation equation in RG 1.99, Revision 2. All entries are given in units of 10^{19} n/cm^2.

Column 7: **Unirradiated USE** is the unirradiated upper-shelf energy in units of ft-lb.

Column 8: **Method of Determining Unirradiated USE** describes the method of determining the unirradiated upper-shelf energy. The following methods provide the possible inputs to this column:

Direct—for plates, this indicates that the unirradiated USE was determined from Charpy-V tests on transverse test specimens. For welds, this indicates that the unirradiated USE was determined from Charpy-V test data.

65 % indicates that the unirradiated USE was calculated in accordance with Section 1.2 of Branch Technical Position MTEB 5-2, "Fracture Toughness Requirments" at 65 % of the USE value obtained from Charpy-V tests on longitudinal test specimens.

Generic indicates that the unirradiated USE was reported by the licensee from USE data of other plants with similar materials to the beltline material.

NRC Generic indicates that the unirradiated USE was derived by the staff from the USE data of other plants with similar materials to the beltline weld.

10, 30, 40 or 50 °F indicates that the unirradiated USE was derived from Charpy-V tests conducted at 10, 30, 40 or 50 °F.

Surv Weld indicates that the unirradiated USE was from the surveillance weld having the same weld wire heat number.

Sister Plant indicates that the unirradiated USE was derived by using the reported value from other plant(s) with the same weld wire heat number.

EMA indicates that an unirradiated USE is unnecessary because the licensee has satisfied the USE requirements of Appendix G to 10 CFR Part 50 (Ref. 7), through an equivalent margins analysis.

Column 9: **% Drop USE @ EOL @ 1/4T** describes the percentage drop in USE from the initial unirradiated value to the value projected to occur at EOL as a result of radiation embrittlement.

Column 10: **Method Determ % Drop** describes the method of determining the percentage drop in USE. The following methods provide the possible inputs to this column:

Position 1 of RG 1.99, Rev. 2 indicates that the percentage drop in USE was determined using the percentage copper and the methodology in Position 1 of RG 1.99, Revision 2.

Surveillance Data indicates that the percentage drop in USE was determined using surveillance data and the methodology in Position 2 of RG 1.99, Revision 2.

EMA indicates that the percentage drop in USE is unnecessary because the licensee has used an equivalent margins analysis to satisfy the USE requirements of Appendix G to 10 CFR Part 50.

Column 11: **Cu%** provides the copper content, cited directly from the licensee's report, except that when more than one value was reported, the staff used the average of the reported values.

The following represent columns in the Summary File for USE whose numerical or text values are entered directly from a source document:

Column 1: Plant Name

Column 2: Beltline Identification

Column 3: Heat No. Identification

Column 4: Material Type

Column 7: Unirradiated USE

Column 8: Method of Determining USE

Column 10: Method of Determining % Drop

Column 11: Cu% (the average value is cited if more than one value is reported)

The following columns represent columns in the Summary File for USE Limits whose numerical data have been obtained by using the calculational methodology of RG 1.99, Revision 2:

Column 5: USE @ EOL @ 1/4T

Column 6: 1/4T Neutron Fluence @ EOL

Column 9: % Drop @ EOL @ 1/4T

3.2.3 Chemistry Summary Table

Information headings for the Chemistry Summary Tables include:

Column 1: **Plant Name** contains the name of the plant, date of EOL, and docket number.

Column 2: **Beltline Identification** contains the plant-specific beltline material identification, which generally consists of a component description, location, and number.

Column 3: **Heat No. Ident.** indicates the beltline material heat number.

Column 4: **%Cu** provides the copper content, cited directly from the licensee's report, except that when more than one value was reported, the staff used the average of the reported values.

Column 9: **%Ni** provides the nickel content, cited directly from the licensee's report, except that when more than one value was reported, the staff used the average of the reported values.

Column 14: **%P** provides the phosphorous content, cited directly from the licensee's report, except that when more than one value was reported, the staff used the average of the reported values.

Column 15: **%S** provides the sulfur content, cited directly from the licensee's report, except that when more than one value was reported, the staff used the average of the reported values.

All other columns are blank at this time, for all plants.

3.2.4 Plant Background Information Table

The plant background information table contains general information for each plant, including the following data:

- Plant Name
- Docket Number

- NSSS (Nuclear Steam Supply System) Vendor
- Vessel Manufacturer
- Date of License Expiration
- Vessel Beltline Thickness
- Vessel Inside Radius

3.3 Quality Assurance

The staff performed a quality assurance (QA) check of the data and information contained in the RVID. The staff compared data from the source documents to the data in the RVID and independently verified the accuracy of calculated database values. The staff attributed small discrepancies in the calculated values to differences in the methods for performing calculations or for rounding off numerical values.

Each licensee received copies of the summary tables for its respective plant(s). The staff requested that licensees confirm the applicability of the unirradiated properties, neutron fluence, and chemical composition that provided the basis for the plant summaries. Most licensees confirmed that the data in the RVID are applicable to their plants; however, some licensees submitted new or additional data for their vessels in their plant-specific responses to the staff's closeout letters to GL 92-01, Revision 1, or in their plant-specific responses to GL 92-01, Revision 1, Supplement 1 (Ref. 3). Most licensees have participated in the vessel integrity data searches performed by the industry owners groups in order to address the issues raised in the GL. The new information is expected to be available by the end of Summer 1997. The staff will assess all new plant data, and any revisions to the plant-specific data will be reflected in a future version of the RVID. Data regarding decommissioned plants have not been included in the database.

Data for each surveillance capsule report are listed individually. The source for surveillance data was the Power Reactor Embrittlement Database (PR-EDB), Version 2 (Ref. 11), with the exceptions that data from the following plant-specific surveillance capsule reports were added:

- Cooper, GE-NE-523-159-1292
- Diablo Canyon, WCAP-12811
- McGuire 2, WCAP-13516
- Millstone 1, GE-NE-523-165-1292,
- Calvert Cliffs, BAW-1260

The PR-EDB is a comprehensive collection of data from surveillance reports and other published reports of commercial nuclear reactors. However, the data have not been verified by reactor vendors, and the capsule data were not evaluated according to credibility criteria. Surveillance data for the following plants were excluded from the RVID Surveillance Files because credibility could not be established:

- Haddam Neck, Capsule A/BMI-1070, not credible for welds
- Quad Cities 1, not credible for welds
- Turkey Point 3 and 4, not credible for weld heat no. 71249

The staff did not complete credibility studies of plant-specific surveillance data prior to issuance of the original version (Version 1.1) of the RVID. The staff compared data values from the PR-EDB to data stored in the RVID under "Surveillance Capsule Reports" in order to identify and correct discrepancies and data entry errors. The staff added a means of identifying surveillance data as credible or non-credible in the RVID Version 1.1, Revision 1, and completed a credibility assessment for the following eight nuclear plants: (1) Kewaunee, (2) Indian Point Unit 2, (3) Indian Point Unit 3, (4) Maine Yankee, (5) Robinson Unit 2, (6) North Anna Unit 1, (7) Haddam Neck, and (8) Diablo Canyon Unit 1. The staff assessed the surveillance data for these units because the RVID reflected that surveillance data were being utilized for calculation of the chemistry factor for the limiting material in the reactor vessel. The staff determined that the licensees for Kewaunee, Indian Point Unit 2, Indian Point Unit 3, Maine Yankee, Robinson Unit 2, and North Anna Unit 1 had two or more sets of credible surveillance capsule data for the limiting materials in their vessels (reflected as credible "Y" in the database). The staff determined that the licensees for Haddam Neck and Diablo Canyon Unit 1 did not

have two credible sets of surveillance capsule data for the limiting materials in their vessels (reflected as credible "N" in the database). The staff will continue to review surveillance data and will make appropriate changes for non-credible surveillance data accordingly in future versions of the RVID.

4 DISTRIBUTION

The staff presented the RVID to the public at an NRC/NEI Workshop that occurred on July 13, 1995, and announced the availability of the database in Administrative Letter 95-03, "Availability of the Reactor Vessel Integrity Database" (Ref. 12). Revision 1 of the Administrative Letter (Ref. 4) announced the availability of the RVID Version 1.1, Revision 1. This is the version of the RVID that is currently available on the world-wide web.[7] For users who do not have access to a web browser such as Mosaic[8], Lynx[9], or Netscape[10], the RVID is available, free of charge, by writing to:

RVID Project Manager
U.S. Nuclear Regulatory Commission
Mailstop O-7D4
Washington, DC 20555-0001

For issuance of the original version of the RVID, each set of diskettes for the database was accompanied by an RVID User's Manual and hard-copy printouts of the Summary Tables for each plant. Availability of Revision 1 to the RVID Version 1.1, on the World Wide Web[7] has made dissemination of the RVID more efficient.

Distribution of the RVID began in August 1995. Several hundred copies have been distributed to date. The wide range of requestors comprises licensees, research institutions and universities, public interest groups and individuals, State government agencies, and foreign regulatory agencies.

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7. The world wide web location for the RVID Version 1.1, Revision 1, is http://www.nrc.gov/NRR/adw1/rvid.htm.

8. Mosaic is a trademark of Mosaic Communications.

9. Lynx is a trademark of Lynx Real-Time Systems, Inc.

10. Netscape is a trademark of the Netscape Communications Corporation.

5 NUREG-1511, SUPPLEMENT NO. 1

The RVID was a source of data and information for NUREG-1511, "Reactor Pressure Vessel Status Report" (Ref. 13). In addition to being the source of background information for the report's Reactor Vessel Integrity Database Summary Sheets (as provided in Appendix B to the report), the RVID was the source for the staff's determination of each plant's limiting beltline material(s), and respective RT_{PTS} and USE data, information, and references.

On May 19, 1995, the staff issued Supplement 1 to Generic Letter (GL) 92-01, Revision 1 (Ref. 3), to ensure that industry licensees were considering all relevant data in their RPV assessments and to resolve any apparent discrepancies in regard to the data reported in response to GL 92-01, Revision 1 (Ref. 1). In October 1996, the staff issued Supplement No. 1 to NUREG-1511 (Ref. 14), a summary of the staff's assessment of the industry's responses to GL 92-01, Revision 1, Supplement 1. The supplement to the NUREG report also described new information regarding Revision 1 of the RVID and future revisions to the database.

The staff is currently switching the environment for accessing the RVID data to a more user-friendly format. Microsoft Access[11] software is being used to bring the database into the Windows environment (as opposed to the current DOS-based Foxpro[11] software).

11. Access™ and FoxPro ™ are trademarks of the Microsoft Corporation.

6 COMPARISON OF THE RVID TO THE INDUSTRY DATABASE "RPVDATA"

The original version of RVID is now contained in the industry database "RPVDATA" which is maintained by the Electric Power Research Institute (EPRI). RPVDATA runs under Microsoft Access[12] and is a flat file (no computations are performed within the database).

RPVDATA also contains several "tiers" of information which are not in the RVID. Examples include details of weld property sampling and comparisons of licensee "best estimate" chemical composition values with docketed information.

The NRC staff and industry are currently working together to resolve inconsistencies between the two databases. The NRC will make revisions to the RVID subsequent to the completion of the staff's reviews of the industry's responses to GL 92-01, Revision 1, Supplement 1 (Ref. 3). At that time, it will be possible to compare the NRC and industry databases and to establish an NRC-approved baseline database. Subsequently, it may be possible to have the industry maintain the database with NRC oversight. The NRC will be able to verify the updates by comparisons with docketed plant information.

12. Access™ is a trademark of the Microsoft Corporation.

7 SUMMARY AND CONCLUSIONS

The NRC developed the RVID following the staff's review of licensee responses to Generic Letter (GL) 92-01, Revision 1 (Ref. 1). The database summarizes the properties of the reactor vessel beltline materials for each operating commercial nuclear power plant.

The staff designed and developed the RVID to reflect the current status of RPV integrity. The design of the RVID consolidates the plant-specific data and information in a convenient and accessible manner. Some of the information categories (data fields) contain data inputs from docketed information; others contain data that represent computed numerical values, which are not necessarily docketed.

The objective of the software design was to present the information in an efficient "user-friendly" manner. Therefore, the staff designed the RVID screens in "Windows-type" formats and summarized the plant-specific information in four tables per plant. The staff added "sort" and "query" capabilities to provide the user with the ability to select a customized set of information categories from the data and information categories contained in the four tables.

The staff used the following documents as the sources of information and data for development of the RVID tables: licensee responses to GL 92-01, Revision 1, licensee responses to staff RAIs, documents referenced in the responses to GL 92-01, Revision 1, surveillance capsule reports, and as applicable, P-T limits or PTS submittals. The data and information contained in the RVID, Version 1.1, with the exception of Palisades, are current through December 31, 1994. The data and information for the Palisades RPV are current through April 12, 1995. The staff evaluated the Palisades RPV during the development of the RVID, Version 1.1. The staff summarized the PTS evaluation for the Palisades RPV in a letter to the Consumers Power Company (the licensee for Palisades) dated April 12, 1995 (Ref. 9).

The staff performed a quality assurance (QA) check of the data and information contained in the RVID. The staff compared data from the source documents to the data in the RVID and independently verified the accuracy of calculated database values. The staff attributed small discrepancies in the calculated values to differences in the methods for performing calculations or for rounding off numerical values.

Each licensee received copies of the summary tables for its respective plant(s). The staff requested that licensees confirm the applicability of the unirradiated properties, neutron fluence, and chemical composition that provided the basis for the plant summaries. Most licensees confirmed that the data in the RVID are applicable to their plants; however, some licensees submitted new or additional data for their vessels in their responses to the staff's closeout letters regarding GL 92-01, Revision 1, or in their responses to GL 92-01, Revision 1, Supplement 1 (Ref. 3). Licensees have participated in the vessel integrity data searches performed by the industry owners groups in order to address the issues raised in the GL. The new information is expected to be available by the end of Summer 1997. The staff will assess all new plant data, and any revisions to the plant-specific data will be reflected in a future version of the RVID.

The staff revised the RVID and expanded the user's manual as a result of the its assessment of the RVID Version 1.1 and comments from database users. The staff issued Revision 1 to RVID, Version 1.1, on the world-wide web in June of 1996.[13] To access the homepage, one must have an Internet account and a web browser such as Mosaic[14], Lynx[15], or Netscape[16]. Administrative Letter 95-03, Revision 1, "Availability of the Reactor Vessel Integrity Database" (Ref. 4) was issued on July 10, 1996, to inform the industry of the availability of the RVID.

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13. The World Wide Web location for the RVID Version 1.1, Revision 1 is http://www.nrc.gov/NRR/adw1/rvid.htm.

14. Mosaic is a trademark of Mosaic Communications.

15. Lynx is a trademark of Lynx Real-Time Systems, Inc.

16. Netscape is a trademark of the Netscape Communications Corporation.

The staff did not complete credibility studies of plant-specific surveillance data prior to issuance of the original version (Version 1.1) of the RVID. The staff compared data values from the PR-EDB (Ref. 11) to data stored in the RVID under "Surveillance Capsule Reports" in order to identify and correct discrepancies and data entry errors. The staff added a means of identifying surveillance data as credible or not-credible in the RVID Version 1.1, Revision 1, and completed a credibility assessment for the following eight nuclear plants: (1) Kewaunee, (2) Indian Point 2, (3) Indian Point 3, (4) H.R. Robinson 2, (5) Maine Yankee, (6) North Anna 1, (7) Haddam Neck, and (8) Diablo Canyon 1. The staff assessed the surveillance data for these units because the RVID reflected that surveillance data were being utilized for calculation of the chemistry factor for the limiting material in the reactor vessel. The staff determined that the licensees for Kewaunee, Indian Point 2, Indian Point 3, Maine Yankee, H.R. Robinson 2, and North Anna 1 had two or more sets of credible surveillance capsule data for the limiting materials in their vessels (reflected as credible "Y" in the database). The staff determined that the licensees for Haddam Neck and Diablo Canyon 1 did not have two credible sets of surveillance capsule data for the limiting materials in their vessels (reflected as credible "N" in the database). The staff will continue to review surveillance data and will make appropriate changes for non-credible surveillance data accordingly in future versions of the RVID.

The RVID was a source of data and information for NUREG-1511, "Reactor Pressure Vessel Status Report" (Ref. 13). In addition to being the source of background information for the report's Reactor Vessel Integrity Database Summary Sheets (as contained in Appendix B to the report), the RVID was the source for the staff's determination of each plant's limiting beltline material(s) and the respective RT_{PTS} and USE data, information, and references. In addition, NUREG-1511, Supplement No. 1 (Ref. 14), also contained a chapter that describes new information regarding Revision 1 of the RVID and future revisions to the database.

The original version of RVID is now contained in the industry database "RPVDATA" which is maintained by EPRI. RPVDATA runs under Microsoft Access[17] and is a flat file (no computations are performed within the database).

The staff is currently switching the environment for accessing the RVID data to a more user-friendly format. Microsoft Access[17] software is being used to bring the database into the Windows environment (as opposed to the current DOS-based Foxpro[17] software).

The NRC will revise the RVID after it completes its reviews of the industry's responses to GL 92-01, Revision 1, Supplement 1. At that time, it will be possible to compare the NRC and industry databases and establish an NRC-approved baseline database. Subsequently, it may be possible to have the industry maintain the database with NRC oversight. The NRC will be able to verify the updates by comparisons with docketed plant information.

17. Access™ and FoxPro™ are trademarks of the Microsoft Corporation.

8 REFERENCES

1. Generic Letter 92-01, Revision 1, "Reactor Vessel Structural Integrity. 10 CFR 50.54(f)," March 6, 1992.

2. Regulatory Guide 1.99, Revision 2, "Radiation Embrittlement of Reactor Vessel Materials," May 1988.

3. Generic Letter 92-01, Revision 1, Supplement 1, "Reactor Vessel Structural Integrity," May 19, 1995.

4. NRC Administrative Letter 95-03, Revision 1, "Availability of the Reactor Vessel Integrity Database," July 10, 1996.

5. Title 10, *Code of Federal Regulations*, Section 50.60, "Acceptance Criteria for Fracture Prevention Measures for Lightwater Nuclear Power Reactors for Normal Operation."

6. Title 10, *Code of Federal Regulations*, Section 50.61, "Fracture Toughness Requirements for Protection Against Pressurized Thermal Shock Events."

7. Title 10, *Code of Federal Regulations*, Part 50, Appendix G, "Fracture Toughness Requirements."

8. Title 10, *Code of Federal Regulations*, Part 50, Appendix H, "Reactor Vessel Material Surveillance Program Requirements."

9. Letter from E.G. Adensam, Acting Director — Division of Reactor Projects III/IV, Office of Nuclear Reactor Regulation, to K.M. Haas, Plant Safety and Licensing Manager — Palisades Plant, "Palisades Plant — Pressurized Thermal Shock Safety Evaluation (TAC No. M83227)," April 12, 1995.

10. NUREG-0800, "Standard Review Plan," Section 5.3.2, "Pressure-Temperature Limits," Branch Technical Position MTEB 5-2, "Fracture Toughness Requirements," Revision 1, July 1981.

11. NUREG/CR-4816, ORLN/TM-10328/R2, Rev. 2, "PR-EDB: Power Reactor Embrittlement Database, Version 2," January 1994.

12. NRC Administrative Letter 95-03, "Availability of the Reactor Vessel Integrity Database," August 4, 1995.

13. NUREG-1511, "Reactor Pressure Vessel Status Report," December 1994.

14. NUREG-1511 Supplement 1, "Reactor Pressure Vessel Status Report," October 1996.

APPENDIX A

Reactor Vessel Integrity Database
Version 1.1
Revision 1

User's Manual

Initial Publishing: June 1996
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Republished for NUREG-1612: July 1997

U.S. Nuclear Regulatory Commission

DISCLAIMER NOTICE

This database was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, or any of its employees, makes any warranty, expressed or implied, or assumes any legal liability of responsibility for any third-party's use, or the results of such use, of any information, apparatus, product or process disclosed in this report, or represents that its use by such third party would not infringe privately owned rights.

ABSTRACT

The Reactor Vessel Integrity Database (RVID) was developed following NRC staff review of licensee responses to Generic Letter (GL) 92-01, Revision 1. The database summarizes the properties of the reactor vessel beltline materials for each operating commercial nuclear power plant.

The RVID contains four tables for each plant: (1) background information table, (2) chemistry data table, (3) upper-shelf energy table, and (4) pressure-temperature limits or pressurized thermal shock table. References and notes following each table document the source(s) of data and provide supplemental information. Additionally, the RVID has "sort" and "data search" capabilities. The user can select a desired grouping of plants and then specify information categories to search and list.

The RVID was designed and developed to reflect the current status of reactor pressure vessel integrity, and the data are consolidated in a convenient and accessible manner. Some of the data categories are inputs of docketed information; other data categories are computed values, which are not necessarily docketed. The programming logic used for calculations in the RVID follows the methodology in Regulatory Guide 1.99, Revision 2.

The data and information contained in the RVID are current through December 31, 1994, except for the data and information for the Palisades nuclear plant which are current through April 12, 1995. The Palisades reactor pressure vessel was being evaluated during the development of the RVID, Version 1.1. On April 12, 1995, in a letter to the licensee, the staff summarized its PTS evaluation. The RVID will be updated periodically to reflect the latest information available. Information contained in the responses to the staff's closeout letters to GL 92-01, Revision 1, and information contained in industry submittals to GL 92-01, Revision 1, Supplement 1, are not necessarily reflected in this version, but will be included in a future version of the RVID.

CONTENTS

FIGURES

REACTOR VESSEL INTEGRITY DATABASE
USER'S MANUAL

1.0 SET UP THE SYSTEM

This section gives step-by-step instructions for getting your computer ready to run the Reactor Vessel Integrity Database (RVID).

1.1 System Requirements

The following system requirements are needed in order to operate the RVID:

- 386 personal computer (486 preferred)
- DOS Version 5.0 or above
- 6 to 8 megabytes RAM
- color monitor (preferred)
- mouse (preferred)
- files = 99
- buffers = 20

1.2 Files and Buffers

Files and buffers are best adjusted by your resident computer expert. If you do not have the minimum system requirements listed above you will encounter such errors as "Too many files are open" and "Too many memory variables." These files and buffer configurations set up the space available in which FoxPro[1] may work. If there is not enough space the database will fail. These configurations are in the config.sys file; however, if you are not familiar with this file you should consult your resident computer expert for assistance.

1.3 LAN Configurations

This version of RVID was not specifically designed to work in a networked environment; however, it can limp along under that scenario. A user may encounter several problems when multiple users try to access the system simultaneously. These problems are listed at the top of the next page:

---

1. FoxPro is a trademark of the MicroSoft Corporation.

1) If a user tries to Reindex the database while another user is in the system, an error message will appear stating that the operation cannot be completed because another user is in the system. That will only be resolved when the other user logs out of the system.

2) If several users try to run different reports simultaneously, the user will get the same error message as stated above. Several of the files are used exclusively because indexes are recreated. Therefore, only one user can run the reports at a time.

1.4 Transferring RVID Files to Hard Drive

Create a directory called "RVID" and copy files from the system diskettes to your hard drive by following these steps:

- Start at the DOS prompt in the DOS root directory (C:\>) or change to the root directory by typing **CD** and pressing the **<Enter>** key.
- You will now be at the DOS prompt in the root directory (C:\>).
- Type **MD\RVID** and press **<Enter>** to create an "RVID" subdirectory.
- Type **CD\RVID** and press **<Enter>**. You will now be at the DOS prompt in the RVID subdirectory (C:\RVID\>).

Follow the instructions below to copy the files from the diskette (in your "A:" drive) to the RVID subdirectory on your hard drive.

- Type **COPY A:*.*** and press **<Enter>**.
- Repeat for each of the five diskettes. The diskettes may be copied in any order.

Now that you have copied the files from the diskette to your hard drive, you need to ensure that you have an RVIDPUB.BAT file. Since you are in the RVID subdirectory (C:\RVID\>), type **dir *.bat** and press the **<Enter>** key. This will give you a listing of all the batch files in the subdirectory. If you do not see RVIDPUB.BAT batch file, you will need to create it. If such a batch file exists, skip to Section 1.4.2 of this Appendix (Instruction B); otherwise, go on to Section 1.4.1 of this Appendix (Instruction A).

1.4.1 Instruction A — Setting Up the RVIDPUB.BAT Batch File

Create an RVIDPUB.BAT batch file. To create the batch file you need to type **edit** and press the **<Enter>** key. You will find yourself in the DOS edit function. Your cursor defaults to the first line. Perform the following actions:

(1) Type **CD\RVID**, then press **<Enter>**.

(2) Type **RVIDPUB**, then press **<Enter>**.

(3) Simultaneously press the **Alt and F** keys. It will bring up a menu as is illustrated below (Figure 0).

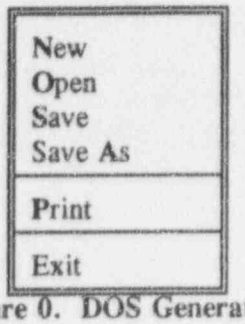

Figure 0. DOS Generated Systems Menu

(4) Select **Exit** (or hit the <x> key) to exit from the DOS edit function.

(5) A message will appear asking the user if the user wants to save the document before exiting. Select **Yes** (or hit the <y> key). The system will then save the RVIDPUB.BAT file and exit from the DOS edit function.

(6) You will then be at the DOS prompt in the RVID subdirectory (C:\RVID\>).

(7) Continue on with Instruction B.

1.4.2 Instruction B — Moving the RVIDPUB.BAT Batch File to the C:\BATCH Directory

You are ready to move the RVIDPUB.BAT file from the C:\RVID directory to the C:\BATCH directory. This is accomplished by performing the following actions:

(1) Start at the DOS prompt in the RVID subdirectory (C:\RVID\>) or change to the RVID subdirectory by typing **CD\RVID**. You will now be at the DOS prompt in the RVID subdirectory (C:\RVID\>).

(2) Type **COPY RVIDPUB.BAT C:\BATCH** and press **<Enter>**.

(3) Type **DEL RVIDPUB.BAT** and press **<Enter>**.

Note that most personal computer systems have the BATCH directory already established. If your system does not have a BATCH directory established, consult your DOS software manual for instruction. Creating a BATCH file will involve editing the AUTOEXEC.BAT file; therefore, the assistance of available software support services is recommended.

However, as an alternative to creating the C:\BATCH directory, you may access the RVID by doing the following:

(1) Start at the DOS prompt in the RVID subdirectory (C:\RVID\>).

(2) Type **FOXR RVIDPUB** and press **<Enter>**.

1.5 Preparing a Windows Icon or DOS Menu Addition

If you intend to run the RVID using Windows, then add an icon to your screen by following the steps below under "Preparing a Windows Icon." If you intend to start RVID directly from DOS, follow the steps below under "Preparing a DOS Menu Addition." If you do not wish to modify or work with a DOS menu, you may disregard the explanations that follow and skip to Section 2.0, "Start Using RVID" on page A-11.

1.5.1 Preparing a Windows Icon

Perform the following actions to prepare a "Windows" icon for the RVID:

(1) Start Windows.

(2) Select the **Applications** icon. If there is no Applications icon, select an icon that you would like to use in place of it.

(3) Select **New** from the File menu.

(4) Select **Program Item**.

(5) Select **OK**.

(6) In the Description field, type **Reactor Vessel Integrity Database** or **RVID**

(7) In the Command box, type **C:\BATCH\RVIDPUB.BAT**

(8) In the Working Directory, type **C:\RVID**

(9) Select **OK**.

Your new icon will allow you to start the RVID system.

1.5.2 Preparing a DOS Menu Addition

(1) Type **CD\DOS** and press **<Enter>**. You will now be in the C:\DOS directory.

(2) Type **EDIT MENU.TXT** and press **<Enter>**. Your menu will appear on the screen. If the screen is blank, it means that your MENU.TXT file is in a different directory.

(3) Add **RVID** to your DOS menu with the following description: **Reactor Vessel Integrity Database**.

(4) When you are ready to save your new menu, press **<Alt>**. The File menu will be highlighted.

(5) Press the up arrow twice to highlight the Exit option.

(6) Press **<Enter>**.

(7) Press **<Enter>** again to save the changes. You will be taken back to the DOS prompt.

(8) Type **MENU** and press **<Enter>** to view your new menu.

2.0 START USING RVID

This section describes the RVID and some of its menu options; also, it gives a brief summary of the options in the Main Menu. NOTE: After installing the RVID, a reindex and pack must be executed before accessing the data and information files (see Section 6.0, Reindex & Pack for instructions). This step is not necessary for subsequent use of the RVID.

2.1 Starting the Database

Perform one of the two actions listed below, as appropriate, to access the RVID:

(1) To start RVID in DOS, type **RVIDPUB** and press **<Enter>**, or

(2) To start RVID in Windows, select the **RVID** icon.

The Main Menu will appear as shown in Figure 1.

Figure 1. Main Menu

2.2 Selecting Main Menu Options

The following procedures work the same way in every screen of RVID. If you are using a mouse, select a menu by doing the following:

- **Point and click** on the desired menu or menu option.

If you do not have a mouse, select a menu or menu option in the following way:

- Press **Alt** once to highlight the desired system menu.
- Press key corresponding to the **bold** letter in the desired menu option to display the options in next menu desired. For example, from the Main Menu options, press the **R** key to access the options for the **R**eports menu. Also, you may press **arrow** keys to display the menu options and to highlight the option you want; then press **<Enter>** to select the option.

To quit working with the menu:

- Press **Alt**. All menus will be deactivated. Also, if you are working with a database record and have activated the menu, press **Alt** again to remove the menu. The cursor will return to its original position on the screen.

You may activate or deactivate menus as often as you wish by pressing **Alt**. The options available in the Main Menu are shown in Figure 2. The following subsections briefly summarize the Main Menu options shown in Figure 2.

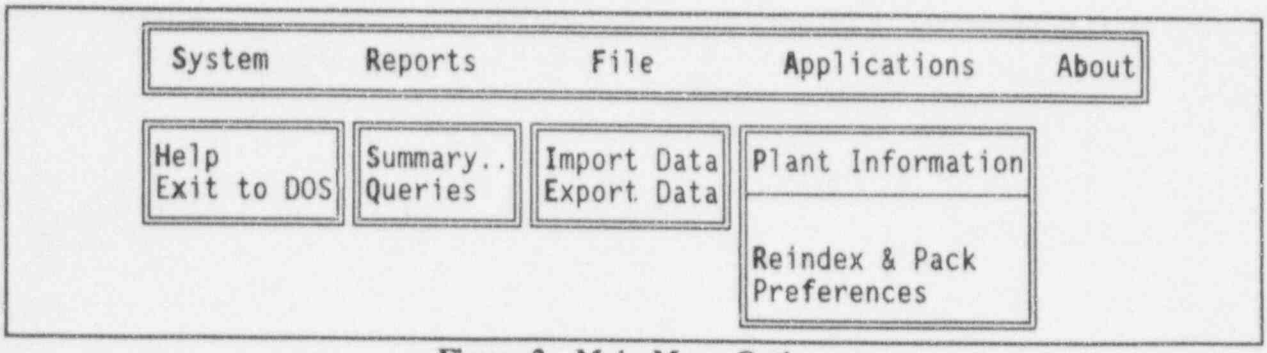

Figure 2. Main Menu Options

2.2.1 System Menu

- **Help** displays instructions for using all the screens in the database.
- **Exit to DOS** quits RVID and takes you back to the Windows screen or the DOS prompt.

2.2.2 Reports Menu

- **Summary...** lets you print three kinds of summary reports (Summary Files): (1) the Summary File for Pressurized Thermal Shock (PTS) or Pressure-Temperature (P-T) Limits, (2) the Summary File for Upper Shelf Energy (USE), and (3) the Summary File for Chemistry Data.
- **Queries** lets you customize the type of information that you want printed in a report.

2.2.3 Applications Menu

- **Plant Information** displays background and surveillance capsule information about individual commercial nuclear reactor plants.
- **Reindex & Pack** removes deleted records and reorganizes the database to use disk space more efficiently.
- **Preferences** displays printer selections.

2.2.4 About Menu

This option displays the following information concerning the RVID: (1) a disclaimer notice and (2) an address for forwarding comments, feedback, and requests for RVID diskettes or hard copies.

3.0 PRINTING REPORTS

RVID lets you print reports with almost any combination of information on them. Besides being able to print out the Summary Reports for pressurized thermal shock (PTS) or pressure-temperature (P-T) limits, upper shelf energy (USE), and chemistry data, the user may customize the information in the desired printout by querying to the information in the Summary Report. In the event that an error message (red box) is displayed when the printer is selected, highlight "Ignore" to begin printing.

3.1 Printing PTS Summary, USE Summary, and Chemistry Data Reports

To print out summary reports:

- Select **Reports** from the Main Menu options.
- Select **Summary...** from the Reports submenu options. RVID will display the Summary Reports Menu as shown in Figure 3.

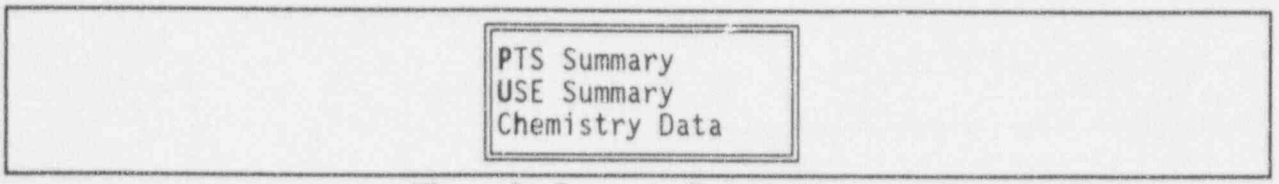

Figure 3. Summary Reports Menu

- Select the type of summary report you would like to print out. No matter which type you select, the Report Selection Screen will appear like the example shown in Figure 4 on the next page.
- From the Select List box at the top of the screen, select all plants that you would like to print information about. The names of all plants you select will appear in the Selected box at the bottom.

If you have a mouse, you may use the scroll bar to the right of the list to find a name you want, point and click to highlight it, and click **<Move>** to add it to the Selected box. Or, you may click **<Move All>** to add all names at once. Conversely, if you decide to remove some or all of the selections from the Selected box, click **<Remove>** or **<Remove All>**.

If you do not have a mouse, you may highlight a name either by using the arrow keys or by typing the first letter of the plant name. RVID will display the first occurrence of that letter. Then press **<Enter>** to add the desired name to the Selected box.

- After you have selected all the names of plants you want on the report, select **<OK>**.

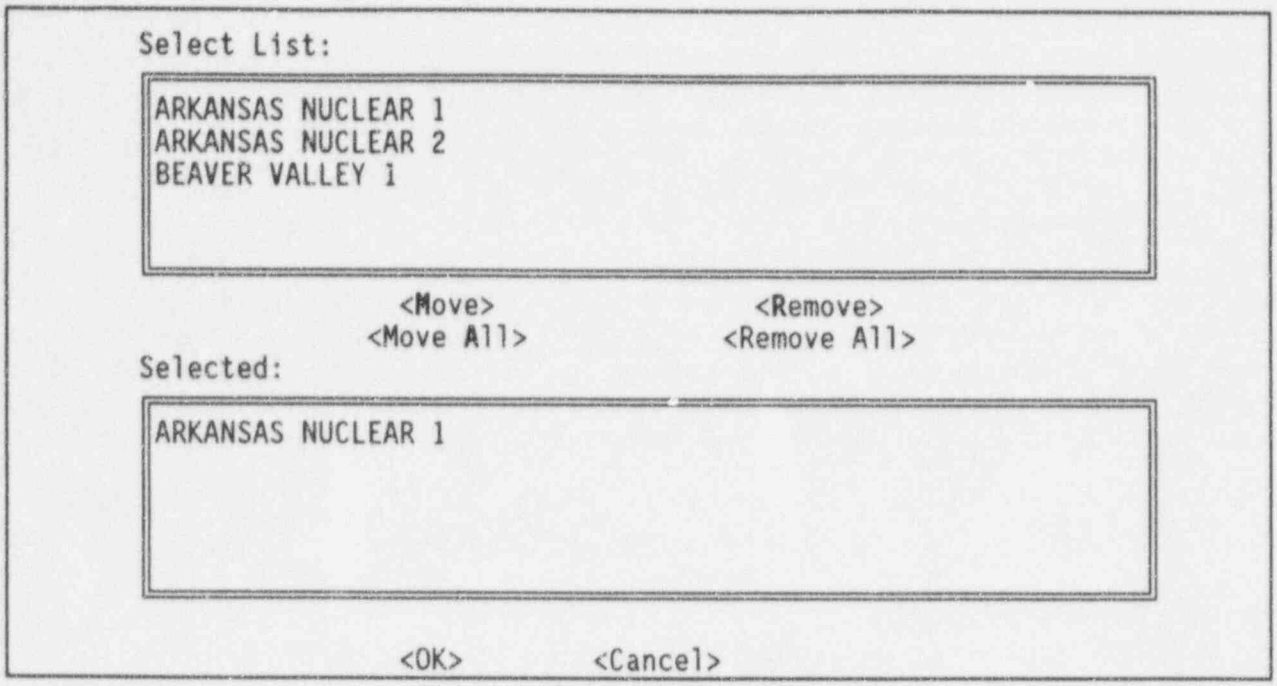

Figure 4. Report Selection Screen

- Choose either **Printer** or **Screen** to send the report to the desired form of output.

3.2 Printing Reports from Queries

To print a report with customized information:

- Select **Reports** from the Main Menu options.
- Select **Queries** from the Reports submenu. The Query Subjects Screen will appear as depicted in Figure 5 on the following page. The Query Subjects Screen lets you choose very specific categories for the report.

In the boxes labeled Reactor Type, Material, and Owner's Group, you may choose just one category for each. If you do not select a specific reactor type, material, or owner's group, the report will show all reactor types, materials, and owner's groups. If you want your report to show fewer records, you may choose a specific reactor type, material, and owner's group; the more specific you are, the smaller your report will be.

In the Vessel Fabricator and Vessel Designer boxes, you may select as many vessel fabricators and designers as you wish. The more you select, the more records will appear in your report. Selecting no fabricators from the Vessel Fabricator box is the same as selecting all of the fabricators from the Vessel Fabricator Box. Selection of the vessel designers specified in the Vessel Designer box works the same way. To perform the query:

- Select any combination of **Reactor Type**, **Material**, and **Owner's Group**.

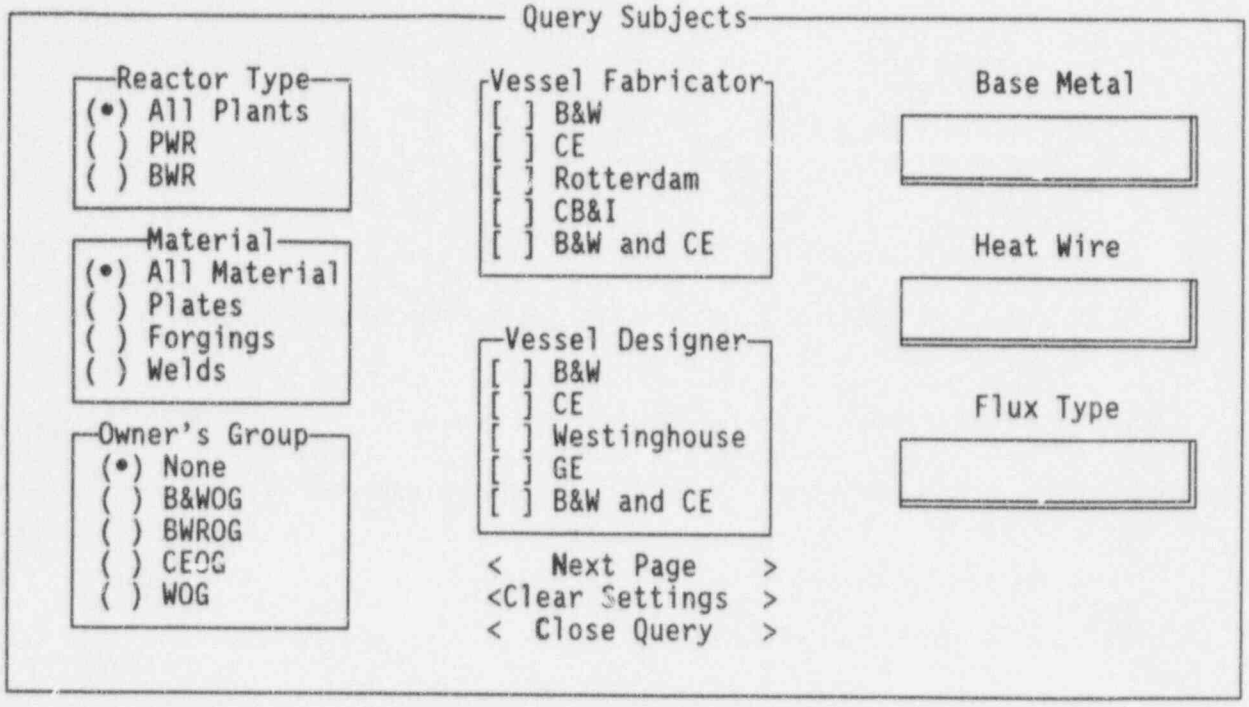

Figure 5. Query Subjects Screen

- Select as many **Vessel Fabricators** and **Vessel Designers** as you would like RVID to search for.

The Base Metal, Heat Wire, and Flux Type boxes on the right side of the screen work in conjunction with the Material box and let you further narrow your search of records so that RVID will print only those plant records that contain the specific base metal, heat wire, or flux type you select. The three boxes are dependent on the type of material you selected in the Material box. You may choose a **Base Metal** if you selected **Plates** or **Forgings**. You may choose a **Heat Wire** and a **Flux Type** if you selected **Welds**. If you selected **All Material**, it means that you want RVID to accept all types of base metals, heat wires, and flux types, so none of the three boxes will be accessible.

3.2.1 Selecting a Base Metal

If you selected **Plates** or **Forgings**, follow the instructions below. If you selected **Welds**, refer to the procedure described in Section 3.2.2, "Selecting a Heat Wire and Flux Type," of this User's Manual. If you selected All Material, refer to the procedure described in Section 3.2.3, "Enter Query Selection Criteria," of this User's Manual.

- Select the **Base Metal** box. RVID will display a list of base metals (as shown in Figure 6 on the following page). If you do not have a mouse, press **<Tab>** or the down arrow to move the cursor to the **Base Metal** box and press **<Enter>** to display the list.[2]

2. NOTE: If you try to select either the **Heat Wire** or the **Flux Type** box, RVID will display the following message: "Selection inconsistent with material. Please select Welds;" if the message appears, press any key to remove it. RVID will move your cursor to the top of the Material box.

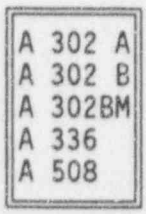

Figure 6. Example Box

- Select the type of base metal you want RVID to search for. In the **Base Metal** box, RVID will display the name you selected.[3]

- Select **<Next Page>** to select more options and to print the report. RVID will display the Query Selection Criteria Screen, which is shown in Figure 7 on the following page. If you do not have a mouse, press **<Shift-Tab>** or the up arrow to move the cursor to the **<Next Page>** selection and press **<Enter>**.

3.2.2 Selecting a Heat Wire and Flux Type

- If you selected **Welds** in the Material box, select the **Heat Wire** or the **Flux Type** box. RVID will display a list of each that you can choose from. If you do not have a mouse, press **<Shift-Tab>** or the up arrow to move the cursor to the **Flux Type** box and press **<Enter>**. Then you can move the cursor up to the **Heat Wire** box and press **<Enter>**.[4]

- Select a heat wire or a flux type or both, if desired. RVID will display the names you selected in the **Heat Wire** and **Flux Type** boxes.

- Select **<Next Page>** to select more options for your report. RVID will display the Query Selection Criteria Screen, which is shown in Figure 7 on the following page. If you do not have a mouse, press **<Tab>** or the down arrow to move the cursor to the **<Next Page>** selection and press **<Enter>**.

3.2.3 Entering Query Selection Criteria

- Select **<Next Page>** if you have not already done so to display the Query Selection Criteria Screen (as shown in Figure 7 on the following page).

The Query Selection Criteria Screen (as shown in Figure 7 below) shows the names of columns that you may print in the report. The first option, **Alphabetical**, corresponds to the Plant Names column, which

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3. NOTE: Some base metals correspond only to forgings and some correspond only to plates. If you select a base metal that does not correspond to the type of material you selected in the Material box, RVID will display the following message for about 3 seconds: "This base metal is associated with plates/forgings. Settings will now clear." RVID will then display a new Query Subjects Screen. You will need to select options again and choose a different base metal.

4. NOTE: If you try to select the **Base Metal** box, RVID will display the following message: "Selection inconsistent with material. Please select Plates or Forgings." If the message appears, press any key to remove it. RVID will move your cursor to the top of the Material box.

will always be the first column in the report. The second column will always be Plant Identifiers. You may choose additional columns by entering a number (1, 2, 3, etc.) next to the names. The numbers you enter determine the order in which the columns will be displayed on the report (after the plant name and plant identifier) and the order in which those columns will be sorted.

For example, if you entered the number **1** next to **% S**, the number **2** next to **Alphabetical**, and the number **3** next to **% Ni**, RVID would print four columns: Plant Names, Plant Identifiers, Percent Sulfur, and Percent Nickel (in that order), with the Percent Sulfur column sorted first, the Plant Names column sorted second, and the Percent Nickel column sorted third. In other words, because you entered the number **1** next to **% S**, RVID would display all records in numerical order from the lowest to highest percent sulfur. Also, because you entered the number **2** next to **Alphabetical**, RVID would display plant names in alphabetical order for each set of records that had the same value for percent sulfur. Percent nickel would then be sorted last, if necessary.

If you do not enter a number to the left of a column name, RVID will not include that column in the report. However, if you do not enter any numbers, RVID will include all columns in the report.

If you enter the same number next to two column names (such as the number **1** next to both **% Cu** and **% S**), RVID will sort them in the order shown in Figure 7 (percent copper first and then percent sulfur).

- Enter numbers to select the order in which the columns you want in the report will be displayed and sorted.
- Select **<Run Query>**.

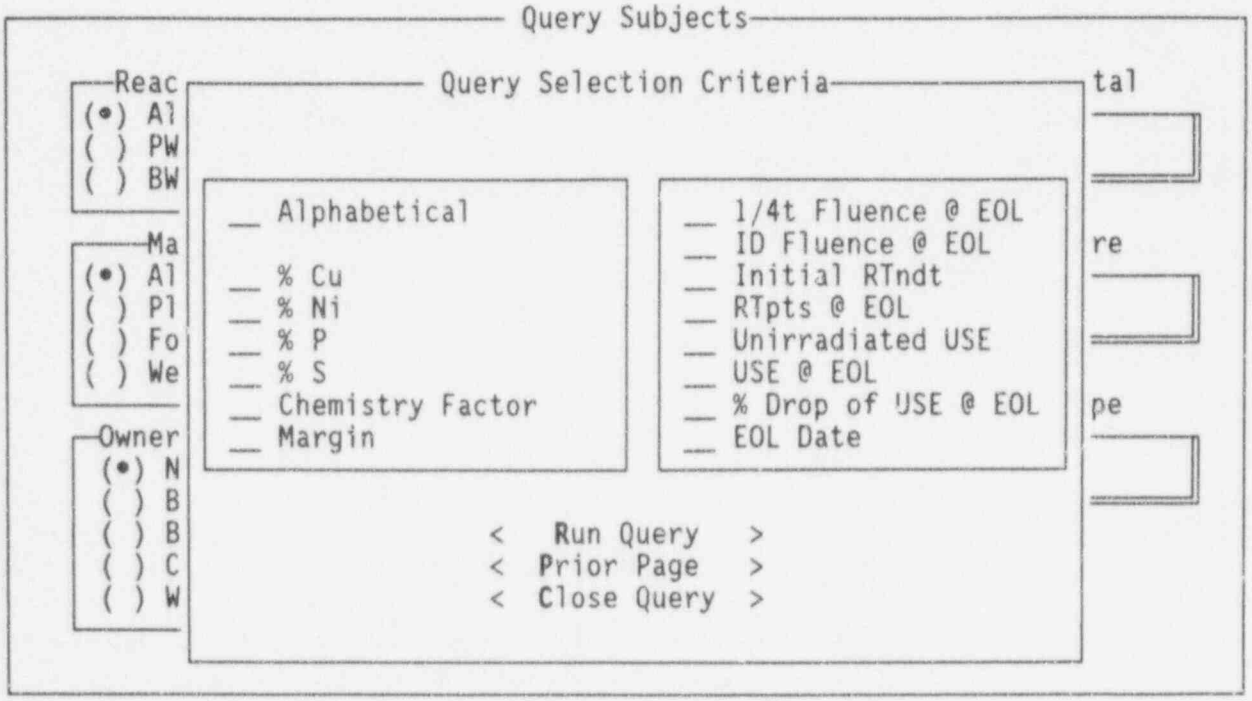

Figure 7. Query Selection Criteria Screen

- To see the report on the screen, press **<Enter>**; to print the report, type **P** and press **<Enter>**. RVID will display the message "Executing query..." until the report is ready.

If you decided to view the report on the screen, you may use the options in the Browse menu to find records (see details on the Browse menu).

- Press **<Esc>** to go back to the Query Selection Criteria Screen.
- Select **<Prior Page>** to select options for another report, if desired.
- Select **<Close Query>** to go back to the Main menu.

4.0 PLANT INFORMATION

4.1 Viewing Plant Information

Plant Information provides basic background information for each plant, and surveillance data based upon information from the Power Reactor Embrittlement Database (PR-EDB), Version 2. Plant Information also provides the σ_I and σ_Δ values used to calculate the margin.

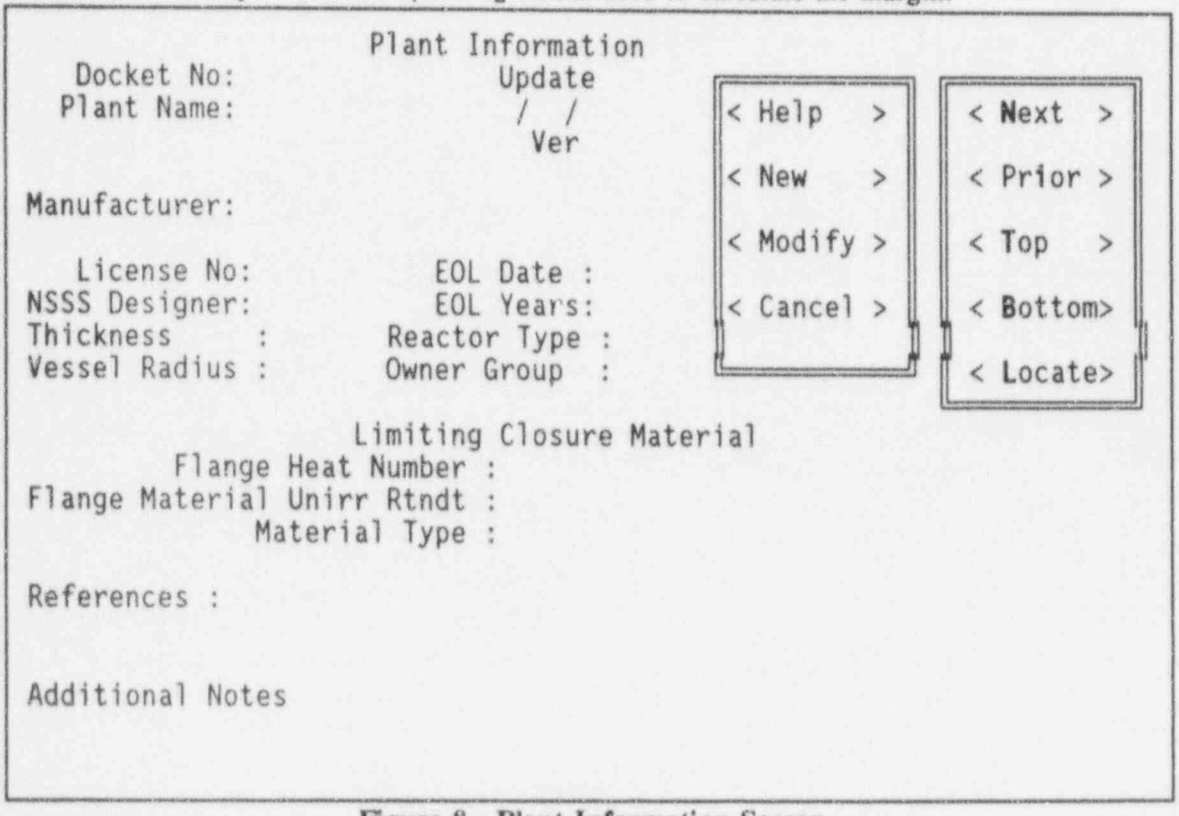

Figure 8. Plant Information Screen

- Select **Applications** from the Main Menu Options (Figure 2.); then select **Plant Information** from the Applications menu. RVID will display the Plant Information Screen (as shown in Figure 8 above) for the first record in the file.

- View the Plant Information

4.2 Finding a Plant Record

On the right-hand side of the Plant Information screen is the Record Search box (as shown in Figure 9 to the right), which helps you find the plant record you want to view. The Record Search Box has the following features:

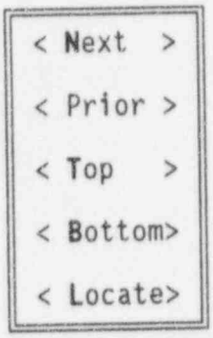

Figure 9. Record Search Box

- **<Next>** displays the next record in the file (in ascending order according to plant docket numbers).
- **<Prior>** displays the previous record.
- **<Top>** displays the first record in the file.
- **<Bottom>** displays the last record.
- **<Locate>** lets you select **<Browse>** to display the Browse screen, which shows a list of plant records. An example of the Browse screen is shown in Figure 10 (as shown below).

At the top of the Browse screen, you will find the Browse menu, which has several options to help you further search for plant records (see Section 4.3, "Selecting Browse Menu Options," regarding these options). Perform the following steps to display the information for a particular plant record in the Browse Screen:

- Highlight any field for the particular record in the Browse Screen (Figure 10.).

System Reports Application Record Browse
NI_PLANT

Pl_docno	Pl_name	Pl_licen	Pl_nsss	Pl_r
50-313	ARKANSAS NUCLEAR 1	NPR-51	B&W	09/20
50-368	ARKANSAS NUCLEAR 2	NPF-6	C-E	09/20
50-334	BEAVER VALLEY 1	DPR-66	WESTINGHOUSE	09/20
50-412	BEAVER VALLEY 2	NPF-73	WESTINGHOUSE	09/20
50-155	BIG ROCK POINT	DPR-6	GF	09/20
50-456	BRAIDWOOD 1	NPF-72	WESTINGHOUSE	09/20
50-457	BRAIDWOOD 2	NPF-71	WESTINGHOUSE	09/20
50-259	BROWNS FERRY 1	DPR-33	GE	09/20
50-260	BROWNS FERRY 2	DPR-52	GE	09/21
50-296	BROWNS FERRY 3	DPR-68	GE	09/21
50-325	BRUNSWICK 1	NPR-71	GE	04/16
50-324	BRUNSWICK 2	NPR-62	GE	04/16
50-454	BYRON 1	NPF-37	WESTINGHOUSE	09/21
50-455	BYRON 2	NPF-66	WESTINGHOUSE	09/21

Figure 10. Browse Screen

- Press **<Esc>** or, if using a mouse, click once on the yellow box in the upper left-hand corner to close the Browse Screen; then,

- Select **<Quit>**. RVID will then display the Plant Information Screen for the particular record you selected.

4.3 Selecting Browse Menu Options

The Browse menu contains the follwing options:

- **Change** displays the records list in the Browse screen in a different format.

- **Grid off/on** removes/adds the grid lines in the Browse screen.

- **Size Field** lets you make fields (columns) in the Browse screen either wider or narrower. Press **<Tab>** and **<Shift-Tab>** to move the cursor to fields you want to size. Use arrow keys to alter the size of fields. Press **<Esc>** to quit sizing fields.

- **Move Field** lets you move any field (column) to any location in the Browse screen. Press **<Tab>** and **<Shift-Tab>** to move the cursor to fields you want to move. Use arrow keys to move fields. Press **<Esc>** to quit moving fields.

- **Resize Partitions** lets you move the entire Browse screen. Use arrow keys to move the Browse screen. Press **<Esc>** to quit.

- **Goto...** displays a screen with the following options (press **<Tab>** to move the cursor from one selection to another):

  - **Top** takes you to the first record in the list.

  - **Bottom** takes you to the last record in the list.

  - **Record** lets you enter the number of the record you want to see. For example, to move to the ninth record in the list, enter **9**.

  - **Skip** lets you enter the number of records you want to skip. For example, if you are on the ninth record in the list and want to skip to the twentieth record, enter **11**.

  - **Goto** carries out the option you select.

  - **Cancel** takes you back to the records list without moving your cursor.

4.4 Viewing Forgings, Plates, Welds, and Surveillance Data

The Application submenu in the Main Menu Options (Refer to Figure 2.) allows the user to access the Plant Information screen, and view further information about a particular plant. You may also view

records with forging, plate and weld material data and surveillance data. To view the appropriate data:

- Select **Plant Information** from the Application submenu. The Plant Information Screen will appear (Refer to Figure 8.) for the first record in the file.
- Find the plant record that you want to work with by doing the following steps.
  - Select **<Locate>**.
  - Select **<Browse>** to display records.
  - Find the record you want to view or modify, and highlight any field in the record.
  - Press the **<Esc>** key.
  - Select **<Quit>**. RVID will take you back to the Plant Information Screen and display the plant information for the specific record you highlighted.
- Select either **Forgings, Plates, Welds, or Surveillances** from the Application submenu. RVID will display the screen with appropriate type of information for the plant you selected.
- After viewing the type of data desired, select **<Close>** to get back to the Plant Information Screen.

5.0 USING HELP OPTIONS

The System submenu contains an option called Help Topics, which displays information concerning every aspect of the database.

- Select **Help Topics** from the System submenu.

With the Help Topics screen, you may locate and view information.

Locate Help Topics

- Scroll up and down to look for the subject desired. Click on the desired topic for detailed information.

6.0 REINDEX & PACK

The Reindex & Pack feature was included in RVID to let the NRC staff delete records and organize the remaining records to more efficiently use the disk space in the computer. In other words, it reorganizes the data to make data files smaller, so they do not take up so much space on the hard drive.

To reindex and pack the database:

- Make sure you are at the Main menu.

- Select **Reindex & Pack** from the Applications menu. RVID will display the Reindex & Pack screen as shown in Figure 11.

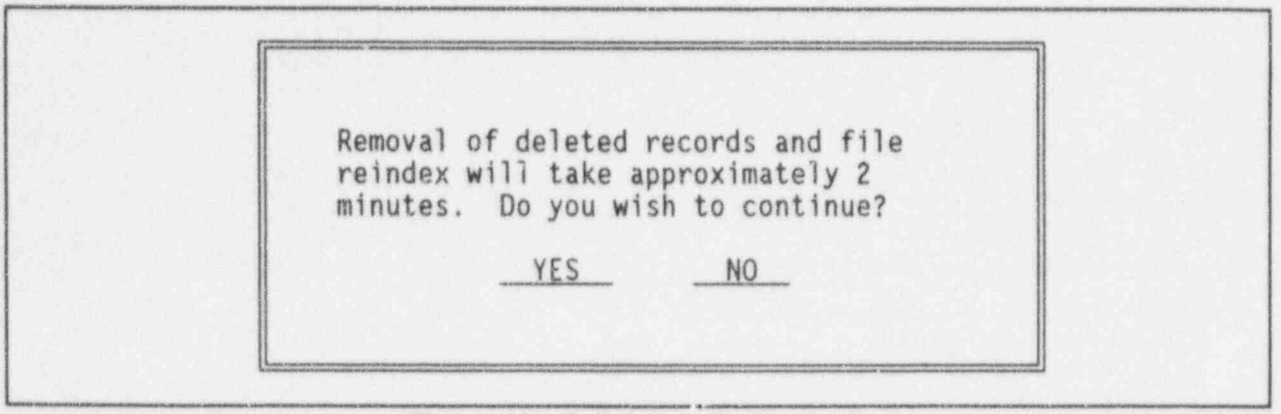

Figure 11. Reindex & Pack screen.

- Press **<Enter>** to select **YES**.

RVID will delete all records in the database that have been marked for deletion. This means that when you were working with plant information records or code records, you should have selected **Toggle Delete** from the Record menu for each record you wanted to delete. That way, those records were marked for deletion, and would be deleted only after you select **Reindex & Pack**.

After RVID deletes marked records, it eliminates the excess space between remaining records and makes your database run faster. The Reindex & Pack process will take approximately 2 minutes to complete.

7.0 SETTING PREFERENCES

The Preferences option allows printer selection.

- Printer Settings:
  - For the Default Printer, select **LOCAL** for LPT1 or **REMOTE** for LPT2.
  - For the Printer Type, the **<L>** key for a laserjet printer or the **<M>** key for a dot matrix printer.

8.0 BACKGROUND AND SOURCE DOCUMENTS

In addition to the licensee responses to GL 92-01, the following documents were included in the review process and development of the RVID:

- surveillance capsule reports
- documents referenced in GL 92-01

- PTS and P-T limits submittals (as applicable)
- responses to the staff's requests for additional information (as applicable)

The plant summary reports were derived from the staff review of these documents. The staff requested that licensees confirm the applicability of the unirradiated properties, neutron fluence, a chemical composition data that provide the basis for the plant summaries. The majority of licensees have confirmed that these data are applicable to their plants. Data regarding decommissioned plants has not been included in the RVID.

The source for surveillance data was the Power Reactor Embrittlement Database (PR-EDB), Version 2, with the following exceptions:

- Surveillance capsule reports for the following plants were added:

  - Cooper, GE-NE-523-159-1292
  - Diablo Canyon, WCAP-12811
  - McGuire 2, WCAP-13516
  - Millstone 1, GE-NE-523-165-1292
  - Calvert Cliffs 1, BAW-1260

The PR-EDB is a comprehensive collection of data from surveillance reports and other published reports on commercial nuclear reactors. However, not all of the data have been verified by reactor vendors, and the capsule data were not evaluated according to credibility criteria. Surveillance data for the following plants were excluded from the RVID Surveillance Files because credibility could not be established:

- Haddam Neck, Capsule A/BMI-1070, not credible for welds
- Quad Cities 1, not credible for welds
- Turkey Point 3 and 4, not credible for weld 71249

Surveillance data will be reviewed by NRC staff according to credibility criteria of the revised rule (10 CFR 50.61) or Regulatory Guide (RG) 1.99, Revision 2, and incorporated into a future version of the RVID.

The RVID performs logarithmic calculations on the difference between the measured and unirradiated USE. In the event that the measured USE is equal to or greater than the unirradiated USE, the RVID cannot perform the calculation and, therefore, disregards the surveillance data for that capsule and material. In one case, the surveillance data were adjusted to accommodate this programming logic: Robinson 2, Capsule V, intermediate shell W10201-5, the unirradiated USE was changed from 100 to 101 ft-lb. This programming issue will be reviewed and addressed in a future version of the RVID.

The database can contain information that is not docketed (i.e., results of calculated procedures that use docketed information). Source documentation and notes for each plant can be found in the References section.

Data in the RVID for the Palisades RPV are current through April 12, 1995. The data in the RVID for all other plants are current through December 31, 1994. Surveillance data, with the exception noted, are current with the data contained in the PR-EDB, Version 2.

9.0 EXPORTING QUERIES TO A SPREADSHEET

The user may export a query to a spreadsheet (i.e., software such as Lotus[5], QuattroPro[6], etc.) by following the directions for that particular software to import the file WRKQUERY.DBF from the C:\RVID subdirectory. This may be done only with the last RVID query that the user has selected. To export another query, the user must return to the RVID, run the query, return to the spreadsheet, and repeat the process.

10.0 NOMENCLATURE: USE, PTS, AND CHEMISTRY DATA SUMMARY REPORTS

This section explains the column headings and nomenclature used in the format of the USE, PTS, and Chemistry Data Summary Reports. Instructions for accessing these reports can be found in this Appendix under Section 3.0, "Printing Reports." There is a corresponding USE, PTS/P-T Limits, and Chemistry Summary Report for each plant. The summary reports are presented as tables; each beltline material is identified in one column, and various information categories are identified in other columns.

10.1 Summary File for PTS/P-T Limits

Each BWR has a P-T limits table; each PWR has a PTS table. Information headings for these tables are as follows:

Column 1: **Plant Name** contains the name of the plant, date of expiration of license (EOL), and docket number.

Column 2: **Beltline Identification** provides the plant-specific beltline material identification, which generally consists of a component description, location, and number.

Column 3: **Heat Identification Number** identifies the heat number of the beltline material. The following items represent possible suffixes that may be used in conjunction with or in lieu of the Heat Number Identifications for RPV beltline materials:

(S) — when this suffix is used after a heat number for a specified beltline weld material, the suffix indicates that a single wire was used in the single arc welding (SAW) process.

(T) — when this suffix is used after a heat number for a specified beltline weld material, the suffix indicates that a tandem wire was used in the SAW process.

NA/W-A — when this suffix is used in-lieu of a heat number the suffix indicates that a corresponding heat number was not available for the plant specific beltline weld material specified in Column 2 of the Summary File. In the event that more than one weld did not have an available heat number for a given plant, these would be identified as NA/W-B, NA/W-C, etc.

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5. Lotus is a trademark of the Lotus Corporation.

6. QuattroPro is a trademark of Novell, Inc.

NA/PL-A — when this suffix is used in lieu of a heat number, the suffix indicates that a corresponding heat number was not available for the plant specific beltline plate material specified in Column 2 of the Summary File. In the event that more than one plate did not have an available heat number for a given plant, these would be identified as NA/PL-B, NA/PL-C, etc.

NA/F-A — when this suffix is used in lieu of a heat number, the suffix indicates that a corresponding heat number was not available for the plant-specific beltline forging material specified in Column 2 of the Summary File. In the event that more than one forging did not have an available heat number for a given plant, these would be identified as NA/F-B, NA/F-C, etc.

Column 4: **RT_{PTS} @ EOL** provides the reference temperature as adjusted for the effects of neutron irradiation at the EOL. This adjusted reference value temperature is equivalent to the sum of the initial RT_{NDT} value, margin value, and ΔRT_{NDT} value at EOL.

Column 5: **ID Neutron Fluence @ EOL** is the neutron fluence value at the inner diameter (ID) of the reactor vessel at EOL. This value is either cited directly or calculated by applying the neutron fluence of the one-quarter thickness (1/4T) location, as reported in the licensee's most recent submittal for the beltline material, to the neutron fluence attenuation equation in Regulatory Guide (RG) 1.99, Revision 2. All entries are given in units of 10^{19} n/cm^2.

Column 6: **IRT_{NDT}** is the initial RT_{NDT} of the unirradiated material as defined in ASME Code Section III, paragraph NB-2331, or from alternative methodologies, in accordance with Branch Technical Position MTEB 5-2 in Standard Review Plan Section 5.3.2 (NUREG-0800).

Column 7: **Method of Determining IRT_{NDT}** is the method of determining the initial reference temperature. The following methods provide the possible inputs to this column:

B&W Generic indicates the initial reference temperature is the generic value for all Linde 80 welds fabricated by Babcock and Wilcox, excluding material heat number 72105.

Generic indicates that the initial reference temperature is the generic value for Linde 0091, Linde 1092, Linde 124, and ARCOS B-5 welds fabricated by Combustion Engineering.

MTEB 5-2 indicates that the initial reference temperature is a value determined using the methodology in Branch Technical Position MTEB 5-2 in Standard Review Plan Section 5.3.2.

NRC Generic indicates that the initial reference temperature is a bounding generic value for heat number 72105 welds fabricated by Babcock & Wilcox.

Plant Specific indicates that the initial reference temperature value was determined from tests on material removed from the same material heat as was the identified beltline material.

Column 8: **ΔRT_{NDT} @ EOL** is the mean value of the adjustment in reference temperature caused by irradiation. ΔRT_{NDT} is calculated in accordance with the PTS rule as follows: $\Delta RT_{NDT} = (CF)*f^{(0.28 - 0.10*\log f)}$, where CF is the chemistry factor and f (in units of 10E19 n/cm^2) is the neutron fluence of the beltline material projected at EOL.

Column 9: **Fluence Factor @ EOL** is calculated as follows: fluence factor at EOL = $f^{(0.28 - 0.10*\log f)}$ where f (in units of 10E19 n/cm^2) is the neutron fluence of the beltline material projected at EOL.

Column 10: **Chemistry Factor** is the chemistry factor for irradiated reference temperature evaluation.

Column 11: **Method of Determining CF** is the method of determining the chemistry factor. The following methods provide the possible inputs to this column:

Table indicates that the chemistry factor was determined using the best-estimate chemistry values (copper and nickel) and the tables in RG 1.99, Revision 2.

Calculated indicates that the chemistry factor was determined using the plant-specific surveillance data.

Override indicates that the chemistry factor was determined using a methodology approved by the NRC.

Column 12: **Margin** is a numerical quantity added to cover uncertainties in the values of initial RT_{NDT}, copper and nickel measurements, fluence, and the calculational procedures involved in determining RT_{NDT}. The margin is calculated according to the methodology of RG 1.99, Revision 2. According to the RG, the Margin = $2*(\sigma_i^2 + \sigma_\Delta^2)^{0.5}$. [7,8]

Column 13: **Method of Determining Margin** is the method of determining the margin value. The following methods provide the possible inputs to this column:

Table indicates that the margin term was calculated using a standard deviation for the increase in reference temperature of 15.6 °C (28 °F) for welds and 9.4 °C (17 °F) for base metal.

Surv. Capsule indicates that the margin term was calculated using a standard deviation for the increase in reference temperature of 7.8 °C (14 °F) for welds and 4.7 °C (8.5 °F) for base metal.

Column 14: **Cu%** provides the copper content, cited directly from the licensee's value, except when more than one value was reported (in which case the staff used the average value).

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7. Here σ_i is the standard deviation for the initial RT_{NDT}. If a measured value of initial RT_{NDT} for the material in question is available, σ_i is to be estimated from the precision of the test method. If not, and generic mean values for that class of material are used, σ_i is the standard deviation obtained from the set of data used to establish the mean.

8. The standard deviation for ΔRT_{NDT}, σ_Δ, is 15.6°C (28°F) for welds and 9.4°C (17°F) for base metal, except that σ_Δ need not exceed 0.50 times the mean value of ΔRT_{NDT}. If two or more sets of credible surveillance data are available and are used to establish the ΔRT_{NDT}, the values for σ_Δ may be cut in half.

Column 15: **Ni%** provides the nickel content, cited directly from the licensee's value, except when more than one value was reported (in which case the staff used the average value).

The following represent columns in the Summary File for PTS/P-T Limits whose numerical or text values are entered directly from a source document:

Column 1: Plant Name

Column 2: Beltline Identification

Column 3: Heat No. Identification

Column 5: ID Neutron Fluence @ EOL

Column 6: IRT_{NDT}

Column 7: Method of Determining IRT_{NDT}

Column 9: Chemistry Factor, in the case of an Override

Column 11: Method of Determining Chemistry Factor

Column 12: Margin—inputs of σ_i and σ_Δ

Column 13: Method of Determining Margin

Column 14: Cu% (the average value is listed if more than one value is reported)

Column 15: Ni% (the average value is listed if more than one value is reported).

The following represent columns in the Summary File for PTS/P-T Limits whose numerical data have been obtained by using the calculational methodology of RG 1.99, Revision 2:

Column 4: RT_{PTS} @ EOL

Column 8: ΔRT_{NDT} @ EOL

Column 9: Fluence Factor @ EOL

Column 10: Chemistry Factor

Column 12: Margin—calculated from the inputs of σ_i and σ_Δ.

10.2 Summary File for Upper-Shelf Energy (USE)

Information headings for the USE Summary Tables include:

Column 1: **Plant Name** contains the name of the plant, date of EOL, and docket number.

Column 2: **Beltline Identification** provides the plant-specific beltline material identification, which generally consists of a component description, location, and number.

Column 3: **Heat Number Identification** identifies the heat number of the beltline material. A number of suffixes may accompany or be used in lieu of the heat number identifications in this column. Refer to the appropriate Heat Number Identification suffixes described under the informational heading for Column 3 in Section 10.1 of this Appendix.

Column 4: **Material Type** provides the material type for each plate, forging or weld.

Column 5: **USE @ EOL @ 1/4 T** is the calculated upper-shelf energy value (in ft-lb) at EOL as determined for the one-quarter thickness location of the RPV.

Column 6: **1/4 T Neutron Fluence @ EOL** is the neutron fluence value at EOL for one-quarter thickness location of the RPV. This value is either cited directly or calculated by applying the ID neutron fluence, as reported in the licensee's most recent submittal for the beltline material, to the neutron fluence attenuation equation in RG 1.99, Revision 2. All entries are given in units of 10^{19} n/cm^2.

Column 7: **Unirradiated USE** is the unirradiated upper-shelf energy in units of ft-lb.

Column 8: **Method of Determining Unirradiated USE** describes the method of determining the unirradiated upper-shelf energy. The following methods provide the possible inputs to this column:

Direct—for plates, this indicates that the unirradiated USE was determined from Charpy-V tests on transverse test specimens. For welds, this indicates that the unirradiated USE was determined from Charpy-V test data.

65 % indicates that the unirradiated USE was calculated in accordance with Section 1.2 of Branch Technical Position MTEB 5-2, "Fracture Toughness Requirments" at 65 % of the USE value obtained from Charpy-V tests on longitudinal test specimens.

Generic indicates that the unirradiated USE was reported by the licensee from USE data of other plants with similar materials to the beltline material.

NRC Generic indicates that the unirradiated USE was derived by the staff from the USE data of other plants with similar materials to the beltline weld.

10, 30, 40 or 50 °F indicates that the unirradiated USE was derived from Charpy-V tests conducted at 10, 30, 40 or 50 °F.

Surv Weld indicates that the unirradiated USE was from the surveillance weld having the same weld wire heat number.

Sister Plant indicates that the unirradiated USE was derived by using the reported value from other plant(s) with the same weld wire heat number.

EMA indicates that an unirradiated USE is unnecessary because the licensee has used an equivalent margins analysis (EMA) to satisfy the USE requirements of Appendix G to Part 50 of Title 10, *Code of Federal Regulations* (10 CFR Part 50, Appendix G).

Column 9: **% Drop USE @ EOL @ 1/4T** describes the percentage drop in USE from the initial unirradiated value to the value projected to occur at EOL as a result of radiation embrittlement.

Column 10: **Method Determ % Drop** describes the method of determining the percentage drop in USE. The following methods provide the possible inputs to this column:

Position 1 of RG 1.99, Rev. 2 indicates that the percentage drop in USE was determined using the percentage copper and the methodology in Position 1 of RG 1.99, Revision 2.

Surveillance Data indicates that the percentage drop in USE was determined using surveillance data and the methodology in Position 2 of RG 1.99, Revision 2.

EMA indicates that the percentage drop in USE is unnecessary because the licensee has used an equivalent margins analysis to satisfy the USE requirements of 10 CFR Part 50, Appendix G.

Column 11: **Cu%** provides the copper content, cited directly from the licensee's report, except that when more than one value was reported, the staff used the average of the reported values.

The following represent columns in the Summary File for USE whose numerical or text values are entered directly from a source document:

Column 1: Plant Name

Column 2: Beltline Identification

Column 3: Heat No. Identification

Column 4: Material Type

Column 7: Unirradiated USE

Column 8: Method of Determining USE

Column 10: Method of Determining % Drop

Column 11: Cu% (the average value is cited if more than one value is reported)

The following represent columns in the Summary File for USE whose numerical data have been obtained by using the calculational methodology of RG 1.99, Revision 2:

Column 5: USE @ EOL @ 1/4T

Column 6: 1/4T Neutron Fluence @ EOL

Column 9: % Drop @ EOL @ 1/4T

10.3 Summary File for Chemistry Data

Information headings for the Chemistry Summary Tables include:

Column 1: **Plant Name** contains the name of the plant, date of EOL, and docket number.

Column 2: **Beltline Identification** contains the plant-specific beltline material identification, which generally consists of a component description, location, and number.

Column 3: **Heat No. Ident.** indicates the beltline material heat number.

Column 4: **%Cu** provides the copper content, cited directly from the licensee's report, except that when more than one value was reported, the staff used the average of the reported values.

Column 9: **%Ni** provides the nickel content, cited directly from the licensee's report, except that when more than one value was reported, the staff used the average of the reported values.

Column 14: **%P** provides the phosphorous content, cited directly from the licensee's report, except that when more than one value was reported, the staff used the average of the reported values.

Column 15: **%S** provides the sulfur content, cited directly from the licensee's report, except that when more than one value was reported, the staff used the average of the reported values.

All other columns are blank at this time, for all plants.

11.0 REFERENCES

The Reference Section lists references of source documents and notes for each plant, and appears at the end of each Summary File.

12.0 COMMENTS AND FEEDBACK

Although every effort has been made to ensure that the information contained in the RVID is accurate, information and data obtained from the RVID are not considered official. Every user explicitly acknowledges that all information obtained from the RVID is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, the implied warranties of merchantability and suitability for a particular purpose, and that the entire risk of acting on information obtained from the RVID, including the entire cost of all necessary remedies, is with those who choose to act on such information and not with the operators of the RVID.

Efforts have also been made to ensure that the RVID is "user-friendly" and that the programming logic is accurate. Comments and feedback regarding all aspects of the RVID and suggestions for future versions are encouraged and may be sent to:

RVID Project Manager
U.S. Nuclear Regulatory Commission
Mailstop O-7D4
Washington, DC 20555—0001

INDEX

APPENDIX B

SAMPLE RVID SUMMARY FILES

06/24/97
15:43:47

REACTOR VESSEL INTEGRITY DATABASE
Summary File for PTS

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Plant Name	Beltline Ident.	Heat No Ident.	RTpts @ EOL	ID Heut. Fluence @ EOL	IRTndt	Method of Determin. IRTndt	σRTndt at EOL	Fluence Factor @ EOL	Chemistry Factor	Method of Determin. CF	Margin	Method of Determin. Margin	Cu%	Ni%
Arkansas Nuclear 1 EOL: 05/20/14 Docket No.: 50-313														
	LOWER NOZZLE BELT FORGING	ATM 131	93	0.86200	3	B&W GENERI	19.2	0.958	20.00	Table	70.71	TABLE	0.030	0.700
	LOWER SHELL COURSE	C-5114-1	88	0.94000	0	PLANT SPEC	54.0	0.983	54.90	Override	34.00	Surv. Capsule	0.150	0.520
	UPPER SHELL COURSE	C-5114-2	163	3.29000	-10	PLANT SPEC	138.5	1.312	105.60	Table	34.00	TABLE	0.150	0.520
	LOWER SHELL COURSE	C-5120-1	145	0.94000	-10	PLANT SPEC	120.7	0.983	122.75	Table	34.00	TABLE	0.170	0.550
	UPPER SHELL COURSE	C-5120-2	146	3.29000	-10	PLANT SPEC	161.0	1.312	122.75	Table	34.00	TABLE	0.170	0.550
	UPPER/LOWER SHELL CIRC. WELD WF-112	406L44	207	0.94000	-5	B&W GENERI	173.3	0.983	176.27	Override	48.33	Surv. Capsule	0.310	0.590
	NOZZLE BELT/UPPER SHELL CIRC. WELD WF-182-1	821T44	214	0.86200	-5	B&W GENERI	155.3	0.958	162.09	Override	48.33	TABLE	0.240	0.630
	UPPER SHELL AXIAL WELD WF-18	8T1762	201	0.70500	-5	B&W GENERI	137.3	0.902	152.25	Table	68.47	TABLE	0.200	0.550
	LOWER SHELL AXIAL WELDS WF-18	8T1762	200	0.69500	-5	B&W GENERI	136.7	0.898	152.25	Table	68.47	TABLE	0.200	0.550

References for Arkansas Nuclear 1

USE for Weld WF-182-1 is 80
Fluence, IRTndt, and chemical composition data are from July 1, 1992, letter from J. J. Fisicaro (EO) to USNRC Document Control Desk, subject: Response to Generic Letter 92-01, Revision 1, "Reactor Vessel Structural Integrity"

Chemistry Factor for plate C5114-1 was calculated using ANO1 surveillance data reported in BAW-2075, Rev. 1

Chemistry Factor for WF-182-1 weld was calculated from Davis-Besse surveillance date that was reported in BAW-1803, Rev. 1. The Davis-Besse surveillance weld was fabricated with the same heat number as WF-182-1.

Table B-1. Sample RVID Summary File for PTS (PWRs) or P-T Limits (BWRs)

06/24/97
15:43:50

REACTOR VESSEL INTEGRITY DATABASE
Summary File for PTS

Page: 2

Plant Name	Beltline Ident.	Heat No Ident.	RTpts @ EOL	ID Neut. Fluence @ EOL	IRTndt	Method of Determin. IRTndt	σRTndt at EOL	Fluence Factor @ EOL	Chemistry Factor	Method of Determin. CF	Margin	Method of Determin. Margin	Cu%	Ni%

References for Arkansas Nuclear 1 (continued)

Chemistry Factor for WF-112 weld was calculated from Oconee 1, Point Beach 2, B&WOG, ANO-1, and Rancho Seco surveillance data that was reported in BAW-1803, Rev. 1. These surveillance welds were fabricated with the same heat number as WF-112.

IRTndt, for nozzle belt forging is a mean value from 24 forings similar to AYN 131. The data is reported in BAW-10046P and has a standard deviation of 31oF.

Fluence data report in BAW-2222.

UAISE for plates C5120-2, C5114-2, C5120-1 and C 5114-1 reported in BAW-2222.

UAISE for forging AYN 131 was 95/95 tolerance limit that was reported in BAW-2222.

Table B-2. Sample RVID Summary File for PTS (PWRs) or P-T Limits (BWRs) (Continued).

06/24/97
15:45:31

REACTOR VESSEL INTEGRITY DATABASE
Summary File for Upper Shelf Energy

Page: 1

Plant Name	Beltline Ident.	Heat No Ident.	Material Type	USE @ EOL @ 1/4T	1/4T Neut. Flu @ EOL	Unirr USE	Method Determ Unirr USE	% Drop USE @ EOL @ 1/4T	Method Determ % Drop	Cu		
Arkansas Nuclear 1 EOL: 05/20/14 Docket No.: 50-313												
	LOWER NOZZLE BELT FORGING	AYN 131	A 508-2	91	0.520	109	GENERIC	16.5%	Position 1 of RG 1.99, Rev. 2	0.03		
	LOWER SHELL COURSE	C-5114-1	A 533B	60	0.567	96	DIRECT	37.5%	Surveillance data	0.15		
	UPPER SHELL COURSE	C-5114-2	A 533B	82	1.984	107	DIRECT	23.3%	Surveillance data	0.15		
	LOWER SHELL COURSE	C-5120-1	A 533B	62	0.567	80	65%	22.6%	Position 1 of RG 1.99, Rev. 2	0.17		
	UPPER SHELL COURSE	C-5120-2	A 533B	60	1.984	86	65%	30.2%	Position 1 of RG 1.99, Rev. 2	0.17		
	UPPER/LOWER SHELL CIRC. WELD WF-112	406L44	LINDE 80	EMA	0.567	EMA	EMA	EMA	EMA	0.31		
	NOZZLE BELT/UPPER SHELL CIRC. WELD WF-182-1	821T44	LINDE 80	EMA	0.520	EMA	SISTER PLANT	EMA	EMA	0.24		
	UPPER SHELL AXIAL WELD WF-18	8T1762	LINDE 80	EMA	0.425	EMA	EMA	EMA	EMA	0.20		
	LOWER SHELL AXIAL WELDS WF-18	8T1762	LINDE 80	EMA	0.419	EMA	EMA	EMA	EMA	0.20		

References for Arkansas Nuclear 1

USE for Weld WF-182-1 is 80
Fluence, IRTndt, and chemical composition data are from July 1, 1992, letter from J. J. Fisicaro (EO) to USNRC Document Control Desk, subject: Response to Generic Letter 92-01, Revision 1, "Reactor Vessel Structural Integrity"

Chemistry Factor for plate C5114-1 was calculated using AMDT surveillance data reported in BAW-2075, Rev. 1

Table B-3. Sample RVID Summary File for Upper Shelf Energy.

Plant Name	Beltline Ident.	Heat No Ident.	Material Type	USE @ EOL @ 1/4T	1/4T Neut. Flu @ EOL	Unirr USE	Method Determ Unirr USE	% Drop USE @ EOL @ 1/4T	Method Determ % Drop	Cu		

References for Arkansas Nuclear 1 (continued)

Chemistry Factor for WF-182-1 weld was calculated from Davis-Besse surveillance data that was reported in BAW-1803, Rev. 1. The Davis-Besse surveillance weld was fabricated with the same heat number as WF-182-1.

Chemistry Factor for WF-112 weld was calculated from Oconee 1, Point Beach 2, B&WOG, ANO-1, and Rancho Seco surveillance data that was reported in BAW-1803, Rev. 1. These surveillance welds were fabricated with the same heat number as WF-112.

IRTndt, for nozzle belt forging is a mean value from 24 forings similar to AYN 131. The data is reported in BAW-10046P and has a standard deviation of 31oF.

Fluence data report in BAW-2222.

UUSF for plates C5120-2, C5114-2, C5120-1 and C 5114-1 reported in BAW-2222.

UUSE for forging AYN 131 was 95/95 tolerance limit that was reported in BAW-2222.

Table B-4. Sample RVID Summary File for Upper Shelf Energy (Continued).

04/24/97
15:46:28

REACTOR VESSEL INTEGRITY DATABASE
Chemistry Data File Summary

Page: 1

Plant Name	Beltline Ident.	Heat No Ident.	% Cu	Data Source for Cu	Method of Determin. Cu	Range of Cu Values	Average Value of Cu	% Ni	Data Source for Ni	Method of Determin. Ni	Range of Ni Values	Average Value of Ni	% P	% S
Arkansas Nuclear 1	EOL: 05/20/14	Docket No.: 50-313												
	LOWER NOZZLE BELT FORGING	AYH 131	0.03					0.70					0.009	0.015
	LOWER SHELL COURSE	C-5114-1	0.15					0.52					0.010	0.016
	UPPER SHELL COURSE	C-5114-2	0.15					0.52					0.010	0.016
	LOWER SHELL COURSE	C-5120-1	0.17					0.55					0.014	0.013
	UPPER SHELL COURSE	C-5120-2	0.17					0.55					0.014	0.013
	UPPER/LOWER SHELL CIRC. WELD WF-112	406L44	0.31					0.59					0.016	0.015
	NOZZLE BELT/UPPER SHELL CIRC. WELD WF-182-1	821T44	0.24					0.63					0.014	0.013
	UPPER SHELL AXIAL WELD WF-18	8T1762	0.20					0.55					0.004	0.017
	LOWER SHELL AXIAL WELDS WF-18	8T1762	0.20					0.55					0.004	0.017

References for Arkansas Nuclear 1

USE for Weld WF-182-1 is 80
Fluence, 1RTndt, and chemical composition data are from July 1, 1992 letter from J. J. Fisicaro (EO) to USNRC Document Control Desk, subject: Response to Generic Letter 92-01, Revision 1, "Reactor Vessel Structural Integrity"

Chemistry Factor for plate C5114-1 was calculated using ANO1 surveillance data reported in BAW-2075, Rev. 1

Chemistry Factor for WF-182-1 weld was calculated from Davis-Besse surveillance data that was reported in BAW-1803, Rev. 1. The Davis-Besse surveillance weld was fabricated with the same heat number as WF-182-1.

Table B-5. Sample RVID Summary File for Chemistry Data

Plant Name	Beltline Ident.	Heat No Ident.	% Cu	Data Source for Cu	Method of Determin. Cu	Range of Cu Values	Average Value of Cu	% Ni	Data Source for Ni	Method of Determin. Ni	Range of Ni Values	Average Value of Ni	% P	% S

References for Arkansas Nuclear 1 (continued)

Chemistry Factor for WF-112 weld was calculated from Oconee 1, Point Beach 2, B&WOG, ANO-1, and Rancho Seco surveillance data that was reported in BAW-1803, Rev. 1. These surveillance welds were fabricated with the same heat number as WF-112.

IRTndt, for nozzle belt forging is a mean value from 24 forings similar to AYN 131. The data is reported in BAW-10046P and has a standard devaiation of 31oF.

Fluence data report in BAW-2222.

URSE for plates C5120-2, C5114-2, C5120-1 and C 5114-1 reported in BAW-2222.

URSE for forging AYN 131 was 95/95 tolerance limit that was reported in BAW-2222.

Table B-6. Sample RVID Summary File for Chemistry Data (Continued)

NRC FORM 335 (2-89) NRCM 1102, 3201, 3202

U.S. NUCLEAR REGULATORY COMMISSION

BIBLIOGRAPHIC DATA SHEET

(See instructions on the reverse)

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J.R. Strosnider, K.R. Wichman, B.J. Elliot

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10. SUPPLEMENTARY NOTES

11. ABSTRACT

The U.S. Nuclear Regulatory Commission (NRC) developed the Reactor Vessel Integrity Database (RVID) following the staff's review of licensee responses to Generic Letter (GL) 92-01, Revision 1 (Ref. 1). The database summarizes the properties of the reactor pressure vessel (RPV) beltline materials for each operating commercial nuclear power plant.

The RVID contains four tables for each plant: (1) background information table, (2) chemistry data table, (3) upper-shelf energy table, and (4) pressure-temperature limits or pressurized thermal shock table. References and notes follow each table documenting the source(s) of data and presenting supplemental information. Additionally, the RVID has "sort" and "data search" capabilities. The user can select a desired grouping of plants and then specify information categories to search and list.

The design of the RVID consolidates the industry's RPV data in a convenient and accessible manner. Some of the data categories contain data inputs of "docketed" information; other data categories contain computed numerical values, which may or may not be "docketed". The programming logic used for calculations in the RVID follows the methodology in Regulatory Guide (RG) 1.99, Revision 2 (Ref. 2).

For the Palisades RPV, the data and information contained in the RVID, Version 1.1, are current through April 12, 1995; the data and information for the RPVs of all other operating commercial nuclear power plants are current through December 31, 1994. The staff will update the RVID periodically to reflect the latest information available. Information contained in the industry's responses to the closeout letters to GL 92-01, Revision 1, and in the industry's responses to GL 92-01, Revision 1, Supplement 1 (Ref. 3), are not necessarily reflected in this version, but will appear in a future version of the RVID.

12. KEY WORDS/DESCRIPTORS (List words or phrases that will assist researchers in locating the report.)

Reactor Vessel Integrity Database, RVID, Pressurized Thermal Shock, Upper-Shelf Energy, Radiation Embrittlement, Reactor Pressure Vessel, Pressure-Temperature Limits, Generic Letter 92-01, Revision 1, NUREG-1511, Equivalent Margins Analysis, Reactor Vessel Beltline Materials

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