IAEA/ANL
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Technical and Administrative Preparations Required for Shipment of Research Reactor Spent Fuel to Its Country of Origin

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Lecture L.13.12

Improved Communication with Electronic Mail (E-mail)

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Introduction

- E-mail is a simple and effective way to transfer information over the Internet.
- E-mail applications use SMTP (Simple Mail Transfer Protocol) to send, which in turn is limited to the US-ASCII character set.
- In order to include non-ASCII data it must be ‘encoded’ in ASCII characters and then ‘decoded’ by the receiver.

Introduction (cont.)

- Conventions have been adopted for encoding and decoding non-ASCII data.
- UU & XX encode/decode UNIX
- MIME PC
- BinHex Mac

Encode/Decode and Attachments

- Attachments in E-mail provide a convenient way of including non-ASCII data for transmission over the Internet.
- Attachments might include Binary files, Graphics, Word Processor files, Spread Sheets, Photos, etc..

Decay Heat Curves

An analytical expression given by El-Wakil (Ref. 10), which correlate with the decay heat curves of Ref. 11, estimate heat loads about one-half the heat loads calculated above. This heat load expression is

$$H = 4.95\times10^{-3}\times P\times t_d{}^{-0.06}\times(t_d{}^{-0.2}-(t_i+t_d)^{-0.2}) \text{ Watts} \qquad (2)$$

where all symbols, etc. have the same meaning as above and the times are in days.

The ratio of Eq. -2 to Eq. -1 is

$$4.95\times t_d{}^{-0.06} / 6.85 = 0.72\times t_d{}^{-0.06}$$

For decay times (t_d) greater than 1 year, the ratio is approximately 0.5.

Experimental Decay Heat Data

Another analytical expression given by Untermyer and Weills (Ref. 12), has been used to fit experimental decay heat data. This heat load expression is

$$H = 0.1\times P\times[(t_d+10)^{-0.2}-(t_i+t_d+10)^{-0.2}]$$
$$-0.087\times P\times[(t_d+2\times10^7)^{-0.2}-(t_i+t_d+2\times10^7)^{-0.2}] \text{ Watts} \quad (3)$$

where the irradiation (t_i) and decay (t_d) times are in seconds.

A plot of the ratio (H / P) for Eqs. -2 and -3 are shown in Fig. 2 as a function of decay time and for an irradiation time of 600 days. The ratio calculated with the ORIGEN code is also shown for comparison.

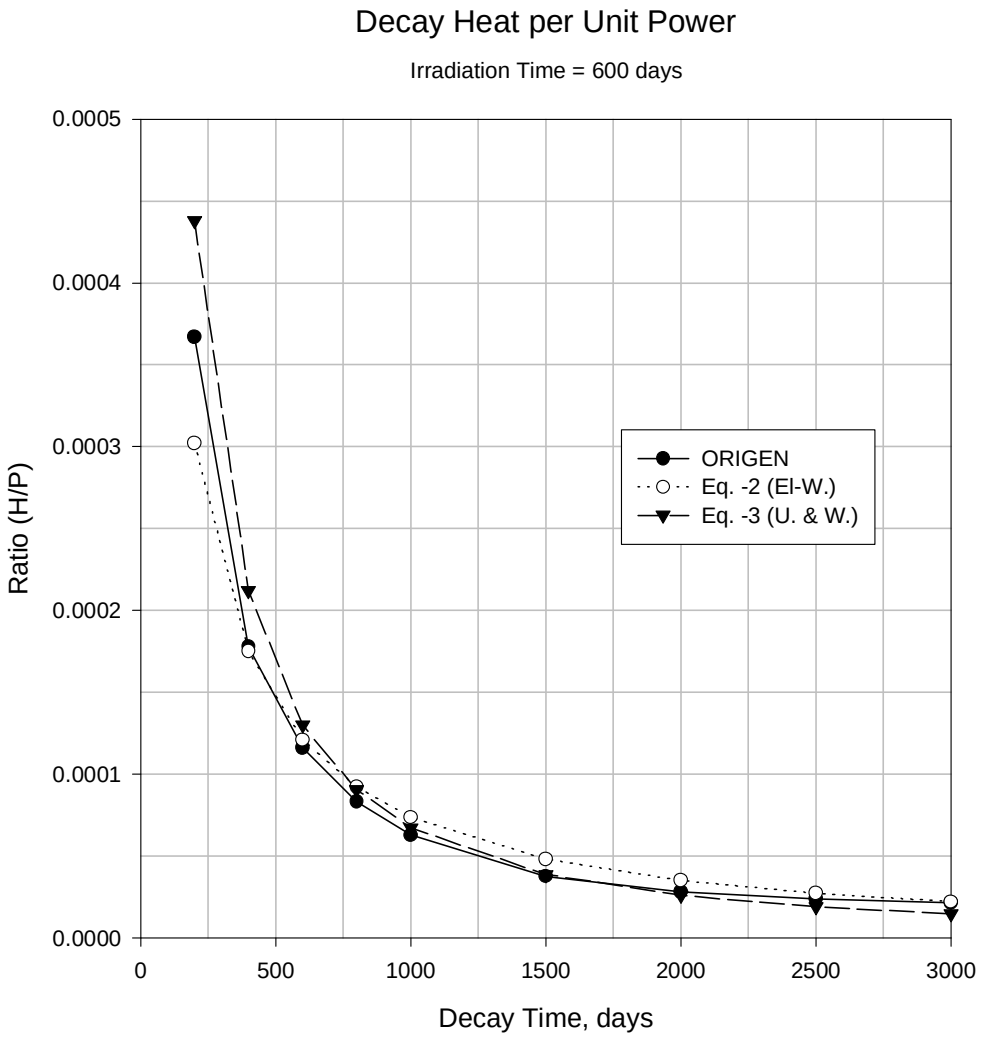

Figure 2. Comparison of Decay Heat Equations-2 and -3 with ORIGEN

These data clearly show the relative decay heat estimated by the decay heat expressions for a typical irradiation time. The ORIGEN ratio is in good agreement with both Eqs. -2 and -3.

Table App V-2a. MTR Fuel, 93% Enrichment, 100 g U-235/Assembly

U-235 Burnup, %	**0**	**5**	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**
U-235 Burned, g	**0**	**5**	**10**	**20**	**30**	**40**	**50**	**80**	**70**	**80**
U-234	0	0	0	0	0	0	0	0	0	0
U-235	100	95	90	80	70	60	50	40	30	20
U-236	0	1	2	3	5	6	8	9	11	12
U-238	8	8	8	8	7	7	7	7	7	7
U	108	103	99	91	82	74	65	56	48	39
Np-237	0	0.0	0.0	0.0	0.0	0.1	0.1	0 2	0.2	0.3
Np	0	0.0	0.0	0.0	0.0	0.1	0 1	0.2	0.2	0.3
Pu-238	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pu-239	0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1
Pu-240	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pu-241	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pu-242	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pu	0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.2
Am-241	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Am	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

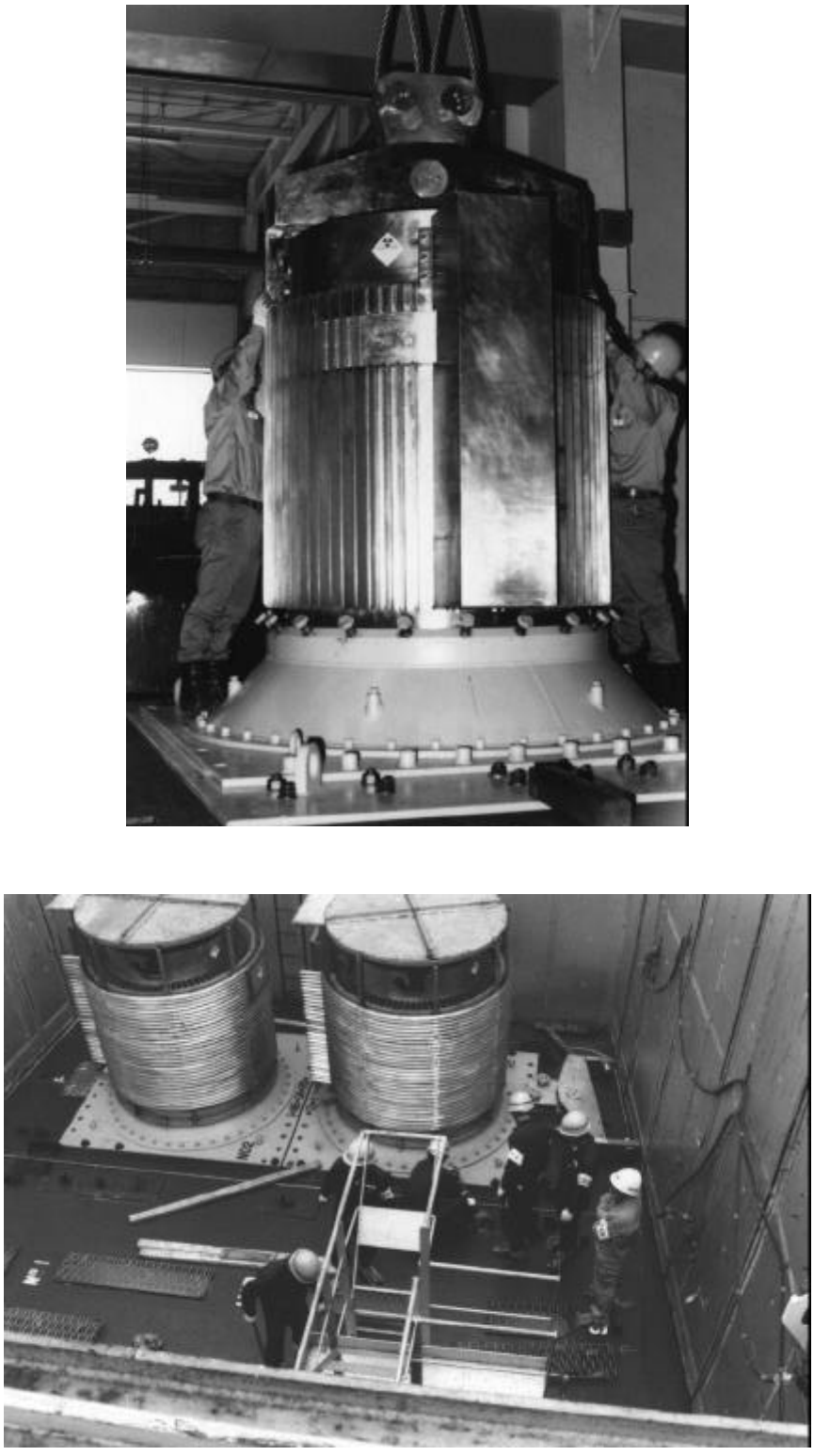

Figure 4. JMRT-W5200 Transporting Cask

E-mail with Eudora Light

- The Eudora Light application is provided **free** of charge for both Mac and PC users.
- For PCs with Windows 3.x, 95 or NT
- For Macs with 680x0 or PPC
- Both require a POP3 server to receive mail, and a SMTP server to send mail.
- Attachments may be included with MIME (preferred option for encode/decode).

Useful World Wide Web Sites on Internet for Software (http:// ...)

- www.eudora.com/light.html - Eudora
- www.adobe.com - Acorbat Reader
- www.awa.com/softlock/zipit/zipit.html - Zip/Unzip for Mac
- www.cdrom.com/pub/infozip/zip.html and ... /unzip.html - Zip and Unzip for Mac

Data Compression of Attachment

- E-mail gateways often limit the file sizes allowed.
- Encoding of data results in a 33% increase in the file size, and compression of file prior to encoding may be necessary.
- Zip/UnZip (pkzip/pkunzip, etc..) with PCs and Stuffit with Macs may be used.
- Zip/Unzip applications for Mac needed.

Codes Available for Diskettes

- Eudora Light code for PC and Mac
- Eudora Light Manual for PC and Mac
- UUDECODE for DOS
- XFERPRO for Windows (UU, XX, MIME)
- Acrobat Reader for PC - PDF Format Reader
- FORTRAN Source for Gamma Dose (Pond)

PC Directories and Target Diskettes by Name

- DISK1 - Segment 1 of Eudora code, Readme.txt and utility for rejoining code
- DISK2 - Segment 2 of Eudora code, Manual, Uudecode files, Zipped XFERPRO file (with Unzip) and Phdose.f (FORTRAN)
- DISK3 - Acrobat Reader segment 1, two readme files, and utility for rejoining code
- DISK4 - Acrobat Reader segment 2

Diskette Selection and Creation

- For Decode utilities or FORTRAN source code - Only DISK2 is needed.
- For Eudora Light code and manual, utilities and FORTRAN source - DISK1 and DISK2
- For the Acrobat Reader for PCs - Only DISK3 and DISK4 are needed.
- Diskettes of the Eudora code and manual for Mac users are available on request.

Diskette Creation (cont.)

- The DISK1, DISK2, DISK3 and DISK4 directories are loaded on selected PCs and blank formatted diskettes are provided.
- Entire directories fit on a single diskette and may be copied with the DOS command **COPY *.* A:** (assuming A: is the drive for diskettes). Mixed files from different directories may not fit on a single diskette.