



UNITED STATES DEPARTMENT OF COMMERCE
National Institute of Standards and Technology
{formerly National Bureau of Standards}
Gaithersburg, Maryland 20899

January 10, 1989

Mr. Charles Peterson
Materials Engineering Section
Technical Review Branch
Division of High-Level Waste Management
Office of Nuclear Materials Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Mr. Peterson:

We have reviewed your comments of October 11, 1988 on the Monthly Letter Report (MLR) for FIN A-4171, "Evaluation and Compilation of DOE Waste Package Test Data," for the month of July. The NRC comment or question is preceded by NRC and the NIST response is indicated in the same manner. We hope this information will clarify some questions and will be useful.

Item No.

1. NRC: State what the improved capabilities of Advanced Revelation over Revelation.

NIST: Advanced Revelation has a number of improvements and some of these are highlighted in Attachment A. One feature that is useful to the data base user is that Advanced Revelation allows for scrolling backward and forward. This is especially helpful for scanning large reports. Previously, scrolling was allowed only in the forward direction. There are other features of Advanced Revelation which are of use to programmers and make programming easier for the systems person.

2. NRC: Provide more information on Compendex Plus. Who is Engineering Information, Inc., what is the size of their database, and what areas so they attempt to cover?

NIST: Compendex Plus is produced by Engineering Information, Inc. Information on this data base is given in Attachment B.

3. NRC: The Bazan report deals with leaching of glass samples in Teflon® dishes. We have recently been advised that long term leaching of Teflon® results in leaching of fluoride ions. Was there any mention of this in the report?

NIST: Teflon® containers or Teflon® in the system as a support could result in some fluorine (F) release. Teflon® is relatively inert, and this fluorine release may not occur in many solutions. However, in analytical procedures, an analysis should always be made for F. Radiation may cause an increase in F release from

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Teflon®. The MCC-1 Static Leach Test Method for determining leaching behavior of waste forms states in Section 3.0 that "The total integrated dose for each Teflon® leach container or any Teflon® support structure may not exceed 10^4 rds during the lifetime of the container." This statement in MCC-1 resulted after numerous tests and also balloting of the test method. The Bazan study would need to account for the presence of F in the leachate and the radiation dosage of the Teflon® if the data are to be useful.

4. NRC: Study of the corrosion of copper in HCL solutions seem to be departing from expected environments. Is there any indication that the work described would add to understanding of copper behavior in tuff?

NIST: Though the chloride concentration in J-13 water is low, inhomogeneous wetting and pitting will concentrate this ion, making HCl an important factor.

5. NRC: The Yow report on possible tests to characterize water flow through pores and fractures is certainly of interest, but we would prefer that NIST not spend time with this and concentrate on documents dealing with materials performance.

NIST: The NIST will not review a large number of reports dealing with geology and the environment. Some reports will be reviewed for the purpose of obtaining information on the environment to which the canister will be exposed.

6. NRC:--Statements like "work is continuing" are not sufficiently informative.

NIST: We try to give a monthly update on the experimental programs. Some months, there are more data to report than in other months. The progress of this work would be more evident when viewed after a three or six month period.

7. A. SCC Propagation

NRC: Please quantify "a considerable improvement in the sensitivity of the measurement system": was it by a factor of 1.5? 10? 100?

NIST: The expectation is for 100 to 1000 times improvement.

NRC: Is any preliminary estimate available yet of the minimum detectable rate of crack propagation?

NIST: The minimum detectable rate of propagation has not yet been estimated, but the results are promising.

NRC: What is the nature of the test planned for August?

NIST: Test one more specimen as soon as all preparations have been made. Do not test until all uncertainties, calibrations, etc. have been adequately handled.

B. Resistivity Effects

NRC: Two problems were noted with respect to the test involving agar: bacterial growth and moisture loss. What is proposed to deal with these problems, or should some other medium be substituted?

NIST: Bacterial growth is avoided by using a higher purity agar without nutrients. 2) Moisture loss is now controlled by running the experiment in a box with controlled humidity.

C. Pitting Corrosion in Steel

NRC: Where will the proposed paper be presented?

NIST: The paper entitled "Corrosion Behavior of Low Carbon Steel in High pH Media" was presented at the Electrochemical Society Meeting, Chicago, IL, October 13, 1988.

NRC: The statements on corrosion rates found are informative. Can the writer offer any rationale, however preliminary, for the lower rate in concentrated J-13 water based on differences in other variables such as chloride content, oxygen content, or test time?

NIST: The corrosion rate of the A27 steel in J-13 water still is 7.08 $\mu\text{A}/\text{cm}^2$ (3.35 mpy) and is significant. This is the result of one test, and the difference can be the result of a variation in the test procedure. The pH of the J-13 water is lower, and this could have some effect.

NRC: We presume μA means microamperes. How is the conversion from μA to mils made?

NIST: The corrosion rate in mils per year (MPY) was calculated as follows.

$$\text{Corrosion Rate (MPY)} = \frac{(0.13) (i_{\text{corr}}) (\text{E.W.})}{d}$$

where 0.13 = metric and time conversion factor, E. W. = equivalent weight and d = density in grams per cm^3 . The i_{corr} ($\mu\text{A}/\text{cm}^2$) is calculated from polarization resistance measurements (R_p in kilo ohms/ cm^2), the anodic (B_a) and cathodic (B_c) Tafel constants in mv/decade and the area of the specimen (A in cm^2).
Polarization Resistance R_p ($k\Omega$) = E (mV)/ ΔI (μA)

$$\text{Corrosion Current } (i_{\text{corr}}) \text{ in } \mu\text{A}/\text{cm}^2 = \frac{(B_a) (B_c)}{2.3 (B_a + B_c) (A) (R_p)}$$

The corrosion rate in MPY also can be calculated from weight loss measurements by using the formula, $\text{MPY} = \frac{534W}{DAT}$, where W = weight loss in mg, D = density in g/cm³, A = area in sq. in. and T = exposure time in hrs.

NRC: Since thick films apparently reduce diffusion rate, it would appear inaccurate to say they are non-protective. Perhaps non-adherent would be better.

NIST: It is true the thick films on the A27 steel limit diffusion and are not always adherent. These films offer reduced, limited and unpredictable protection. It is not entirely correct to state that the films are non-protective.

NRC: See Comment 3 above re the potential impact of leaching fluoride from Teflon.

NIST: Teflon[®] is used in holders for general corrosion tests. In aqueous corrosion tests, it has proved to be a good sealant and nonreactive to the metal. We have not found the ideal arrangement for holding corrosion specimens for testing at high temperatures. We were considering making a special Teflon[®] holder for the NRC work, but this has not been done yet. Previously in other work, we used Teflon[®] holders for testing in aqueous solutions up to 200°C and found no reaction with the holder. We have not checked for fluoride leaching from Teflon[®] but we have not used Teflon[®] holders for the NRC studies.

D. Corrosion of Zircaloy

NRC: The shift from -362 mV to +204 mV in one day appears to be a substantial shift in potential, yet the corrosion rate is essentially zero in both cases. Was this expected?

NIST: Yes

NRC: Is there a tentative rationale?

NIST: Zirconium is a highly reactive metal and readily oxidizes to produce a protective film (and the shift in potential) and achieve high corrosion resistance.

NRC: How are the welded areas characterized prior to testing?

NIST: Welded specimens will be characterized microscopically prior to corrosion testing. Some welds will be chemically etched to permit a better analysis of the microstructure, and these specimens will not be used for corrosion testing.

COST STATEMENT

NRC: Expenditures for Pay Period 15 are more than double those in the two previous periods. Large changes and unusual outlays should be explained.

NIST: The labor hours and their cost shows an increase in Pay Period 15 due to more staff hours after summer vacations. The increase in other objects reflects two obligated contracts - T. Ahn for \$6,000 and B. Adams for \$5,000.

Sincerely,



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Program Manager
Corrosion Group
Metallurgy Division**

**cc: Ronald Ballard, Branch Chief
HLTR, HLWM, NMSS**

**Richard Weller, Section Leader
Materials Engrg. Section., HLTR, HLWM, NMSS**

**Neville Pugh, Chief
Metallurgy Division**

**David Anderson, Group Leader
Corrosion Group, Metallurgy Division**

Highlights of Advanced Revelation include:

- An "Applications Processor" that can produce very sophisticated, high-end applications without any coding or programming. It is a fourth generation applications generator that you can use like a word processor.
- A new, advanced screen painter in the Application Processor that allows users to develop and customize data entry screens with such sophisticated features as multi-valued and associated multi-valued fields. The Applications Processor automatically produces record-locking logic for network use.
- An extensive help system and new documentation and packaging. All fields can have any level of context-sensitive help. All commands and "options" are built into pop-up selection menus so users and programmers do not have to remember commands that can be recalled when needed.
- Extensive windowing capabilities allow development of text windows, pop-up windows, menus and custom programs. Can easily resize windows and move them on the fly. Also has a "pop-up windows designer" and "menu designer."
- New windowing capabilities include a "panning" and "virtual" space feature where an application can be larger than the display screen. Users are able to "pan" through a large application with a small or full-screen sized window.
- Variable-length structure. Like previous Revelation releases, Advanced Revelation continues with variable-length files, fields and records. Advanced Revelation will also come with R/BASIC and an enhanced version of R/LIST.
- Advanced Revelation will be the first DBMS package to have multiple filing structures and indexing methods available to users and programmers. Cosmos' new "Linear Hashing" filing structure will be added to increase network performance.
- Advanced Revelation's filing structures and indexing methods can automatically resize and optimize performance in single-user, network, or distributed processing configurations. Indexing methods include cross-referencing, B-trees, relational, and computational.
- Advanced Revelation will also allow programmers to develop their own alternative filing structures (AFS). With this ability, developers will be able to better integrate applications into true distributed processing systems. AFS also facilitates interactive access to mainframe and minicomputers.

COMPENDEX® PLUS**Information Retrieval Service****FILE DESCRIPTION**

The COMPENDEX® PLUS database provides coverage of the world's significant engineering and technological literature. COMPENDEX PLUS is produced by Engineering Information, Inc., and corresponds to the printed publication *Engineering Index*, plus additional conference records from the Engineering Meetings file. Each record in COMPENDEX PLUS is a reference to a journal article, technical report, engineering society publication, book, conference proceedings, or individual conference paper, and includes a concise abstract describing the document. Author-prepared abstracts are used when available. The COMPENDEX PLUS database utilizes both controlled vocabulary and classification codes to enhance subject searching. Approximately 25% of the documents indexed are published in a language other than English.

Prior to January 1988, COMPENDEX PLUS existed as two databases, COMPENDEX® (File 8) and Ei ENGINEERING MEETINGS® (File 165). File 165 was merged into COMPENDEX PLUS (File 8) in 1988 in order to facilitate one-step searching.

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- Aeronautical and Aerospace Engineering
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- Engineering Management and Industrial Engineering
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- Marine Engineering, Naval Architecture, Ocean and Underwater Technology
- Mechanical Engineering, Automotive Engineering and Transportation
- Mining and Metallurgical Engineering, Materials Science

SOURCES

Publications from around the world are indexed, including approximately 4,500 journals, publications of engineering societies and organizations, approximately 2,000 conferences per year, technical reports, and monographs.

DIALOG FILE DATA

Inclusive Dates: 1970 to the present
 Update Frequency: Monthly (approximately 17,500 records per update)
 File Size: Over 2.2 million records as of January 1988

ORIGIN

COMPENDEX PLUS is produced by Engineering Information, Inc. Questions concerning database content should be directed to:

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SAMPLE RECORD

DIALOG Accession Number

02129213 Monthly No: EIM8610-066399

ANALYSIS OF RING, CUBE AND TREE MULTIMICROCOMPUTER SYSTEMS.

AU= Venkatasubramaniam, Kumar; Liu, Yu-cheng

CS= Reflectone Inc, Tampa, FL, USA

CL= Conference Title: Proceedings - IEEE 1986 Region 5 Conference.

SP= Conference Location: Lafayette, LA, USA Conference Date: 1986, Apr 8-11

Sponsor: IEEE, Region 5, LA, USA

E.I. Conference No.: 08322

Source: IEEE Region 5 Conference 1986. Publ by IEEE, New York, NY, USA.

Available from IEEE Service Cent (Cat n 86CH2304-4), Piscataway, NJ, USA p 150-155

CO= CODEN: IRCOER

LA= Language: English

DT= Document Type: PA; (Conference Paper)

The performance of three types of interconnection schemes for large multimicrocomputer systems, namely, ring, binary cube, and tree networks, is analyzed. These systems are modeled as networks of queues, and analytical results are obtained for two performance measures: mean queue length at any node and mean time spent in system by a random message. The analytical results are then verified through simulation. The results are useful in the design and performance evaluation of multimicrocomputer systems because the need for expensive simulations is reduced or eliminated. 8 refs.

Descriptors: *COMPUTERS, MICROCOMPUTER; COMPUTER SYSTEMS, DIGITAL-- Multiprocessing; COMPUTER NETWORKS

Identifiers: RING, CUBE AND TREE INTERCONNECTIONS; MULTIMICROCOMPUTER SYSTEMS; QUEUEING NETWORKS

Classification Codes: 722 (Computer Hardware); 723 (Computer Software) 72 (COMPUTERS & DATA PROCESSING)

SEARCH OPTIONS

BASIC INDEX

SEARCH SUFFIX*	DISPLAY CODE	FIELD NAME	INDEXING	SELECT EXAMPLES
/AB	AB	Abstract	Word	S BINARY(W)CUBE/AB
/DE	DE	Descriptor ¹	Word & Phrase	S DIGITAL(L)MULTIPROCESS?
/ID	ID	Identifier ²	Word & Phrase	S COMPUTERS, MICROCOMPUTER/DE
/TI	TI	Title ³	Word	S (TREE AND INTERCONNECT?)ID S QUEUEING NETWORKS/ID S RING(W)CUBE(1W)TREE/TI

* If no suffix is specified all Basic Index fields are searched.

¹Also /DF.

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