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SUBJECT: Forwards addl info re radiation monitoring sys per Staff request.

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AEP:NRC:0856X

Donald C. Cook Nuclear Plant Unit Nos. 1 and 2
Docket Nos. 50-315 and 50-316
License Nos. DPR-58 and DPR-74
NUREG 0737, SECTION II.F.1-2

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

ATTN: T. E. Murley

October 5, 1989

Dear Dr. Murley:

This letter provides additional information regarding radiation monitoring systems as requested by a member of your staff.

The information supports our previous submittal AEP:NRC:0678Y, dated July 23, 1986, and is provided on the two attachments. Attachment 1 is a description of how the gaseous radioactive effluent monitor readings are corrected for decay for the purpose of off-site dose calculation. Attachment 2 is a copy of an internal calculation to determine if the radiation monitor could survive in a post accident environment per IE Information Notice 86-30.

This document has been prepared following Corporate procedures that incorporate a reasonable set of controls to ensure its accuracy and completeness prior to signature by the undersigned.

Very truly yours,

M. P. Alexich
Vice President

edg
Attachments
cc: D. H. Williams, Jr.
A. A. Blind - Bridgman
R. C. Callen
NFEM Section Chief
G. Charnoff
NRC Resident Inspector - Bridgman
A. B. Davis - Region III

A009
1/1

ATTACHMENT 1

AEP:NRC:0856X

The response of the Eberline SPING gaseous effluent radiation monitor (low-, mid-, and high-range channels) was calculated as a function of time for a postulated accident. The response of the detectors to the post-accident gas mixture was determined by utilizing the primary calibration efficiencies of each detector type. The result of the analysis provided tables of post-accident decay correction factors which can be applied to the radiation monitoring channels.

These correction factors had been inserted into and made part of our off site dose assessment computer code (DAP). DAP estimates off site doses to the whole body and thyroid resulting from plant releases. The user is prompted to input the following information: meteorological data, radiation monitor reading, time of reactor shutdown, duration of release, effluent flow rates, and the type of the accident that would be considered. During the process of calculating the estimated doses, the computer code automatically retrieves the gas mixture decay factor, which is a dimensionless multiplier, for the appropriate monitor reading.

QUALITY ASSURANCE DOCUMENT

FORM NUC-12

AMERICAN ELECTRIC POWER SERVICE CORPORATION

RADIOLOGICAL SUPPORT SECTION

CALCULATION COVER SHEET

FILE NO. RS-C-0086
SUBJECT Analysis of Dose To Spings

FILE LOCATION DC-RS-7950

PLANT Cook UNIT 1&2
DATE 6/18/86
CALCULATED BY W.T. MacRae
VERIFIED/CHECKED BY W.T. MacRae & D. Jones
APPROVED BY [signature]

PROBLEM DESCRIPTION: IE Information Notice 86-30 stated that the Sping Unit CPU's used at Cook could only endure 1000rads. This calculation was done to help analyse the effect of an accident on the sping.

DESIGN BASIS OR REFERENCES:

(1) Mathmatical Theory of Radiation Dosimetry, Fitzgerald et al
(2) Handbook of Radiation Measurement and Protection, Volume 1, Allen Brodsky
(3) 1-5570-N-3
(4) FSAR
(5) D.L. Fuller to J.L. Leichner 5/14/86
(6) Technical Manual for Sping-3/Sping-4 REVISIONS

NO.	DATE	CHANGE	CALCULATED BY	CHECKED BY	DATE	APPROVED BY	DATE

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REASON: _____

FIGURE RS-1

QUALITY ASSURANCE DOCUMENT

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SUBJECT Analysis of Dose to Sping Cpu

I.E. Info. Notice 86-30 addressed the Eberline Spings used At the Cook Plant. The Notice said that the Eberline CPU's could only withstand 1000 rads.

If an accident would occur, the sping could receive a dose. The dose for all post accident spings would be from the piping associated with the sping.

To Analyse the problem, the doses from an infinite line source at 1, 20, 40, 60, 80 and 100 cm were consider for Radionuclide concentrations of 1 μCi to 10^5 μCi/cc. No credit was taken for attenuation or self Absorption. The equations for the problem were set up as follows:

The Absorbed dose to a target is

$$R\,(\text{rads/hr}) = 5.76 \times 10^{-5} \left(\frac{\mu_a^{med}}{\rho^{med}}\right) I_o$$ ✓ (1) eq 5.108 pg 265

The gamma ray average energy was assumed to be 1 MeV (a very conservative assumption) (over)

$$\frac{\mu_a^{med}}{\rho^{med}} = 0.0277\ \text{cm}^2/\text{g}$$ ✓ (2) Table 3.5-1 pg 232

the target medium is Si. ✓

AND for an infinite line source

$$I_o = 2.96 \times 10^9\ C_i\ E\ \pi/h$$ ✓ (1) eq 5.127 pg 267

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SUBJECT Analysis of Dose to Sping

C_L = # Ci/cm

= Conc * Cross Sectional Area (πr^2)

r = 0.5 in = 1.27 cm since these are 1" lines (G)

C_L = Conc * π * $(1.27)^2$

Now

$R = (5.76 \times 10^{-5})(0.0277)(2.96 \times 10^{9})(Conc)(\pi)^2(1.27)^2(1)/h$

= 75179.8 * Conc/h

This was put into a computer program with h and Conc varied. The computer program is Attachment #1, the output is presented in a table in Attachment #2 and in a graph in Attachment #3.

Compared 3 hand calculated values to computer calculations - matched

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SUBJECT Analysis of Dose to Sping

The results were compared to three accidents. LOCA, Steamgenerator Tube Rupture w/ MSIV open and a Decay Tank Failure.

For the SGTR and the decay tank failure, the events are over in less than 1 hour and the sping piping is 50-100cm (6) away from the CPU, so the dose would never reach 1000 rads.

For the LOCA analysis, the FSAR off site doses were worked backwards to determine the concentrations.

The equation for the dose is: ← whole body

$$D = 0.246\ A(t)\ E(I)\ X/Q \quad \checkmark \qquad (4)\ \text{pg } 14.3.5\text{-}19\ a\text{-}1$$

$E(I) = 1\ MeV$ ✓

$X/Q = 3.15 \times 10^{-4}$ @ 610m ✓ (4) Table 14.3.5-5 a-1

$D = 7.64$ Rem for 2hrs @ 610m ✓ (4) Table 14.3.5-7 a-1

So

$$A(t)_{hr} = \frac{7.64}{(0.246)(1)(3.15\times10^{-4})(2\ hrs)} =$$

$$= 4.929 \times 10^{4}\ ci/hr \quad \checkmark$$

$$= 821.6\ ci/min \quad \checkmark$$

7222(9-83)
FORM GE-8(C)

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SHEET 5 OF 5
DATE 6/17/86 BY WTM CK
COMPANY AEPSC G.O.
PLANT Cook

SUBJECT Analysis of Dose to Sping

The flow out the unit vent w/out off site power is 50,000 cfm (5)

$50{,}000\ cfm = 1.416 \times 10^9\ cc/min$ ✓

So

$$\frac{821.6\ ci/min}{1.416 \times 10^9\ cc/min} = 0.58\ \mu Ci/cc$$ ✓

This is off the low end of the scale but it can be seen that the monitor will not receive 1000 rads. ✓

Integrated dose
~~ED (rads) = 0.785 rad~~ HWT 6/19/86

Integrated dose - assuming no decay

$0.58\ \mu Ci/cc = 0.58 \times 10^{-6}\ Ci/cc$

$D = Rt = (7.52 \times 10^4)(0.58 \times 10^{-6})(24)(30)/50.$

$= 0.628$ Rad $<<$ 1000 rad ✓

Attachment #1

```
) ty sping.txt
00100 create "OUTPUT" replace
00110 open #1:"OUTPUT"
00120 output #1:"DOSE FOR LINE SOURCE"
00130 output #1:"CONCENTRATION VS DOSE"
00140 output #1 using "<########":"      ";
00150 output #1 using "<########":"1CM";
00160 output #1 using "<########":"20CM";
00170 output #1 using "<########":"40CM";
00180 output #1 using "<########":"60CM";
00190 output #1 using "<########":"80CM";
00200 output #1 using "<########":"100CM"
00260 for X=0 to 5 step .5
00270   let CONC=10^X*.000001
00280   let E=1
00290   print CONC;
00300   output #1 using "#.###^^^^":CONC/.000001;
00310   output #1:" ";
00320   for II=0 to 100 step 20
00321     print "II=";II;
00330     if II=0 then let I=1 else let I=II
00340     print R(CONC,I,E);
00350     output #1 using "#.###^^^^":R(CONC,I,E);
00360     output #1:" ";
00370   next II
00371   print
00372   output #1:" "
00380 next X
00390 close #1
00400 cli "TV  output.GR"
00410 def R(CONC,H,E)
00420   let R=75179.8*CONC*E/H
00430 end def
00440 end.
```

Attachment #2

ty output
DOSE FOR LINE SOURCE
CONCENTRATION VS DOSE

	1CM	20CM	40CM	60CM	80CM	100CM
1.000E+0	7.518E-2	3.759E-3	1.879E-3	1.253E-3	9.397E-4	7.518E-4
3.162E+0	2.377E-1	1.189E-2	5.943E-3	3.962E-3	2.972E-3	2.377E-3
1.000E+1	7.518E-1	3.759E-2	1.879E-2	1.253E-2	9.397E-3	7.518E-3
3.162E+1	2.377E+0	1.189E-1	5.943E-2	3.962E-2	2.972E-2	2.377E-2
1.000E+2	7.518E+0	3.759E-1	1.879E-1	1.253E-1	9.397E-2	7.518E-2
3.162E+2	2.377E+1	1.189E+0	5.943E-1	3.962E-1	2.972E-1	2.377E-1
1.000E+3	7.518E+1	3.759E+0	1.879E+0	1.253E+0	9.397E-1	7.518E-1
3.162E+3	2.377E+2	1.189E+1	5.943E+0	3.962E+0	2.972E+0	2.377E+0
1.000E+4	7.518E+2	3.759E+1	1.879E+1	1.253E+1	9.397E+0	7.518E+0
3.162E+4	2.377E+3	1.189E+2	5.943E+1	3.962E+1	2.972E+1	2.377E+1
1.000E+5	7.518E+3	3.759E+2	1.879E+2	1.253E+2	9.397E+1	7.518E+1

Units Concentration - ~~pci~~ $\mu Ci/cc$

Dose - rads

Check 3 cases $D = (7.52 \times 10^{4})\, C_L/h$, release time = 1 hr

Act = 10 μCi @ 40cm

$D = (7.51798 \times 10^{4})(10^{-6})/(40)$

$= 0.01879 = 1.88 \times 10^{-2}$ ✓

Act = 100 μCi @ 1 cm

$D = (7.52 \times 10^{4})(100^{-6})/(1)$

$= 7.52 \times 10^{-2}$ ✓

Act = 3.162×10^{4} μCi @ 80cm

$= (7.52 \times 10^{4})(3.162 \times 10^{4})(10^{-6})/80$

$= 29.72$ ✓

Attachment #3

DOSE FOR LINE SOURCE
CONCENTRATION VS DOSE