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Amendment to Shielding of Multi-Leg Penetrations into the RHIC Collider

P. J. Gollon

July 1996

Collider Accelerator Department
Brookhaven National Laboratory

U.S. Department of Energy
USDOE Office of Science (SC)

DISCLAIMER

AD/RHIC/RD–76A

RHIC PROJECT

Brookhaven National Laboratory

Amendment to Shielding of Multi-Leg Penetrations into the RHIC Collider

Peter J. Gollon

July 1996

Peter J. Gollon
15 Eleanor Place
Huntington, NY 11743

June 28, 1996

Dr. Stephen Musolino
Building 1005
Brookhaven National Laboratory
P. O. Box 5000
Upton, NY 11973

Dear Steve:

Enclosed are my results for the "archetype" RHIC Emergency Vents. Please note that because I wanted to get these out to you before I left for vacation (returning on 7/7), I did **not** thogoughly check them. Please do so yourself (as will I when I return), so that if there is anything wrong (especially wrong dimensions as scaled from the master drawing), I will have the opportunity to fix it on my return.

I did spot-check a couple of the new results against the previous V-nn cases. They differ slightly in exit dose from the originals, and the originals differ among themselves (for supposedly identical configurations) because of variations in input dimensions as scaled from different drawings. The present results have the advantage of placing the beam at its proper position, rather than at the tunnel centerline. As we discussed over the phone, I have taken the horizontal leg length as six feet uniformly, even where the construction drawings show this as being six feet from the outside of the concrete structure wall.

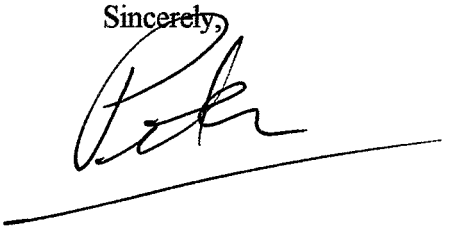
Please note that these results do not include the vents that are inside the experimental hall buildings proper. I had calculated these latter vents for the sake of completeness in my previous submission a year ago, even though they were not officially in the project under consideration. You should save those particular cases for future reference.

If you need laser-printed copies (rather than these inkjet copies), I can supply them. I will also send you a disk with the same data if you wish.

As far as my time goes, I have spent about six hours on this go-around, including my visit to BNL. If your budget permits, you can put in for this at the same rate as a year ago.

If you have any questions, please call me ar 516-942-8517 after July 7. Happy Fourth!

Sincerely,



RHIC EMERGENCY EXHAUST DUCTS, geometry details

Case	Archetype Description	Comment	Dia (in)	Distance to beam (ft)	Vert pipe length (ft)	Source Angle (deg)
A	Sext 3 Conc Struct at Spect Tunnel		42	9.5	25.0	0
B-1	16 FT PLATE ARCH		42	7.0	15.5	0
B-2	16 FT PLATE ARCH		48	7.0	15.5	0
C	20 FT PLATE ARCH		48	8.5	16.5	0
D-1	26 FT PLATE ARCH		42	8.5	18.0	0
D-2	26 FT PLATE ARCH		48	11.5	18.0	0
E	CONC STRUCT @ 4 o'clock		48	8.0	16.5	0
F-1	INJ-EJECT AT SEXT 5,7	Near Wall	48	10.0	16.5	0
F-2	INJ-EJECT AT SEXT 5,7	Far Wall	48	14.3	16.5	0
G-1	INJ/EJCTS AT WIDE ANGL	Near Wall	48	8.3	16.5	0
G-2	INJ/EJCTS AT WIDE ANGL	Far Wall	48	10.0	16.5	0
H	RF CAVITY SEXT. 5		42	10.0	17.5	0
I-1	ALCOVE A AND C - TYPICAL		42	15.5	10.0	15
I-2	ALCOVE A AND C - TYPICAL		48	15.5	10.0	15
J-1	ALCOVE B - TYPICAL		42	16.0	13.0	50
J-2	ALCOVE B - TYPICAL		48	16.0	13.0	50

RHIC EMERGENCY EXHAUST DUCTS, sorted by case

Case	Archetype Description	Dia, in	Sext	Project	Dwg	Comment
A	Sext 3 Conc Struct at Spect Tı	42	3	ISA	S - 2/20 - 13	
		42	3	ISA	A - 4/9 - 13	
		42	3	ISA	A - 7/12 - 13	
B-1	16 FT PLATE ARCH	42	1	ISA	S - 1/56 - 4	
		42	1	ISA	S - 4/59 - 4	
		42	3	ISA	S - 8/63 - 4	
		42	7	ISA	S - 8/62 - 2	
		42	9	ISA	S - 1/56 - 11	
		42	9	ISA	S - 4/59 - 11	
		42	11	RHIC	S - 2/125 -	
		42	11	ISA	S - 5/60 - 11	
		42	11	ISA	S - 8/63 - 11	
		42	3	ISA	S - 5/60 - 4	
		42	3	ISA	S - 5/61 - 4	
B-2		48	1	ISA	S - 2/57 - 4	
		48	1	ISA	S - 3/58 - 4	
		48	3	ISA	S - 6/61 - 4	
		48	3	ISA	S - 7/62 -4	
		48	5	ISA	S - 2/56 - 2	
		48	5	ISA	S - 3/57 - 2	
		48	7	ISA	S - 7/61 - 2	
		48	7	ISA		
		48	9	ISA	S - 2/57 - 11	
		48	9	ISA	S - 3/58 - 11	
		48	11	ISA	S - 6/61 - 11	
		48	11	ISA	S - 7/61 - 11	
C	20 FT PLATE ARCH	48	7	ISA	S - 2/25 - 18	
		48	9	ISA	S - 2/25 - 18	
		48	1	ISA	S - 2/20 - 13	
D-1	26 FT PLATE ARCH	42	11	RHIC	S - 14/75	
D-2		48	1	RHIC	S - 34/75	
		48	9	RHIC	S - 1/125	
E	CONC STRUCT @ 4 o'clock	48	5		S - 1/17 - 10	
	view looking west	48	3		S - 1/17 - 10	
F-1	INJ-EJECT AT SEXT 5,7	48	5		A - 4/16 - 15	NEAR WALL
	view looking west	48	7		A - 3/15 - 15	NEAR WALL
F-2	INJ-EJECT AT SEXT 5,7	48	5		A - 4/16 - 15	FAR WALL
	view looking west	48	7		A - 3/15 - 15	FAR WALL
G-1	INJ/EJCTS AT WIDE ANGLE	48	5		A - 4/16 - 15	NEAR WALL
	view looking east	48	7		A - 3/15 - 15	NEAR WALL
G-2	INJ/EJCTS AT WIDE ANGLE	48	5		A - 4/16 - 15	FAR WALL
	view looking east	48	7		A - 3/15 - 15	FAR WALL
H	RF CAVITY SEXT. 5	42	5		S - 1/55 - 2	

RHIC EMERGENCY EXHAUST DUCTS, sorted by case

Case	Archetype Description	Dia, in	Sext	Project Dwg	Comment
I-1	ALCOVE A AND C - TYPICAL	42	3	S - 7/62 - 4	Alcove C
		42	7	S - 7/61 - 2	Alcove C
		42	1	S - 3/58 - 4	Alcove C
		42	7	S - 6/60 - 2	Alcove A
		42	1	S - 2/57 - 4	Alcove A
		42	3	S - 6/61 - 4	Alcove A
		42	5	S - 3/57 - 2	Alcove C
I-2		48	11	S - 7/62 - 11	Alcove C
		48	9	S - 3/58 - 11	Alcove C
		48	5	S - 2/56 - 2	Alcove A
		48	9	S - 2/57 - 11	Alcove A
		48	11	S - 6/61 - 11	Alcove A
J-1	ALCOVE B - TYPICAL	42	5	S - 2/56 - 2	
		42	7	S - 6/60 - 2	
J-2		48	1	S - 2/57 - 4	
		48	3	S - 6/61 - 4	
		48	9	S - 2/57 - 11	
		48	11	S - 6/61 - 11	

RHIC EMERGENCY EXHAUST DUCTS

Case	Archetype Description	Dia, in	Sext	Project	Dwg	Comment
A	Sext 3 Conc Struct at Spect Tu	42	3	ISA	S - 2/20 - 13	
		42	3	ISA	A - 4/9 - 13	
		42	3	ISA	A - 7/12 - 13	
B-1a	16 FT PLATE ARCH	42	1	ISA	S - 1/56 - 4	
		42	1	ISA	S - 4/59 - 4	
		42	3	ISA	S - 8/63 - 4	
		42	7	ISA	S - 8/62 - 2	
		42	9	ISA	S - 1/56 - 11	
		42	9	ISA	S - 4/59 - 11	
		42	11	RHIC	S - 2/125 -	
		42	11	ISA	S - 5/60 - 11	
		42	11	ISA	S - 8/63 - 11	
B-1	16 FT PLATE ARCH	42	3	ISA	S - 5/60 - 4	
		42	3	ISA	S - 5/61 - 4	
B-2		48	1	ISA	S - 2/57 - 4	
		48	1	ISA	S - 3/58 - 4	
		48	3	ISA	S - 6/61 - 4	
		48	3	ISA	S - 7/62 -4	
		48	5	ISA	S - 2/56 - 2	
		48	5	ISA	S - 3/57 - 2	
		48	7	ISA	S - 7/61 - 2	
		48	7	ISA		
		48	9	ISA	S - 2/57 - 11	
		48	9	ISA	S - 3/58 - 11	
		48	11	ISA	S - 6/61 - 11	
		48	11	ISA	S - 7/61 - 11	
C	20 FT PLATE ARCH	48	7	ISA	S - 2/25 - 18	
		48	9	ISA	S - 2/25 - 18	
		48	1	ISA	S - 2/20 - 13	
D-1	26 FT PLATE ARCH	42	11	RHIC	S - 14/75	
D-2		48	1	RHIC	S - 34/75	
		48	9	RHIC	S - 1/125	
E	CONC STRUCT @ 4 o'clock	48	5		S - 1/17 - 10	
	view looking west	48	3		S - 1/17 - 10	
F-1	INJ-EJECT AT SEXT 5,7	48	5		A - 4/16 - 15	NEAR WALL
	view looking west	48	7		A - 3/15 - 15	NEAR WALL
F-2	INJ-EJECT AT SEXT 5,7	48	5		A - 4/16 - 15	FAR WALL
	view looking west	48	7		A - 3/15 - 15	FAR WALL
G-1	INJ/EJCTS AT WIDE ANGLE	48	5		A - 4/16 - 15	NEAR WALL
	view looking east	48	7		A - 3/15 - 15	NEAR WALL
G-2	INJ/EJCTS AT WIDE ANGLE	48	5		A - 4/16 - 15	FAR WALL
	view looking east	48	7		A - 3/15 - 15	FAR WALL
H	RF CAVITY SEXT. 5	42	5		S - 1/55 - 2	
I-1,I-2	ALCOVE A AND C - TYPICAL	42	1		S - 2/57 - 4	Alcove A
		42	3		S - 6/61 - 4	Alcove A
		48	5		S - 2/56 - 2	Alcove A
		42	7		S - 6/60 - 2	Alcove A
		48	9		S - 2/57 - 11	Alcove A
		48	11		S - 6/61 - 11	Alcove A
		42	1		S - 3/58 - 4	Alcove C

RHIC EMERGENCY EXHAUST DUCTS

	42	3	S - 7/62 - 4	Alcove C
	42	5	S - 3/57 - 2	Alcove C
	42	7	S - 7/61 - 2	Alcove C
	48	9	S - 3/58 - 11	Alcove C
	48	11	S - 7/62 - 11	Alcove C
J-1,J-2 ALCOVE B - TYPICAL	48	1	S - 2/57 - 4	
	48	3	S - 6/61 - 4	
	42	5	S - 2/56 - 2	
	42	7	S - 6/60 - 2	
	48	9	S - 2/57 - 11	
	48	11	S - 6/61 - 11	

RHIC EMERGENCY EXHAUST DUCTS, archetype results

	Vent Case	**A**
	Location	Sext 3 Conc Struct at Spect Tunnel
	Geometry Comments	

		Leg 1	Leg 2
GEOMETRY DATA:			
INPUT	dist to Beam (ft)	9.50	
	pipe dia (in)	42.00	
	horiz. pipe length, d1 (ft)	6.00	
	vertical CL length, d2 (ft)		25.00
METRIC	distance to beam, a (m)	2.90	
	horiz. pipe length, d1 (m)	1.83	
	vertical CL pipe length, d2 (m)		7.62
	pipe dia (m)	1.07	1.07
	pipe area, A (sq m)	0.89	0.89
LEG LENGTHS (meters):			
	Leg 1 length to mid-bend, R1 (m)	2.36	
TESCH	Leg 1: Source to mid-bend, r1 = R1 + a	5.26	
TESCH	Leg 2, length from leg 1 pipe, R2		7.09
GOEBEL	Leg length, Ri/Sqrt(A)	2.50	7.50
ATTENUATION DETAILS:			
TESCH	Tesch leg atten	3.03E-01	1.83E-03
	Tesch vent attenuation:		5.55E-04
	Angle, source to leg 1 axis (deg)		0
	Source Geometry Effect		0.250
	Total Tesch Vent Attenuation		1.39E-04
GOEBEL	Goebel leg atten	5.53E-02	6.56E-04
	Total Goebel Vent Attenuation		3.63E-05
MEAN	Geometric Mean Vent Attenuation		7.09E-05
	"Variance" factor:		1.95
SOURCE TERM:			
	No. of ions lost		1.14E+11
	Std star per cc/ion lost		1.35E-04
	Dose-Equiv (rem) per star		2.66E-05
	Low Energy Fraction		0.85
	Entrance Dose-Equiv (rem)		2.70E+02
OVERALL RESULT:			
	Exit Dose (rem) [Tesch]		3.75E-02
	Exit Dose (rem) [Goebel]		9.80E-03
	Geometric Mean		*1.92E-02*

RHIC EMERGENCY EXHAUST DUCTS, archetype results

	Vent Case	**B-1**	
	Location	16 FT PLATE ARCH	
	Geometry Comments		
GEOMETRY DATA:		**Leg 1**	**Leg 2**
INPUT	dist to Beam (ft)	7.00	
	pipe dia (in)	42.00	
	horiz. pipe length, d1 (ft)	6.00	
	vertical CL length, d2 (ft)		15.50
METRIC	distance to beam, a (m)	2.13	
	horiz. pipe length, d1 (m)	1.83	
	vertical CL pipe length, d2 (m)		4.72
	pipe dia (m)	1.07	1.07
	pipe area, A (sq m)	0.89	0.89
LEG LENGTHS (meters):			
	Leg 1 length to mid-bend, R1 (m)	2.36	
TESCH	Leg 1: Source to mid-bend, r1 = R1 + a	4.50	
TESCH	Leg 2, length from leg 1 pipe, R2		4.19
GOEBEL	Leg length, Ri/Sqrt(A)	2.50	4.43
ATTENUATION DETAILS:			
TESCH	Tesch leg atten	2.25E-01	6.44E-03
	Tesch vent attenuation:		1.45E-03
	Angle, source to leg 1 axis (deg)		0
	Source Geometry Effect		0.250
	Total Tesch Vent Attenuation		3.63E-04
GOEBEL	Goebel leg atten	5.53E-02	4.40E-03
	Total Goebel Vent Attenuation		2.43E-04
MEAN	Geometric Mean Vent Attenuation		2.97E-04
	"Variance" factor:		1.22
SOURCE TERM:			
	No. of ions lost		1.14E+11
	Std star per cc/ion lost		1.35E-04
	Dose-Equiv (rem) per star		2.66E-05
	Low Energy Fraction		0.85
	Entrance Dose-Equiv (rem)		4.98E+02
OVERALL RESULT:			
	Exit Dose (rem) [Tesch]		1.81E-01
	Exit Dose (rem) [Goebel]		1.21E-01
	Geometric Mean		*1.48E-01*

RHIC EMERGENCY EXHAUST DUCTS, archetype results

Vent Case	**B-2**	
Location	16 FT PLATE ARCH	
Geometry Comments		

		Leg 1	Leg 2
GEOMETRY DATA:			
INPUT	dist to Beam (ft)	7.00	
	pipe dia (in)	48.00	
	horiz. pipe length, d1 (ft)	6.00	
	vertical CL length, d2 (ft)		15.50
METRIC	distance to beam, a (m)	2.13	
	horiz. pipe length, d1 (m)	1.83	
	vertical CL pipe length, d2 (m)		4.72
	pipe dia (m)	1.22	1.22
	pipe area, A (sq m)	1.17	1.17
LEG LENGTHS (meters):			
	Leg 1 length to mid-bend, R1 (m)	2.44	
TESCH	Leg 1: Source to mid-bend, r1 = R1 + a	4.57	
TESCH	Leg 2, length from leg 1 pipe, R2		4.11
GOEBEL	Leg length, Ri/Sqrt(A)	2.26	3.81
ATTENUATION DETAILS:			
TESCH	Tesch leg atten	2.18E-01	9.30E-03
	Tesch vent attenuation:		2.03E-03
	Angle, source to leg 1 axis (deg)		0
	Source Geometry Effect		0.250
	Total Tesch Vent Attenuation		5.06E-04
GOEBEL	Goebel leg atten	6.89E-02	6.78E-03
	Total Goebel Vent Attenuation		4.67E-04
MEAN	Geometric Mean Vent Attenuation		4.86E-04
	"Variance" factor:		1.04
SOURCE TERM:			
	No. of ions lost		1.14E+11
	Std star per cc/ion lost		1.35E-04
	Dose-Equiv (rem) per star		2.66E-05
	Low Energy Fraction		0.85
	Entrance Dose-Equiv (rem)		4.98E+02
OVERALL RESULT:			
	Exit Dose (rem) [Tesch]		2.52E-01
	Exit Dose (rem) [Goebel]		2.32E-01
	Geometric Mean		*2.42E-01*

RHIC EMERGENCY EXHAUST DUCTS, archetype results

	Vent Case	**C**
	Location	20 FT PLATE ARCH
	Geometry Comments	

		Leg 1	Leg 2
GEOMETRY DATA:			
INPUT	dist to Beam (ft)	8.50	
	pipe dia (in)	48.00	
	horiz. pipe length, d1 (ft)	6.00	
	vertical CL length, d2 (ft)		16.50
METRIC	distance to beam, a (m)	2.59	
	horiz. pipe length, d1 (m)	1.83	
	vertical CL pipe length, d2 (m)		5.03
	pipe dia (m)	1.22	1.22
	pipe area, A (sq m)	1.17	1.17
LEG LENGTHS (meters):			
	Leg 1 length to mid-bend, R1 (m)	2.44	
TESCH	Leg 1: Source to mid-bend, r1 = R1 + a	5.03	
TESCH	Leg 2, length from leg 1 pipe, R2		4.42
GOEBEL	Leg length, Ri/Sqrt(A)	2.26	4.09
ATTENUATION DETAILS:			
TESCH	Tesch leg atten	2.65E-01	8.09E-03
	Tesch vent attenuation:		2.15E-03
	Angle, source to leg 1 axis (deg)		0
	Source Geometry Effect		0.250
	Total Tesch Vent Attenuation		5.37E-04
GOEBEL	Goebel leg atten	6.89E-02	5.56E-03
	Total Goebel Vent Attenuation		3.83E-04
MEAN	Geometric Mean Vent Attenuation		4.53E-04
	"Variance" factor:		1.18
SOURCE TERM:			
	No. of ions lost		1.14E+11
	Std star per cc/ion lost		1.35E-04
	Dose-Equiv (rem) per star		2.66E-05
	Low Energy Fraction		0.85
	Entrance Dose-Equiv (rem)		3.38E+02
OVERALL RESULT:			
	Exit Dose (rem) [Tesch]		1.81E-01
	Exit Dose (rem) [Goebel]		1.29E-01
	Geometric Mean		*1.53E-01*

RHIC EMERGENCY EXHAUST DUCTS, archetype results

Vent Case	**D-1**	
Location	26 FT PLATE ARCH	
Geometry Comments		

		Leg 1	Leg 2
GEOMETRY DATA:			
INPUT	dist to Beam (ft)	8.50	
	pipe dia (in)	42.00	
	horiz. pipe length, d1 (ft)	6.00	
	vertical CL length, d2 (ft)		18.00
METRIC	distance to beam, a (m)	2.59	
	horiz. pipe length, d1 (m)	1.83	
	vertical CL pipe length, d2 (m)		5.49
	pipe dia (m)	1.07	1.07
	pipe area, A (sq m)	0.89	0.89
LEG LENGTHS (meters):			
	Leg 1 length to mid-bend, R1 (m)	2.36	
TESCH	Leg 1: Source to mid-bend, r1 = R1 + a	4.95	
TESCH	Leg 2, length from leg 1 pipe, R2		4.95
GOEBEL	Leg length, Ri/Sqrt(A)	2.50	5.24
ATTENUATION DETAILS:			
TESCH	Tesch leg atten	2.74E-01	4.56E-03
	Tesch vent attenuation:		1.25E-03
	Angle, source to leg 1 axis (deg)		0
	Source Geometry Effect		0.250
	Total Tesch Vent Attenuation		3.12E-04
GOEBEL	Goebel leg atten	5.53E-02	2.59E-03
	Total Goebel Vent Attenuation		1.43E-04
MEAN	Geometric Mean Vent Attenuation		2.12E-04
	"Variance" factor:		1.48
SOURCE TERM:			
	No. of ions lost		1.14E+11
	Std star per cc/ion lost		1.35E-04
	Dose-Equiv (rem) per star		2.66E-05
	Low Energy Fraction		0.85
	Entrance Dose-Equiv (rem)		3.38E+02
OVERALL RESULT:			
	Exit Dose (rem) [Tesch]		1.05E-01
	Exit Dose (rem) [Goebel]		4.84E-02
	Geometric Mean		*7.14E-02*

RHIC EMERGENCY EXHAUST DUCTS, archetype results

Vent Case	**D-2**	
Location	26 FT PLATE ARCH	
Geometry Comments		

		Leg 1	Leg 2
GEOMETRY DATA:			
INPUT	dist to Beam (ft)	11.50	
	pipe dia (in)	48.00	
	horiz. pipe length, d1 (ft)	6.00	
	vertical CL length, d2 (ft)		18.00
METRIC	distance to beam, a (m)	3.51	
	horiz. pipe length, d1 (m)	1.83	
	vertical CL pipe length, d2 (m)		5.49
	pipe dia (m)	1.22	1.22
	pipe area, A (sq m)	1.17	1.17
LEG LENGTHS (meters):			
	Leg 1 length to mid-bend, R1 (m)	2.44	
TESCH	Leg 1: Source to mid-bend, r1 = R1 + a	5.94	
TESCH	Leg 2, length from leg 1 pipe, R2		4.88
GOEBEL	Leg length, Ri/Sqrt(A)	2.26	4.51
ATTENUATION DETAILS:			
TESCH	Tesch leg atten	3.48E-01	6.61E-03
	Tesch vent attenuation:		2.30E-03
	Angle, source to leg 1 axis (deg)		0
	Source Geometry Effect		0.250
	Total Tesch Vent Attenuation		5.75E-04
GOEBEL	Goebel leg atten	6.89E-02	4.17E-03
	Total Goebel Vent Attenuation		2.87E-04
MEAN	Geometric Mean Vent Attenuation		4.06E-04
	"Variance" factor:		1.41
SOURCE TERM:			
	No. of ions lost		1.14E+11
	Std star per cc/ion lost		1.35E-04
	Dose-Equiv (rem) per star		2.66E-05
	Low Energy Fraction		0.85
	Entrance Dose-Equiv (rem)		1.84E+02
OVERALL RESULT:			
	Exit Dose (rem) [Tesch]		1.06E-01
	Exit Dose (rem) [Goebel]		5.30E-02
	Geometric Mean		*7.49E-02*

RHIC EMERGENCY EXHAUST DUCTS, archetype results

Vent Case		**E**
	Location	CONC STRUCT @ 4 o'clock
	Geometry Comments	

		Leg 1	Leg 2
GEOMETRY DATA:			
INPUT	dist to Beam (ft)	8.00	
	pipe dia (in)	48.00	
	horiz. pipe length, d1 (ft)	6.00	
	vertical CL length, d2 (ft)		16.50
METRIC	distance to beam, a (m)	2.44	
	horiz. pipe length, d1 (m)	1.83	
	vertical CL pipe length, d2 (m)		5.03
	pipe dia (m)	1.22	1.22
	pipe area, A (sq m)	1.17	1.17
LEG LENGTHS (meters):			
	Leg 1 length to mid-bend, R1 (m)	2.44	
TESCH	Leg 1: Source to mid-bend, r1 = R1 + a	4.88	
TESCH	Leg 2, length from leg 1 pipe, R2		4.42
GOEBEL	Leg length, Ri/Sqrt(A)	2.26	4.09
ATTENUATION DETAILS:			
TESCH	Tesch leg atten	2.50E-01	8.09E-03
	Tesch vent attenuation:		2.02E-03
	Angle, source to leg 1 axis (deg)		0
	Source Geometry Effect		0.250
	Total Tesch Vent Attenuation		5.06E-04
GOEBEL	Goebel leg atten	6.89E-02	5.56E-03
	Total Goebel Vent Attenuation		3.83E-04
MEAN	Geometric Mean Vent Attenuation		4.40E-04
	"Variance" factor:		1.15
SOURCE TERM:			
	No. of ions lost		1.14E+11
	Std star per cc/ion lost		1.35E-04
	Dose-Equiv (rem) per star		2.66E-05
	Low Energy Fraction		0.85
	Entrance Dose-Equiv (rem)		3.81E+02
OVERALL RESULT:			
	Exit Dose (rem) [Tesch]		1.93E-01
	Exit Dose (rem) [Goebel]		1.46E-01
	Geometric Mean		*1.68E-01*

RHIC EMERGENCY EXHAUST DUCTS, archetype results

Vent Case		**F-1**
	Location	INJ-EJECT AT SEXT 5,7
	Geometry Comments	Near Wall

		Leg 1	Leg 2
GEOMETRY DATA:			
INPUT	dist to Beam (ft)	10.00	
	pipe dia (in)	48.00	
	horiz. pipe length, d1 (ft)	6.00	
	vertical CL length, d2 (ft)		16.50
METRIC	distance to beam, a (m)	3.05	
	horiz. pipe length, d1 (m)	1.83	
	vertical CL pipe length, d2 (m)		5.03
	pipe dia (m)	1.22	1.22
	pipe area, A (sq m)	1.17	1.17
LEG LENGTHS (meters):			
	Leg 1 length to mid-bend, R1 (m)	2.44	
TESCH	Leg 1: Source to mid-bend, r1 = R1 + a	5.49	
TESCH	Leg 2, length from leg 1 pipe, R2		4.42
GOEBEL	Leg length, Ri/Sqrt(A)	2.26	4.09
ATTENUATION DETAILS:			
TESCH	Tesch leg atten	3.09E-01	8.09E-03
	Tesch vent attenuation:		2.50E-03
	Angle, source to leg 1 axis (deg)		0
	Source Geometry Effect		0.250
	Total Tesch Vent Attenuation		6.24E-04
GOEBEL	Goebel leg atten	6.89E-02	5.56E-03
	Total Goebel Vent Attenuation		3.83E-04
MEAN	Geometric Mean Vent Attenuation		4.89E-04
	"Variance" factor:		1.28

SOURCE TERM:		
	No. of ions lost	1.14E+11
	Std star per cc/ion lost	1.35E-04
	Dose-Equiv (rem) per star	2.66E-05
	Low Energy Fraction	0.85
	Entrance Dose-Equiv (rem)	2.44E+02
OVERALL RESULT:		
	Exit Dose (rem) [Tesch]	1.52E-01
	Exit Dose (rem) [Goebel]	9.34E-02
	Geometric Mean	*1.19E-01*

RHIC EMERGENCY EXHAUST DUCTS, archetype results

Vent Case		**F-2**
	Location	INJ-EJECT AT SEXT 5,7
	Geometry Comments	Far Wall

		Leg 1	Leg 2
GEOMETRY DATA:			
INPUT	dist to Beam (ft)	14.25	
	pipe dia (in)	48.00	
	horiz. pipe length, d1 (ft)	6.00	
	vertical CL length, d2 (ft)		16.50
METRIC	distance to beam, a (m)	4.34	
	horiz. pipe length, d1 (m)	1.83	
	vertical CL pipe length, d2 (m)		5.03
	pipe dia (m)	1.22	1.22
	pipe area, A (sq m)	1.17	1.17
LEG LENGTHS (meters):			
	Leg 1 length to mid-bend, R1 (m)	2.44	
TESCH	Leg 1: Source to mid-bend, r1 = R1 + a	6.78	
TESCH	Leg 2, length from leg 1 pipe, R2		4.42
GOEBEL	Leg length, Ri/Sqrt(A)	2.26	4.09
ATTENUATION DETAILS:			
TESCH	Tesch leg atten	4.10E-01	8.09E-03
	Tesch vent attenuation:		3.32E-03
	Angle, source to leg 1 axis (deg)		0
	Source Geometry Effect		0.250
	Total Tesch Vent Attenuation		8.30E-04
GOEBEL	Goebel leg atten	6.89E-02	5.56E-03
	Total Goebel Vent Attenuation		3.83E-04
MEAN	Geometric Mean Vent Attenuation		5.64E-04
	"Variance" factor:		1.47
SOURCE TERM:			
	No. of ions lost		1.14E+11
	Std star per cc/ion lost		1.35E-04
	Dose-Equiv (rem) per star		2.66E-05
	Low Energy Fraction		0.85
	Entrance Dose-Equiv (rem)		1.20E+02
OVERALL RESULT:			
	Exit Dose (rem) [Tesch]		9.97E-02
	Exit Dose (rem) [Goebel]		4.60E-02
	Geometric Mean		*6.77E-02*

RHIC EMERGENCY EXHAUST DUCTS, archetype results

Vent Case		**G-1**
	Location	INJ/EJCTS AT WIDE ANGLE
	Geometry Comments	Near Wall

		Leg 1	Leg 2
GEOMETRY DATA:			
INPUT	dist to Beam (ft)	8.25	
	pipe dia (in)	48.00	
	horiz. pipe length, d1 (ft)	6.00	
	vertical CL length, d2 (ft)		16.50
METRIC	distance to beam, a (m)	2.51	
	horiz. pipe length, d1 (m)	1.83	
	vertical CL pipe length, d2 (m)		5.03
	pipe dia (m)	1.22	1.22
	pipe area, A (sq m)	1.17	1.17
LEG LENGTHS (meters):			
	Leg 1 length to mid-bend, R1 (m)	2.44	
TESCH	Leg 1: Source to mid-bend, r1 = R1 + a	4.95	
TESCH	Leg 2, length from leg 1 pipe, R2		4.42
GOEBEL	Leg length, Ri/Sqrt(A)	2.26	4.09
ATTENUATION DETAILS:			
TESCH	Tesch leg atten	2.58E-01	8.09E-03
	Tesch vent attenuation:		2.09E-03
	Angle, source to leg 1 axis (deg)		0
	Source Geometry Effect		0.250
	Total Tesch Vent Attenuation		5.21E-04
GOEBEL	Goebel leg atten	6.89E-02	5.56E-03
	Total Goebel Vent Attenuation		3.83E-04
MEAN	Geometric Mean Vent Attenuation		4.47E-04
	"Variance" factor:		1.17
SOURCE TERM:			
	No. of ions lost		1.14E+11
	Std star per cc/ion lost		1.35E-04
	Dose-Equiv (rem) per star		2.66E-05
	Low Energy Fraction		0.85
	Entrance Dose-Equiv (rem)		3.58E+02
OVERALL RESULT:			
	Exit Dose (rem) [Tesch]		1.87E-01
	Exit Dose (rem) [Goebel]		1.37E-01
	Geometric Mean		*1.60E-01*

RHIC EMERGENCY EXHAUST DUCTS, archetype results

Vent Case		**G-2**
	Location	INJ/EJCTS AT WIDE ANGLE
	Geometry Comments	Far Wall

		Leg 1	Leg 2
GEOMETRY DATA:			
INPUT	dist to Beam (ft)	10.00	
	pipe dia (in)	48.00	
	horiz. pipe length, d1 (ft)	6.00	
	vertical CL length, d2 (ft)		16.50
METRIC	distance to beam, a (m)	3.05	
	horiz. pipe length, d1 (m)	1.83	
	vertical CL pipe length, d2 (m)		5.03
	pipe dia (m)	1.22	1.22
	pipe area, A (sq m)	1.17	1.17
LEG LENGTHS (meters):			
	Leg 1 length to mid-bend, R1 (m)	2.44	
TESCH	Leg 1: Source to mid-bend, r1 = R1 + a	5.49	
TESCH	Leg 2, length from leg 1 pipe, R2		4.42
GOEBEL	Leg length, Ri/Sqrt(A)	2.26	4.09
ATTENUATION DETAILS:			
TESCH	Tesch leg atten	3.09E-01	8.09E-03
	Tesch vent attenuation:		2.50E-03
	Angle, source to leg 1 axis (deg)		0
	Source Geometry Effect		0.250
	Total Tesch Vent Attenuation		6.24E-04
GOEBEL	Goebel leg atten	6.89E-02	5.56E-03
	Total Goebel Vent Attenuation		3.83E-04
MEAN	Geometric Mean Vent Attenuation		4.89E-04
	"Variance" factor:		1.28
SOURCE TERM:			
	No. of ions lost		1.14E+11
	Std star per cc/ion lost		1.35E-04
	Dose-Equiv (rem) per star		2.66E-05
	Low Energy Fraction		0.85
	Entrance Dose-Equiv (rem)		2.44E+02
OVERALL RESULT:			
	Exit Dose (rem) [Tesch]		1.52E-01
	Exit Dose (rem) [Goebel]		9.34E-02
	Geometric Mean		*1.19E-01*

RHIC EMERGENCY EXHAUST DUCTS, archetype results

Vent Case	**H**	
Location	RF CAVITY SEXT. 5	
Geometry Comments		

		Leg 1	Leg 2
GEOMETRY DATA:			
INPUT	dist to Beam (ft)	10.00	
	pipe dia (in)	42.00	
	horiz. pipe length, d1 (ft)	6.00	
	vertical CL length, d2 (ft)		17.50
METRIC	distance to beam, a (m)	3.05	
	horiz. pipe length, d1 (m)	1.83	
	vertical CL pipe length, d2 (m)		5.33
	pipe dia (m)	1.07	1.07
	pipe area, A (sq m)	0.89	0.89
LEG LENGTHS (meters):			
	Leg 1 length to mid-bend, R1 (m)	2.36	
TESCH	Leg 1: Source to mid-bend, r1 = R1 + a	5.41	
TESCH	Leg 2, length from leg 1 pipe, R2		4.80
GOEBEL	Leg length, Ri/Sqrt(A)	2.50	5.08
ATTENUATION DETAILS:			
TESCH	Tesch leg atten	3.17E-01	4.88E-03
	Tesch vent attenuation:		1.55E-03
	Angle, source to leg 1 axis (deg)		0
	Source Geometry Effect		0.250
	Total Tesch Vent Attenuation		3.87E-04
GOEBEL	Goebel leg atten	5.53E-02	2.88E-03
	Total Goebel Vent Attenuation		1.59E-04
MEAN	Geometric Mean Vent Attenuation		2.48E-04
	"Variance" factor:		1.56

SOURCE TERM:		
	No. of ions lost	1.14E+11
	Std star per cc/ion lost	1.35E-04
	Dose-Equiv (rem) per star	2.66E-05
	Low Energy Fraction	0.85
	Entrance Dose-Equiv (rem)	2.44E+02
OVERALL RESULT:		
	Exit Dose (rem) [Tesch]	9.45E-02
	Exit Dose (rem) [Goebel]	3.88E-02
	Geometric Mean	*6.05E-02*

RHIC EMERGENCY EXHAUST DUCTS, archetype results

Vent Case	**I-1**	
Location	ALCOVE A AND C - TYPICAL	
Geometry Comments		

		Leg 1	Leg 2
GEOMETRY DATA:			
INPUT	dist to Beam (ft)	15.50	
	pipe dia (in)	42.00	
	horiz. pipe length, d1 (ft)	6.00	
	vertical CL length, d2 (ft)		10.00
METRIC	distance to beam, a (m)	4.72	
	horiz. pipe length, d1 (m)	1.83	
	vertical CL pipe length, d2 (m)		3.05
	pipe dia (m)	1.07	1.07
	pipe area, A (sq m)	0.89	0.89
LEG LENGTHS (meters):			
	Leg 1 length to mid-bend, R1 (m)	2.36	
TESCH	Leg 1: Source to mid-bend, r1 = R1 + a	7.09	
TESCH	Leg 2, length from leg 1 pipe, R2		2.51
GOEBEL	Leg length, Ri/Sqrt(A)	2.50	2.66
ATTENUATION DETAILS:			
TESCH	Tesch leg atten	4.44E-01	2.01E-02
	Tesch vent attenuation:		8.95E-03
	Angle, source to leg 1 axis (deg)		15
	Source Geometry Effect		0.250
	Total Tesch Vent Attenuation		2.24E-03
GOEBEL	Goebel leg atten	5.53E-02	1.61E-02
	Total Goebel Vent Attenuation		8.92E-04
MEAN	Geometric Mean Vent Attenuation		1.41E-03
	"Variance" factor:		1.58

SOURCE TERM:		
	No. of ions lost	1.14E+11
	Std star per cc/ion lost	1.35E-04
	Dose-Equiv (rem) per star	2.66E-05
	Low Energy Fraction	0.85
	Entrance Dose-Equiv (rem)	1.02E+02
OVERALL RESULT:		
	Exit Dose (rem) [Tesch]	2.27E-01
	Exit Dose (rem) [Goebel]	9.06E-02
	Geometric Mean	*1.43E-01*

RHIC EMERGENCY EXHAUST DUCTS, archetype results

Vent Case	**I-2**	
Location	ALCOVE A AND C - TYPICAL	
Geometry Comments		

		Leg 1	Leg 2
GEOMETRY DATA:			
INPUT	dist to Beam (ft)	15.50	
	pipe dia (in)	48.00	
	horiz. pipe length, d1 (ft)	6.00	
	vertical CL length, d2 (ft)		10.00
METRIC	distance to beam, a (m)	4.72	
	horiz. pipe length, d1 (m)	1.83	
	vertical CL pipe length, d2 (m)		3.05
	pipe dia (m)	1.22	1.22
	pipe area, A (sq m)	1.17	1.17
LEG LENGTHS (meters):			
	Leg 1 length to mid-bend, R1 (m)	2.44	
TESCH	Leg 1: Source to mid-bend, r1 = R1 + a	7.16	
TESCH	Leg 2, length from leg 1 pipe, R2		2.44
GOEBEL	Leg length, Ri/Sqrt(A)	2.26	2.26
ATTENUATION DETAILS:			
TESCH	Tesch leg atten	4.35E-01	2.72E-02
	Tesch vent attenuation:		1.18E-02
	Angle, source to leg 1 axis (deg)		15
	Source Geometry Effect		0.250
	Total Tesch Vent Attenuation		2.96E-03
GOEBEL	Goebel leg atten	6.89E-02	2.27E-02
	Total Goebel Vent Attenuation		1.56E-03
MEAN	Geometric Mean Vent Attenuation		2.15E-03
	"Variance" factor:		1.38

SOURCE TERM:		
	No. of ions lost	1.14E+11
	Std star per cc/ion lost	1.35E-04
	Dose-Equiv (rem) per star	2.66E-05
	Low Energy Fraction	0.85
	Entrance Dose-Equiv (rem)	1.02E+02
OVERALL RESULT:		
	Exit Dose (rem) [Tesch]	3.00E-01
	Exit Dose (rem) [Goebel]	1.58E-01
	Geometric Mean	*2.18E-01*

RHIC EMERGENCY EXHAUST DUCTS, archetype results

Vent Case	**J-1**	
Location	ALCOVE B - TYPICAL	
Geometry Comments		

		Leg 1	Leg 2
GEOMETRY DATA:			
INPUT	dist to Beam (ft)	16.00	
	pipe dia (in)	42.00	
	horiz. pipe length, d1 (ft)	6.00	
	vertical CL length, d2 (ft)		13.00
METRIC	distance to beam, a (m)	4.88	
	horiz. pipe length, d1 (m)	1.83	
	vertical CL pipe length, d2 (m)		3.96
	pipe dia (m)	1.07	1.07
	pipe area, A (sq m)	0.89	0.89
LEG LENGTHS (meters):			
	Leg 1 length to mid-bend, R1 (m)	2.36	
TESCH	Leg 1: Source to mid-bend, r1 = R1 + a	7.24	
TESCH	Leg 2, length from leg 1 pipe, R2		3.43
GOEBEL	Leg length, Ri/Sqrt(A)	2.50	3.63
ATTENUATION DETAILS:			
TESCH	Tesch leg atten	4.54E-01	9.63E-03
	Tesch vent attenuation:		4.37E-03
	Angle, source to leg 1 axis (deg)		50
	Source Geometry Effect		0.100
	Total Tesch Vent Attenuation		4.37E-04
GOEBEL	Goebel leg atten	5.53E-02	7.72E-03
	Total Goebel Vent Attenuation		4.26E-04
MEAN	Geometric Mean Vent Attenuation		4.32E-04
	"Variance" factor:		1.01

SOURCE TERM:		
	No. of ions lost	1.14E+11
	Std star per cc/ion lost	1.35E-04
	Dose-Equiv (rem) per star	2.66E-05
	Low Energy Fraction	0.85
	Entrance Dose-Equiv (rem)	9.53E+01
OVERALL RESULT:		
	Exit Dose (rem) [Tesch]	4.16E-02
	Exit Dose (rem) [Goebel]	4.06E-02
	Geometric Mean	*4.11E-02*

RHIC EMERGENCY EXHAUST DUCTS, archetype results

Vent Case	**J-2**	
Location	ALCOVE B - TYPICAL	
Geometry Comments		

		Leg 1	Leg 2
GEOMETRY DATA:			
INPUT	dist to Beam (ft)	16.00	
	pipe dia (in)	48.00	
	horiz. pipe length, d1 (ft)	6.00	
	vertical CL length, d2 (ft)		13.00
METRIC	distance to beam, a (m)	4.88	
	horiz. pipe length, d1 (m)	1.83	
	vertical CL pipe length, d2 (m)		3.96
	pipe dia (m)	1.22	1.22
	pipe area, A (sq m)	1.17	1.17
LEG LENGTHS (meters):			
	Leg 1 length to mid-bend, R1 (m)	2.44	
TESCH	Leg 1: Source to mid-bend, r1 = R1 + a	7.32	
TESCH	Leg 2, length from leg 1 pipe, R2		3.35
GOEBEL	Leg length, Ri/Sqrt(A)	2.26	3.10
ATTENUATION DETAILS:			
TESCH	Tesch leg atten	4.44E-01	1.37E-02
	Tesch vent attenuation:		6.09E-03
	Angle, source to leg 1 axis (deg)		50
	Source Geometry Effect		0.100
	Total Tesch Vent Attenuation		6.09E-04
GOEBEL	Goebel leg atten	6.89E-02	1.14E-02
	Total Goebel Vent Attenuation		7.84E-04
MEAN	Geometric Mean Vent Attenuation		6.91E-04
	"Variance" factor:		1.13

SOURCE TERM:		
	No. of ions lost	1.14E+11
	Std star per cc/ion lost	1.35E-04
	Dose-Equiv (rem) per star	2.66E-05
	Low Energy Fraction	0.85
	Entrance Dose-Equiv (rem)	9.53E+01
OVERALL RESULT:		
	Exit Dose (rem) [Tesch]	5.80E-02
	Exit Dose (rem) [Goebel]	7.47E-02
	Geometric Mean	*6.58E-02*