ATTACHMENT 1

DRESDEN RADIATION PROCEDURE

DRP 37-1-B-1, CONTROL OF PERSONNEL

EXTERNAL EXPOSURES TO RADIATION

CONTROL OF PERSONNEL EXTERNAL EXPOSURES TO RADIATION

A. PURPOSE

To provide background information and guidelines for all personnel in regard to control of external exposures to radiation.

B. REFERENCES

Radiation Control Standards.

C. PREREQUISITES

None.

D. PRECAUTIONS

None.

FOR INFORMATION ONLY

E. LIMITATIONS AND ACTIONS

None.

F. PROCEDURE

1. General.

Radiation Control Standard, "Personnel Occupational External Exposure Limits", describes the amount of radiation an individual may be allowed to receive during each calendar quarter, during each calendar year, and during the lifetime of the worker. Each radiation worker, together with his Supervisor, is responsible for maintaining individual radiation exposures within these limits.

The radiation exposure estimate based on Radiation Protection's dose rate determinations, timekeeping* data, and the doses recorded from personnel ionization chambers are the most important indicators of the radiation status of an individual, and are of prime importance in maintaining control over exposures on a daily basis. The film badge results constitute the legal record of exposure received by the wearer. Since the processing of the badge may lag weeks behind the time of exposure, badge results are not useful for providing daily control information.

The exposure limits described in the above standard must be complied with for each of the periods indicated. A separate account of an individual's exposure status relative to each of these limits would be prohibitively confusing and unwieldy in practice. To avoid this confusion, Radiation Protectionmen interpret the limiting dose rate to the worker in terms of a single number after considering the relative amounts of penetrating and non-penetrating radiations, the parts of the body exposed, and the various exposure limits. This single timekeeping number is used for control purposes and may or may not reflect the maximum dose rate to which a part of the body is exposed. This figure does,

* Timekeeper - any person determined to be qualified by Radiation Protection.

however, indicate that if work is continued (under the same radiological conditions, using the same dose rate figure) until the man has received 1250 units, the most limiting of the exposure limits could have been reached.

2. Control of Personnel External Exposures.

a. Each individual performing radiation work is responsible for:

(1) Requesting supervisory approval before exceeding a daily whole body dose in excess of 50 mrem.

(2) Requesting supervisory approval before exceeding a weekly whole body dose in excess of 300 mrem.

(3) Informing timekeepers of the dose authorized by supervision before performing the work.

b. Each Supervisor is responsible for:

(1) Initiating a special work permit for all employees except Radiation Protectionmen before authorizing daily doses in excess of 50 mrem (excludes emergencies).

(2) Obtaining Radiation Protection supervisory approval before permitting anyone to exceed a daily whole body dose in excess of 100 mrem or a dose in excess of 300 mrem in any calendar week.

(3) Establishing the allowable dose for each job prior to the start of the job.

(4) Making any job assignment or work location change which is necessary to keep their personnel within quarterly, annual, and lifetime limits.

G. CHECKLISTS

None.

H. TECHNICAL SPECIFICATION REFERENCES

None.

ATTACHMENT 2

CECO. RESPONSE TO NRC ROUND 1, QUESTION 1

Question No. 1:

Provide a Breakdown of the Man-Rem Calculation.

Response:

Numbers are based on a 5 day work week, 6 hours per day. A dose rate of 2 mrem/hour to 5 mrem/hour is utilized. The rack designations "A thru "F" represent rows in the pool. Current plans are to shift fuel to the "A", "B" & "C" rows of racks remove "D", "E" and "F" and install the high density racks, move fuel to the high density racks and remove the remaining racks. If a diver is requred a minimum of 8 feet will be maintained between the diver and spent fuel keeping doses to the diver at a minimum.

		Dose* At 2 mrem/hr	Dose* At 5 mrem/hr
1) Move Fuel	1½ Weeks (45 Hours)	0.09 rem	0.225 rem
2) Clean Pool	½ Week (15 Hours)	0.03 rem	0.075 rem
3) Remove "D" Racks	1 Week (30 Hours)	0.06 rem	0.15 rem
4) Move Fuel & Vacuum	1 Week (30 Hours)	0.06 rem	0.15 rem
5) Remove "E" "F" Racks	1½ Weeks (45 Hours)	0.09 rem	0.225 rem
6) Install 8 Absorber Racks	½ Week (15 Hours)	0.03 rem	0.075 rem
7) Fuel Hdlng. Trng.	½ Week (15 Hours)	0.03 rem	0.075 rem
8) Dummy Check	2 Week (60 Hours)	0.12 rem	0.3 rem
9) Move Fuel To Absorber Racks	2 Weeks (60 Hours)	0.12 rem	0.3 rem
10) Clean Pool	½ Week (15 Hours)	0.03 rem	0.075 rem
11) Remove "A" "B" "C" Racks	2½ Weeks (75 Hours)	0.15 rem	0.375 rem

*Per man

Question No. 1:(Cont.)

			2 mrem/Hr.	5 mrem/Hr.
12)	Install Remaining Absorber Racks	2½ Weeks (75 Hours)	0.15 rem	0.375 rem
13)	Dummy Check	6 Weeks (180 Hours)	0.36 rem	0.9 rem
14)	Box Existing Racks	4 Weeks (120 Hours)	0.24 rem	0.6 rem
	Total	26 Weeks (780 Hours)	1.56 rem	3.9 rem

1.56 X 2 Units = 3.12 Rem
3.9 X 2 Units = 7.8 Rem

With 6 men working, the total dose for the job is 18.72 to 46.8 man-rem.

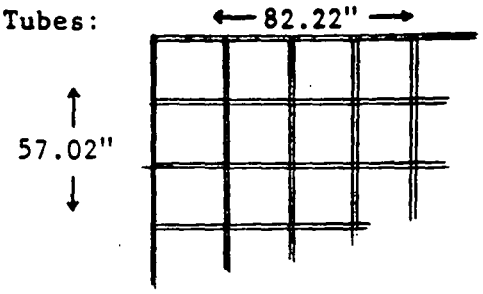
ATTACHMENT 3

VOLUME DISPLACEMENT OF RACK

Use the largest type 9 x 13 rack (vs. 9 x 11).

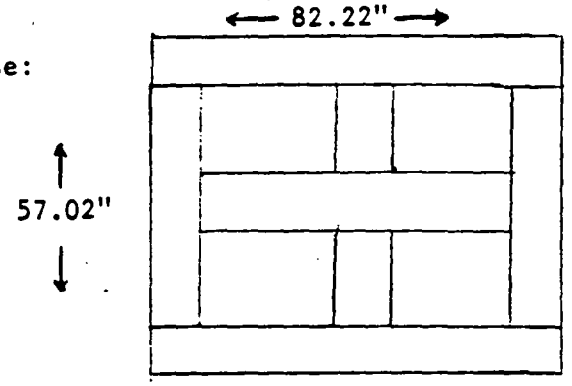
Assumption 1: Volume of the six legs is negligible.
Assumption 2: Wall thickness is a constant .217 inches from top to bottom of tube (actually it tapers at top and bottom where there is no Boral)

Tubes:



Height = 168"

Base:



Wall thickness = .217"

Thickness = .75"

Volume of Tubes:

$$V_t = \frac{10 \times (.217 \times 82.22 \times 168)}{12^3} + \frac{14 \times (.217 \times 57.02 \times 168)}{12^3} - \frac{10 \times 14 \, (.217^2 \times 168)}{12^3} = 31.1 \text{ ft}^3$$

Volume of base:

$$Vb = \frac{3 \times 82.22 \times 6.62 \times .75}{} + \frac{3 \, (57.02 - 3 \times 6.62 \times 6.62 \times .75}{} = 1.02 \text{ ft}^3$$

Total Volume = 31.1 + 1.0 = 32.1 ft^3 = 240 gal.

Fuel Pool = 33' x 41' = 1353 ft^2

$$\text{Water Level from Rack} = \frac{32.1 \text{ ft}^3}{1353 \text{ ft}^2} = .0237 \text{ ft.} = .28"$$

References: Drawings S040 b-682
NSC 1000496
NSC 1000497
NSC 1000499