united engineers & constructors inc.

CALCULATION CONTROL SHEET

PROJECT PASNY DISCIPLINE Nuclear

CALC SET NO	
PRELIM	
FINAL	✓
VOID	

SYSTEM Control Room

SUBJECT Dose Rates Inside IP-3 Control Room

DESIGN CLASSIFICATION Safety Related

STARTED BY M. Golshani DATE 4/18/85

AUTHORIZED BY J. Simon DATE 4/18/85

PROBLEM STATEMENT

To Evaluate the Radiation Dose Rate inside IP-3 Control Room due to an IP-2 LOCA.

DESIGN BASIS

Control Room Habitability study - unit no-2, April 1-81

8510220340 851017
PDR ADOCK 05000286
P PDR

TOTAL NUMBER OF SET COMPUTATION SHEETS 13

FINISHED BY M. Golshani CHECKED BY J P Wilson

	CHECKER	DESIGN SUPER	COGNIZANT ENG'R	DESIGN REVIEW
BY	JPW		M.G	
DATE	4-25-85		4/23/85	

REVISION 1 STARTED DATE _____ BY _____

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CALCULATION SUMMARY & REFERENCE SHEET

PROJECT TITLE: PASNY DISCIPLINE: Nuclear

CALC SET NO	
PRELIM	
FINAL	
VOID	

SHEET 1 OF 13

JO 6604.260

REV	COMP BY	CHK'D BY
0	MG DATE 4/23/85	JPW DATE 4-25-85
	DATE	DATE

SYSTEM: Control Room

SUBJECT: Dose Rates Inside IP-3 Control Room

DESIGN CLASSIFICATION: Safety Related

SUMMARY/CONCLUSIONS

Dose Rate of 1.75 mrem/hr was calculated in the control Room in one hr, after IP-2 accident. Therefore in less than 1 hr, the high radiation level in the control room as sensed by area radiation monitor channel R-1 (0.75 mR/hr).

REFERENCES (SPECIFICATIONS, DRAWINGS, CODES, CALCULATION SETS, TEXTS, REPORTS, COMPUTER DATA PSAR ETC)

1- Control Room Habitability study - unit No-2, April, 1, 81

2- DWG # 9321-F-15343

3- PIN NO. 6604-NA-1500-0003

4- ACTESP Computer code NU-569

5- QAD-UE Computer code NU-542

6. 13th AEC Air Cleaning Conference, p. 401-430 (Murphy's Paper)

GENERAL COMPUTATION SHEET

DISCIPLINE

united engineers

NAME OF COMPANY PASNY UNITS IP-3

SUBJECT Dose rates inside IP-3 Control Room

CALC SET NO		REV	COMP BY	CHKD BY
PRELIM		0	MG	JPW
FINAL	✓		DATE 4/22/85	DATE 2-25
VOID				
SHEET 2 OF 13				
NO 6624.260			DATE	DATE

1- Calculational Procedures

In order to calculate the radiation dose rate in the control room (IP-3) due to Containment leakage at IP-2: ACTESP computer is used to generate gamma ray energy source terms in mev/cc.sec.

2- QAD-UE computer code is used to find direct dose rates in the control room (IP-3)

2- Results

Dose rate of 1.75 mrem/hr was calculated in the control room in one hr after IP-2 accident. Therefore in less than 1 hr the high radiation level in the control room as sensed by area radiation monitor channel R-1 (0.75 mR/hr).

The overall doses to IP-3 Control Room personnel, due to an IP-2 LOCA, are presented in sheets 12 & 13.

GENERAL COMPUTATION SHEET

united engineers

CALC SET NO		REV	COMP. BY	CHK'D BY
PRELIM		C	MG	[illegible]
FINAL	✓		DATE 6/17/85	DATE 9-25-85
SHEET 3	13			
6604.260			DATE	DATE

NAME PASNY NO. IP-3

SUBJECT Dose Rate inside IP-3 Control Room

3- Source Terms
By using equation

$$* \quad (X/Q)_2 \Big/ \left(\frac{X}{Q}\right)_3 = \frac{D_3}{D_2}$$

and $$\frac{C_2}{C_3} = (X/Q)_2 \Big/ \left(\frac{X}{Q}\right)_3$$

Therefore $$\frac{C_2}{C_3} = \frac{D_3}{D_2}$$

where D = Distance , C = Activity

D_2 = distance from IP-2 Control room to IP-2 Containment

D_3 = distance from IP-3 Control room to IP-2 Containment

C_2 = Activity concentration outside IP-2 Control room

C_3 = Activity concentration outside IP-3 Control room

* It could be assumed that the (X/Q)'s are inversely proportional to the square of the distance, this will lead to a lower estimate of the radioactivity concentrations outside the IP-3 Control Room. Consequently, the R-1 high radiation set-points would be reached within 2 hours(instead of within 1 hour).

GENERAL COMPUTATION SHEET

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SCIPLINE

NAME OF COMPANY PASNY UNIT'S IP-3

SUBJECT Dose Rates Inside IP-3 Control Room

6604 [illegible] C-CR-[illegible]

CALC SET NO		REV	COMP BY	CHKD BY
PRELIM		C	MG	JTW
FINAL	✓		DATE 4/19/85	DATE 4-25-85
VOID				
SHEET 4 OF 13			DATE	DATE
JO 6604.260				

Time-integrated activity concentration outside IP-2 control room due to IP-2 containment leakage (μci/cc -Hr) * - (IP-2)

Isotope	0-2 hrs	2-8 hrs	8-24 hrs	1-4 days	4-30 days
Kr-85m	3.16-4	2.58-4	1.50-4	6.20-6	0
Kr-85	1.80-5	2.70-5	7.17-5	1.61-4	1.39-3
Kr-87	4.34-4	1.10-4	4.32-6	0	0
Kr-88	7.91-4	4.71-4	1.36-4	0	0
Xe-133m	4.71-4	6.75-4	1.58-3	2.12-3	1.44-3
Xe-133	1.89-3	2.81-3	7.31-3	1.40-2	3.06-2
Xe-135m	2.75-4	3.66-4	5.55-4	1.24-4	0
Xe-135	5.31-4	8.53-4	1.84-3	7.26-4	6.20-6
I-131	2.09-5	6.01-6	2.97-6	6.20-8	0
I-132	2.75-5	2.79-6	1.86-7	0	0
I-133	4.61-5	1.18-5	4.63-6	6.20-8	0
I-134	3.96-5	9.91-7	0	0	0
I-135	4.05-5	7.99-6	1.86-6	0	0

* From "Control Room Habitability Study" - unit NO-2 April 1, 81

GENERAL COMPUTATION SHEET

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NAME OF COMPANY PASNY UNIT/S IP-3

SUBJECT Dose Rate Inside IP-3 Control Room

CALC SET NO		REV	COMP BY	CHKD BY
PRELIM		C	MG	gpw
FINAL	✓		DATE 4/13/85	DATE 9-2-85
VOID				
SHEET 5 OF 13			DATE	DATE
JO 6604.260				

Time-Integrated Activity concentration outside IP-3 Control room due to containment leakage at IP-2 ($\mu Ci/cc$-HR) *

Isotope	0-2 hrs	2-4 hrs	8-24 hrs	1-4 days	4-30 days
Kr-85m	7.57-5	6.18-5	3.59-5	1.49-6	0
Kr-85	4.31-6	6.47-6	1.72-5	3.86-5	3.33-4
Kr-87	1.04-4	2.64-5	1.04-6	0	0
Kr-88	1.90-4	1.13-4	3.26-5	0	0
Xe-133m	1.13-4	1.62-4	3.79-4	5.08-4	3.45-4
Xe-133	4.53-4	6.73-4	1.75-3	3.35-3	7.33-3
Xe-135m	6.59-5	8.77-5	1.33-4	2.97-5	0
Xe-135	1.27-4	2.04-4	4.41-4	1.74-4	1.49-6
I-131	5.01-6	1.44-6	7.12-7	1.49-8	0
I-132	6.59-6	6.68-7	4.46-8	0	0
I-133	1.10-5	2.83-6	1.11-6	1.49-8	0
I-134	9.49-6	2.37-7	0	0	0
I-135	9.70-6	1.91-6	4.46-7	0	0

* using $\frac{C_2}{C_3} = \frac{D_3}{D_2}$ where $D_2 = 230'$ and $D_3 = 960'$ +

+ D-G # 9321-F-15343

GENERAL COMPUTATION SHEET

united engineers & constructors inc

DISCIPLINE

NAME OF COMPANY PASNY UNITS IP-3

SUBJECT Dose Rates Inside IP-3 Control Room

CALC SET NO		REV	COMP BY	CHKD BY
PRELIM		0	MG DATE 4/17/85	PW DATE 4/25/85
FINAL	✓			
VOID				
SHEET 6 OF 13			DATE	DATE
JO 6604.260				

Activity concentration outside IP-3 control room due to containment leakage at IP-2 (μCi/cc) (C_0)

Isotope	2 hrs	1 hr	0.5 hr
Kr-85m	3.79-5	1.90-5	9.50-6
Kr-85	2.16-6	1.08-6	5.40-7
Kr-87	5.20-5	2.60-5	1.30-5
Kr-88	9.50-5	4.75-5	2.38-5
Xe-133m	5.65-5	2.83-5	1.42-5
Xe-133	2.27-4	1.14-4	5.70-5
Xe-135m	3.30-5	1.65-5	8.25-6
Xe-135	6.35-5	3.18-5	1.59-5
I-131	2.51-6	1.26-6	6.30-7
I-132	3.30-6	1.65-6	8.25-7
I-133	5.50-6	2.75-6	1.38-6
I-134	2.75-6	1.38-6	6.90-6
I-135	4.85-6	2.43-6	1.22-6

GENERAL COMPUTATION SHEET

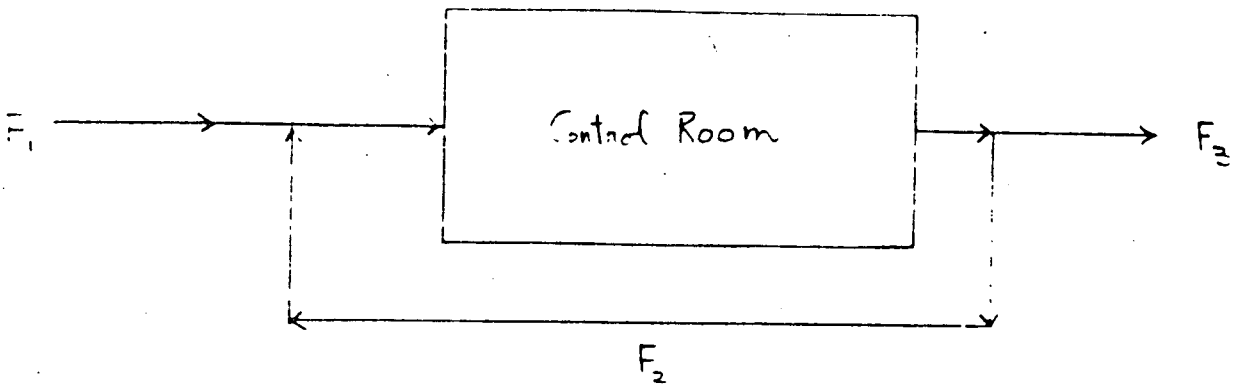
united engineers & constructors inc

CALC SET NO		REV	COMP BY	CHK'D BY
PRELIM		0	MG	JPW
FINAL	✓		DATE 4/15/85	DATE 4-25-85
VOID				
SHEET 7 OF 13			DATE	DATE
JO 6604260				

NAME OF COMPANY PASNY NITS IP-3

SUBJECT Dose Rate Inside IP-3 Control Room

Before "Trilling" Alarm Setpoint for Radiation Monitor R-1



$F_1 = 1500$ cfm , $F_2 = 9000$ cfm , $F_3 = 1500$ cfm

C_{OCR} = activity concentration outside Control Room

C_{ICR} = activity concentration inside Control Room

V_{CR} = volume of Control Room

$$\frac{d}{dt}\left(V_{CR}\, C_{ICR}\right) = F_1 C_{OCR} - F_3 C_{ICR} \Rightarrow \begin{cases} F_1 = F_3 \\ \text{at } t = 0 \Rightarrow C_{ICR} = 0 \end{cases}$$

$$C_{ICR} = C_{OCR}\left\{1 - \exp\left(-\frac{F_1}{V_{CR}}\, t\right)\right\}$$

[illegible] F_1, F_2, F_3 – see MEGC # 9321-F-40593-3, REV # 3

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John C. Brons
Senior Vice President
Nuclear Generation

July 19, 1985
IPN-85-38

Mr. Harold R. Denton
Director of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Indian Point 3 Nuclear Power Plant
Docket No. 50-286
1985 Annual FSAR Update

Dear Sir:

Pursuant to 10 CFR 50.71 (e), the Indian Point 3 FSAR has been updated to accurately present changes made during the one year period ending January 22, 1985, necessary to reflect information and analyses submitted to the Commission or prepared pursuant to Commission requirement. Enclosed herewith are thirteen (13) copies of the replacement pages reflecting these changes. Each replacement page is marked with the date of revision and revision number, which indicates the number of times that page has been revised. The revisions are indicated by a solid bar appearing in the right hand margin. A revision bar at the bottom of a page indentifies those pages presenting unchanged text which has been relocated due to preceding additions or deletions.

The revisions to FSAR Chapter 17, "Quality Assurance Program" are editorial in nature, only. As these revisions do not reduce the commitments in the program description previously transmitted via the Authority's July 20, 1984 letter (IPN-84-25), this submittal satisfies the requirements of 10 CFR 50.54 (a) (3).

Should you or your staff have any questions regarding this matter, please contact Mr. P. Kokolakis of my staff.

Very truly yours,

John C. Brons
Senior Vice President
Nuclear Generation

cc: Dr. Thomas Murley
Regional Administrator
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U.S. Nuclear Regulatory Commission
631 Park Avenue
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A053
1/13

Resident Inspector's Office
Indian Point Unit 3
U.S. Nuclear Regulatory Commission
P.O. Box 66
Buchanan, NY 10511

State of New York
County of Westchester
Subscribed and sworn to
before me this 19th day of July 1985

Mina Holden

Notary Public

MINA HOLDEN
Notary Public, State of New York
No. 4823150
Qualified in Westchester County
Term Expires March 30, 1987