Final Status Survey Plan
for the
Plum Brook Reactor Facility

Attachment C
Embedded Piping Dose Assessment & DCGL Calculation
Addendum 3
MicroShield Case Run Reports for Area Factor Calculations

MicroShield Case Run Reports for Area Factor Calculations

Index

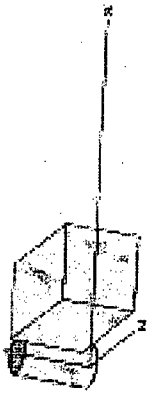
Run Date	Case Title	Description	MS5 File Name	Dose Rate (mrem/hr)
2/4/2006	Line 1.21 AF-A	PBRF Revised Model Co-60 Area Factor Calculation	PB020401	1.0810E-10
2/4/2006	Line 1.21 AF-B	PBRF Revised Model Co-60 Area Factor Calculation	PB020402	2.0910E-10
2/4/2006	Line 1.21 AF-C	PBRF Revised Model Co-60 Area Factor Calculation	PB020403	4.2570E-10
2/4/2006	Line 1.21 AF-D	PBRF Revised Model Co-60 Area Factor Calculation	PB020404	5.3940E-10
2/4/2006	Line 1.23 AF-A	PBRF Revised Model Co-60 Area Factor Calculation	PB020405	1.0820E-10
2/4/2006	Line 1.23 AF-B	PBRF Revised Model Co-60 Area Factor Calculation	PB020406	2.0910E-10
2/4/2006	Line 1.23 AF-C	PBRF Revised Model Co-60 Area Factor Calculation	PB020407	4.2580E-10
2/4/2006	Line 1.23 AF-D	PBRF Revised Model Co-60 Area Factor Calculation	PB020408	5.3950E-10
2/4/2006	Line 1.24 AF-A	PBRF Revised Model Co-60 Area Factor Calculation	PB020409	3.2270E-11
2/4/2006	Line 1.24 AF-B	PBRF Revised Model Co-60 Area Factor Calculation	PB020410	6.2720E-11
2/4/2006	Line 1.24 AF-C	PBRF Revised Model Co-60 Area Factor Calculation	PB020411	1.3130E-10
2/4/2006	Line 1.24 AF-D	PBRF Revised Model Co-60 Area Factor Calculation	PB020412	1.7250E-10
2/4/2006	Line 1.641 AF-A	PBRF Revised Model Co-60 Area Factor Calculation	PB020413	5.2760E-11
2/4/2006	Line 1.641 AF-B	PBRF Revised Model Co-60 Area Factor Calculation	PB020414	1.0250E-10
2/4/2006	Line 1.641 AF-C	PBRF Revised Model Co-60 Area Factor Calculation	PB020415	2.1390E-10
2/4/2006	Line 1.641 AF-D	PBRF Revised Model Co-60 Area Factor Calculation	PB020416	2.7950E-10

MicroShield v5.05 (5.05-00362)
Radiological Services, Inc.

Page : 1
DOS File : PB020401.MS5
Run Date : February 4, 2006
R Time: 2:01:22 PM
Duration : 00:00:00

File Ref: _____
Date: _____
By: _____
Checked: _____

Case Title: Line 1.21 AF-A
Description: PBRF Rev Model Co-60 Area Factor Calculation
Geometry: 10 - Cylinder Surface - External Dose Point



Source Dimensions

Height	30.48 cm	1 ft
Radius	7.62 cm	3.0 in

Dose Points

	X	Y	Z
# 1	138.78 cm	15.24 cm	45.72 cm
	4 ft 6.6 in	6.0 in	1 ft 6.0 in

Shields

Shield Name	Dimension	Material	Density
Cyl. Core	7.62 cm	Concrete	1.6
Shield 1	.65 cm	Iron	7.86
Transition		Concrete	2.4
Shield 3	30.48 cm	Concrete	2.4
Air Gap		Air	0.00122
Wall Clad	.025 cm	Iron	7.86

Source Input
Grouping Method : Actual Photon Energies

Nuclide	curies	becquerels	uCi/cm²	Bq/cm²
Co-60	6.5669e-012	2.4298e-001	4.5000e-009	1.6650e-004

Buildup
The material reference is : Cyl. Core

Integration Parameters

Y Direction (axial)	20
Circumferential	20

Results

Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.6938	3.963e-05	7.261e-14	1.178e-12	1.402e-16	2.274e-15
1.1732	2.430e-01	3.571e-09	3.023e-08	6.381e-12	5.402e-11
1.3325	2.430e-01	5.722e-09	4.191e-08	9.928e-12	7.270e-11

Page : 2
DOS File : PB020401.MS5
Run Date: February 4, 2006
Run Time: 2:01:22 PM
Duration : 00:00:00

Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
TOTALS:	4.860e-01	9.293e-09	7.213e-08	1.631e-11	1.267e-10

MicroShield v5.05 (5.05-00362)
Radiological Services, Inc.
Conversion of calculated exposure in air to dose
FILE: C:\MS5\DATA\PB020401.MS5
Case Title: Line 1.21 AF-A
This case was run on Saturday, February 4, 2006 at 2:01:22 PM
Dose Point # 1 - (138.78,15.24,45.72) cm

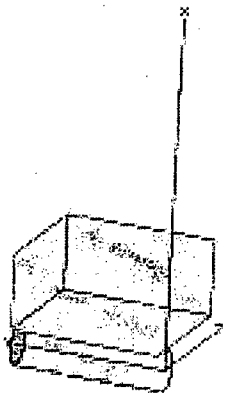
Results (Summed over energies)	Units	Without Buildup	With Buildup
Photon Fluence Rate (flux)	Photons/cm²/sec	7.336e-009	5.721e-008
Photon Energy Fluence Rate	MeV/cm²/sec	9.293e-009	7.213e-008
Exposure and Dose Rates:			
Exposure Rate in Air	mR/hr	1.631e-011	1.267e-010
Absorbed Dose Rate in Air	mGy/hr	1.424e-013	1.106e-012
"	mrad/hr	1.424e-011	1.106e-010
Deep Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	1.616e-013	1.256e-012
o Opposed	"	1.392e-013	1.081e-012
o Rotational	"	1.392e-013	1.081e-012
o Isotropic	"	1.244e-013	9.658e-013
Shallow Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	1.721e-013	1.337e-012
o Opposed	"	1.657e-013	1.287e-012
o Rotational	"	1.657e-013	1.287e-012
o Isotropic	"	1.317e-013	1.023e-012
Effective Dose Equivalent Rate	(ICRP 51 - 1987)		
o Anterior/Posterior Geometry	mSv/hr	1.456e-013	1.131e-012
o Posterior/Anterior	"	1.341e-013	1.042e-012
o Lateral	"	1.066e-013	8.280e-013
o Rotational		1.207e-013	9.379e-013
o Isotropic		1.069e-013	8.299e-013

MicroShield v5.05 (5.05-00362)
Radiological Services, Inc.

Page : 1
DOS File : PB020402.MS5
Run Date : February 4, 2006
Run Time : 2:05:04 PM
Duration : 00:00:00

File Ref: _____
Date: _____
By: _____
Checked: _____

Case Title: Line 1.21 AF-B
Description: PBRF Rev Model Co-60 Area Factor Calculation
Geometry: 10 - Cylinder Surface - External Dose Point



Source Dimensions

Height	60.96 cm	2 ft
Radius	7.62 cm	3.0 in

Dose Points

	X	Y	Z
# 1	138.78 cm	30.48 cm	45.72 cm
	4 ft 6.6 in	1 ft	1 ft 6.0 in

Shields

Shield Name	Dimension	Material	Density
Cyl. Core	7.62 cm	Concrete	1.8
Shield 1	.65 cm	Iron	7.86
Transition		Concrete	2.4
Shield 3	30.48 cm	Concrete	2.4
Air Gap		Air	0.00122
Wall Clad	.025 cm	Iron	7.86

Source Input
Grouping Method : Actual Photon Energies

Nuclide	curies	becquerels	uCi/cm³	Bq/cm³
Co-60	1.3134e-011	4.8595e-001	4.5000e-009	1.6650e-004

Buildup
The material reference is : Cyl. Core

Integration Parameters

Y Direction (axial)	20
Circumferential	20

Results

Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.6938	7.927e-05	1.383e-13	2.260e-12	2.669e-16	4.363e-15
1.1732	4.860e-01	6.855e-09	5.838e-08	1.225e-11	1.043e-10
1.3325	4.860e-01	1.101e-08	8.106e-08	1.909e-11	1.406e-10

DOS File : PB020402.MS5
Run Date: February 4, 2006
Run Time: 2:05:04 PM
Duration : 00:00:00

Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
TOTALS:	9.720e-01	1.786e-08	1.394e-07	3.134e-11	2.450e-10

MicroShield v5.05 (5.05-00362)
Radiological Services, Inc.
Conversion of calculated exposure in air to dose
FILE: C:\MS5\DATA\PB020402.MS5
Case Title: Line 1.21 AF-B
This case was run on Saturday, February 4, 2006 at 2:06:04 PM
Dose Point # 1 - (138.78,30.48,45.72) cm

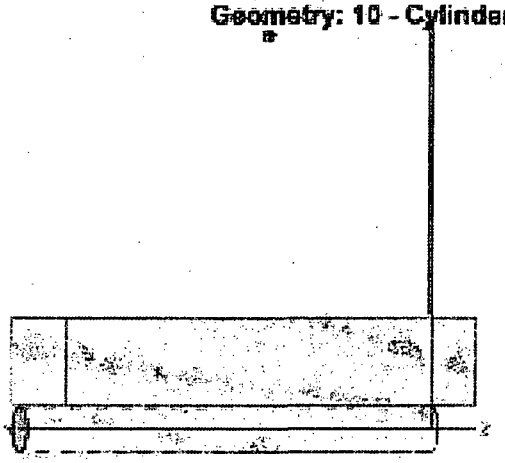
Results (Summed over energies)	Units	Without Buildup	With Buildup
Photon Fluence Rate (flux)	Photons/cm²/sec	1.410e-008	1.106e-007
Photon Energy Fluence Rate	MeV/cm²/sec	1.786e-008	1.394e-007
Exposure and Dose Rates:			
Exposure Rate in Air	mR/hr	3.134e-011	2.450e-010
Absorbed Dose Rate in Air	mGy/hr	2.736e-013	2.139e-012
"	mrad/hr	2.736e-011	2.139e-010
Deep Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	3.107e-013	2.428e-012
o Opposed	"	2.675e-013	2.091e-012
o Rotational	"	2.675e-013	2.091e-012
o Isotropic	"	2.390e-013	1.867e-012
Shallow Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	3.307e-013	2.585e-012
o Opposed	"	3.184e-013	2.489e-012
o Rotational	"	3.184e-013	2.489e-012
o Isotropic	"	2.532e-013	1.979e-012
Effective Dose Equivalent Rate	(ICRP 51 - 1987)		
o Anterior/Posterior Geometry	mSv/hr	2.797e-013	2.187e-012
o Posterior/Anterior	"	2.577e-013	2.014e-012
o Lateral	"	2.049e-013	1.601e-012
o Rotational	"	2.320e-013	1.813e-012
o Isotropic	"	2.054e-013	1.604e-012

MicroShield v5.05 (5.05-00362)
Radiological Services, Inc.

Page : 1
DOS File : PB020403.MS5
Run Date: February 4, 2005
Run Time: 2:06:55 PM
Duration : 00:00:00

File Ref: _____
Date: _____
By: _____
Checked: _____

Case Title: Line 1.21 AF-C
Description: PBRF Rev Model Co-60 Area Factor Calculation
Geometry: 10 - Cylinder Surface - External Dose Point



Source Dimensions

Height	152.4 cm	5 ft 0.0 in
Radius	7.62 cm	3.0 in

Dose Points

	X	Y	Z
# 1	138.78 cm	76.2 cm	45.72 cm
	4 ft 6.6 in	2 ft 6.0 in	1 ft 6.0 in

Shields

Shield Name	Dimension	Material	Density
Cyl. Core	7.62 cm	Concrete	1.8
Shield 1	.65 cm	Iron	7.86
Transition		Concrete	2.4
Shield 3	30.48 cm	Concrete	2.4
Air Gap		Air	0.00122
Wall Clad	.025 cm	Iron	7.86

Source Input
Grouping Method : Actual Photon Energies

Nuclide	curies	becquerels	uCi/cm²	Bq/cm²
Co-60	3.2835e-011	1.2148e+000	4.5000e-009	1.6650e-004

Buildup
The material reference is : Cyl. Core

Integration Parameters

Y Direction (axial)	20
Circumferential	20

Results

Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.6938	1.982e-04	2.607e-13	4.424e-12	5.034e-16	8.542e-15
1.1732	1.215e+00	1.346e-08	1.163e-07	2.406e-11	2.115e-10
1.3325	1.215e+00	2.182e-08	1.656e-07	3.786e-11	2.874e-10

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DOS File : PB020403.MS5
Run Date: February 4, 2006
Run Time: 2:06:55 PM
Duration : 00:00:00

Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
TOTALS:	2.430e+00	3.528e-08	2.840e-07	6.192e-11	4.966e-10

MicroShield v5.05 (5.05-00362)
Radiological Services, Inc.
Conversion of calculated exposure in air to dose
FILE: C:\MS5\DATA\FB020403.MS5
Case Title: Line 1.21 AF-C
This case was run on Saturday, February 4, 2006 at 2:06:55 PM
Dose Point # 1 - (138.78,76.2,45.72) cm

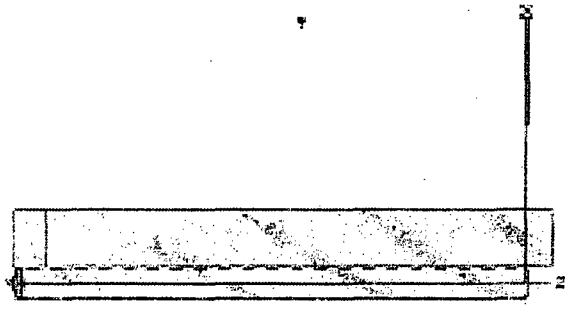
Results (Summed over energies)	Units	Without Buildup	With Buildup
Photon Fluence Rate (flux)	Photons/cm²/sec	2.785e-008	2.252e-007
Photon Energy Fluence Rate	MeV/cm²/sec	3.528e-008	2.840e-007
Exposure and Dose Rates:			
Exposure Rate in Air	mR/hr	6.192e-011	4.988e-010
Absorbed Dose Rate in Air	mGy/hr	5.405e-013	4.355e-012
"	mrad/hr	5.405e-011	4.355e-010
Deep Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	6.137e-013	4.945e-012
o Opposed	"	5.285e-013	4.257e-012
o Rotational	"	5.285e-013	4.257e-012
o Isotropic	"	4.721e-013	3.802e-012
Shallow Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	6.532e-013	5.265e-012
o Opposed	"	6.290e-013	5.068e-012
o Rotational	"	6.290e-013	5.068e-012
o Isotropic	"	5.002e-013	4.029e-012
Effective Dose Equivalent Rate	(ICRP 51 - 1987)		
o Anterior/Posterior Geometry	mSv/hr	5.526e-013	4.463e-012
o Posterior/Anterior	"	5.091e-013	4.101e-012
o Lateral	"	4.049e-013	3.260e-012
o Rotational	"	4.584e-013	3.692e-012
o Isotropic		4.057e-013	3.267e-012

MicroShield v5.05 (5.05-00362)
Radiological Services, Inc.

Page : 1
DOS File : PB020404.MS5
Run Date : February 4, 2006
R Time: 2:11:09 PM
Duration : 00:00:00

File Ref: _____
Date: _____
By: _____
Checked: _____

Case Title: Line 1.21 AF-D
Description: PBRF Rev Model Co-60 Area Factor Calculation
Geometry: 10 - Cylinder Surface - External Dose Point



Source Dimensions

Height	304.8 cm	10 ft 0.0 in
Radius	7.62 cm	3.0 in

Dose Points

	X	Y	Z
# 1	138.78 cm	152.4 cm	45.72 cm
	4 ft 6.6 in	5 ft 0.0 in	1 ft 6.0 in

Shields

Shield Name	Dimension	Material	Density
Cyl. Core	7.62 cm	Concrete	1.6
Shield 1	.65 cm	Iron	7.86
Transition		Concrete	2.4
Shield 2	30.48 cm	Concrete	2.4
Air Gap		Air	0.00122
Wall Clad	.635 cm	Iron	7.86

Source Input
Grouping Method : Actual Photon Energies

Nuclide	curies	becquerels	$\mu Ci/cm^2$	Bq/cm^2
Co-60	6.5669e-011	2.4298e+000	4.5000e-009	1.6650e-004

Buildup
The material reference is : Cyl. Core

Integration Parameters

Y Direction (axial)	20
Circumferential	20

Results

Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.6938	3.963e-04	3.019e-13	5.320e-12	5.830e-16	1.027e-14
1.1732	2.430e+00	1.630e-08	1.469e-07	2.914e-11	2.661e-10
1.3325	2.430e+00	2.673e-08	2.109e-07	4.638e-11	3.659e-10

DOS File : PB020404.MS5
Run Date : February 4, 2006
Run Time : 2:11:09 PM
Duration : 00:00:00

Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
TOTALS:	4.860e+00	4.304e-08	3.598e-07	7.552e-11	6.321e-10

MicroShield v5.05 (5.05-00362)
Radiological Services, Inc.
Conversion of calculated exposure in air to dose
FILE: C:\MS5\DATA\PB020404.MS5
Case Title: Line 1.21 AF-D
This case was run on Saturday, February 4, 2006 at 2:11:09 PM
Dose Point # 1 - (138.78,152.4,45.72) cm

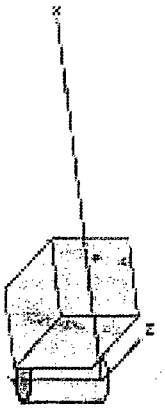
Results (Summed over energies)	Units	Without Buildup	With Buildup
Photon Fluence Rate (flux)	Photons/cm²/sec	3.396e-008	2.852e-007
Photon Energy Fluence Rate	MeV/cm²/sec	4.304e-008	3.598e-007
Exposure and Dose Rates:			
Exposure Rate in Air	mR/hr	7.552e-011	6.321e-010
Absorbed Dose Rate in Air	mGy/hr	6.593e-013	5.518e-012
"	mrad/hr	6.593e-011	5.518e-010
Deep Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	7.484e-013	6.265e-012
o Opposed	"	6.446e-013	5.394e-012
o Rotational	"	6.446e-013	5.394e-012
o Isotropic	"	5.758e-013	4.818e-012
Shallow Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	7.967e-013	6.670e-012
o Opposed	"	7.671e-013	6.422e-012
o Rotational	"	7.671e-013	6.422e-012
o Isotropic	"	6.101e-013	5.105e-012
Effective Dose Equivalent Rate	(ICRP 51 - 1987)		
o Anterior/Posterior Geometry	mSv/hr	6.740e-013	5.641e-012
o Posterior/Anterior	"	6.209e-013	5.196e-012
o Lateral		4.938e-013	4.130e-012
o Rotational	"	5.591e-013	4.678e-012
o Isotropic	"	4.948e-013	4.140e-012

MicroShield v5.05 (5.05-00362)
Radiological Services, Inc.

Page : 1
MS File : PB030401.MS5
Run Date: March 4, 2006
Run Time: 3:58:06 PM
Duration : 00:00:00

File Ref: _____
Date: _____
By: _____
Checked: _____

Case Title: Line 1.23 AF-A
Description: PBRF Rev Model Co-60 Area Factor Calculation
Geometry: 10 - Cylinder Surface - External Dose Point



Source Dimensions

Height	30.48 cm	1 ft
Radius	7.62 cm	3.0 in

Dose Points

	X	Y	Z
# 1	138.78 cm	15.24 cm	45.7 cm
	4 ft 6.6 in	6.0 in	1 ft 6.0 in

Shields

Shield Name	Dimension	Material	Density
Cyl. Core	7.62 cm	Concrete	1.8
Shield 1	.65 cm	Iron	7.88
Transition		Concrete	2.4
Shield 3	30.48 cm	Concrete	2.4
Air Gap		Air	0.00122
Wall Clad	.025 cm	Iron	7.88

Source Input
Grouping Method : Actual Photon Energies

Nuclide	curies	becquerels	μCi/cm³	Bq/cm³
Co-60	6.5669e-012	2.4298e-001	4.5000e-009	1.6650e-004

Buildup
The material reference is : Cyl. Core

Integration Parameters

Y Direction (axial)	20
Circumferential	20

Results

Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.6938	3.963e-05	7.263e-14	1.178e-12	1.402e-16	2.275e-15
1.1732	2.430e-01	3.572e-09	3.023e-08	6.383e-12	5.403e-11
1.3325	2.430e-01	5.724e-09	4.192e-08	9.931e-12	7.272e-11

Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
TOTALS:	4.860e-01	9.296e-09	7.215e-08	1.631e-11	1.268e-10

MicroShield v5.05 (5.05-00362)
Radiological Services, Inc.
Conversion of calculated exposure in air to dose
FILE: C:\MS5\DATA\PB030401.MS5
Case Title: Line 1.23 AF-A
This case was run on Saturday, March 4, 2006 at 3:58:06 PM
Dose Point # 1 - (138.78,15.24,45.7) cm

Results (Summed over energies)	Units	Without Buildup	With Buildup
Photon Fluence Rate (flux)	Photons/cm²/sec	7.340e-009	5.723e-008
Photon Energy Fluence Rate	MeV/cm²/sec	9.296e-009	7.215e-008
Exposure and Dose Rates:			
Exposure Rate in Air	mR/hr	1.631e-011	1.268e-010
Absorbed Dose Rate in Air	mGy/hr	1.424e-013	1.107e-012
"	mrad/hr	1.424e-011	1.107e-010
Deep Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	1.617e-013	1.256e-012
o Opposed	"	1.393e-013	1.082e-012
o Rotational	"	1.393e-013	1.082e-012
o Isotropic	"	1.244e-013	9.661e-013
Shallow Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	1.721e-013	1.338e-012
o Opposed	"	1.657e-013	1.288e-012
o Rotational	"	1.657e-013	1.288e-012
o Isotropic	"	1.318e-013	1.024e-012
Effective Dose Equivalent Rate	(ICRP 51 - 1987)		
o Anterior/Posterior Geometry	mSv/hr	1.458e-013	1.131e-012
o Posterior/Anterior	"	1.341e-013	1.042e-012
o Lateral	"	1.067e-013	8.283e-013
o Rotational	"	1.206e-013	9.362e-013
o Isotropic	"	1.069e-013	8.301e-013

MicroShield v5.05 (5.05-00362)
Radiological Services, Inc.

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DOS File : PB020406.MS5
Run Date: February 4, 2006
R Time: 2:25:44 PM
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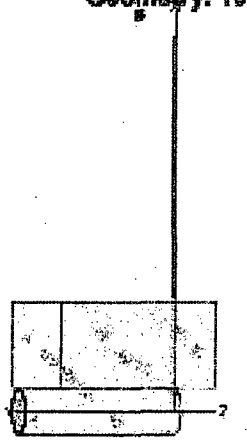
Case Title: Line 1.23 AF-B
Description: PBRF Rev Model Co-60 Area Factor Calculation
Geometry: 10 - Cylinder Surface - External Dose Point



Source Dimensions

Height	60.96 cm	2 ft
Radius	7.62 cm	3.0 in

Dose Points

	X	Y	Z
# 1	138.78 cm	30.48 cm	45.7 cm
	4 ft 6.6 in	1 ft	1 ft 6.0 in

Shields

Shield Name	Dimension	Material	Density
Cyl. Core	7.62 cm	Concrete	1.6
Shield 1	.65 cm	Iron	7.86
Transition		Concrete	2.4
Shield 3	30.48 cm	Concrete	2.4
Air Gap		Air	0.00122
Wall Clad	.025 cm	Iron	7.86

Source Input
Grouping Method : Actual Photon Energies

Nuclide	curies	becquerels	μCi/cm²	Bq/cm²
Co-60	1.3134e-011	4.8595e-001	4.5000e-009	1.6650e-004

Buildup
The material reference is : Cyl. Core

Integration Parameters

Y Direction (axial)	20
Circumferential	20

Results

Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.6938	7.927e-05	1.383e-13	2.261e-12	2.670e-16	4.365e-15
1.1732	4.660e-01	6.857e-09	5.840e-08	1.225e-11	1.044e-10
1.3325	4.660e-01	1.101e-08	8.108e-08	1.910e-11	1.407e-10

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Run Date: February 4, 2006
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Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
TOTALS:	9.720e-01	1.787e-06	1.395e-07	3.135e-11	2.450e-10

MicroShield v5.05 (5.05-00362)
Radiological Services, Inc.
Conversion of calculated exposure in air to dose
FILE: C:\MS5\DATA\PB020406.MS5
Case Title: Line 1.23 AF-B
This case was run on Saturday, February 4, 2006 at 2:25:44 PM
Dose Point # 1 - (138.78,30.48,45.7) cm

Results (Summed over energies)	Units	Without Buildup	With Buildup
Photon Fluence Rate (flux)	Photons/cm²/sec	1.411e-008	1.106e-007
Photon Energy Fluence Rate	MeV/cm²/sec	1.787e-008	1.395e-007
Exposure and Dose Rates:			
Exposure Rate in Air	mR/hr	3.135e-011	2.450e-010
Absorbed Dose Rate in Air	mGy/hr	2.737e-013	2.139e-012
"	mrad/hr	2.737e-011	2.139e-010
Deep Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	3.108e-013	2.429e-012
o Opposed	"	2.676e-013	2.091e-012
o Rotational		2.676e-013	2.091e-012
o Isotropic	"	2.391e-013	1.868e-012
Shallow Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	3.308e-013	2.586e-012
o Opposed	"	3.185e-013	2.490e-012
o Rotational	"	3.185e-013	2.490e-012
o Isotropic	"	2.533e-013	1.979e-012
Effective Dose Equivalent Rate	(ICRP 51 - 1987)		
o Anterior/Posterior Geometry	mSv/hr	2.798e-013	2.187e-012
o Posterior/Anterior	"	2.578e-013	2.014e-012
o Lateral	"	2.050e-013	1.601e-012
o Rotational	"	2.321e-013	1.814e-012
o Isotropic	"	2.054e-013	1.605e-012

MicroShield v5.05 (5.05-00362)
Radiological Services, Inc.

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DOS File : PB020407.MS5
Run Date: February 4, 2006
R Time: 2:24:25 PM
Duration : 00:00:00

File Ref: _____
Date: _____
By: _____
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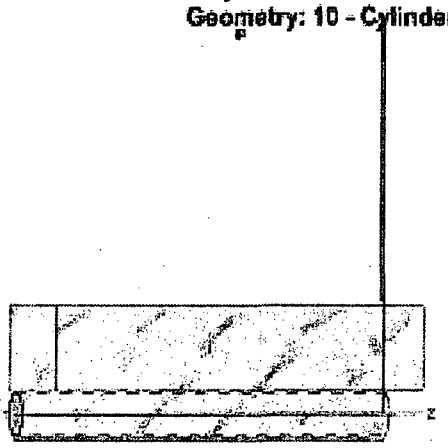
Case Title: Line 1.23 AF-C
Description: PBRF Rev Model Co-60 Area Factor Calculation
Geometry: 10 - Cylinder Surface - External Dose Point



Source Dimensions

Height	152.4 cm	5 ft 0.0 in
Radius	7.62 cm	3.0 in

Dose Points

	X	Y	Z
# 1	138.78 cm	76.2 cm	45.7 cm
	4 ft 6.6 in	2 ft 6.0 in	1 ft 6.0 in

Shields

Shield Name	Dimension	Material	Density
Cyl. Core	7.62 cm	Concrete	1.6
Shield 1	.65 cm	Iron	7.86
Transition		Concrete	2.4
Shield 3	30.48 cm	Concrete	2.4
Air Gap		Air	0.00122
Wall Clad	.025 cm	Iron	7.86

Source Input
Grouping Method : Actual Photon Energies

Nuclide	curies	becquerels	μCi/cm²	Bq/cm²
Co-60	3.2835e-011	1.2149e+000	4.5000e-009	1.6650e-004

Buildup
The material reference is : Cyl. Core

Integration Parameters

Y Direction (axial)	20
Circumferential	20

Results

Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.6938	1.982e-04	2.608e-13	4.426e-12	5.036e-16	8.545e-15
1.1732	1.215e+00	1.347e-08	1.184e-07	2.407e-11	2.115e-10
1.3325	1.215e+00	2.163e-08	1.857e-07	3.787e-11	2.675e-10

Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
TOTALS:	2.430e+00	3.529e-08	2.841e-07	6.194e-11	4.990e-10

MicroShield v5.05 (5.05-00362)
Radiological Services, Inc.
Conversion of calculated exposure in air to dose
FILE: C:\MS5\DATA\PB020407.MS5
Case Title: Line 1.23 AF-C
This case was run on Saturday, February 4, 2006 at 2:24:25 PM
Dose Point # 1 - (138.78,76.2,45.7) cm

Results (Summed over energies)	Units	Without Buildup	With Buildup
Photon Fluence Rate (flux)	Photons/cm²/sec	2.786e-008	2.252e-007
Photon Energy Fluence Rate	MeV/cm²/sec	3.529e-008	2.841e-007
Exposure and Dose Rates:			
Exposure Rate in Air	mR/hr	6.194e-011	4.990e-010
Absorbed Dose Rate in Air	mGy/hr	5.407e-013	4.356e-012
"	mrad/hr	5.407e-011	4.356e-010
Deep Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	6.138e-013	4.946e-012
o Opposed	"	5.287e-013	4.258e-012
o Rotational	"	5.287e-013	4.258e-012
o Isotropic	"	4.723e-013	3.803e-012
Shallow Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	6.534e-013	5.266e-012
o Opposed	"	6.292e-013	5.070e-012
o Rotational	"	6.292e-013	5.070e-012
o Isotropic	"	5.003e-013	4.030e-012
Effective Dose Equivalent Rate	(ICRP 51 - 1987)		
o Anterior/Posterior Geometry	mSv/hr	5.526e-013	4.454e-012
o Posterior/Anterior	"	5.092e-013	4.102e-012
o Lateral	"	4.050e-013	3.261e-012
o Rotational	"	4.585e-013	3.693e-012
o Isotropic	"	4.056e-013	3.266e-012

MicroShield v5.05 (5.05-00362)
Radiological Services, Inc.

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DOS File : PB020408.MS5
Run Date : February 4, 2006
Run Time : 2:23:00 PM
Duration : 00:00:00

File Ref: _____
Date: _____
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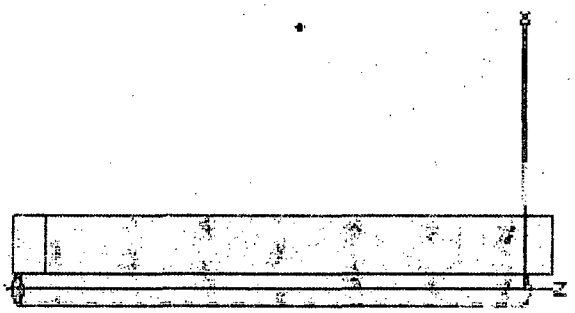
Case Title: Line 1.23 AF-D
Description: PBRF Rev Model Co-60 Area Factor Calculation
Geometry: 10 - Cylinder Surface - External Dose Point



Source Dimensions

Height	304.8 cm	10 ft 0.0 in
Radius	7.62 cm	3.0 in

Dose Points

	X	Y	Z
# 1	138.78 cm	152.4 cm	45.7 cm
	4 ft 6.6 in	5 ft 0.0 in	1 ft 6.0 in

Shields

Shield Name	Dimension	Material	Density
Cyl. Core	7.62 cm	Concrete	1.8
Shield 1	.65 cm	Iron	7.86
Transition		Concrete	2.4
Shield 3	30.48 cm	Concrete	2.4
Air Gap		Air	0.00122
Wall Clad	.025 cm	Iron	7.86

Source Input
Grouping Method : Actual Photon Energies

Nuclide	curies	becquerels	μCi/cm²	Bq/cm²
Co-60	6.5669e-011	2.4296e+000	4.5000e-009	1.6650e-004

Buildup
The material reference is : Cyl. Core

Integration Parameters

Y Direction (axial)	20
Circumferential	20

Results

Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.6938	3.963e-04	3.021e-13	5.322e-12	5.832e-16	1.028e-14
1.1732	2.430e+00	1.631e-08	1.490e-07	2.914e-11	2.662e-10
1.3325	2.430e+00	2.674e-08	2.110e-07	4.639e-11	3.660e-10

...ergy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
TOTALS:	4.660e+00	4.305e-08	3.599e-07	7.554e-11	6.322e-10

MicroShield v5.05 (5.05-00362)
Radiological Services, Inc.
Conversion of calculated exposure in air to dose
FILE: C:\MS5\DATA\PB020408.MS5
Case Title: Line 1.23 AF-D
This case was run on Saturday, February 4, 2006 at 2:23:00 PM
Dose Point # 1 - (138.78,152.4,45.7) cm

Results (Summed over energies)	Units	Without Buildup	With Buildup
Photon Fluence Rate (flux)	Photons/cm²/sec	3.397e-008	2.853e-007
Photon Energy Fluence Rate	MeV/cm²/sec	4.305e-008	3.599e-007
Exposure and Dose Rates:			
Exposure Rate in Air	mR/hr	7.554e-011	6.322e-010
Absorbed Dose Rate in Air	mGy/hr	6.595e-013	5.519e-012
"	mrad/hr	6.595e-011	5.519e-010
Deep Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	7.487e-013	6.267e-012
o Opposed	"	6.448e-013	5.395e-012
o Rotational	"	6.448e-013	5.395e-012
o Isotropic	"	5.760e-013	4.819e-012
Shallow Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	7.989e-013	6.672e-012
o Opposed	"	7.674e-013	6.423e-012
o Rotational	"	7.674e-013	6.423e-012
o Isotropic	"	6.103e-013	5.106e-012
Effective Dose Equivalent Rate	(ICRP 51 - 1987)		
o Anterior/Posterior Geometry	mSv/hr	6.742e-013	5.643e-012
o Posterior/Anterior	"	6.211e-013	5.197e-012
o Lateral	"	4.940e-013	4.131e-012
o Rotational	"	5.582e-013	4.670e-012
o Isotropic	"	4.950e-013	4.141e-012

MicroShield v5.05 (5.05-00362)
Radiological Services, Inc.

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DOS File : PB020409.MS5
Run Date : February 4, 2006
R Time: 2:39:29 PM
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File Ref: _____
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By: _____
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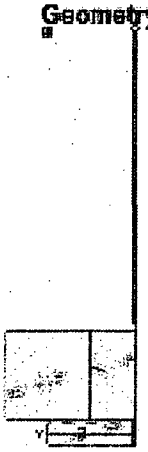
Case Title: Line 1.24 AF-A
Description: PBRF Rev Model Co-60 Area Factor Calculation
Geometry: 10 - Cylinder Surface - External Dose Point



Source Dimensions

Height	30.48 cm	1 ft
Radius	3.81 cm	1.5 in

Dose Points

	X	Y	Z
# 1	134.97 cm	15.24 cm	91.44 cm
	4 ft 5.1 in	6.0 in	3 ft

Shields

Shield Name	Dimension	Material	Density
Cyl. Core	3.81 cm	Concrete	1.8
Shield 1	.65 cm	Iron	7.86
Transition		Concrete	2.4
Shield 3	30.48 cm	Concrete	2.4
Air Gap		Air	0.00122
Wall Clad	.025 cm	Iron	7.86

Source Input
Grouping Method : Actual Photon Energies

Nuclide	curies	becquerels	μCi/cm²	Bq/cm²
Co-60	3.2835e-012	1.2149e-001	4.5000e-009	1.6650e-004

Buildup
The material reference is : Cyl. Core

Integration Parameters

Y Direction (axial)	20
Circumferential	20

Results

Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.6938	1.982e-05	1.605e-14	3.064e-13	3.099e-17	5.916e-16
1.1732	1.215e-01	9.367e-10	8.884e-09	1.674e-12	1.588e-11
1.3325	1.215e-01	1.555e-09	1.264e-08	2.697e-12	2.194e-11

DOS File : PB020409.MS5
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Duration : 00:00:00

Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
TOTALS:	2.430e-01	2.491e-09	2.153e-08	4.371e-12	3.781e-11

MicroShield v5.05 (5.05-00362)
Radiological Services, Inc.
Conversion of calculated exposure in air to dose
FILE: C:\MS5\DATA\PB020409.MS5
Case Title: Line 1.24 AF-A
This case was run on Saturday, February 4, 2006 at 2:39:29 PM
Dose Point # 1 - (134.97,15.24,91.44) cm

Results (Summed over energies)	Units	Without Buildup	With Buildup
Photon Fluence Rate (flux)	Photons/cm²/sec	1.965e-009	1.706e-008
Photon Energy Fluence Rate	MeV/cm²/sec	2.491e-009	2.153e-008
Exposure and Dose Rates:			
Exposure Rate in Air	mR/hr	4.371e-012	3.781e-011
Absorbed Dose Rate in Air	mGy/hr	3.816e-014	3.301e-013
"	mrad/hr	3.816e-012	3.301e-011
Deep Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	4.332e-014	3.748e-013
o Opposed	"	3.731e-014	3.227e-013
o Rotational	"	3.731e-014	3.227e-013
o Isotropic	"	3.333e-014	2.882e-013
Shallow Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	4.611e-014	3.991e-013
o Opposed	"	4.440e-014	3.842e-013
o Rotational		4.440e-014	3.842e-013
o Isotropic	"	3.531e-014	3.054e-013
Effective Dose Equivalent Rate	(ICRP 51 - 1987)		
o Anterior/Posterior Geometry	mSv/hr	3.901e-014	3.375e-013
o Posterior/Anterior	"	3.594e-014	3.109e-013
o Lateral	"	2.858e-014	2.471e-013
o Rotational	"	3.236e-014	2.799e-013
o Isotropic	"	2.864e-014	2.477e-013

MicroShield v5.05 (5.05-00362)
Radiological Services, Inc.

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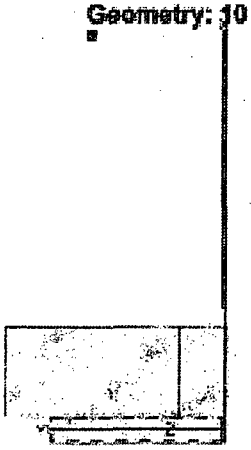
Run Time: 2:40:59 PM
Duration : 00:00:00

File Ref: _____
Date: _____
By: _____
Checked: _____

Case Title: Line 1.24 AF-B
Description: PBRF Rev Model Co-60 Area Factor Calculation
Geometry: 10 - Cylinder Surface - External Dose Point



Source Dimensions

Height	60.96 cm	2 ft
Radius	3.81 cm	1.5 in

Dose Points

	X	Y	Z
# 1	134.97 cm	30.48 cm	91.44 cm
	4 ft 5.1 in	1 ft	3 ft

Shields

Shield Name	Dimension	Material	Density
Cyl. Core	3.81 cm	Concrete	1.8
Shield 1	.65 cm	Iron	7.86
Transition		Concrete	2.4
Shield 3	30.48 cm	Concrete	2.4
Air Gap		Air	0.00122
Wall Clad	.025 cm	Iron	7.86

Source Input
Grouping Method : Actual Photon Energies

Nuclide	curies	becquerels	uCi/cm³	Bq/cm³
Co-60	6.5669e-012	2.4298e-001	4.5000e-009	1.6650e-004

Buildup
The material reference is : Cyl. Core

Integration Parameters

Y Direction (axial)	20
Circumferential	20

Results

Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.6938	3.963e-05	3.080e-14	5.916e-13	5.946e-17	1.142e-15
1.1732	2.430e-01	1.810e-09	1.725e-08	3.235e-12	3.083e-11
1.3325	2.430e-01	3.009e-09	2.459e-08	5.220e-12	4.266e-11

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DOS File : PB020410.MS5
Run Date: February 4, 2006
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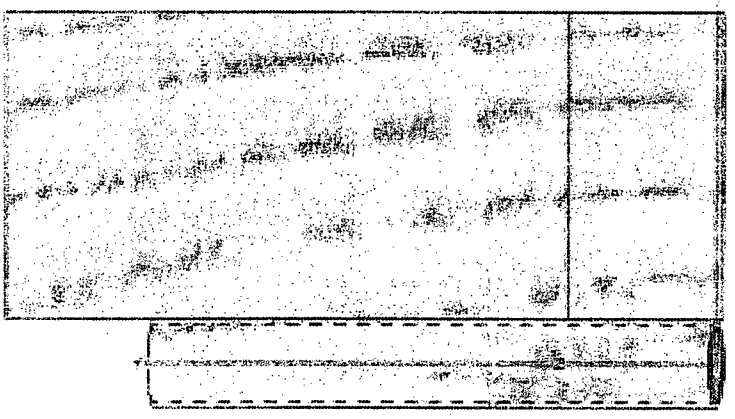
Duration : 00:00:00

...ergy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
TOTALS:	4.860e-01	4.819e-09	4.184e-08	8.455e-12	7.349e-11



MicroShield v5.05 (5.05-00362)
Radiological Services, Inc.
Conversion of calculated exposure in air to dose
FILE: C:\MS5\DATA\PB020410.MS5
Case Title: Line 1.24 AF-B
This case was run on Saturday, February 4, 2006 at 2:40:58 PM
Dose Point # 1 - (134.97,30.48,91.44) cm

Results (Summed over energies)	Units	Without Buildup	With Buildup
Photon Fluence Rate (flux)	Photons/cm²/sec	3.801e-009	3.316e-008
Photon Energy Fluence Rate	MeV/cm²/sec	4.819e-009	4.184e-008
Exposure and Dose Rates:			
Exposure Rate in Air	mR/hr	8.455e-012	7.349e-011
Absorbed Dose Rate in Air	mGy/hr	7.381e-014	6.416e-013
"	mrad/hr	7.381e-012	6.416e-011
Deep Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	8.379e-014	7.285e-013
o Opposed	"	7.217e-014	6.272e-013
o Rotational	"	7.217e-014	6.272e-013
o Isotropic	"	6.447e-014	5.602e-013
Shallow Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	8.920e-014	7.756e-013
o Opposed	"	8.589e-014	7.467e-013
o Rotational	"	8.589e-014	7.467e-013
o Isotropic	"	6.830e-014	5.936e-013
Effective Dose Equivalent Rate	(ICRP 51 - 1987)		
o Anterior/Posterior Geometry	mSv/hr	7.546e-014	6.559e-013
o Posterior/Anterior	"	6.951e-014	6.041e-013
o Lateral	"	5.529e-014	4.803e-013
o Rotational	"	6.259e-014	5.440e-013
o Isotropic	"	5.540e-014	4.813e-013

MicroShield v5.05 (5.05-00362)
Radiological Services, Inc.

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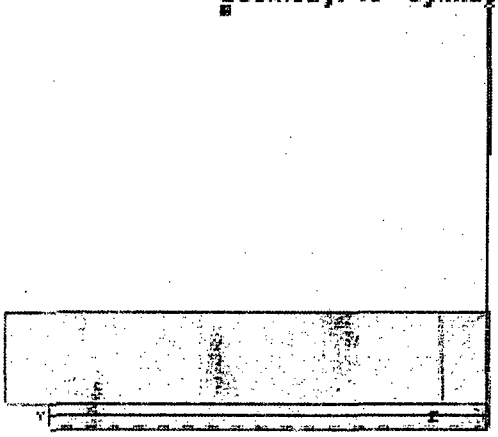
DOS File : PB020411.MS5
Run Date: February 4, 2006
R Time: 2:43:21 PM
Duration : 00:00:00

File Ref: _____
Date: _____
By: _____
Checked: _____

Case Title: Line 1.24 AF-C
Description: PBRF Rev Model Co-60 Area Factor Calculation
Geometry: 10 - Cylinder Surface - External Dose Point



Source Dimensions

Height	152.4 cm	5 ft 0.0 in
Radius	3.81 cm	1.5 in

Dose Points

	X	Y	Z
# 1	134.97 cm	76.2 cm	91.44 cm
	4 ft 5.1 in	2 ft 6.0 in	3 ft

Shields

Shield Name	Dimension	Material	Density
Cyl. Core	3.81 cm	Concrete	1.8
Shield 1	.65 cm	Iron	7.86
Transition		Concrete	2.4
Shield 3	30.48 cm	Concrete	2.4
Air Gap		Air	0.00122
Wall Clad	.025 cm	Iron	7.86

Source Input
Grouping Method : Actual Photon Energies

Nuclide	curies	becquerels	μCi/cm²	Bq/cm²
Co-60	1.6417e-011	6.0744e-001	4.5000e-009	1.6650e-004

Buildup
The material reference is : Cyl. Core

Integration Parameters

Y Direction (axial)	20
Circumferential	20

Results

Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.6938	9.909e-05	6.018e-14	1.194e-12	1.162e-16	2.305e-15
1.1732	6.074e-01	3.673e-09	3.596e-08	6.564e-12	6.427e-11
1.3325	6.074e-01	6.158e-09	5.164e-08	1.088e-11	8.959e-11

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DOS File : PB020411.MS5
Run Date : February 4, 2006
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Duration : 00:00:00

Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
TOTALS:	1.215e+00	9.831e-09	8.760e-08	1.725e-11	1.539e-10

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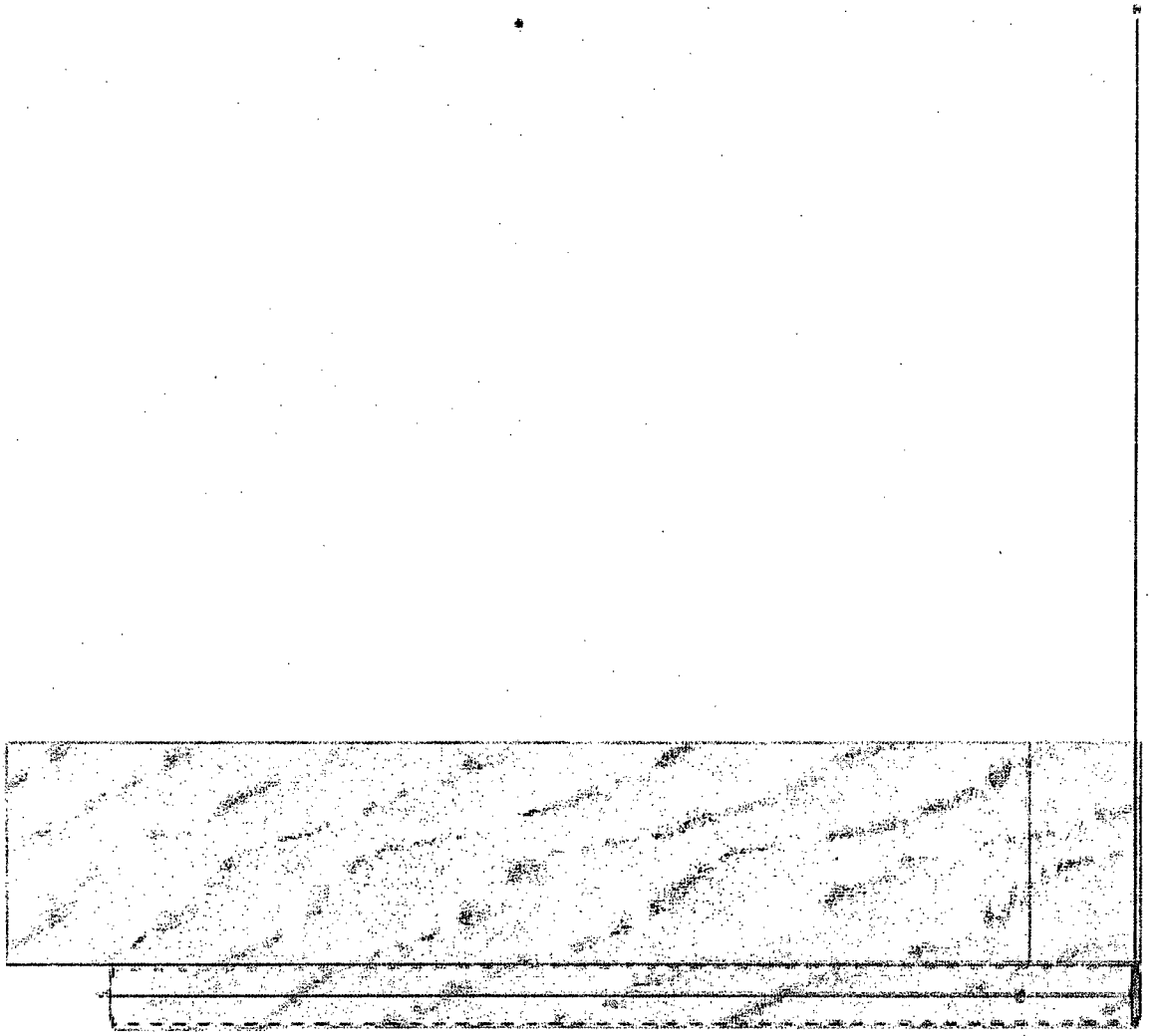
DOS File : PB020411.MSS
Run Date : February 4, 2006
Run Time : 2:43:21 PM
Duration : 00:00:00



MicroShield v5.05 (5.05-00362)
Radiological Services, Inc.
Conversion of calculated exposure in air to dose
FILE: C:\MS5\DATA\PB020411.MS5
Case Title: Line 1.24 AF-C
This case was run on Saturday, February 4, 2006 at 2:43:21 PM
Dose Point # 1 - (134.97,76.2,91.44) cm

Results (Summed over energies)	Units	Without Buildup	With Buildup
Photon Fluence Rate (flux)	Photons/cm²/sec	7.752e-009	6.941e-008
Photon Energy Fluence Rate	MeV/cm²/sec	9.831e-009	8.760e-008
Exposure and Dose Rates:			
Exposure Rate in Air	mR/hr	1.725e-011	1.539e-010
Absorbed Dose Rate in Air	mGy/hr	1.506e-013	1.343e-012
"	mrad/hr	1.506e-011	1.343e-010
Deep Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	1.709e-013	1.525e-012
o Opposed	"	1.472e-013	1.313e-012
o Rotational	"	1.472e-013	1.313e-012
o Isotropic	"	1.315e-013	1.173e-012
Shallow Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	1.820e-013	1.624e-012
o Opposed	"	1.752e-013	1.563e-012
o Rotational	"	1.752e-013	1.563e-012
o Isotropic		1.393e-013	1.243e-012
Effective Dose Equivalent Rate	(ICRP 51 - 1987)		
o Anterior/Posterior Geometry	mSv/hr	1.539e-013	1.373e-012
o Posterior/Anterior	"	1.418e-013	1.265e-012
o Lateral		1.128e-013	1.006e-012
o Rotational	"	1.277e-013	1.139e-012
o Isotropic	"	1.130e-013	1.008e-012

MicroShield v5.05 (5.05-00362)
Radiological Services, Inc.

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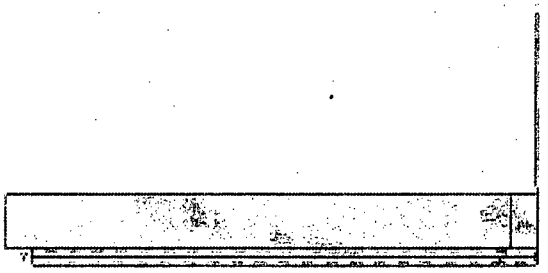
DOS File : PB020412.MS5
Run Date : February 4, 2005
R Time: 2:44:33 PM
Duration : 00:00:00

File Ref: _____
Date: _____
By: _____
Checked: _____

Case Title: Line 1.24 AF-D
Description: PBRF Rev Model Co-60 Area Factor Calculation
Geometry: 10 - Cylinder Surface - External Dose Point



Source Dimensions

Height	304.8 cm	10 ft 0.0 in
Radius	3.81 cm	1.5 in

Dose Points

X	Y	Z
134.97 cm	152.4 cm	91.44 cm
4 ft 5.1 in	5 ft 0.0 in	3 ft

Shields

Shield Name	Dimension	Material	Density
Cyl. Core	3.81 cm	Concrete	1.8
Shield 1	.65 cm	Iron	7.86
Transition		Concrete	2.4
Shield 3	30.48 cm	Concrete	2.4
Air Gap		Air	0.00122
Wall Clad	.025 cm	Iron	7.86

Source Input
Grouping Method : Actual Photon Energies

Nuclide	curies	becquerels	μCi/cm³	Bq/cm³
Co-60	3.2835e-011	1.2149e+000	4.5000e-009	1.6650e-004

Buildup
The material reference is : Cyl. Core

Integration Parameters

Y Direction (axial)	20
Circumferential	20

Results

Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.6936	1.982e-04	7.198e-14	1.483e-12	1.390e-16	2.863e-15
1.1732	1.215e+00	4.612e-09	4.692e-08	8.242e-12	8.384e-11
1.3325	1.215e+00	7.828e-09	6.818e-08	1.358e-11	1.183e-10

Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
TOTALS:	2.430e+00	1.244e-08	1.151e-07	2.182e-11	2.021e-10

MicroShield v5.05 (5.05-00362)
Radiological Services, Inc.
Conversion of calculated exposure in air to dose
FILE: C:\MS5\DATA\PB020412.MS5
Case Title: Line 1.24 AF-D
This case was run on Saturday, February 4, 2006 at 2:44:33 PM
Dose Point # 1 - (134.97,152.4,91.44) cm

Results (Summed over energies)	Units	Without Buildup	With Buildup
Photon Fluence Rate (flux)	Photons/cm²/sec	9.806e-009	9.116e-008
Photon Energy Fluence Rate	MeV/cm²/sec	1.244e-008	1.151e-007
Exposure and Dose Rates:			
Exposure Rate in Air	mR/hr	2.182e-011	2.021e-010
Absorbed Dose Rate in Air	mGy/hr	1.905e-013	1.765e-012
"	mrad/hr	1.905e-011	1.765e-010
Deep Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	2.163e-013	2.004e-012
o Opposed	"	1.863e-013	1.725e-012
o Rotational	"	1.863e-013	1.725e-012
o Isotropic	"	1.664e-013	1.541e-012
Shallow Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	2.302e-013	2.133e-012
o Opposed	"	2.217e-013	2.054e-012
o Rotational	"	2.217e-013	2.054e-012
o Isotropic	"	1.763e-013	1.633e-012
Effective Dose Equivalent Rate	(ICRP 51 - 1987)		
o Anterior/Posterior Geometry	mSv/hr	1.948e-013	1.804e-012
o Posterior/Anterior	"	1.794e-013	1.662e-012
o Lateral	"	1.427e-013	1.321e-012
o Rotational	"	1.616e-013	1.496e-012
o Isotropic	"	1.430e-013	1.324e-012

MicroShield v5.05 (5.05-00362)
Radiological Services, Inc.

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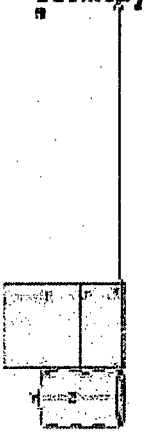
DOS File : PB020413.MS5
Run Date: February 4, 2006
R Time: 2:58:20 PM
Duration : 00:00:00

File Ref: _____
Date: _____
By: _____
Checked: _____

Case Title: Line 1.641 AF-A
Description: PBRF Rev Model Co-60 Area Factor Calculation
Geometry: 10 - Cylinder Surface - External Dose Point



Source Dimensions

Height	30.48 cm	1 ft
Radius	10.16 cm	4.0 in

Dose Points

	X	Y	Z
# 1	141.32 cm	15.24 cm	91.44 cm
	4 ft 7.6 in	6.0 in	3 ft

Shields

Shield Name	Dimension	Material	Density
Cyl. Core	10.16 cm	Concrete	1.8
Shield 1	.65 cm	Iron	7.86
Transition		Concrete	2.4
Shield 3	30.48 cm	Concrete	2.4
Air Gap		Air	0.00122
Wall Clad	.025 cm	Iron	7.86

Source Input
Grouping Method : Actual Photon Energies

Nuclide	curies	becquerels	μCi/cm²	Bq/cm²
Co-60	8.7559e-012	3.2397e-001	4.5000e-009	1.6650e-004

Buildup
The material reference is : Cyl. Core

Integration Parameters

Y Direction (axial)	20
Circumferential	20

Results

Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.6938	5.285e-05	2.406e-14	4.708e-13	4.646e-17	9.090e-16
1.1732	3.240e-01	1.459e-09	1.440e-08	2.807e-12	2.573e-11
1.3325	3.240e-01	2.451e-09	2.080e-08	4.253e-12	3.609e-11

Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
TOTALS:	6.480e-01	3.910e-09	3.520e-08	6.860e-12	6.182e-11

MicroShield v5.05 (5.05-00362)
Radiological Services, Inc.
Conversion of calculated exposure in air to dose
FILE: C:\MS5\DATA\PB020413.MS5
Case Title: Line 1.641 AF-A
This case was run on Saturday, February 4, 2006 at 2:58:20 PM
Dose Point # 1 - (141.32,15.24,91.44) cm

Results (Summed over energies)	Units	Without Buildup	With Buildup
Photon Fluence Rate (flux)	Photons/cm²/sec	3.083e-009	2.789e-008
Photon Energy Fluence Rate	MeV/cm²/sec	3.910e-009	3.520e-008
Exposure and Dose Rates:			
Exposure Rate in Air	mR/hr	6.660e-012	6.182e-011
Absorbed Dose Rate in Air	mGy/hr	5.989e-014	5.397e-013
"	mrad/hr	5.989e-012	5.397e-011
Deep Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	6.799e-014	6.128e-013
o Opposed	"	5.856e-014	5.276e-013
o Rotational	"	5.856e-014	5.276e-013
o Isotropic	"	5.231e-014	4.713e-013
Shallow Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	7.237e-014	6.524e-013
o Opposed	"	6.968e-014	6.281e-013
o Rotational	"	6.968e-014	6.281e-013
o Isotropic	"	5.542e-014	4.994e-013
Effective Dose Equivalent Rate	(ICRP 51 - 1987)		
o Anterior/Posterior Geometry	mSv/hr	6.122e-014	5.518e-013
o Posterior/Anterior	"	5.640e-014	5.082e-013
o Lateral		4.486e-014	4.041e-013
o Rotational		5.079e-014	4.576e-013
o Isotropic		4.495e-014	4.049e-013

MicroShield v5.05 (5.05-00362)
Radiological Services, Inc.

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DOS File : PB020414.MS5
Run Date: February 4, 2006
R Time: 3:00:06 PM
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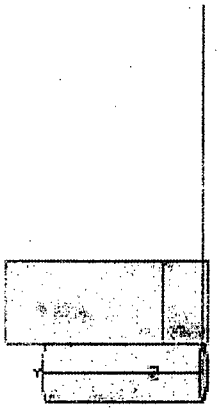
File Ref: _____
Date: _____
By: _____
Checked: _____

Case Title: Line 1.641 AF-B
Description: PBRF Rev Model Co-60 Area Factor Calculation
Geometry: 10 - Cylinder Surface - External Dose Point



Source Dimensions

Height	60.96 cm	2 ft
Radius	10.16 cm	4.0 in

Dose Points

	X	Y	Z
# 1	141.32 cm	30.48 cm	91.44 cm
	4 ft 7.6 in	1 ft	3 ft

Shields

Shield Name	Dimension	Material	Density
Cyl. Core	10.16 cm	Concrete	1.6
Shield 1	.65 cm	Iron	7.86
Transition		Concrete	2.4
Shield 3	30.48 cm	Concrete	2.4
Air Gap		Air	0.00122
Wall Clad	.025 cm	Iron	7.86

Source Input
Grouping Method : Actual Photon Energies

Nuclide	curies	becquerels	μCi/cm²	Bq/cm²
Co-60	1.7512e-011	6.4794e-001	4.5000e-009	1.6650e-004

Buildup
The material reference is : Cyl. Core

Integration Parameters

Y Direction (axial)	20
Circumferential	20

Results

Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.6938	1.057e-04	4.615e-14	9.085e-13	8.910e-17	1.754e-15
1.1732	6.479e-01	2.617e-09	2.795e-08	5.035e-12	4.994e-11
1.3325	6.479e-01	4.742e-09	4.043e-08	8.228e-12	7.014e-11

DOS File : PB020414.MS5
Run Date: February 4, 2006
Run Time: 3:00:06 PM
Duration : 00:00:00

ergy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
TOTALS:	1.296e+00	7.560e-09	6.838e-08	1.326e-11	1.201e-10

MicroShield v5.05 (5.05-00362)
Radiological Services, Inc.
Conversion of calculated exposure in air to dose
FILE: C:\MS5\DATA\PB020414.MS5
Case Title: Line 1.641 AF-B
This case was run on Saturday, February 4, 2006 at 3:00:06 PM
Dose Point # 1 - (141.32,30.48,91.44) cm

Results (Summed over energies)	Units	Without Buildup	With Buildup
Photon Fluence Rate (flux)	Photons/cm²/sec	5.961e-009	5.416e-008
Photon Energy Fluence Rate	MeV/cm²/sec	7.560e-009	6.838e-008
Exposure and Dose Rates:			
Exposure Rate in Air	mR/hr	1.326e-011	1.201e-010
Absorbed Dose Rate in Air	mGy/hr	1.158e-013	1.048e-012
"	mrad/hr	1.158e-011	1.048e-010
Deep Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	1.314e-013	1.190e-012
o Opposed	"	1.132e-013	1.025e-012
o Rotational	"	1.132e-013	1.025e-012
o Isotropic	"	1.011e-013	9.154e-013
Shallow Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	1.399e-013	1.267e-012
o Opposed	"	1.347e-013	1.220e-012
o Rotational	"	1.347e-013	1.220e-012
o Isotropic	"	1.071e-013	9.700e-013
Effective Dose Equivalent Rate	(ICRP 51 - 1987)		
o Anterior/Posterior Geometry	mSv/hr	1.184e-013	1.072e-012
o Posterior/Anterior	"	1.090e-013	9.872e-013
o Lateral	"	8.674e-014	7.848e-013
o Rotational	"	9.819e-014	8.889e-013
o Isotropic	"	8.691e-014	7.865e-013

MicroShield v5.05 (5.05-00362)
Radiological Services, Inc.

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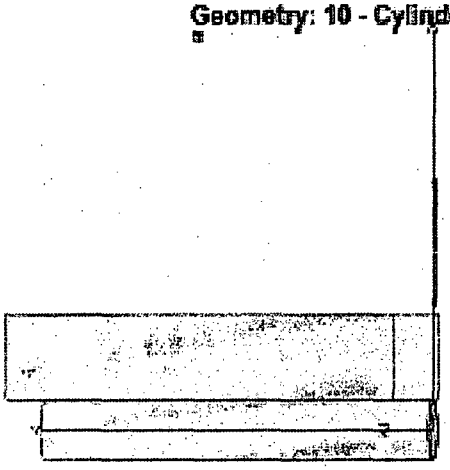
DOS File : PB020415.MS5
Run Date : February 4, 2006
R Time: 3:01:23 PM
Duration : 00:00:00

File Ref: _____
Date: _____
By: _____
Checked: _____

Case Title: Line 1.641 AF-C
Description: PBRF Rev Model Co-60 Area Factor Calculation
Geometry: 10 - Cylinder Surface - External Dose Point



Source Dimensions

Height	152.4 cm	5 ft 0.0 in
Radius	10.16 cm	4.0 in

Dose Points

	X	Y	Z
# 1	141.32 cm	76.2 cm	91.44 cm
	4 ft 7.6 in	2 ft 6.0 in	3 ft

Shields

Shield Name	Dimension	Material	Density
Cyl. Core	10.16 cm	Concrete	1.8
Shield 1	.65 cm	Iron	7.86
Transition		Concrete	2.4
Shield 3	30.48 cm	Concrete	2.4
Air Gap		Air	0.00122
Wall Clad	.025 cm	Iron	7.86

Source Input
Grouping Method : Actual Photon Energies

Nuclide	curies	becquerels	μCi/cm³	Bq/cm³
Co-60	4.3760e-011	1.6198e+000	4.5000e-009	1.6650e-004

Buildup
The material reference is : Cyl. Core

Integration Parameters

Y Direction (axial)	20
Circumferential	20

Results

Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.6938	2.642e-04	8.998e-14	1.828e-12	1.737e-16	3.529e-15
1.1732	1.620e+00	5.703e-09	5.807e-08	1.019e-11	1.038e-10
1.3325	1.620e+00	9.682e-09	8.463e-08	1.680e-11	1.468e-10

Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
TOTALS:	3.240e+00	1.530e-08	1.427e-07	2.699e-11	2.506e-10

MicroShield v5.05 (5.05-00362)
Radiological Services, Inc.
Conversion of calculated exposure in air to dose
FILE: C:\MS5\DATA\PB020415.MS5
Case Title: Line 1.641 AF-C
This case was run on Saturday, February 4, 2006 at 3:01:23 PM
Dose Point # 1 - (141.32,76.2,91.44) cm

Results (Summed over energies)	Units	Without Buildup	With Buildup
Photon Fluence Rate (flux)	Photons/cm²/sec	1.213e-006	1.130e-007
Photon Energy Fluence Rate	MeV/cm²/sec	1.538e-006	1.427e-007
Exposure and Dose Rates:			
Exposure Rate in Air	mR/hr	2.699e-011	2.506e-010
Absorbed Dose Rate in Air	mGy/hr	2.356e-013	2.188e-012
"	mrad/hr	2.356e-011	2.188e-010
Deep Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	2.675e-013	2.484e-012
o Opposed	"	2.304e-013	2.139e-012
o Rotational		2.304e-013	2.139e-012
o Isotropic	"	2.058e-013	1.910e-012
Shallow Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	2.847e-013	2.644e-012
o Opposed	"	2.742e-013	2.546e-012
o Rotational	"	2.742e-013	2.546e-012
o Isotropic	"	2.180e-013	2.024e-012
Effective Dose Equivalent Rate	(ICRP 51 - 1987)		
o Anterior/Posterior Geometry	mSv/hr	2.409e-013	2.237e-012
o Posterior/Anterior	"	2.219e-013	2.060e-012
o Lateral	"	1.765e-013	1.638e-012
o Rotational		1.998e-013	1.855e-012
o Isotropic		1.769e-013	1.641e-012

MicroShield v5.05 (5.05-00362)
Radiological Services, Inc.

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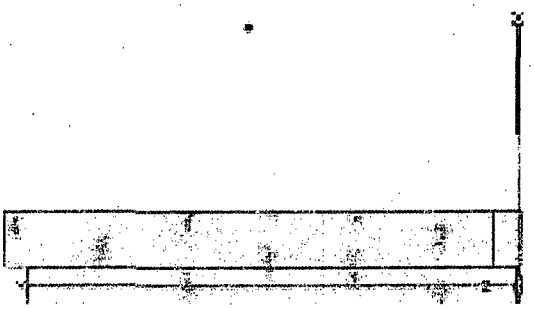
DOS File : PB020416.MS5
Run Date : February 4, 2006
R Time: 3:02:23 PM
Duration : 00:00:00

File Ref: _____
Date: _____
By: _____
Checked: _____

Case Title: Line 1.641 AF-D
Description: PBRF Rev Model Co-60 Area Factor Calculation
Geometry: 10 - Cylinder Surface - External Dose Point



Source Dimensions

Height	304.8 cm	10 ft 0.0 in
Radius	10.16 cm	4.0 in

Dose Points

	X	Y	Z
# 1	141.32 cm	152.4 cm	91.44 cm
	4 ft 7.6 in	5 ft 0.0 in	3 ft

Shields

Shield Name	Dimension	Material	Density
Cyl. Core	10.16 cm	Concrete	1.8
Shield 1	.65 cm	Iron	7.86
Transition		Concrete	2.4
Shield 3	30.48 cm	Concrete	2.4
Air Gap		Air	0.00122
Wall Clad	.025 cm	Iron	7.86

Source Input
Grouping Method : Actual Photon Energies

Nuclide	curies	becquerels	uCi/cm³	Bq/cm³
Co-60	8.7559e-011	3.2397e+000	4.5000e-009	1.6650e-004

Buildup
The material reference is : Cyl. Core

Integration Parameters

Y Direction (axial)	20
Circumferential	20

Results

Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.6938	5.285e-04	1.074e-13	2.262e-12	2.073e-16	4.368e-15
1.1732	3.240e+00	7.136e-09	7.536e-08	1.275e-11	1.347e-10
1.3325	3.240e+00	1.226e-08	1.111e-07	2.128e-11	1.928e-10

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DOS File : PB020416.MS5
Run Date: February 4, 2006
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Duration : 00:00:00

Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
TOTALS:	6.480e+00	1.940e-08	1.865e-07	3.403e-11	3.275e-10

MicroShield v5.05 (5.05-00362)
Radiological Services, Inc.
Conversion of calculated exposure in air to dose
FILE: C:\MS5\DATA\PB020416.MS5
Case Title: Line 1.641 AF-D
This case was run on Saturday, February 4, 2006 at 3:02:23 PM
Dose Point # 1 - (141.32,152.4,91.44) cm

Results (Summed over energies)	Units	Without Buildup	With Buildup
Photon Fluence Rate (flux)	Photons/cm²/sec	1.529e-008	1.477e-007
Photon Energy Fluence Rate	MeV/cm²/sec	1.940e-008	1.865e-007
Exposure and Dose Rates:			
Exposure Rate in Air	mR/hr	3.403e-011	3.275e-010
Absorbed Dose Rate in Air	mGy/hr	2.971e-013	2.859e-012
"	mrad/hr	2.971e-011	2.859e-010
Deep Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	3.372e-013	3.246e-012
o Opposed	"	2.905e-013	2.795e-012
o Rotational	"	2.905e-013	2.795e-012
o Isotropic	"	2.595e-013	2.497e-012
Shallow Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	3.590e-013	3.456e-012
o Opposed	"	3.457e-013	3.327e-012
o Rotational	"	3.457e-013	3.327e-012
o Isotropic	"	2.749e-013	2.645e-012
Effective Dose Equivalent Rate	(ICRP 51 - 1987)		
o Anterior/Posterior Geometry	mSv/hr	3.037e-013	2.923e-012
o Posterior/Anterior	"	2.798e-013	2.692e-012
o Lateral	"	2.226e-013	2.141e-012
o Rotational	"	2.519e-013	2.424e-012
o Isotropic	"	2.230e-013	2.145e-012

Final Status Survey Plan
for the
Plum Brook Reactor Facility

Attachment D

Illustrations of Survey Area Classification

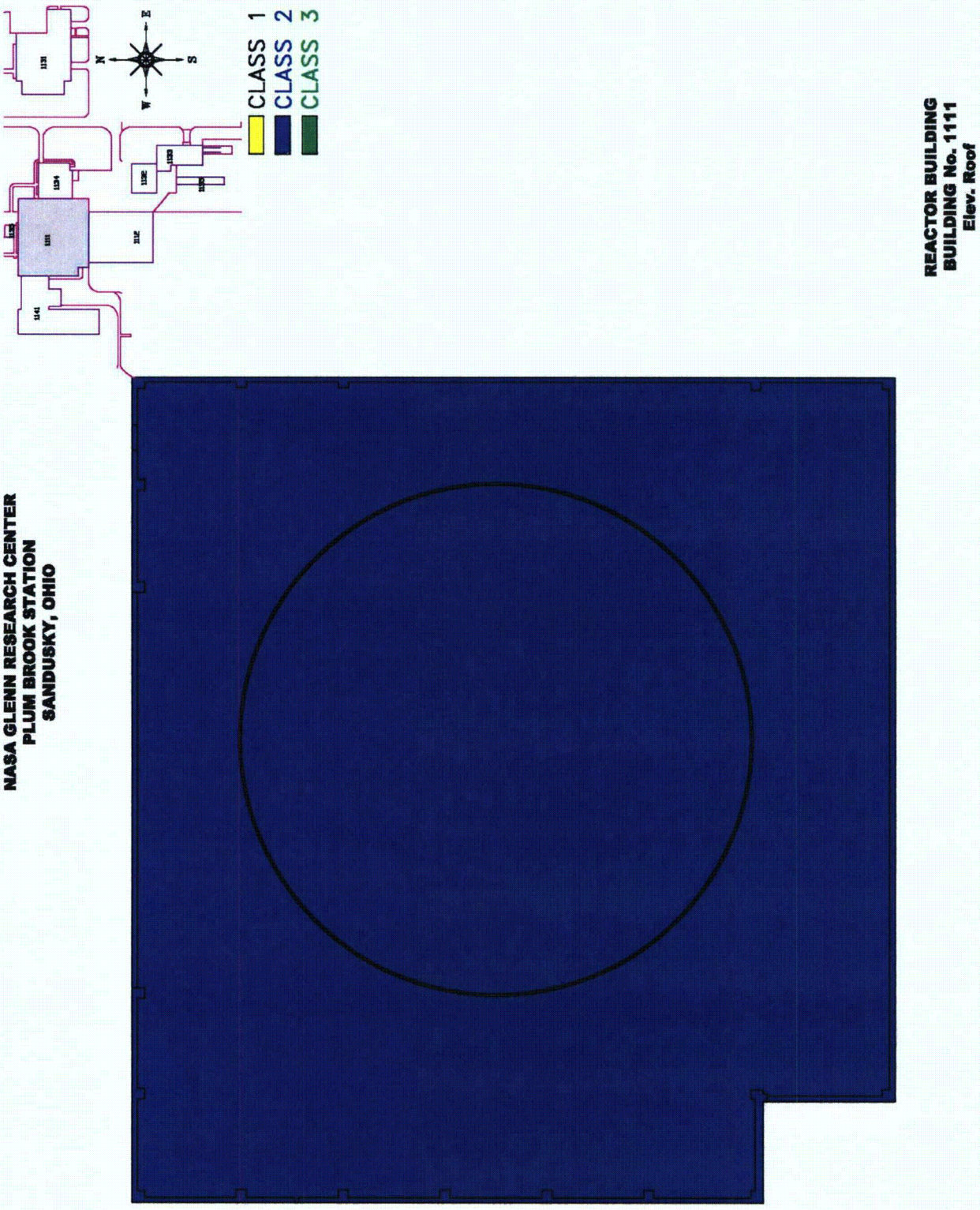

Figure D-1 – Reactor Building Roof Elevation

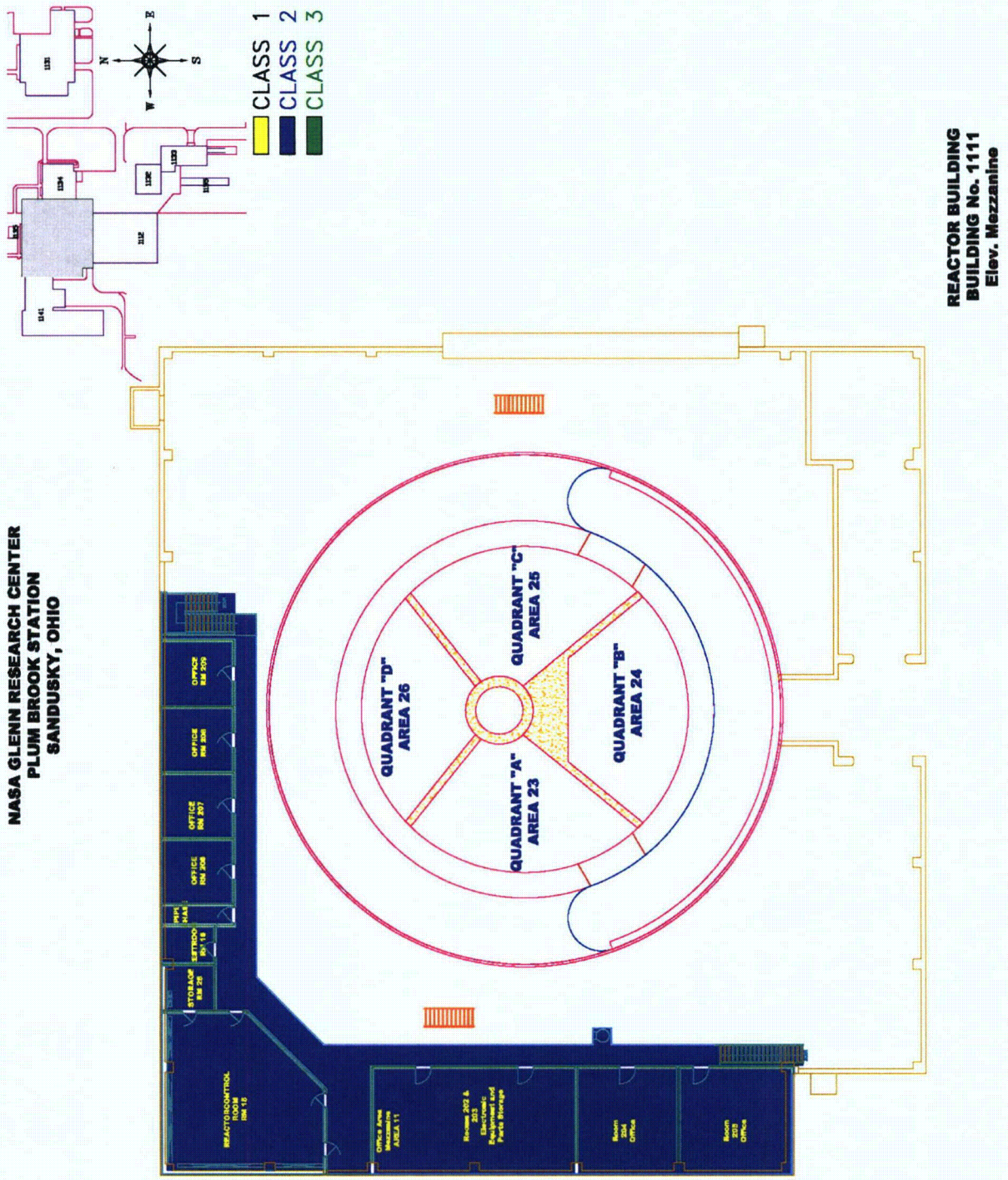

Figure D-2 – Reactor Building Mezzanine Elevation

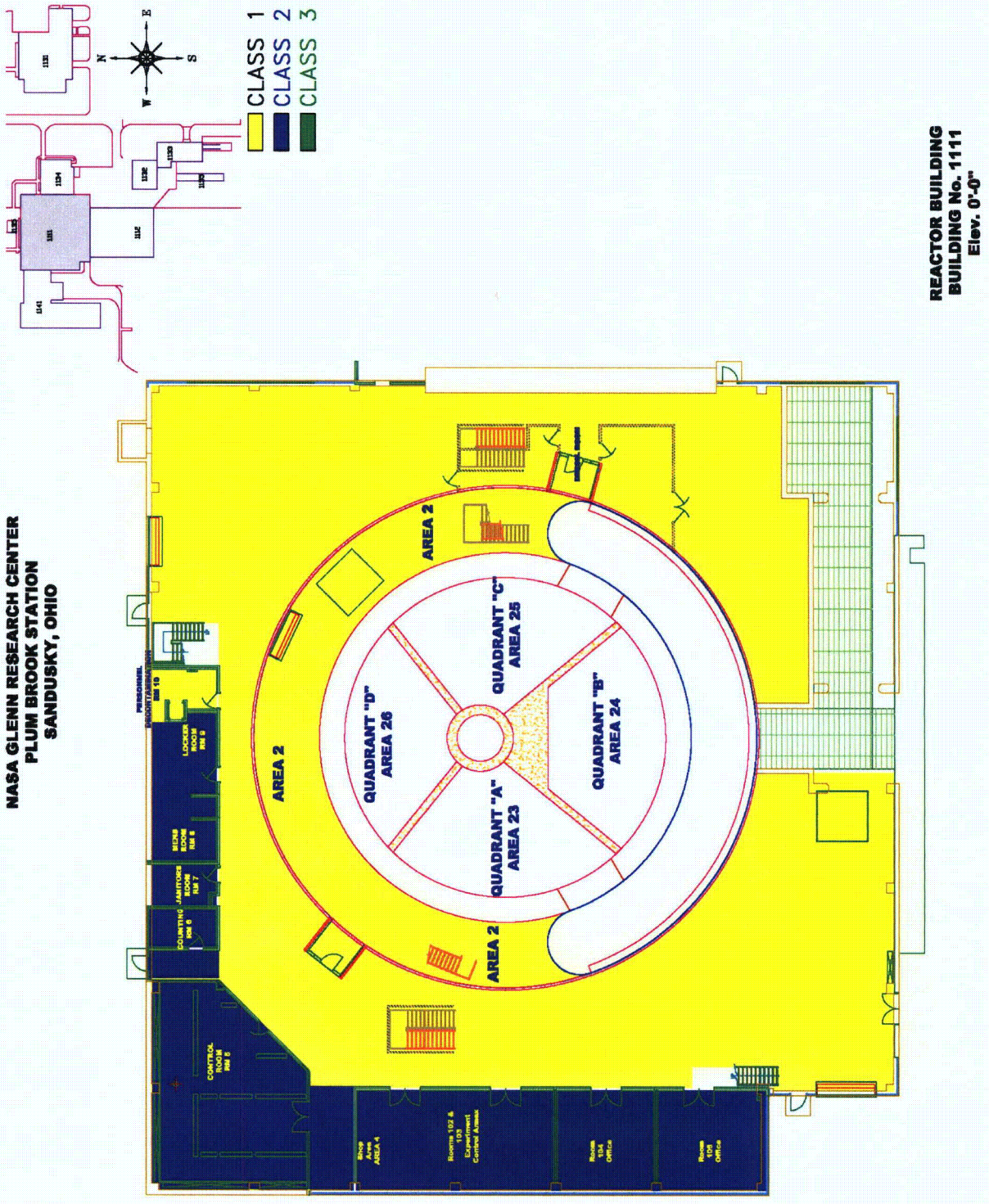

Figure D-3 – Reactor Building 0'-0" Elevation

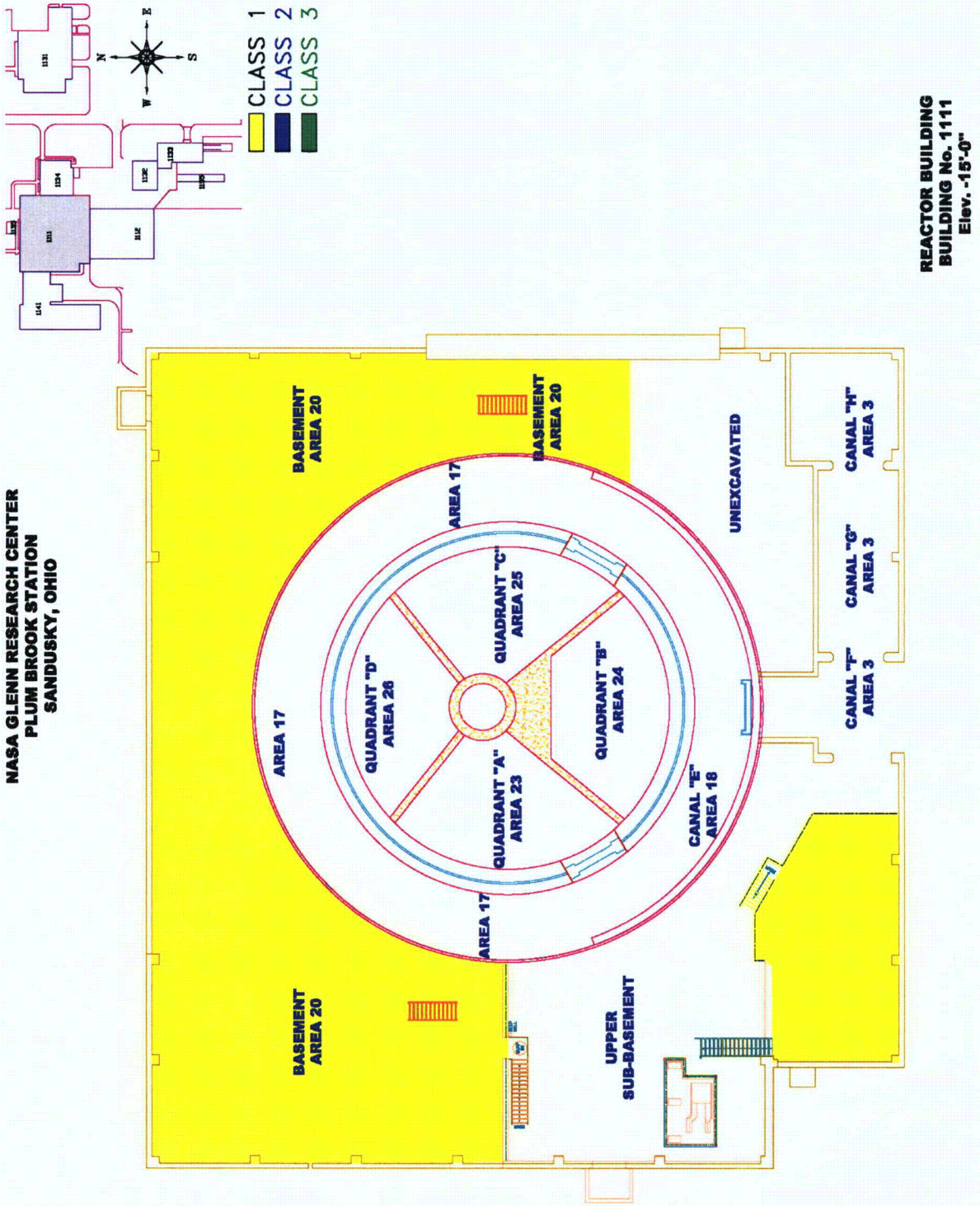

Figure D-4– Reactor Building -15'-0" Elevation

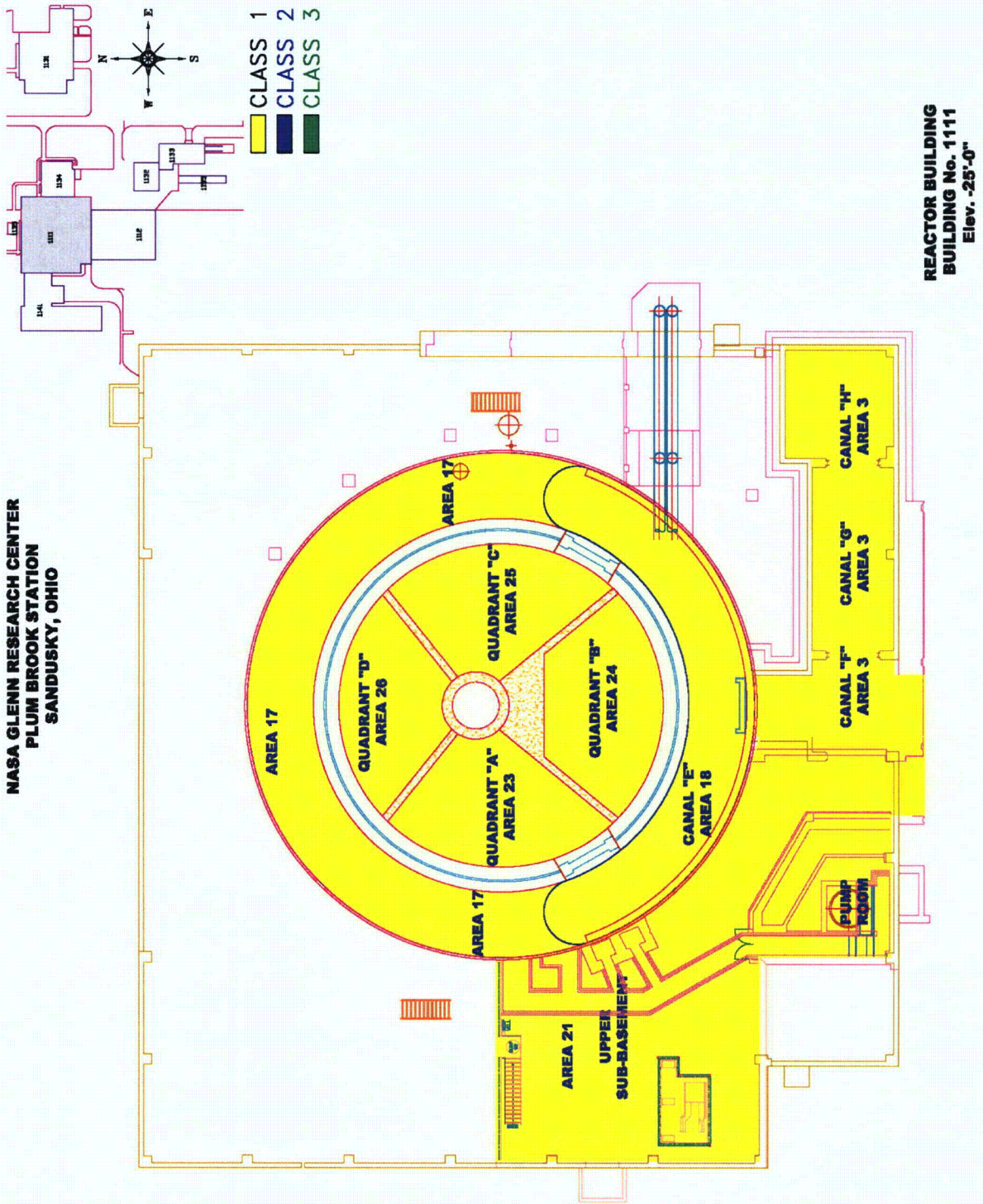

Figure D-5 – Reactor Building -25'-0" Elevation

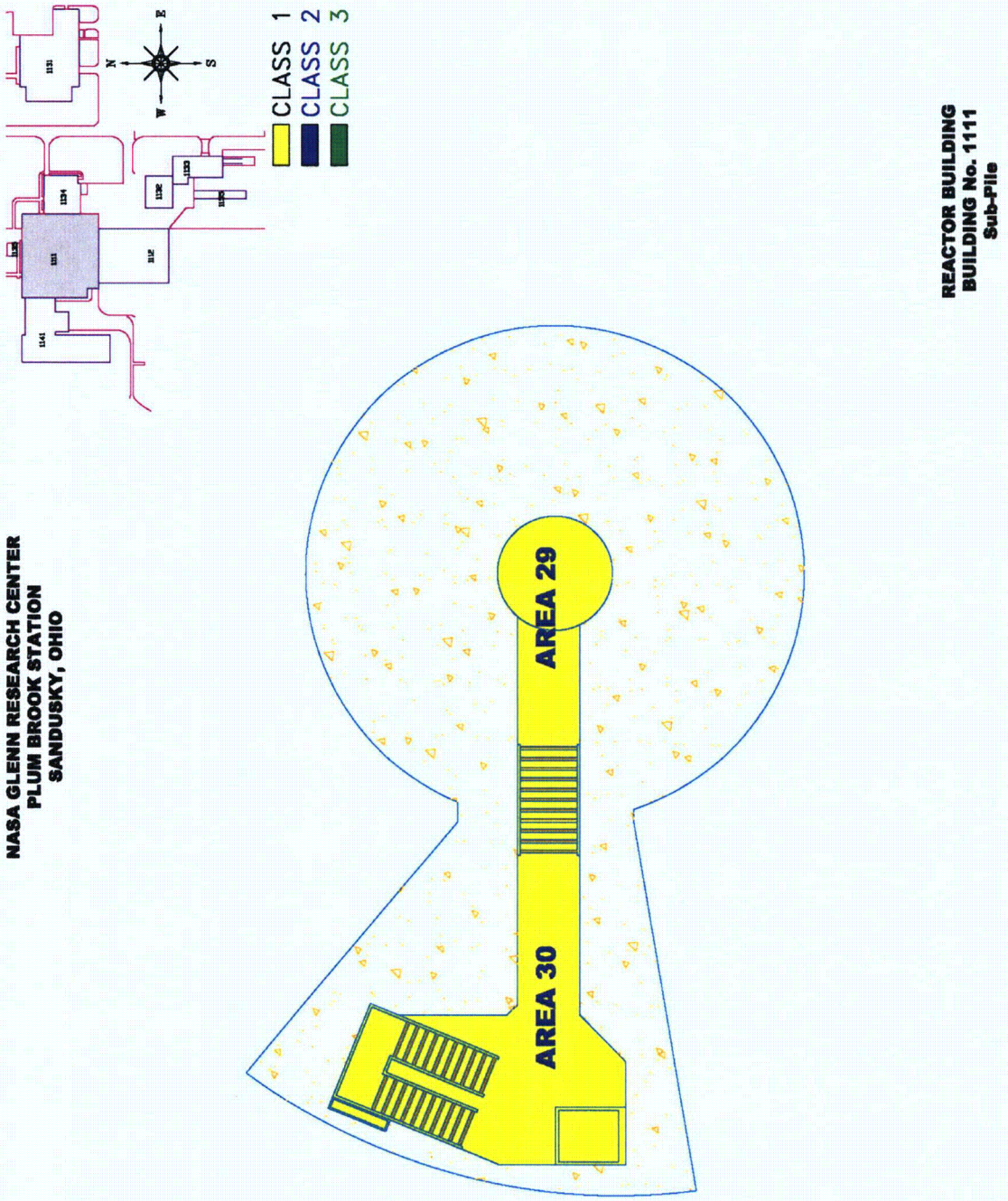

Figure D-6 – Reactor Building Sub-Pile Elevation

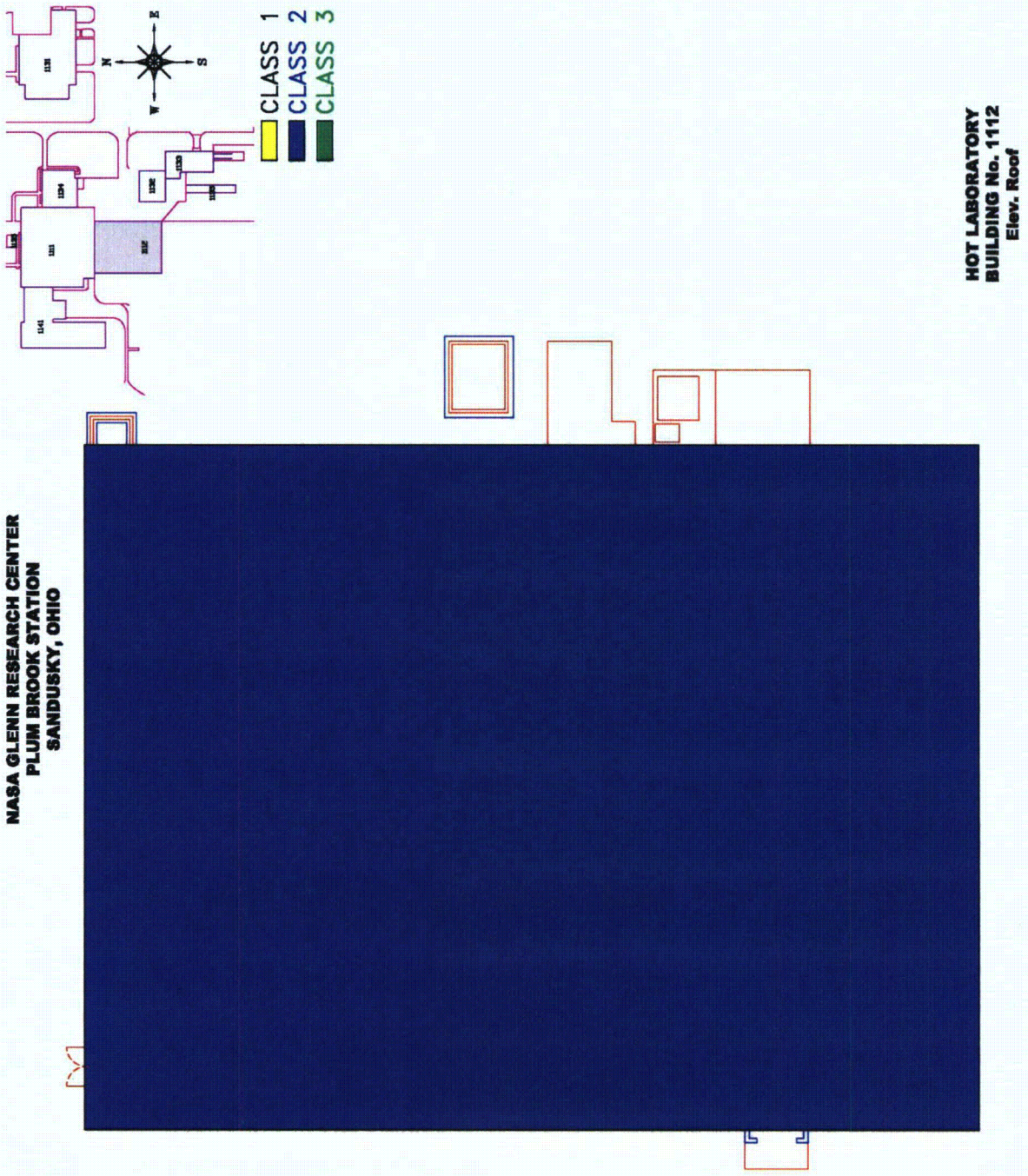

Figure D-7 – Hot Laboratory Building Roof Elevation

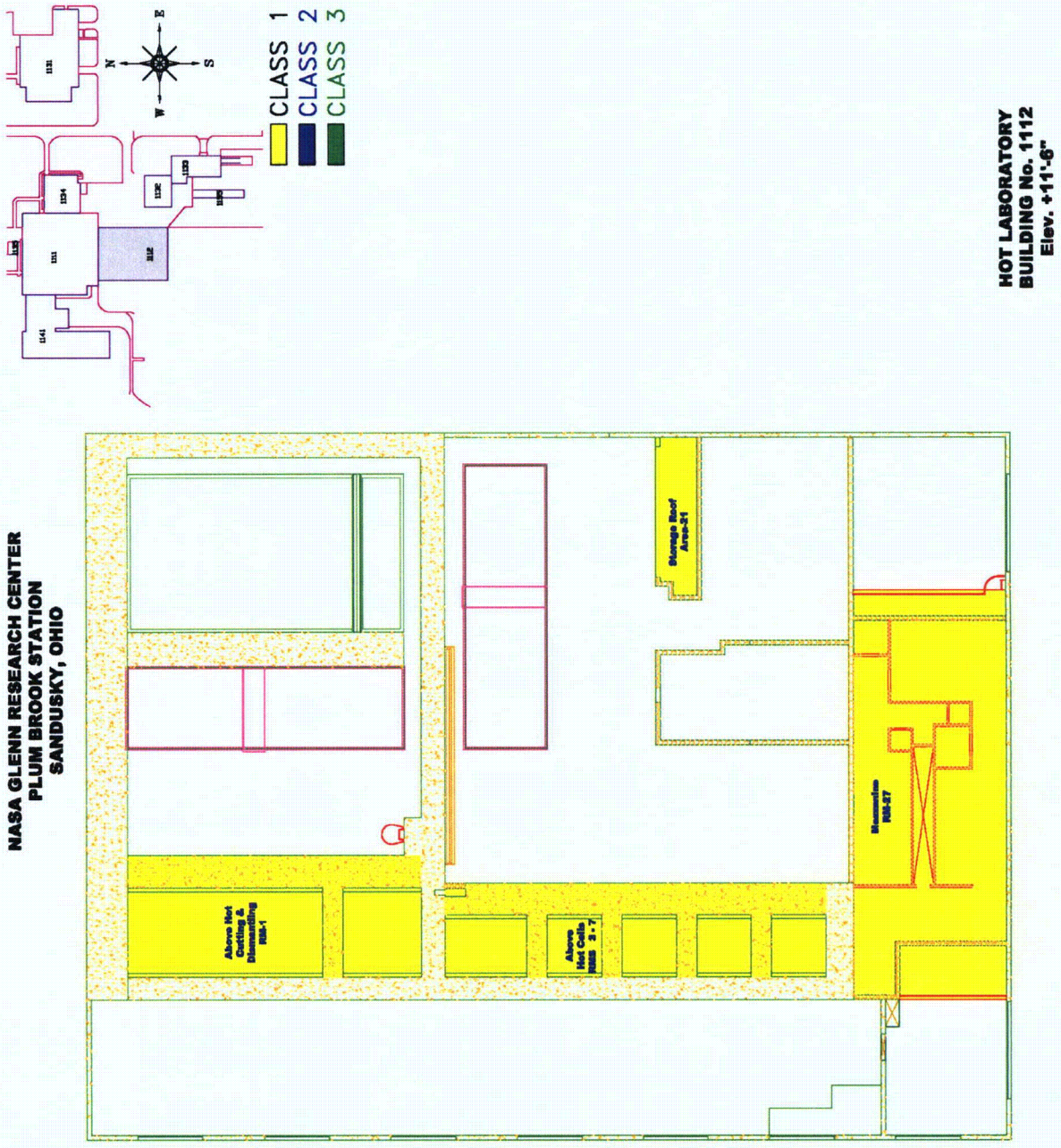

Figure D-8 – Hot Laboratory Building +11'-6" Elevation

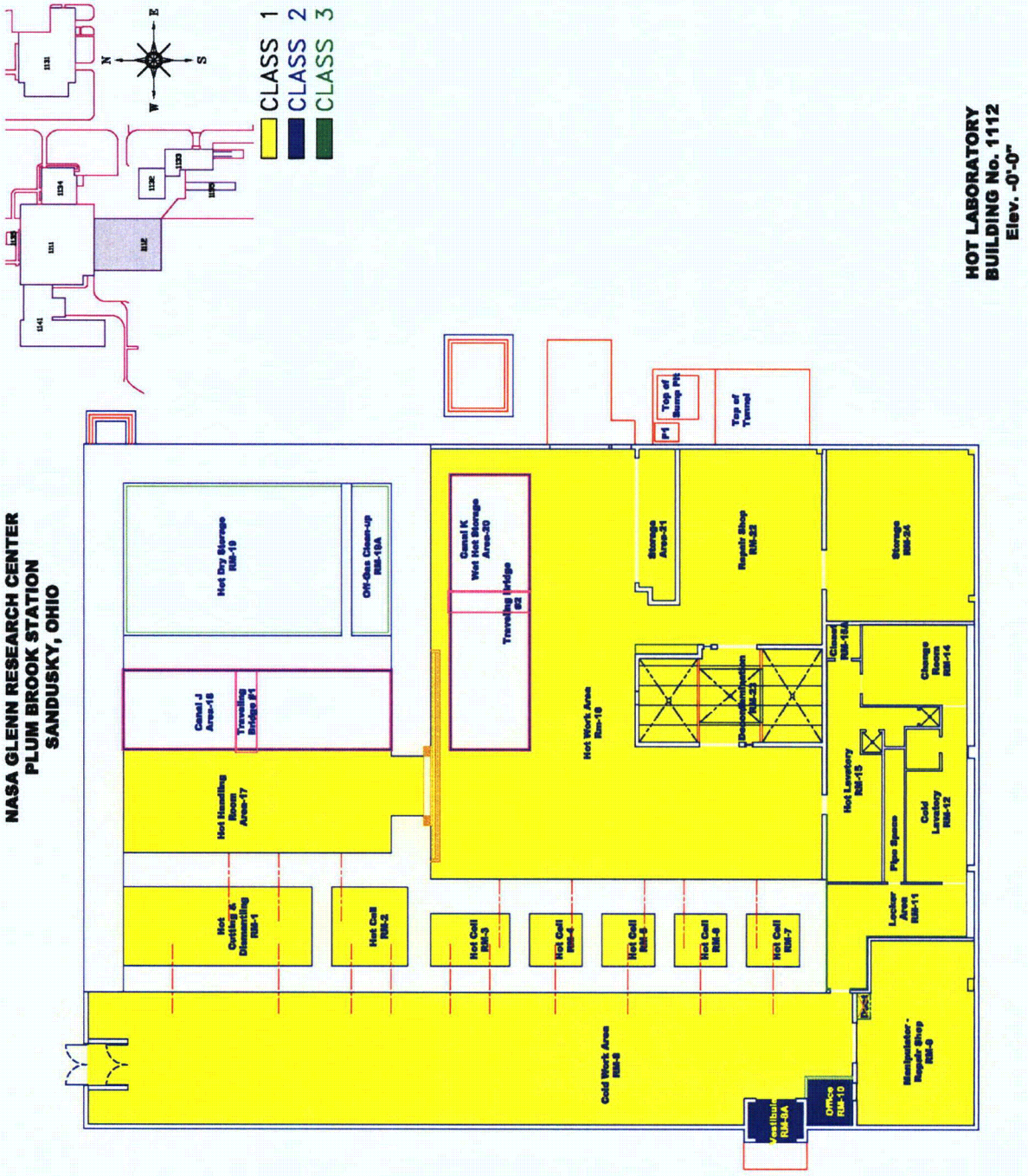

Figure D-9 – Hot Laboratory Building 0'-0" Elevation

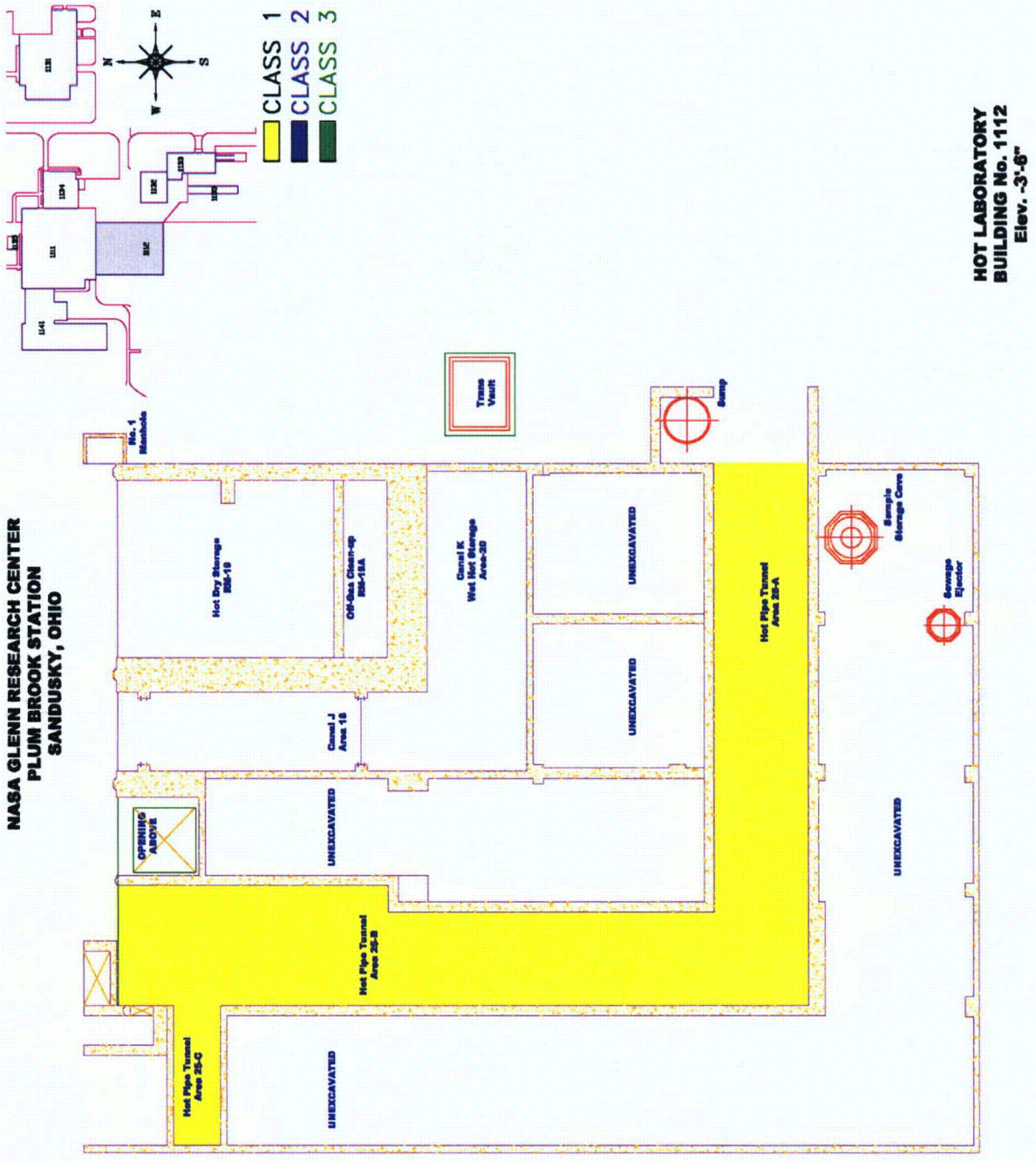

Figure D-10 – Hot Laboratory Building -3'-6" Elevation

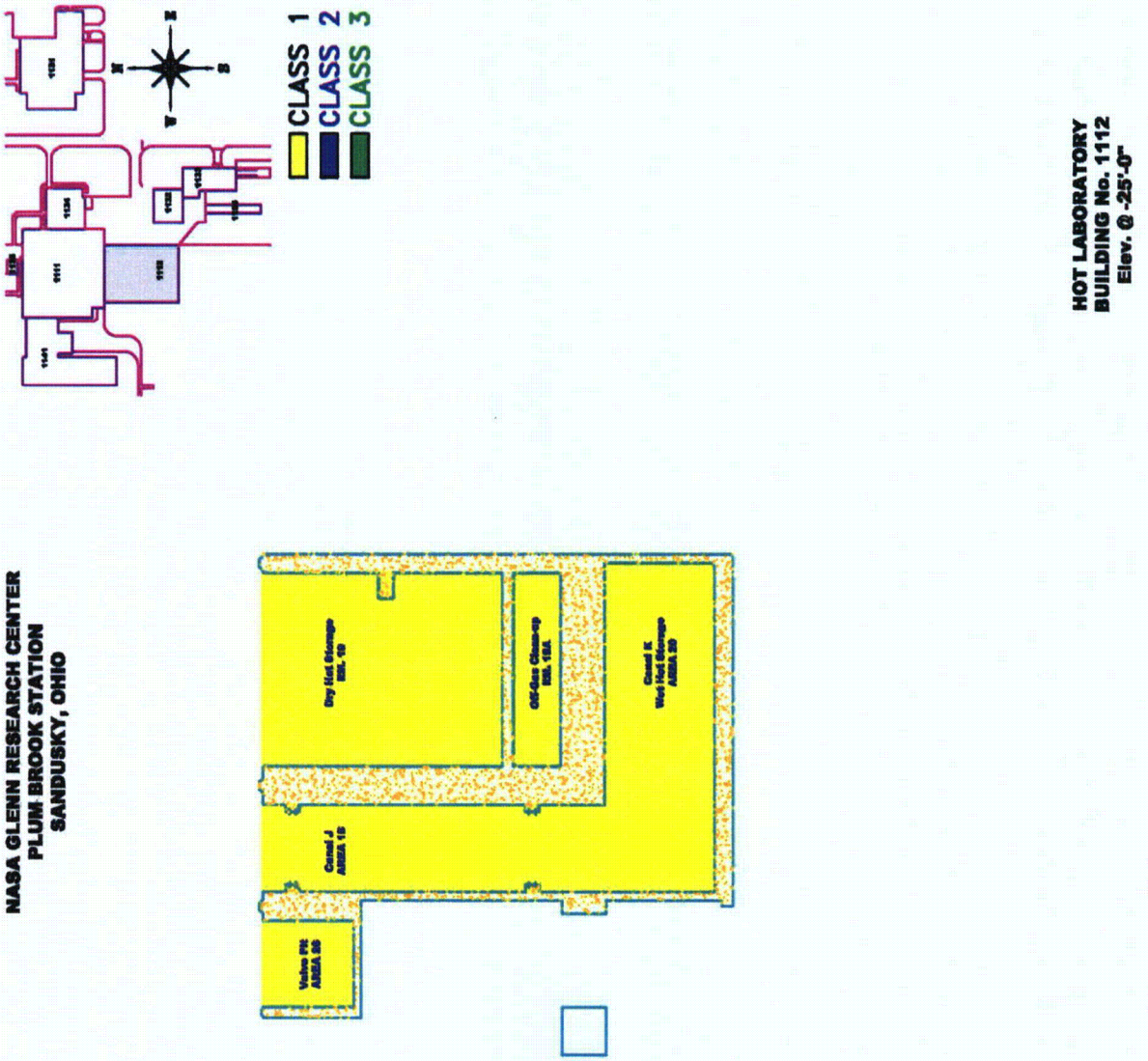

Figure D-11 – Hot Laboratory Building -25'-0" Elevation

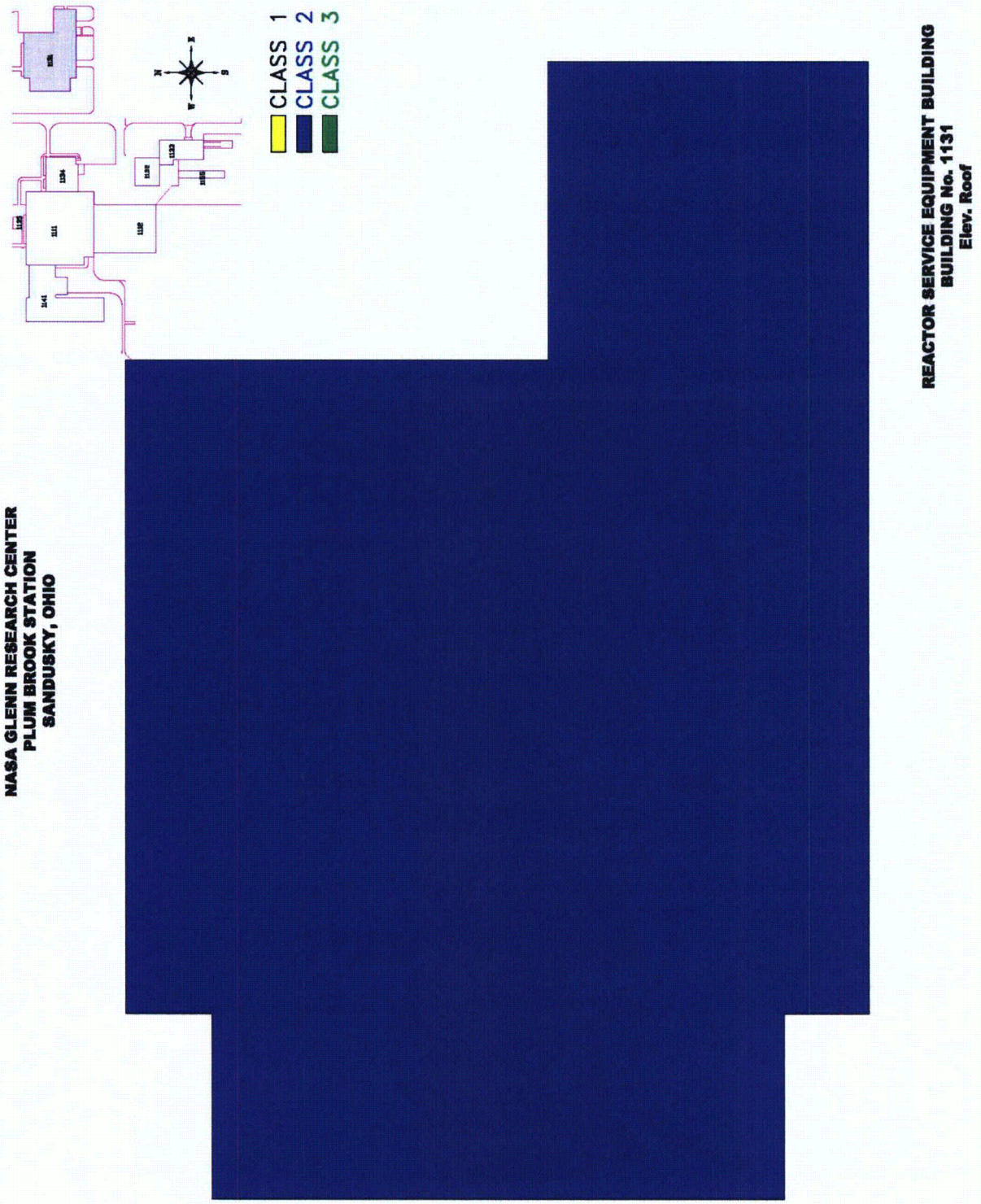

Figure D-12 – Service Equipment Building Roof Elevation

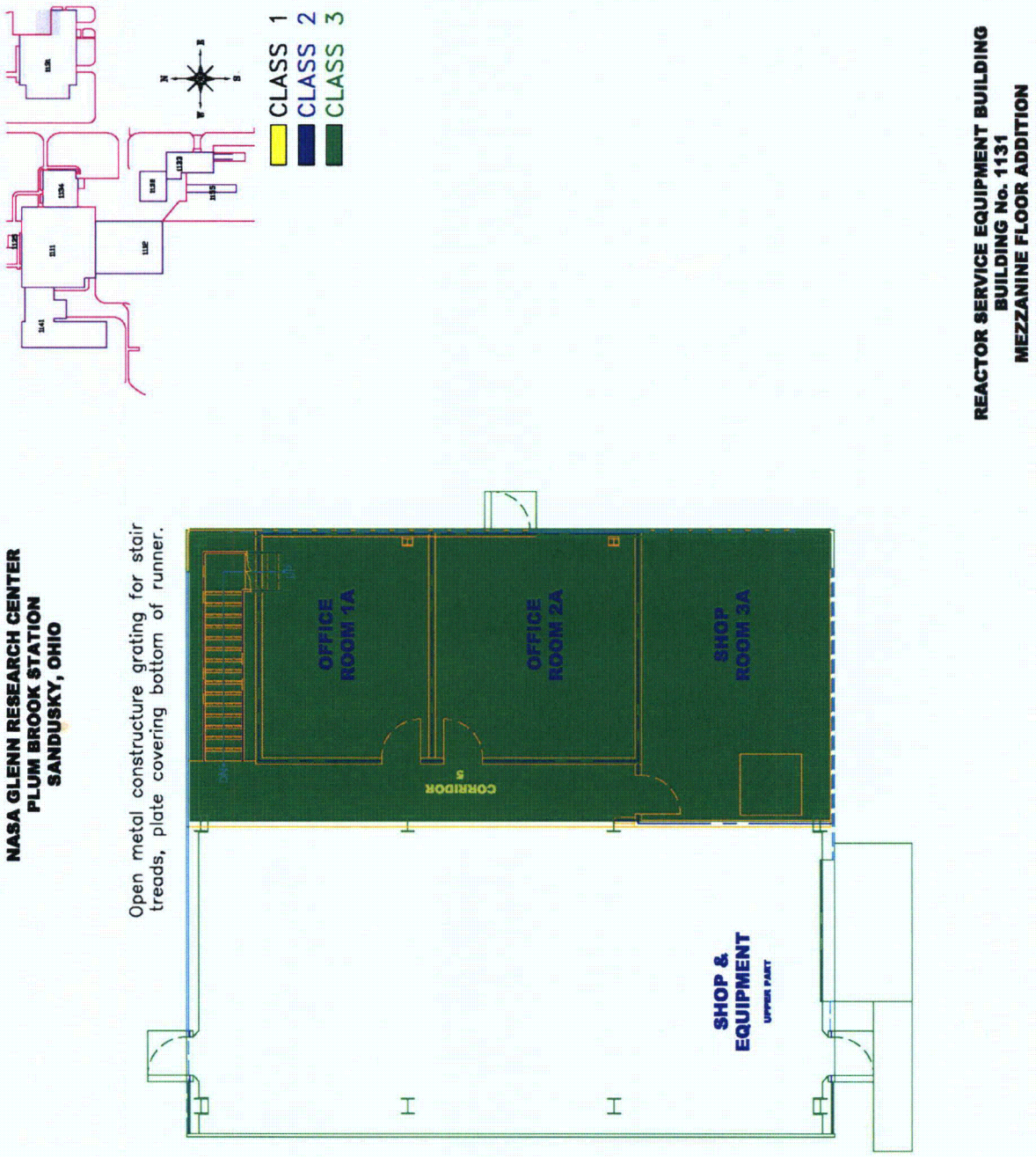

Figure D-13 – Service Equipment Building Mezzanine over Addition

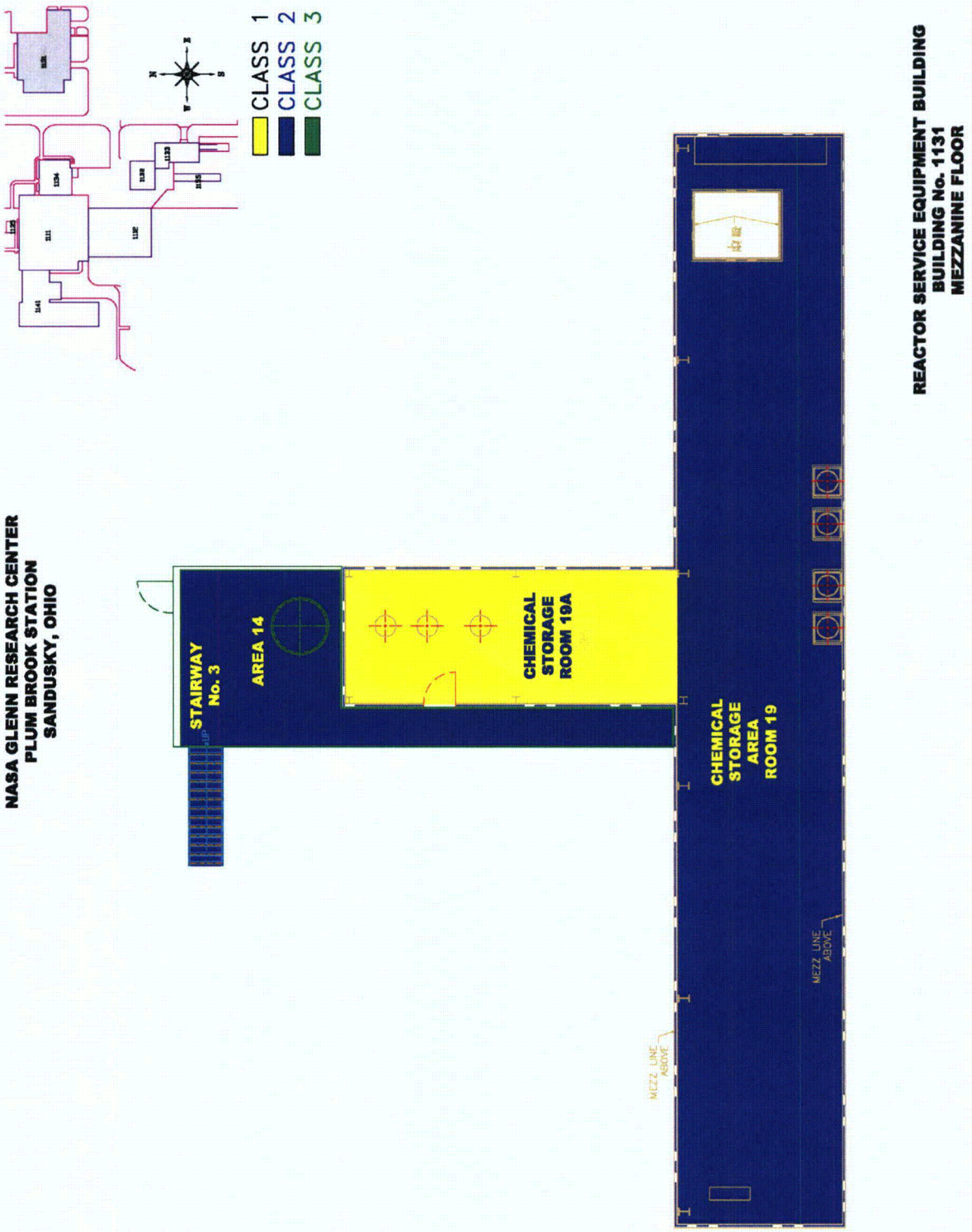

Figure D-14 – Service Equipment Building Mezzanine Elevation

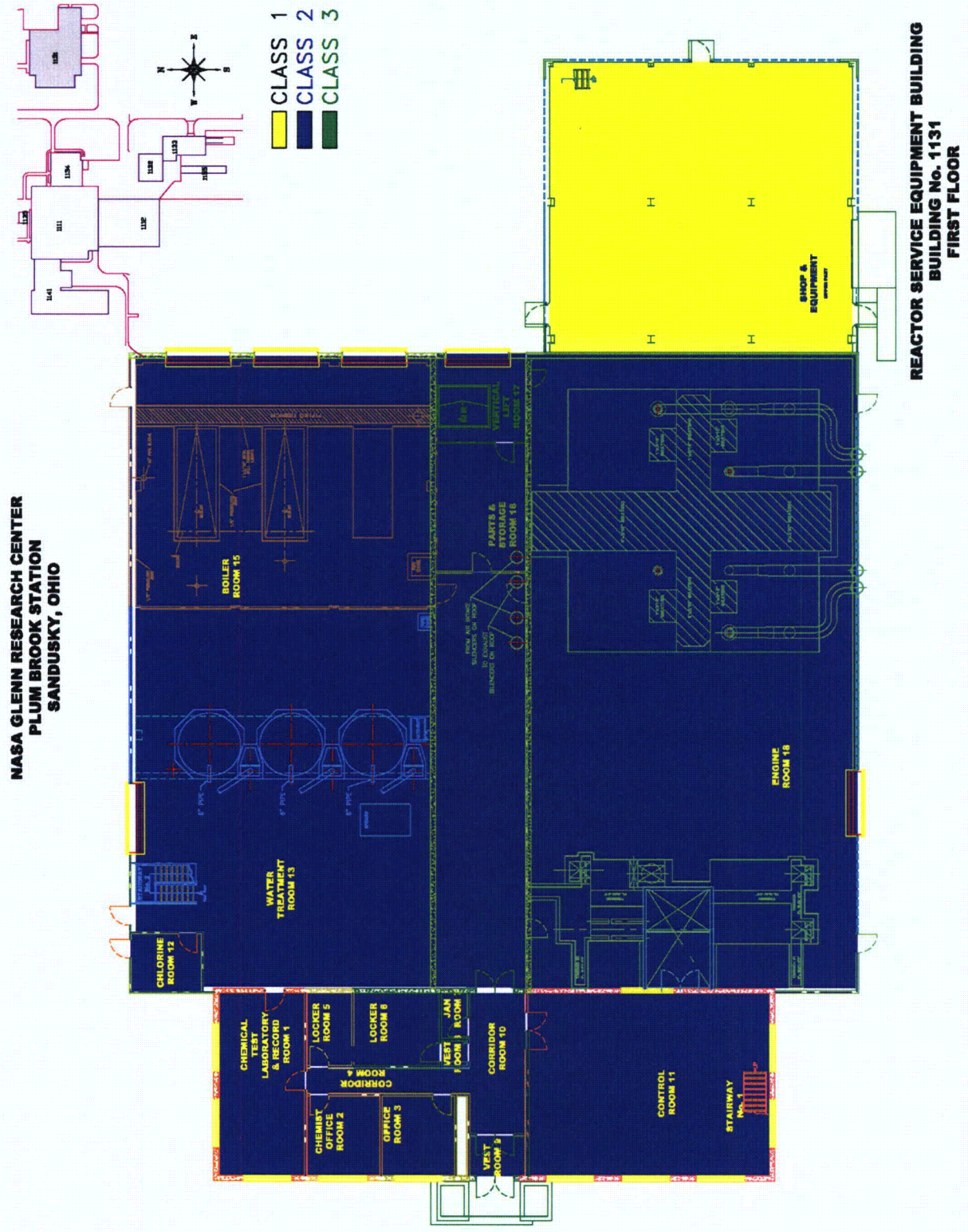

Figure D-15 – Service Equipment Building First Floor Elevation

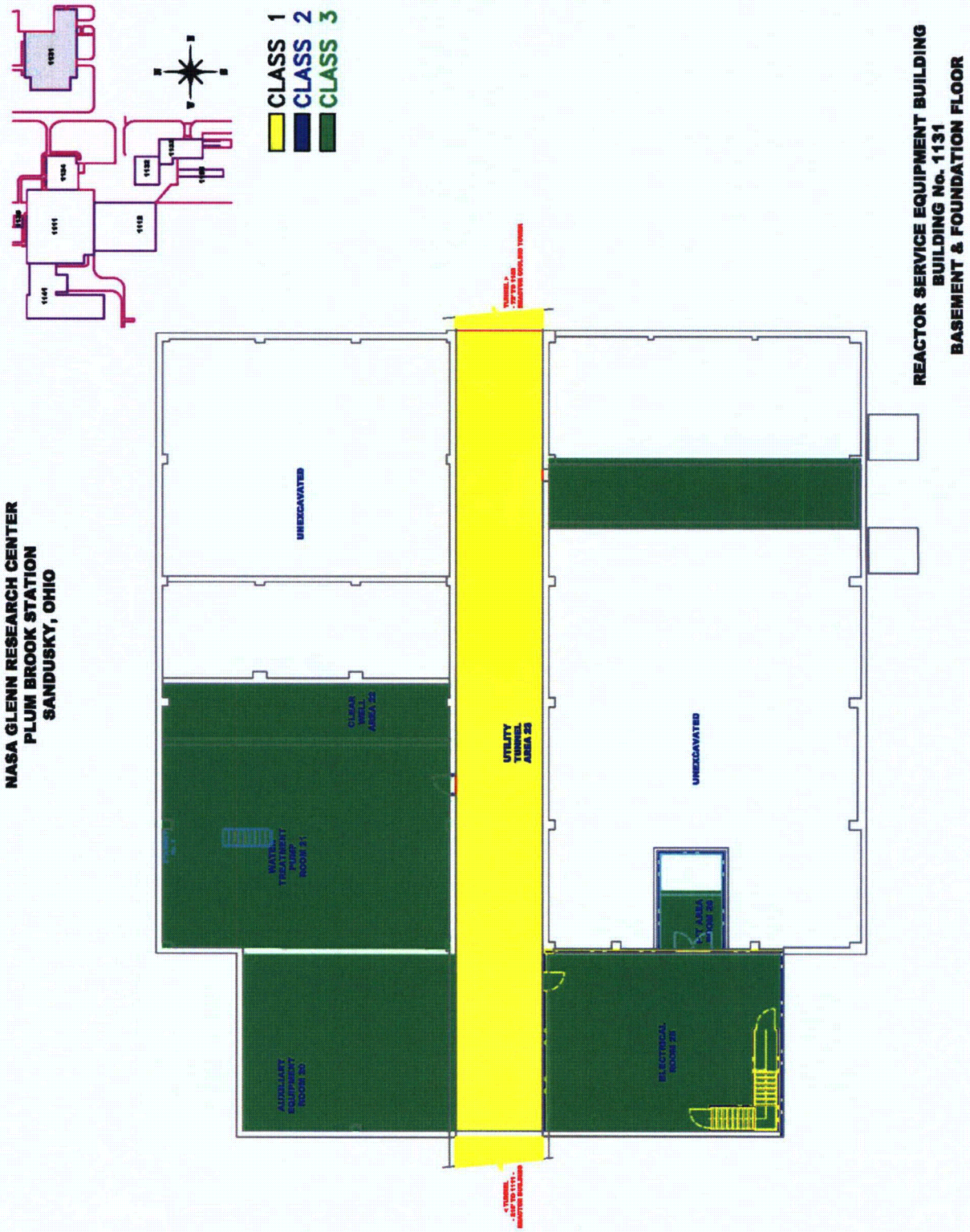

Figure D-16 – Service Equipment Building Basement Elevation

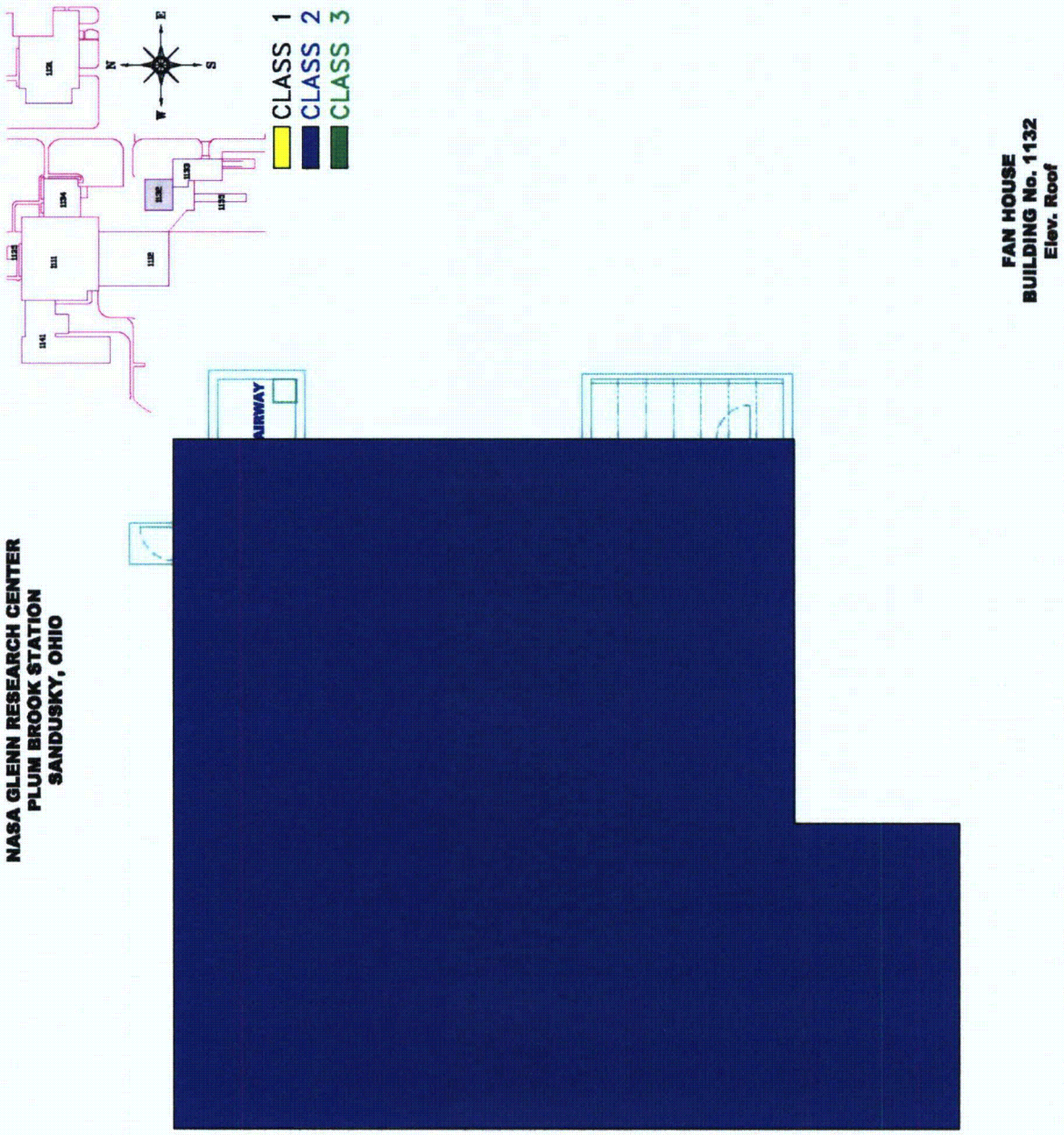

Figure D-17 – Fan House 0'-0" Elevation

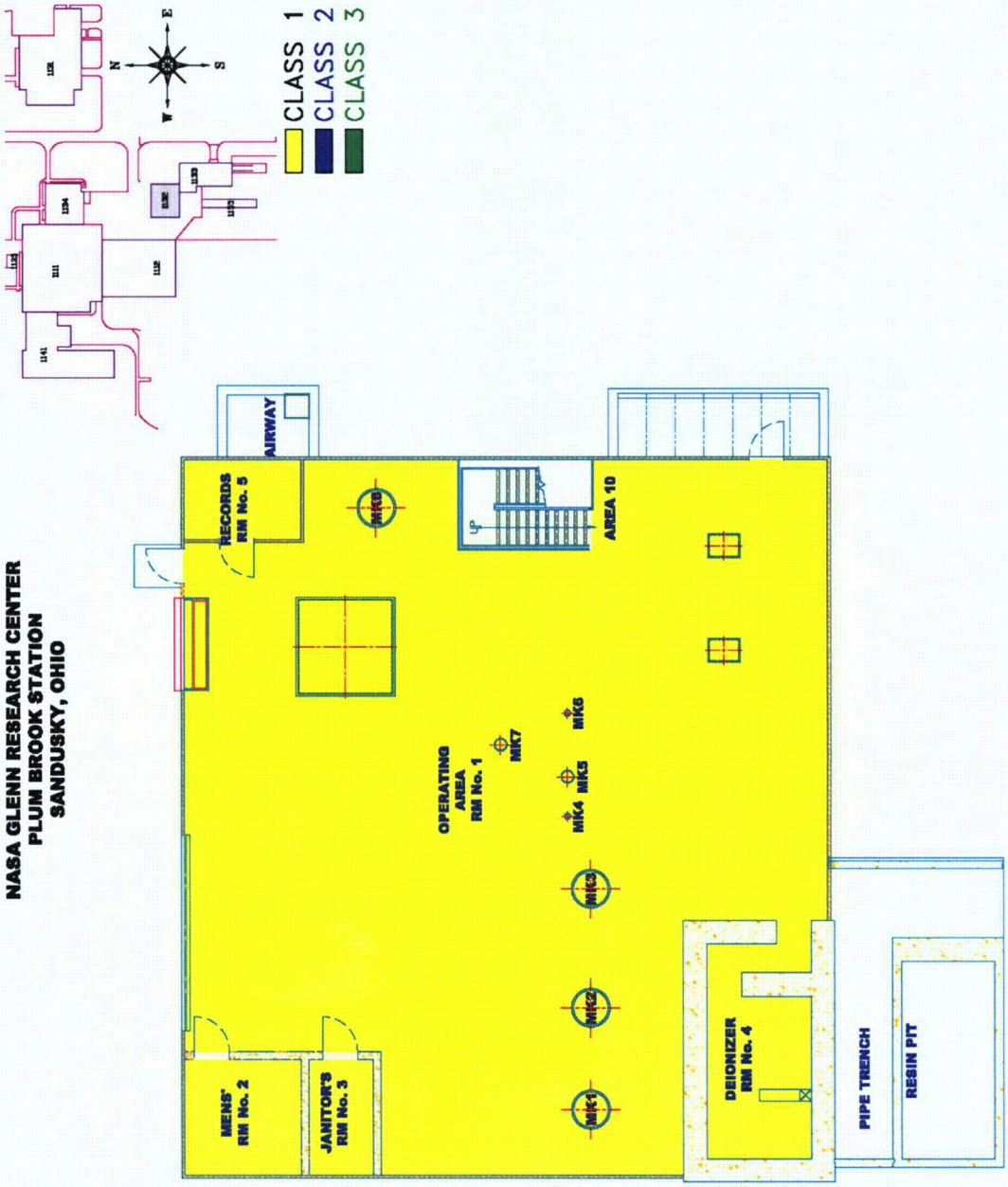

Figure D-18 – Fan House 0'-0" Elevation

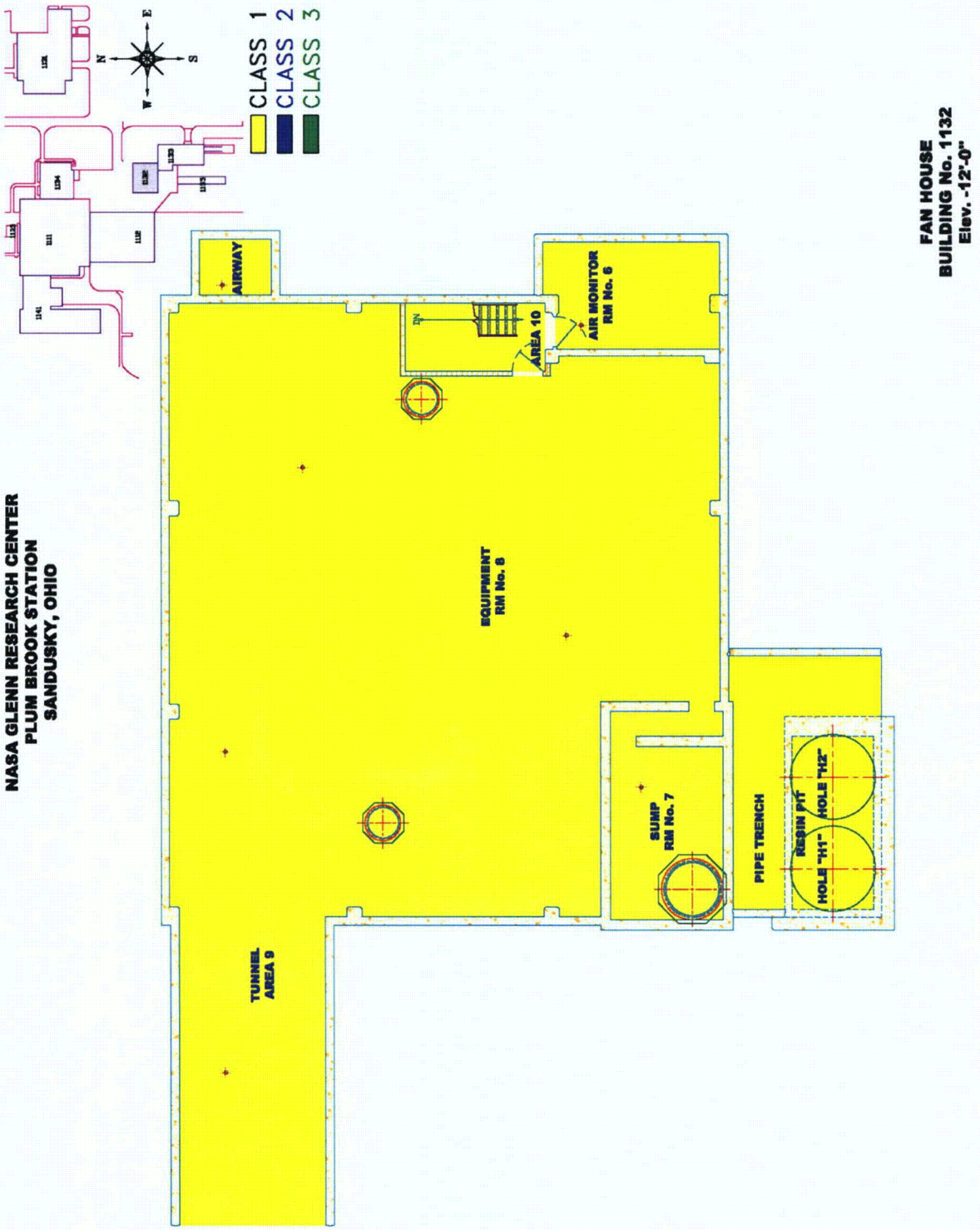

Figure D-19 – Fan House -12'-6" Elevation

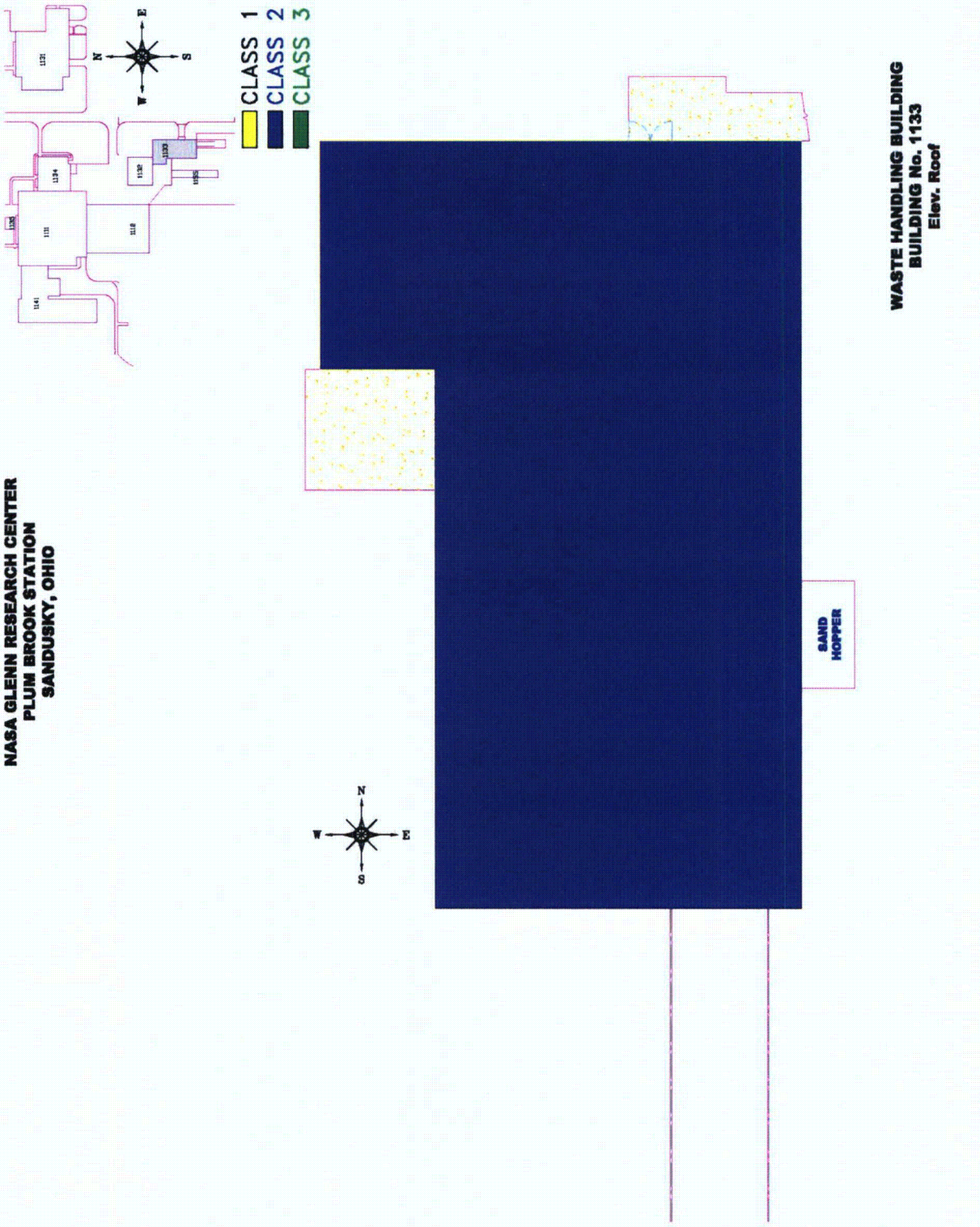

Figure D-20 – Waste Handling Building Roof Elevation

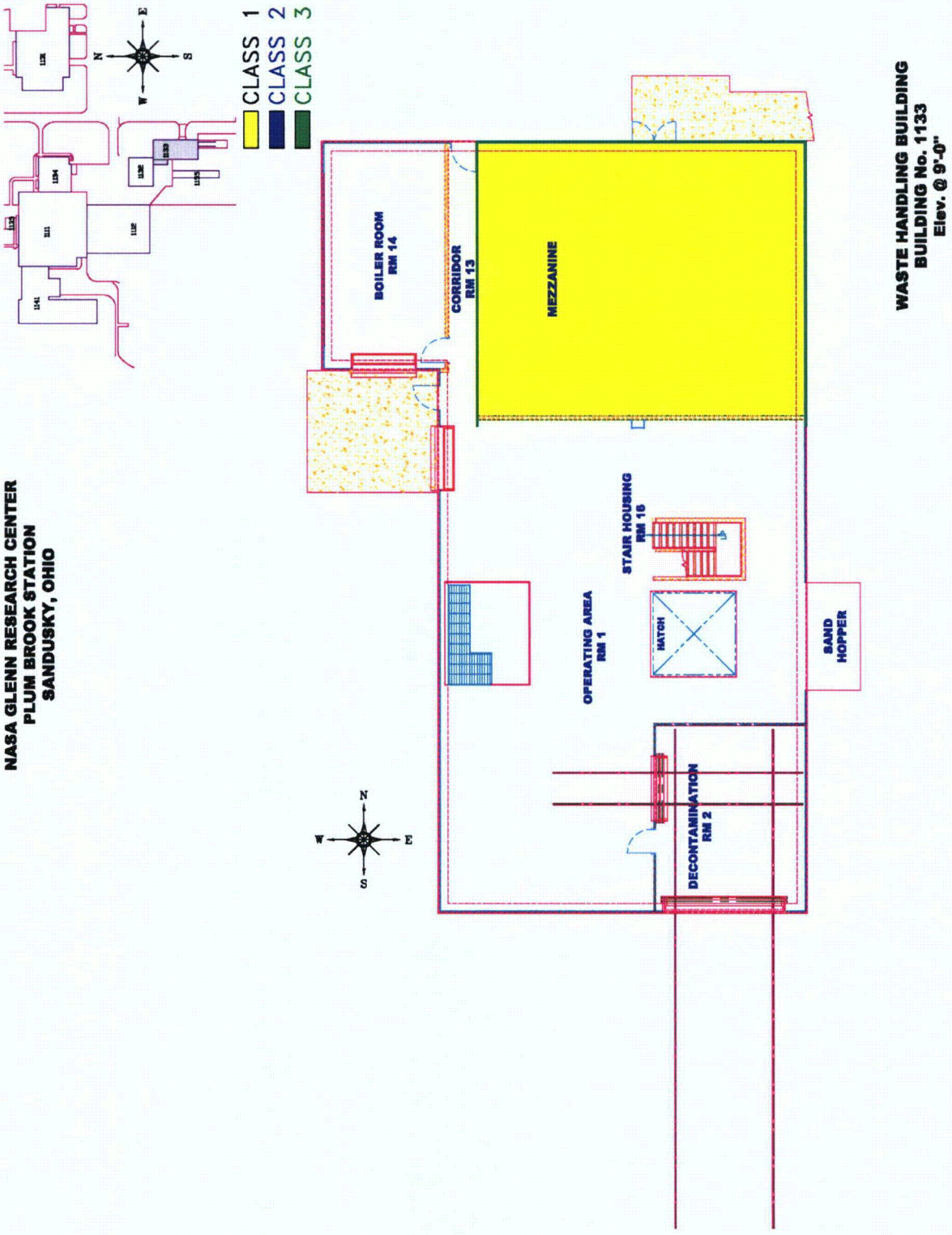

Figure D-21 – Waste Handling Building +9'-0" Elevation

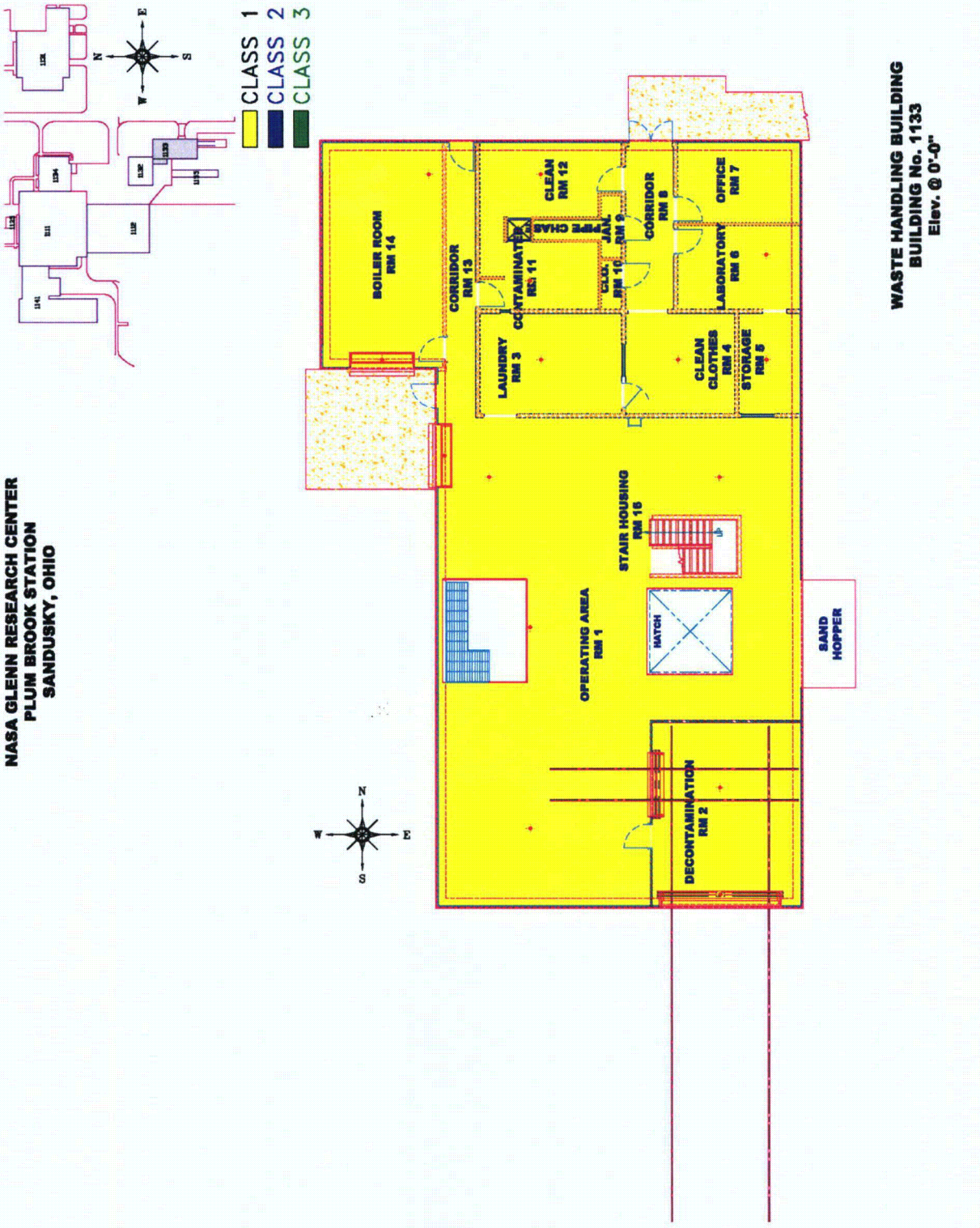

Figure D-22 – Waste Handling Building 0'-0" Elevation

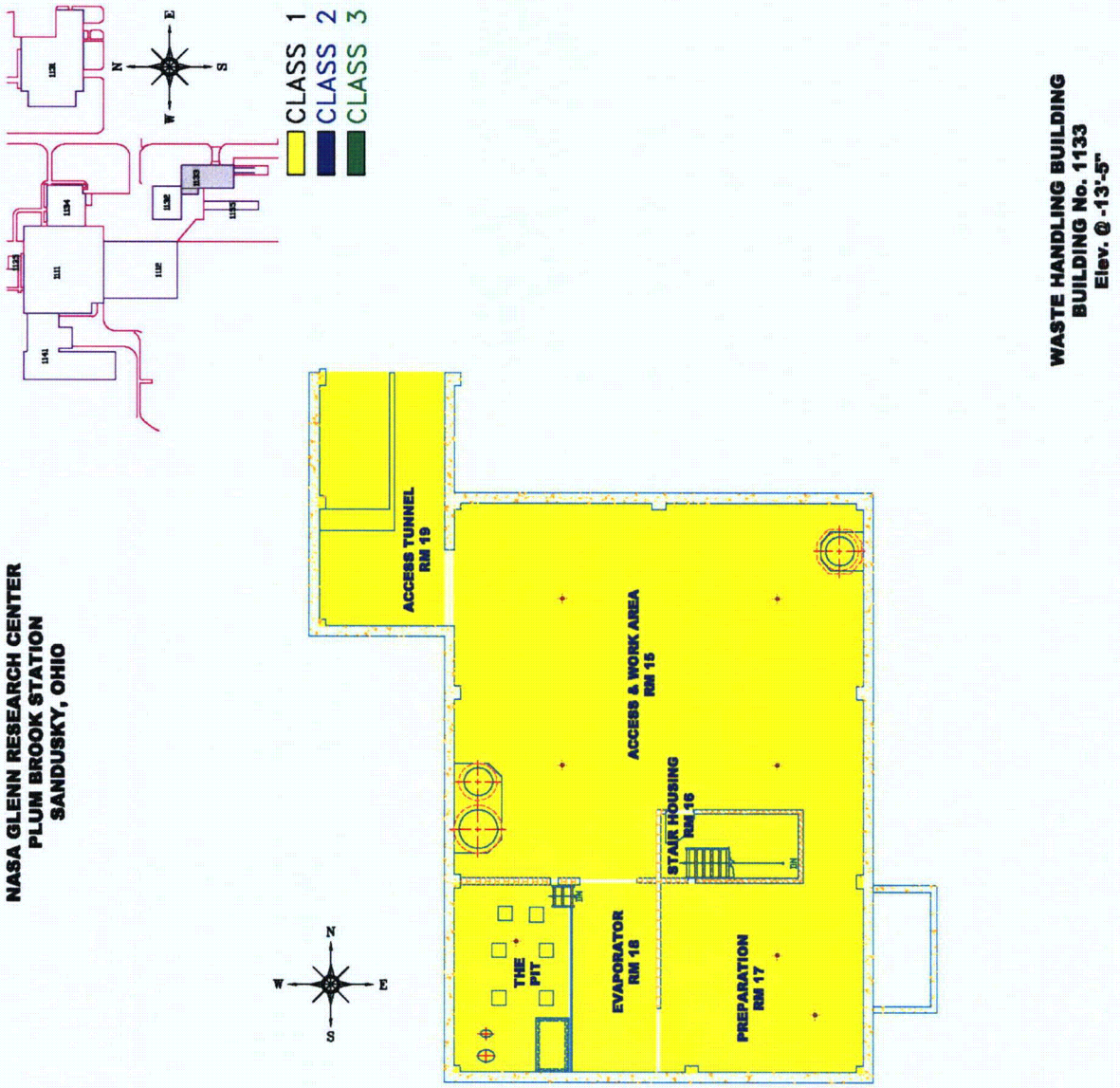

Figure D-23 – Waste Handling Building -13'-5" Elevation

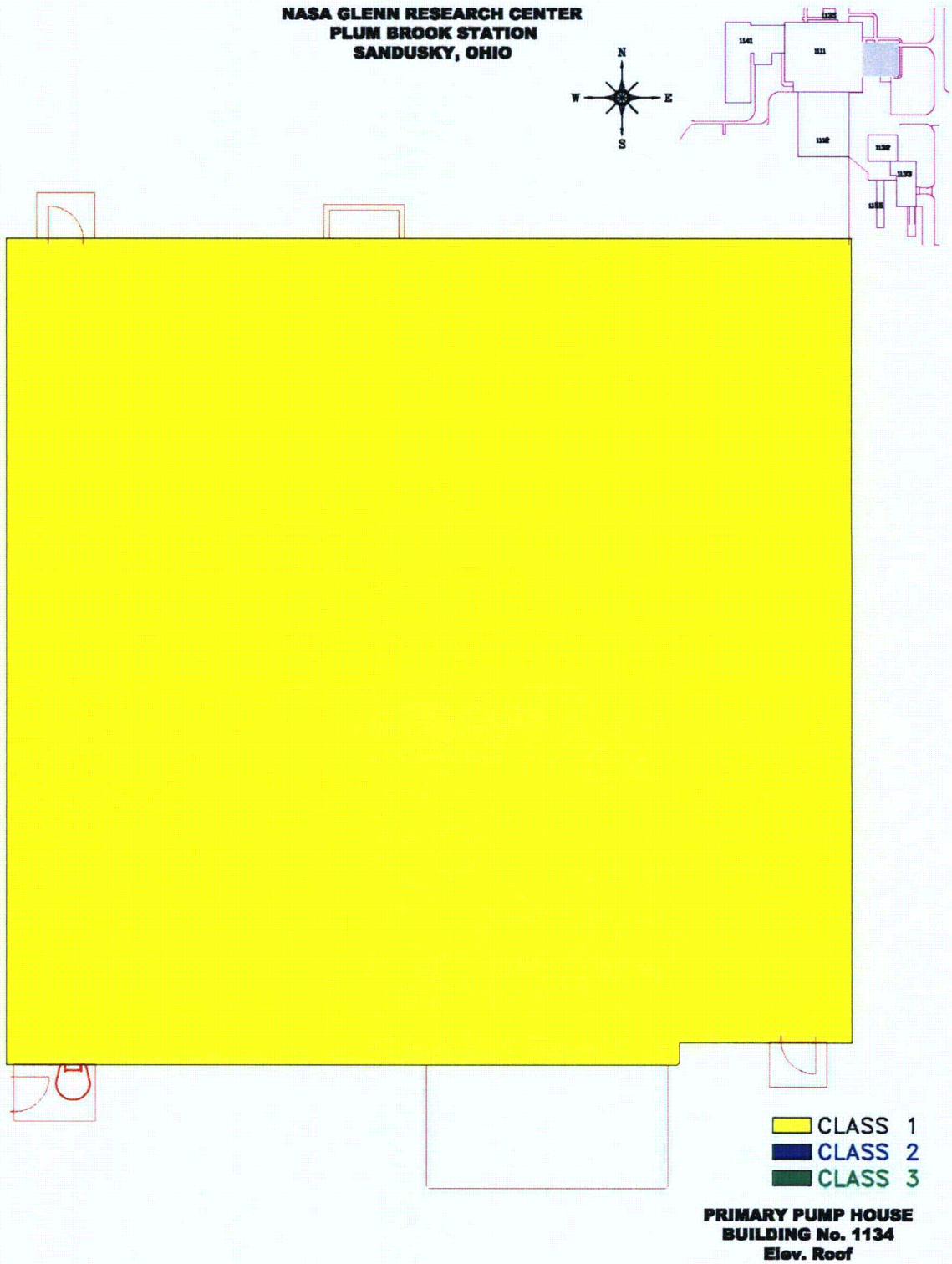

Figure D-24 – Primary Pump House Roof Elevation

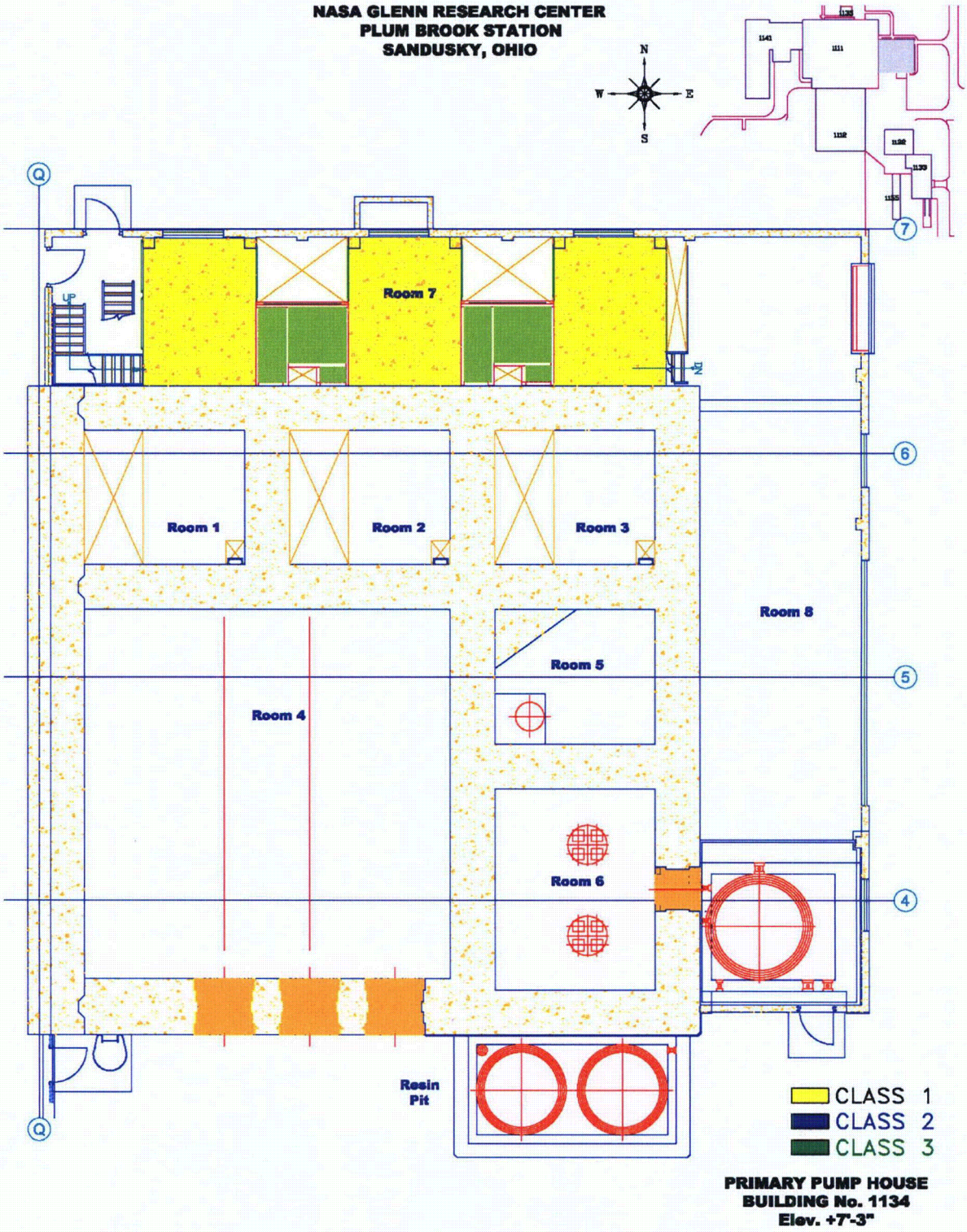

Figure D-25 – Primary Pump House +7'-3" Elevation

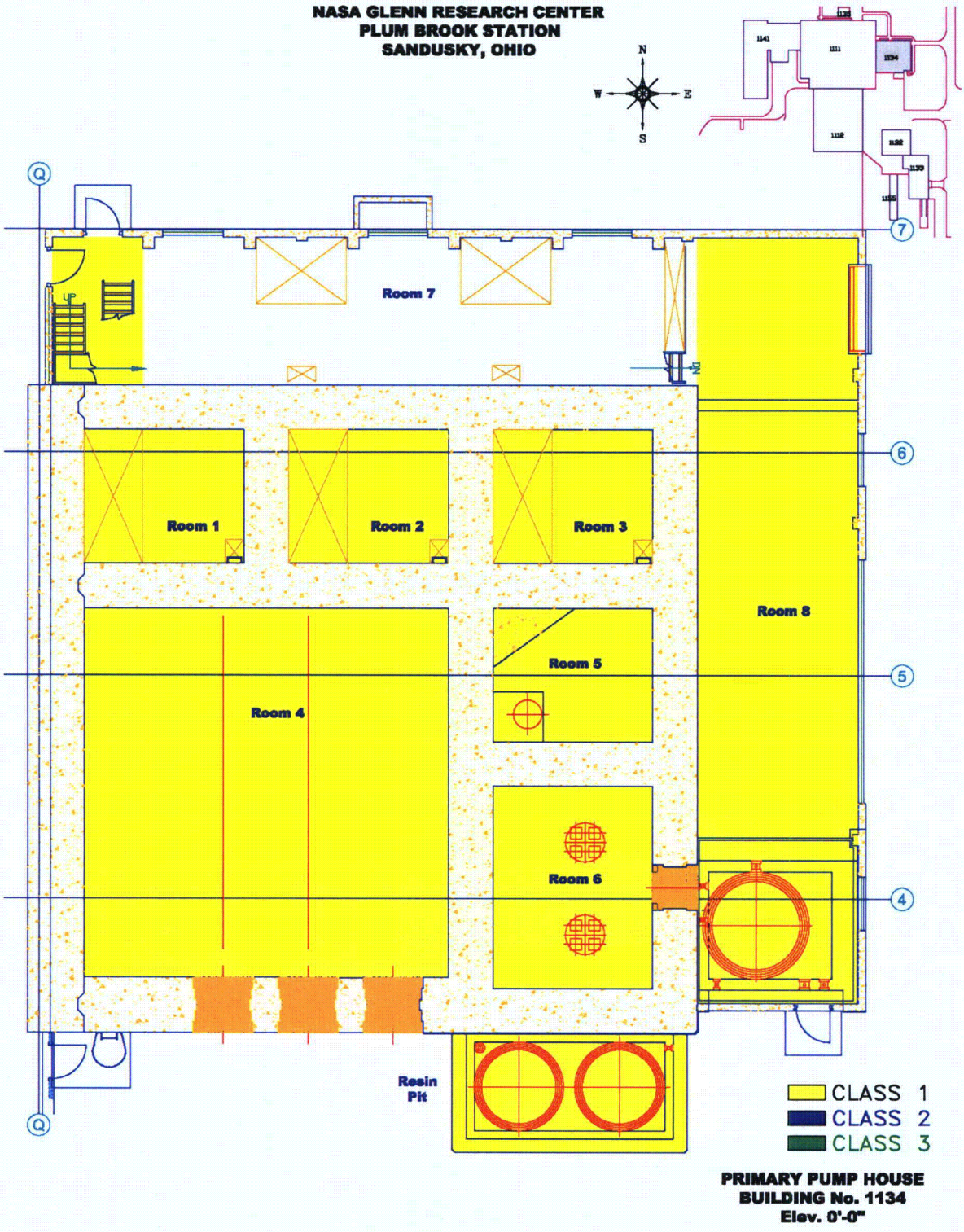

Figure D-26 – Primary Pump House 0'-0" Elevation

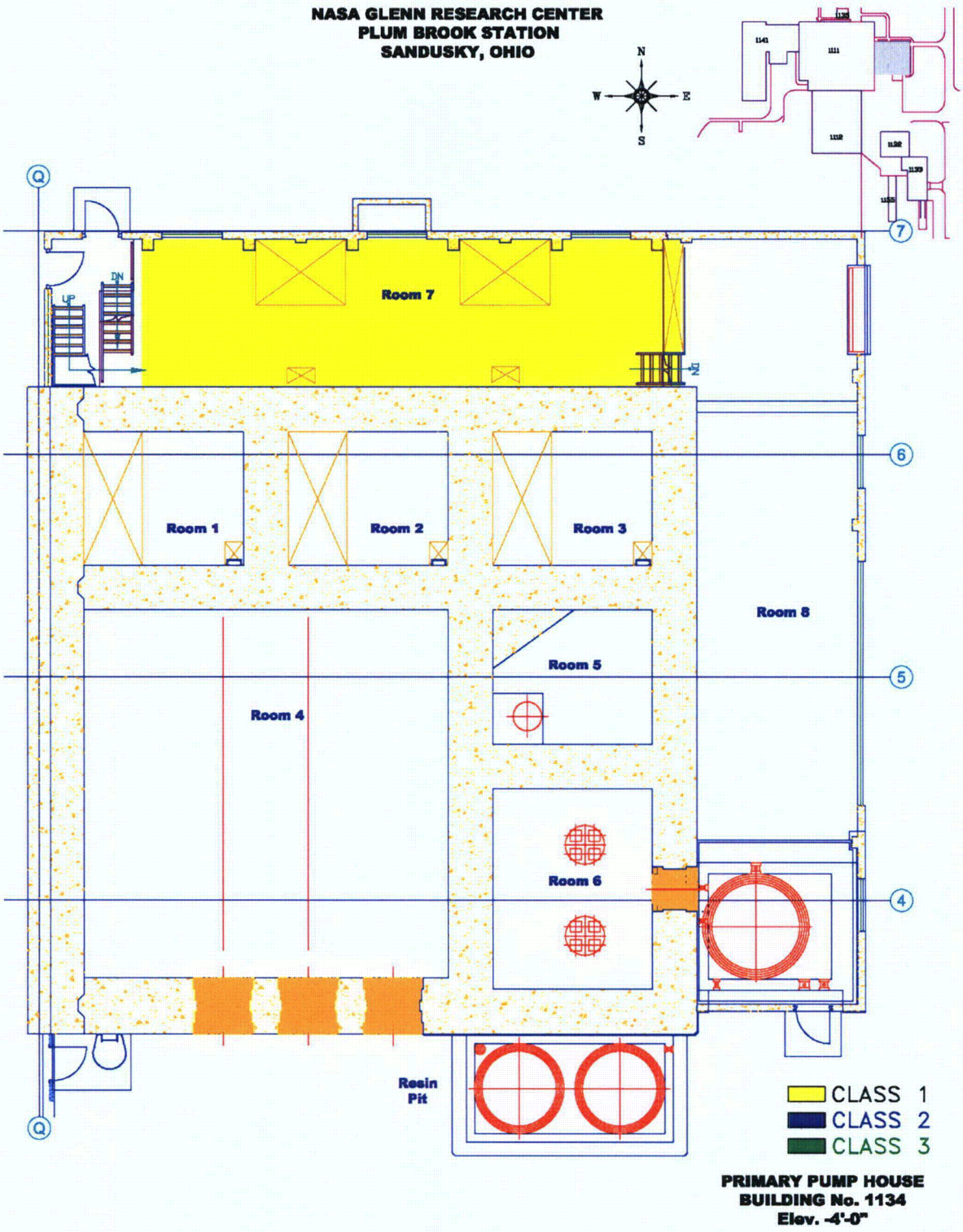

Figure D-27 – Primary Pump House -4'-0" Elevation

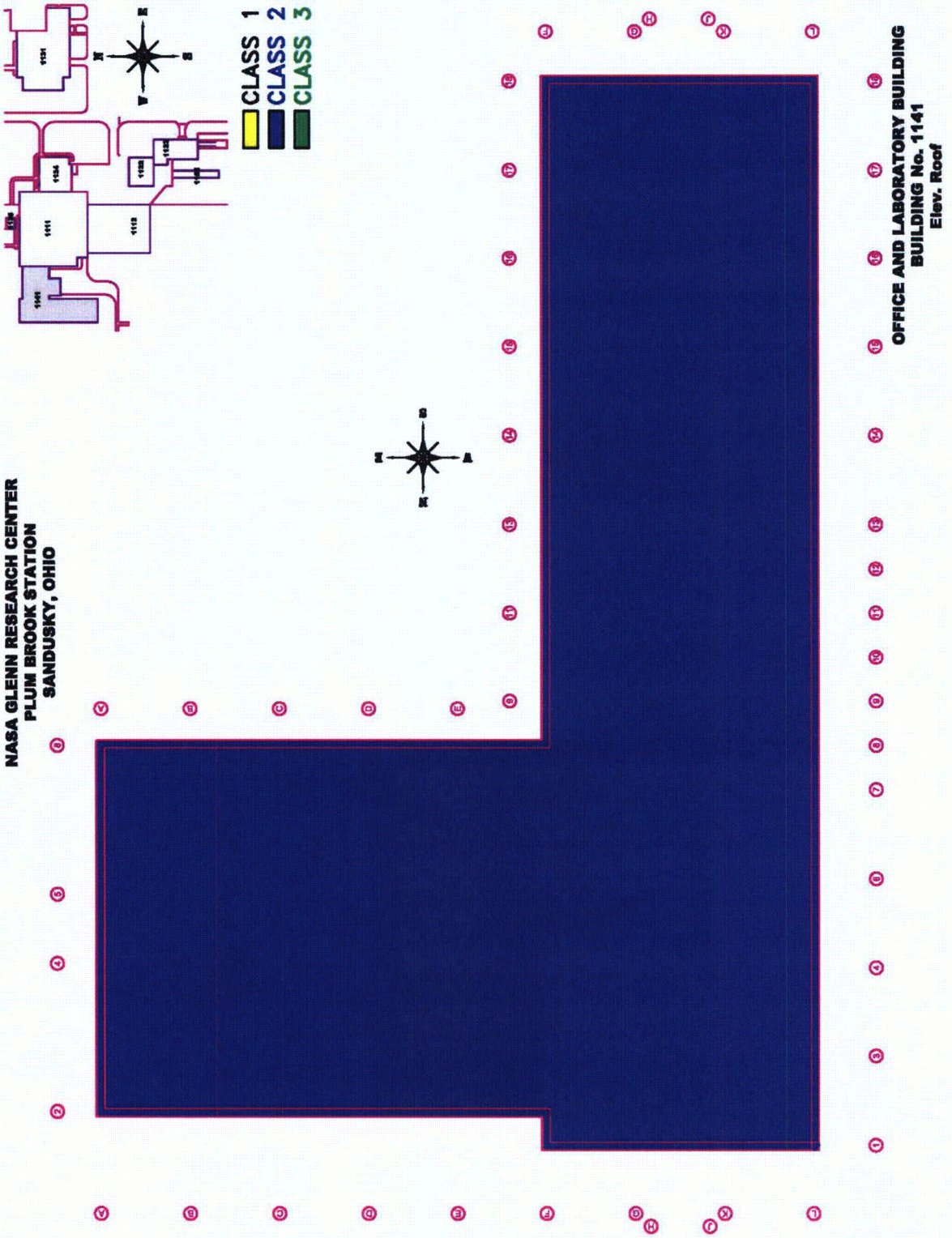

Figure D-28 – Reactor Office and Laboratory Building Roof Elevation

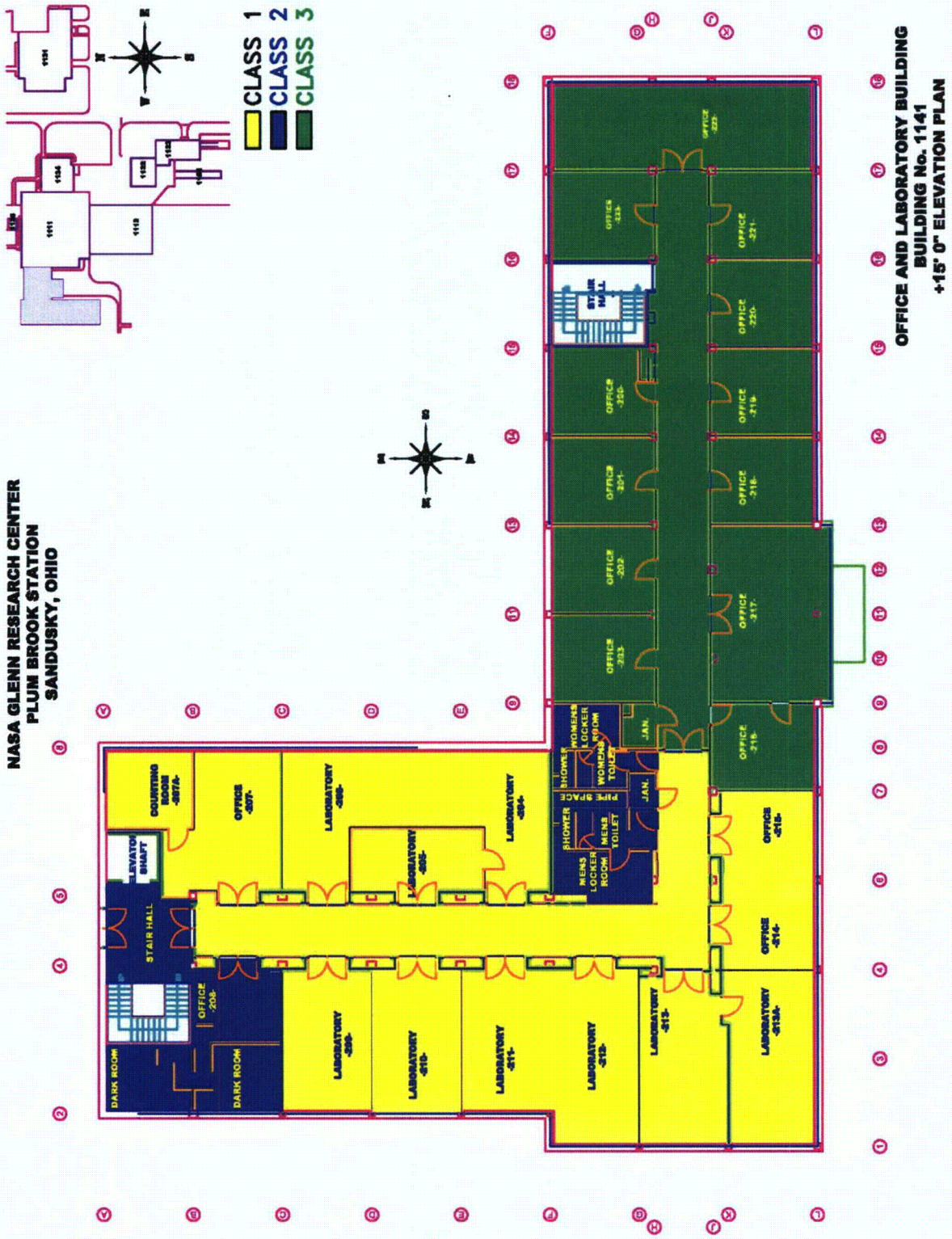

Figure D-29 – Reactor Office and Laboratory Building 2nd Floor Elevation

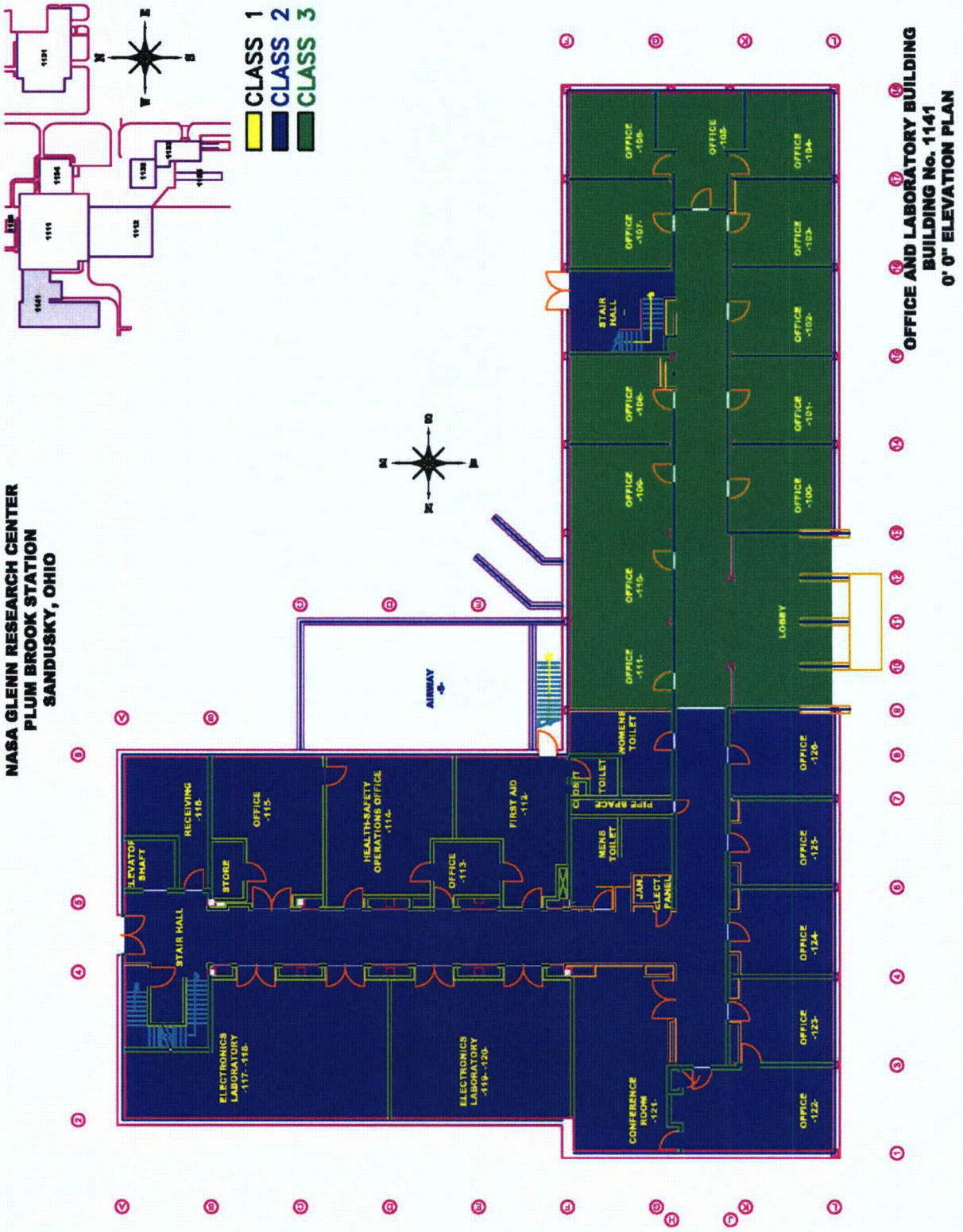

Figure D-30 – Reactor Office and Laboratory Building 1st Floor Elevation

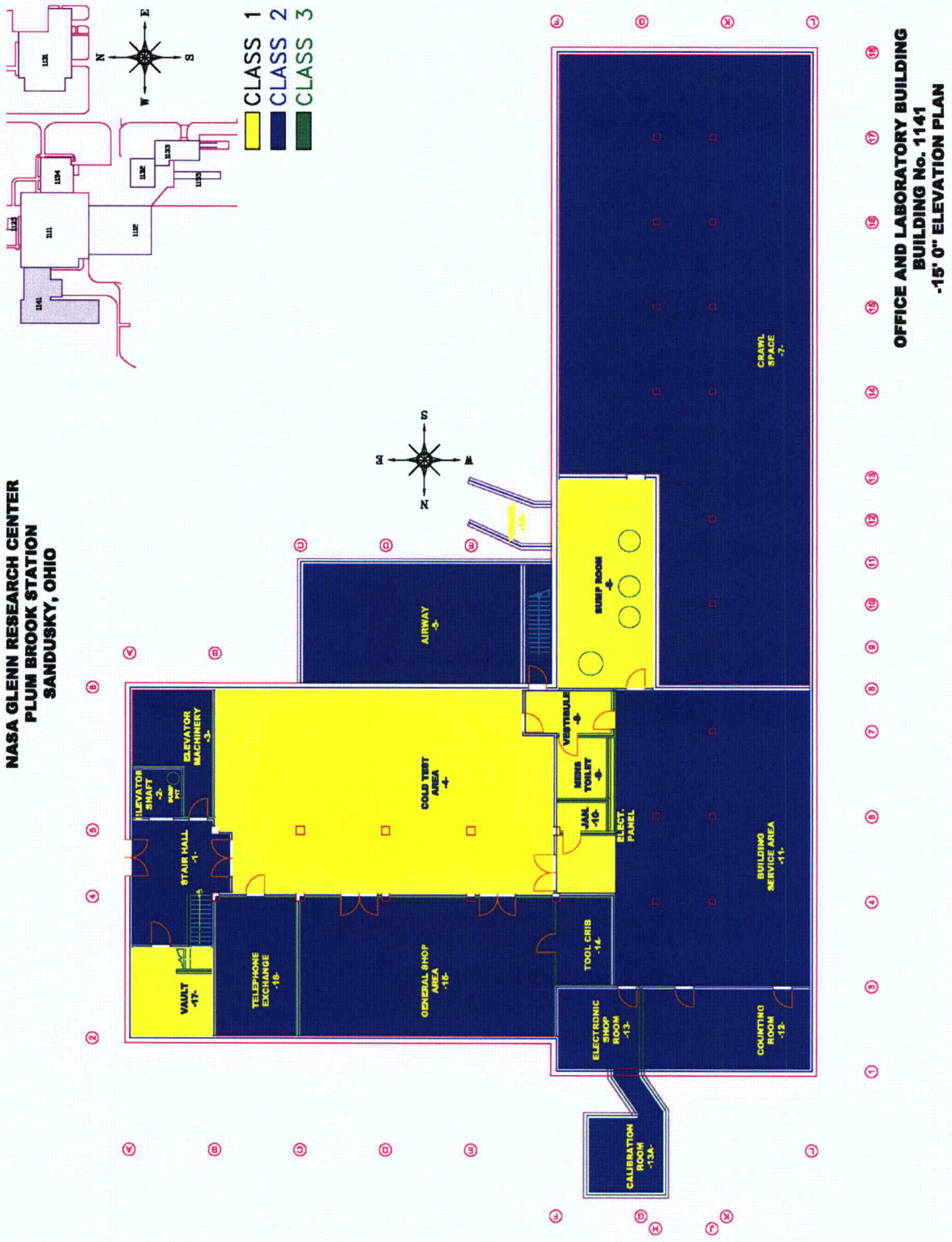

Figure D-31 – Reactor Office and Laboratory Building Basement Elevation

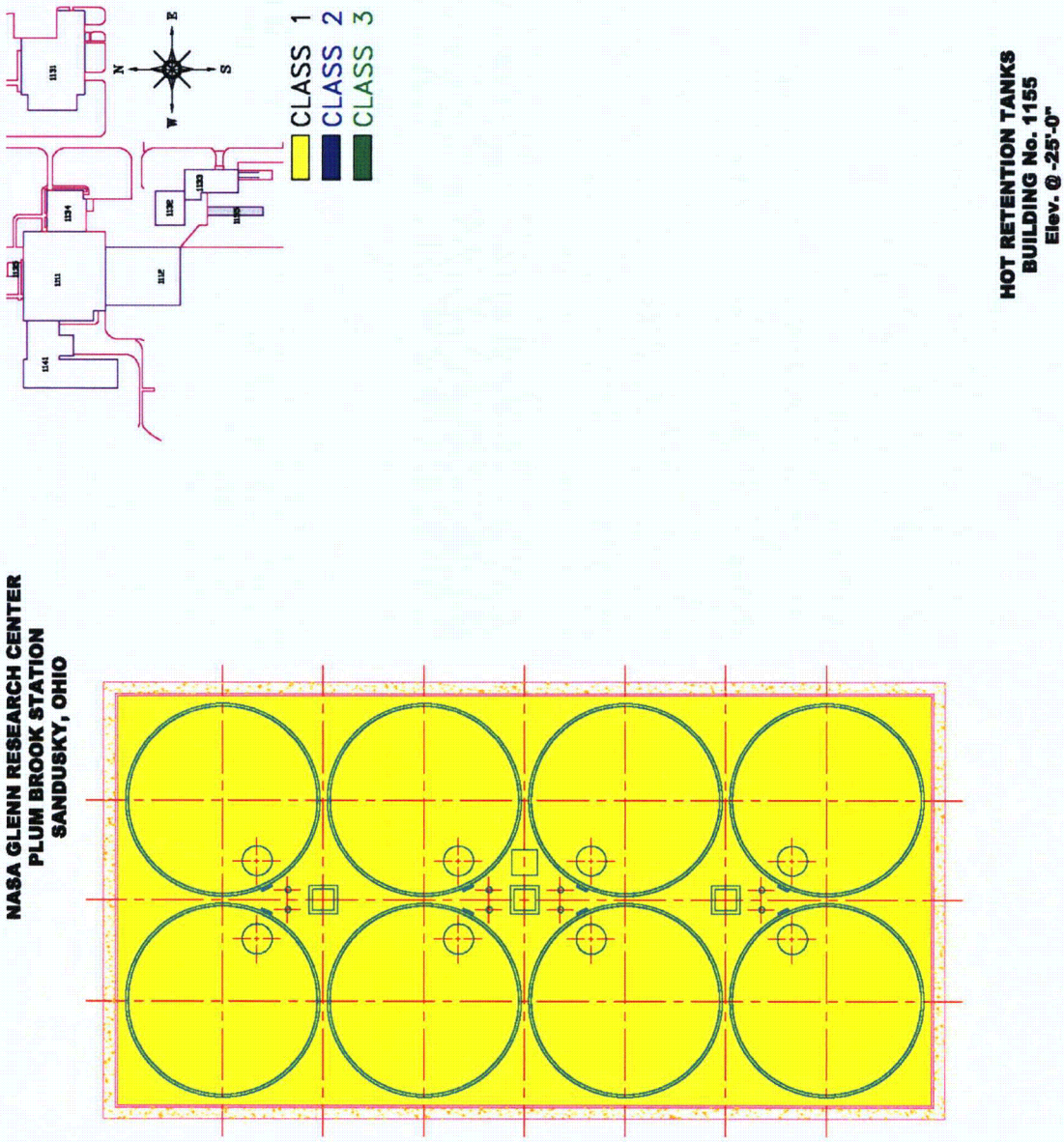

Figure D-32 – Hot Retention Area

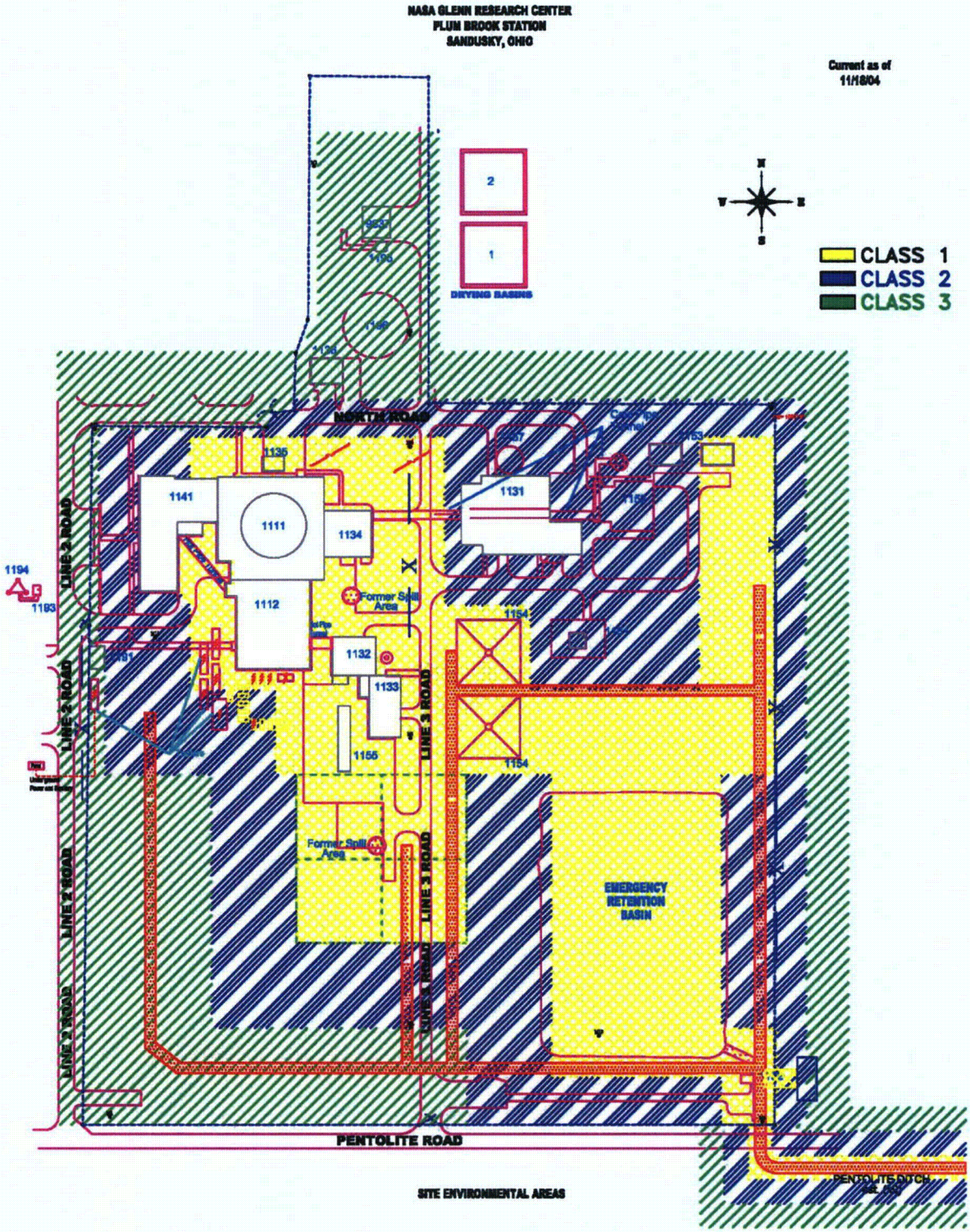

Figure D-33 – PBRF Environmental Areas

Final Status Survey Plan
for the
Plum Brook Reactor Facility

Attachment D

Illustrations of Survey Area Classification

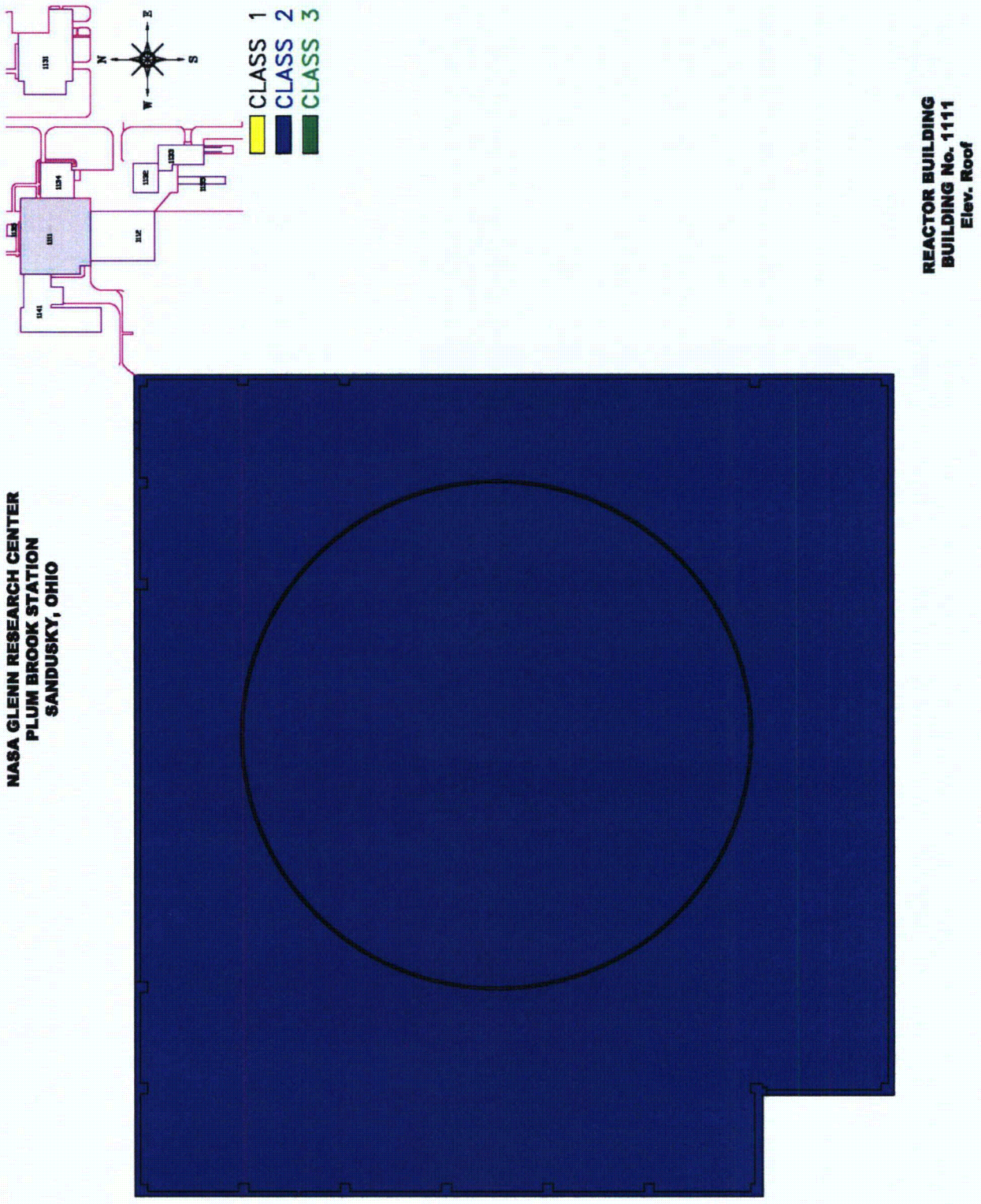

Figure D-1 – Reactor Building Roof Elevation

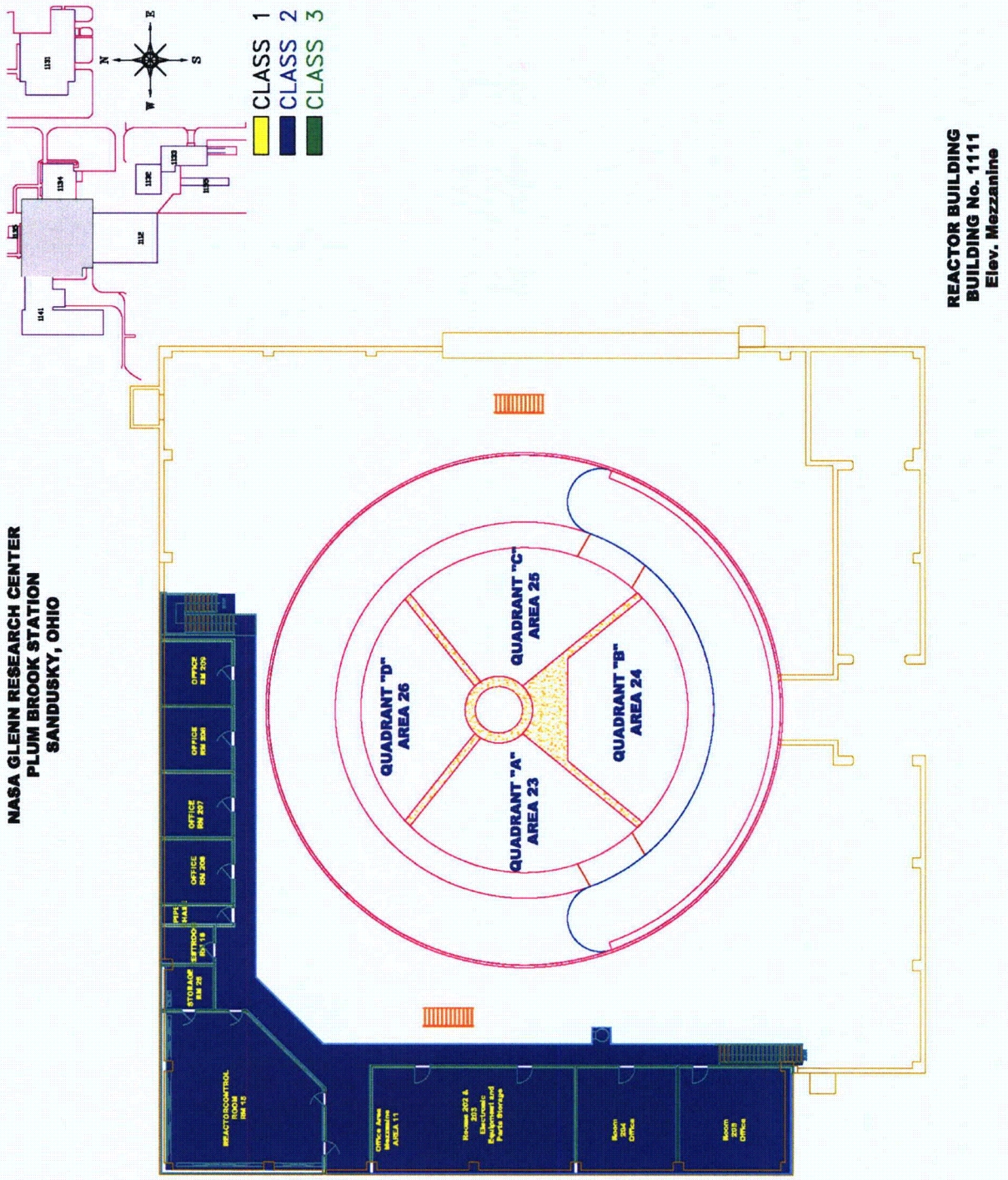

Figure D-2 – Reactor Building Mezzanine Elevation

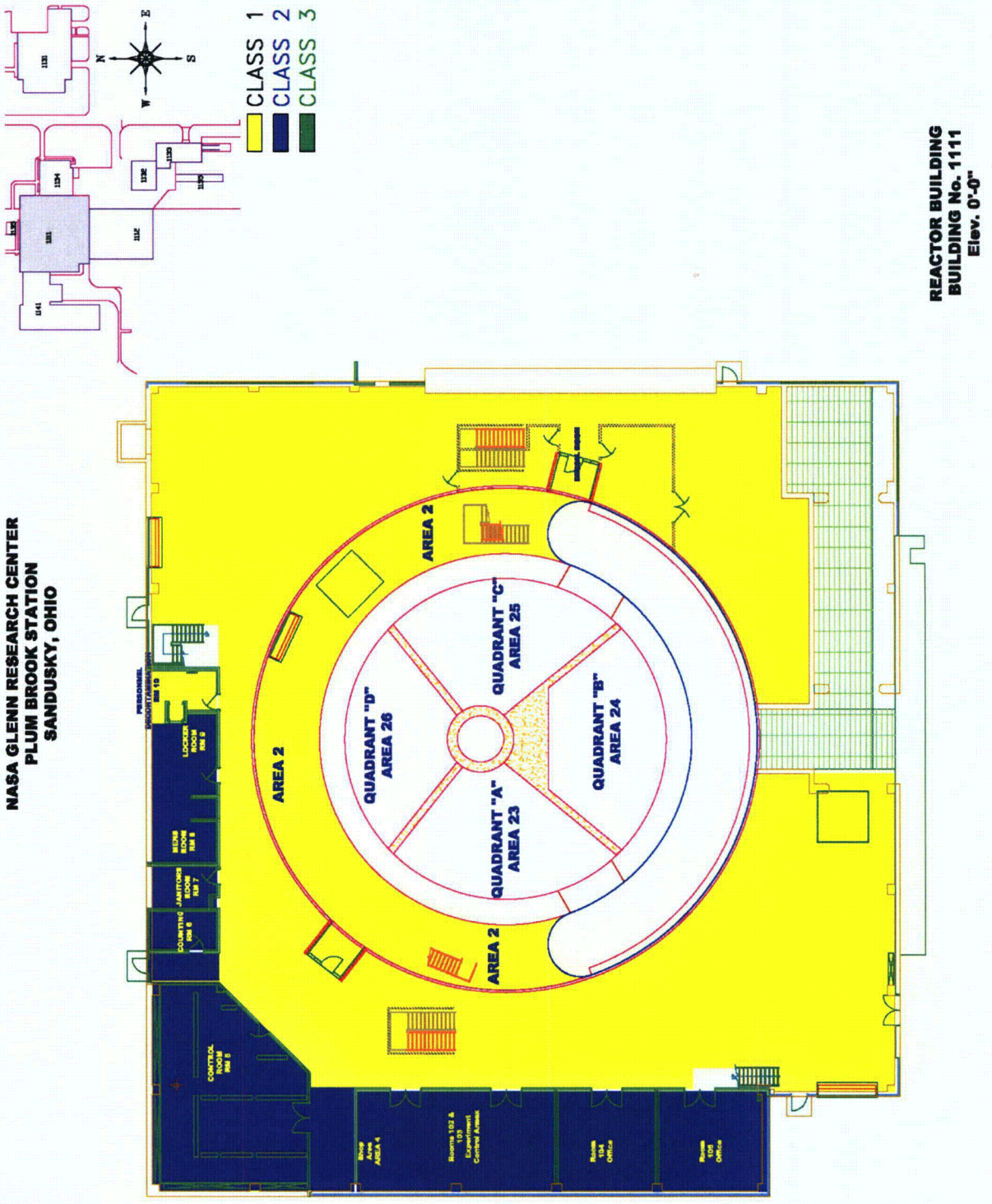

Figure D-3 – Reactor Building 0'-0" Elevation

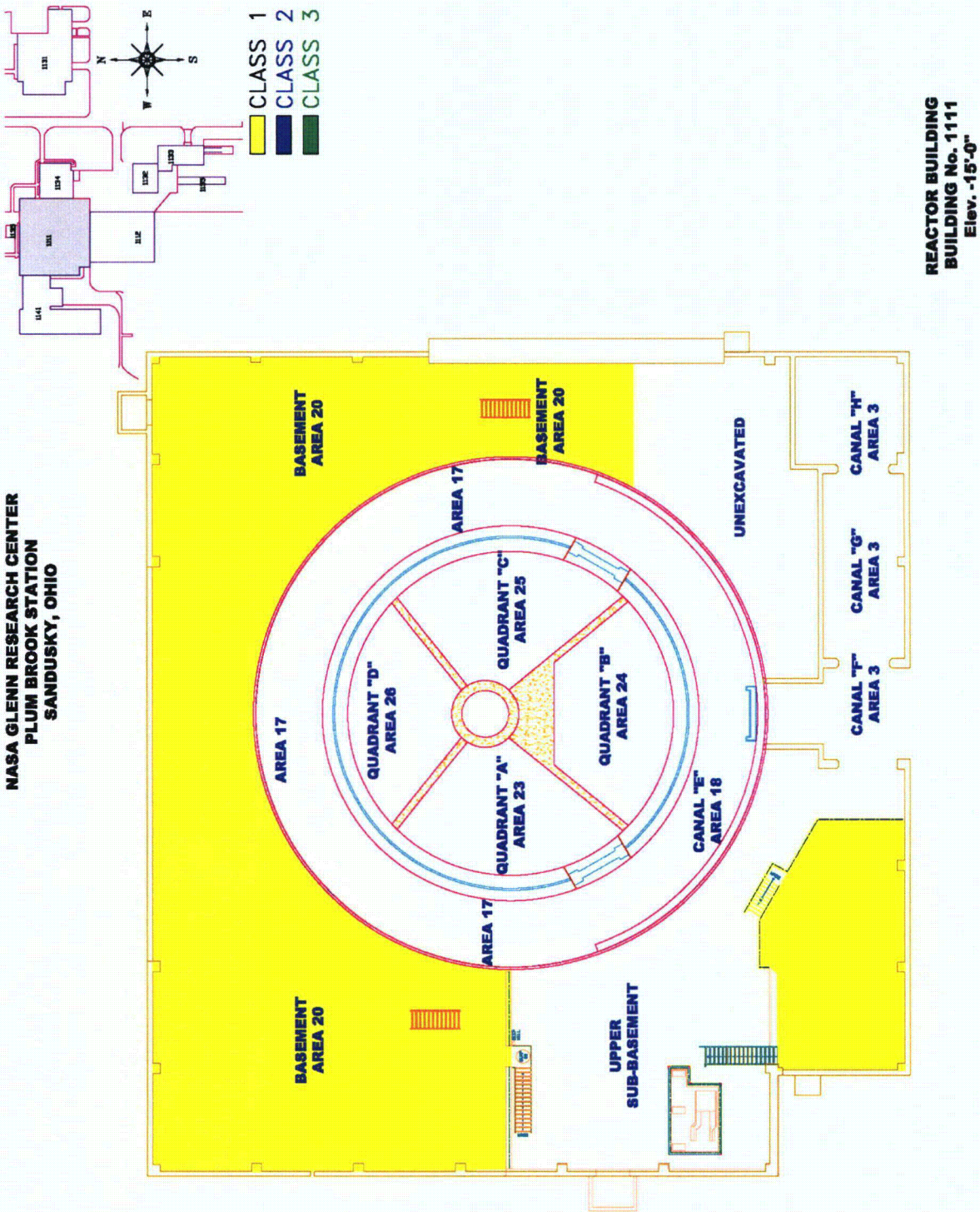

Figure D-4– Reactor Building -15'-0" Elevation

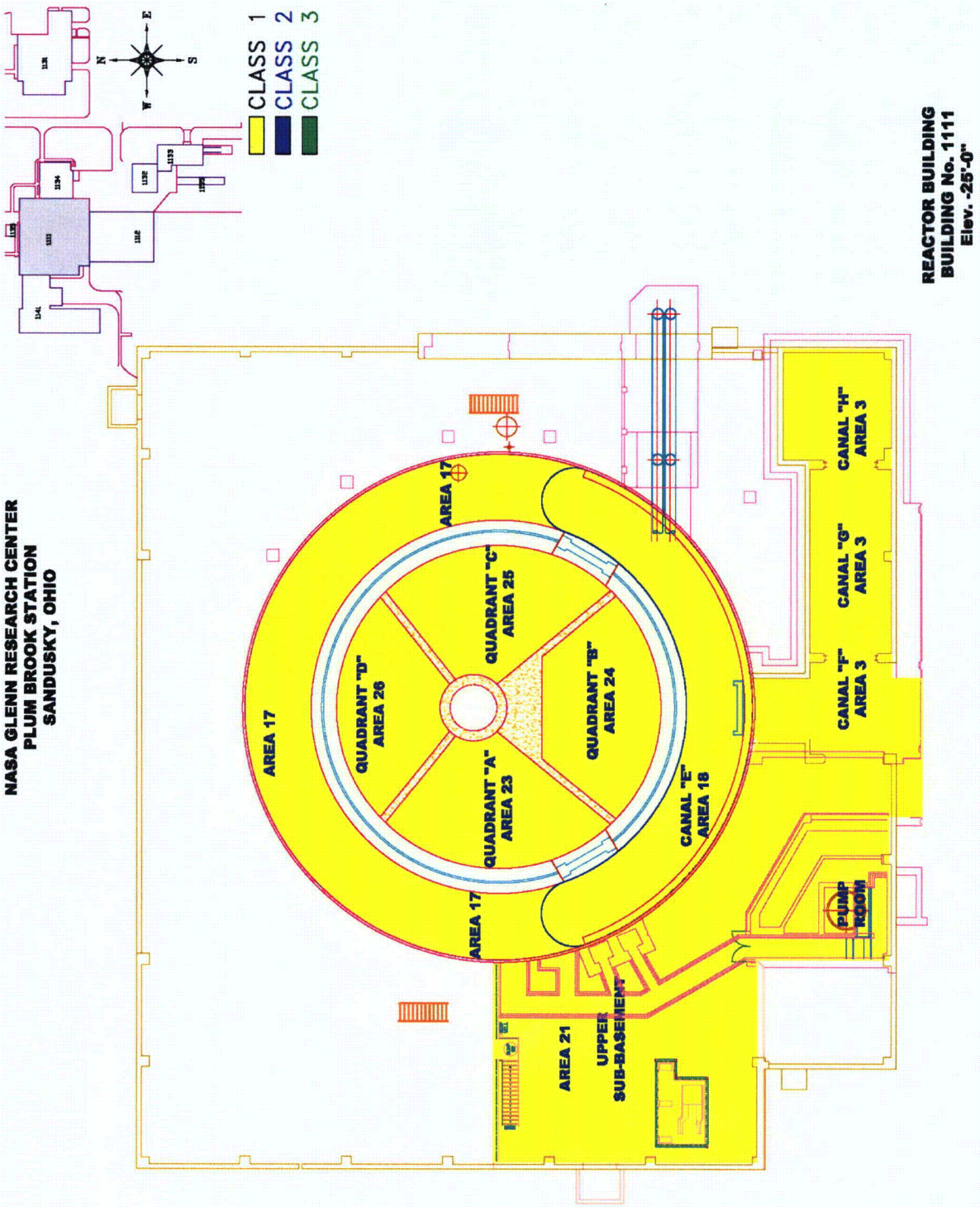

Figure D-5 – Reactor Building -25'-0" Elevation

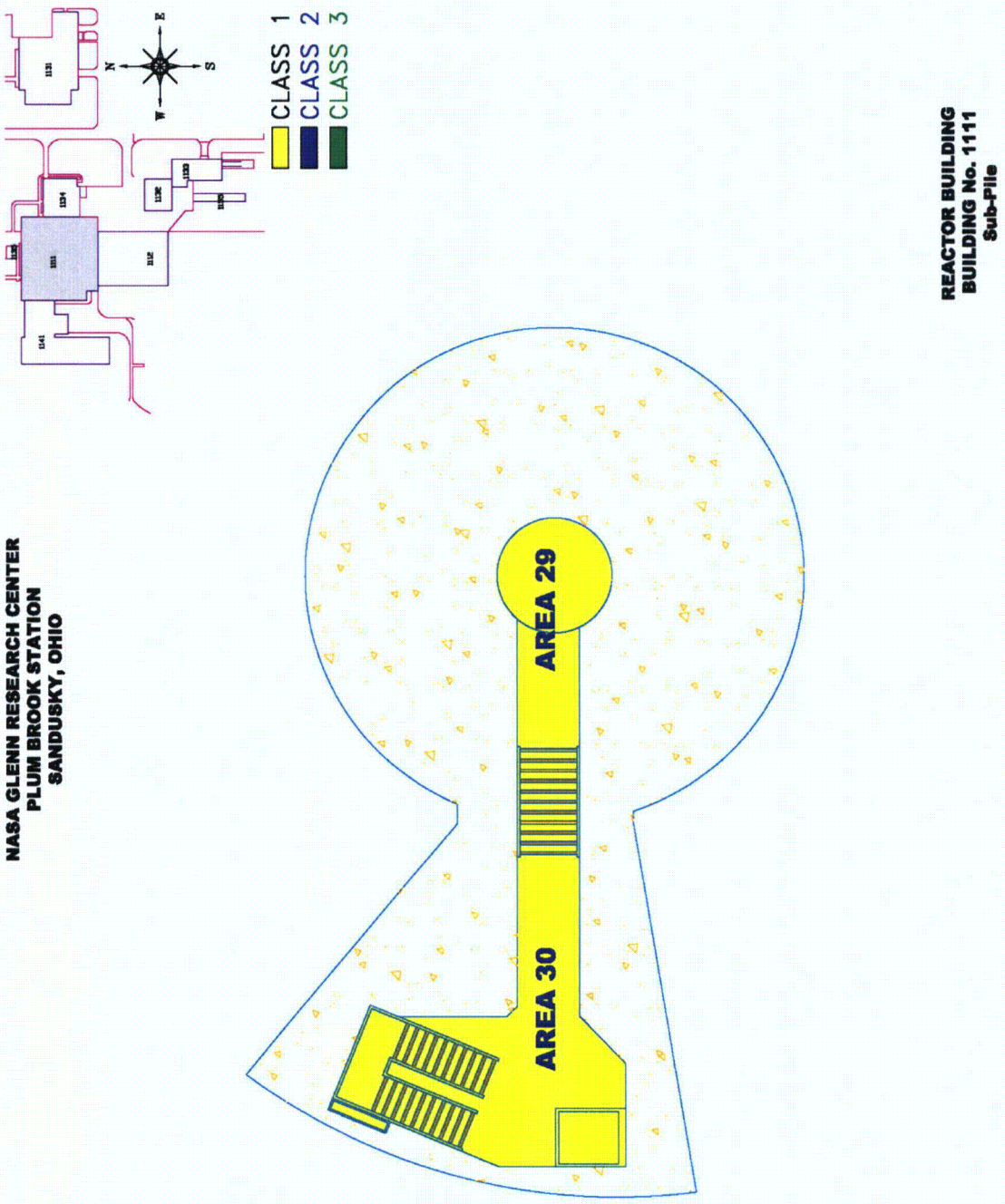

Figure D-6 – Reactor Building Sub-Pile Elevation

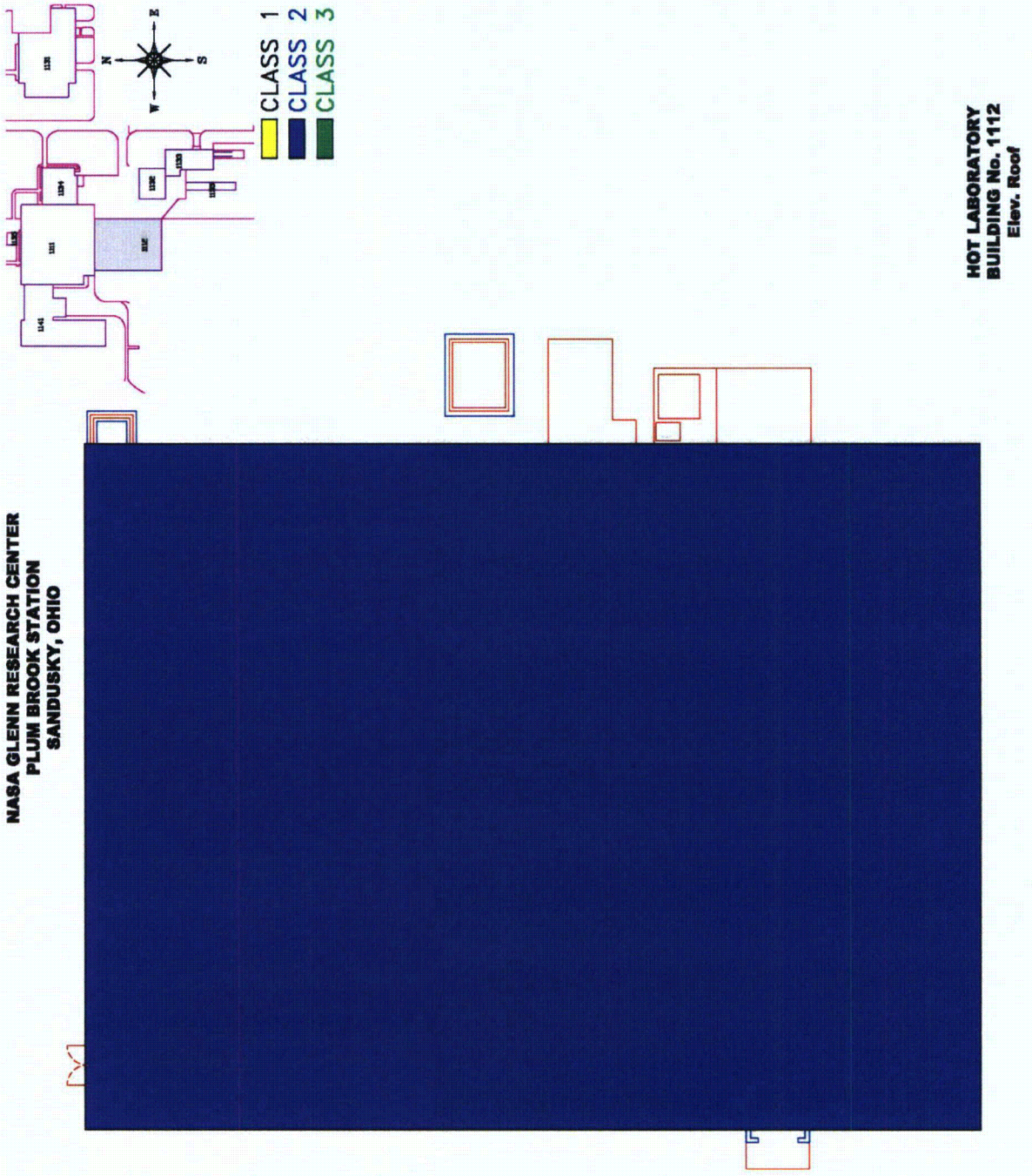

Figure D-7 – Hot Laboratory Building Roof Elevation

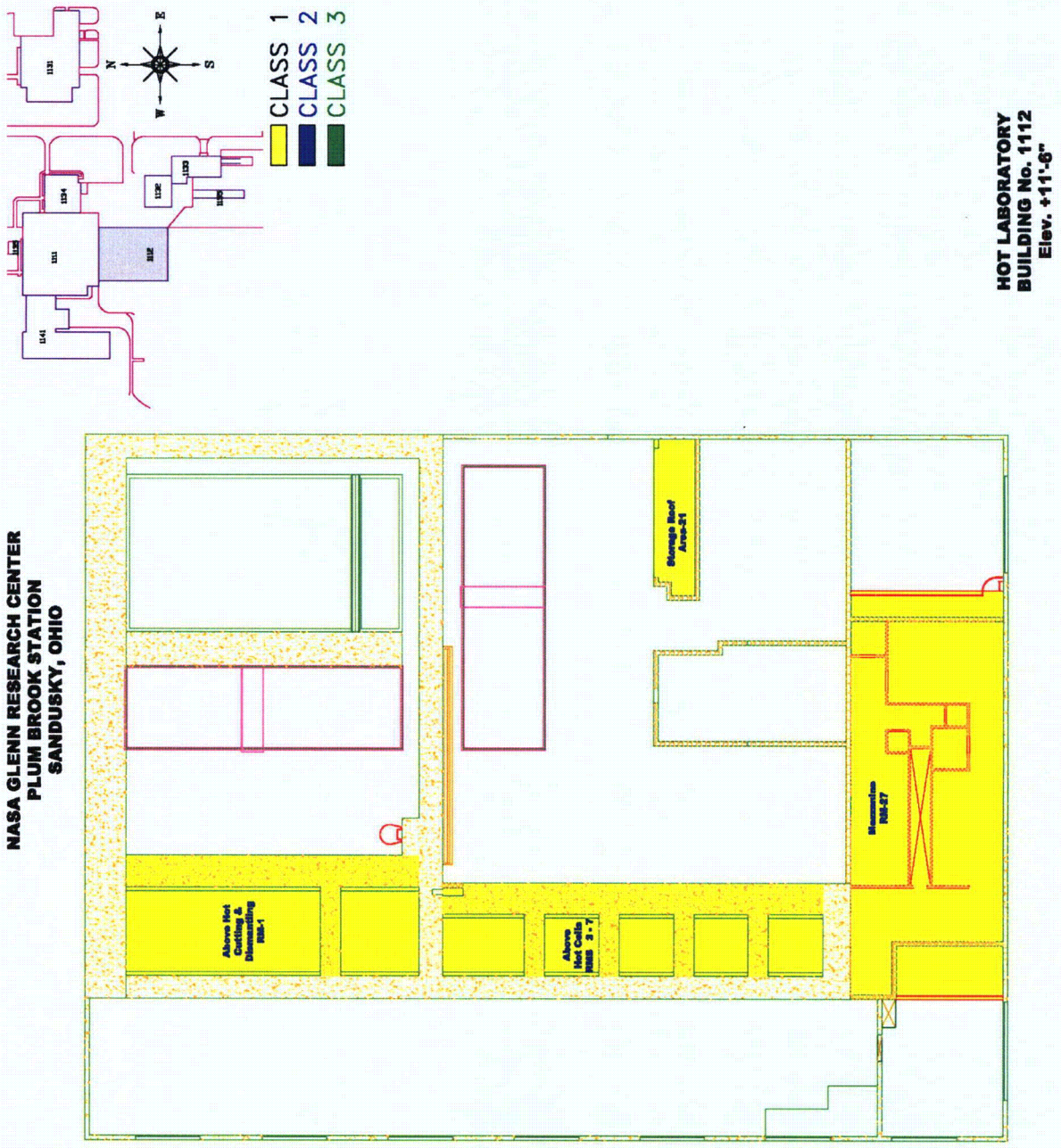

Figure D-8 – Hot Laboratory Building +11'-6" Elevation

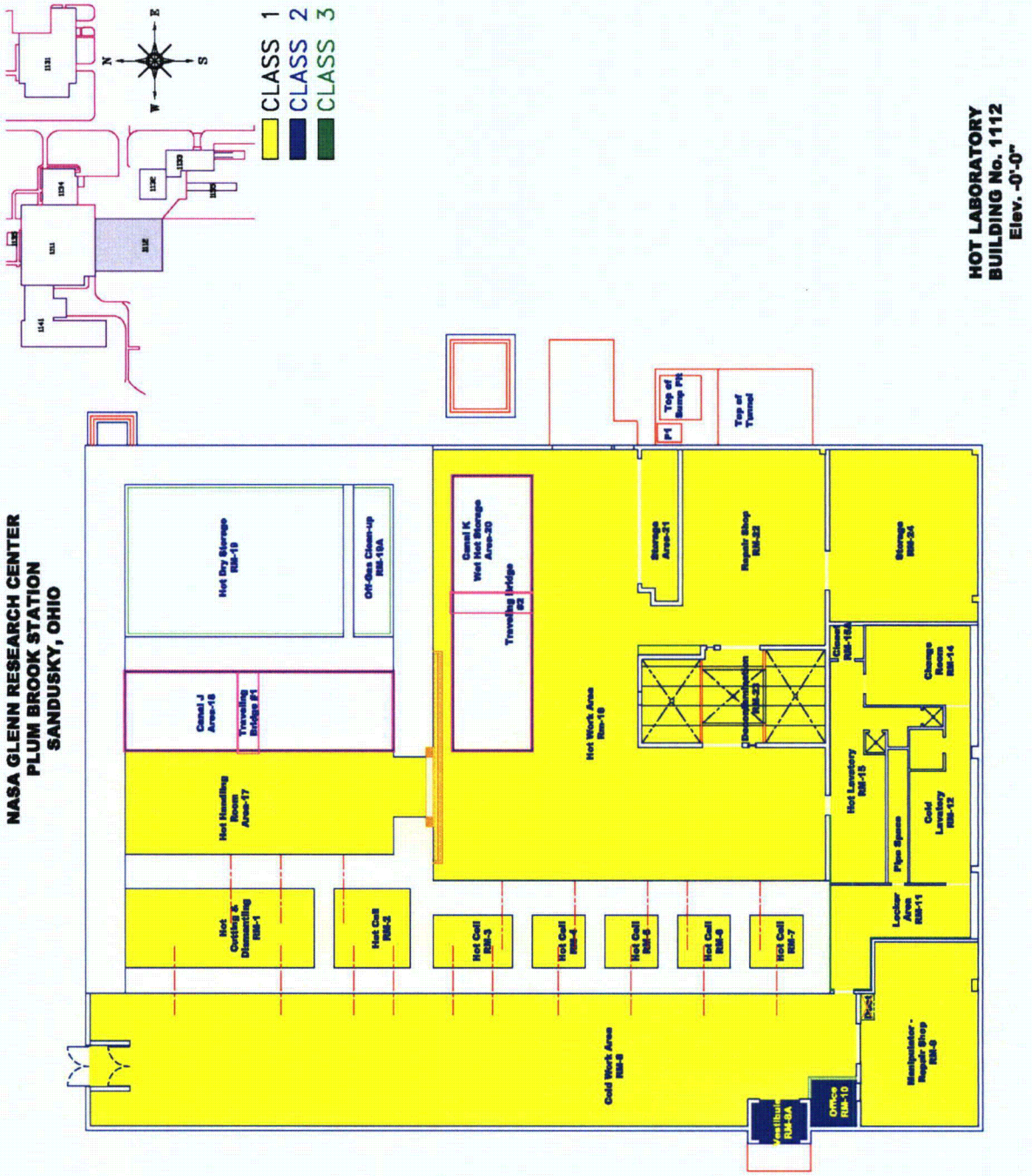

Figure D-9 – Hot Laboratory Building 0'-0" Elevation

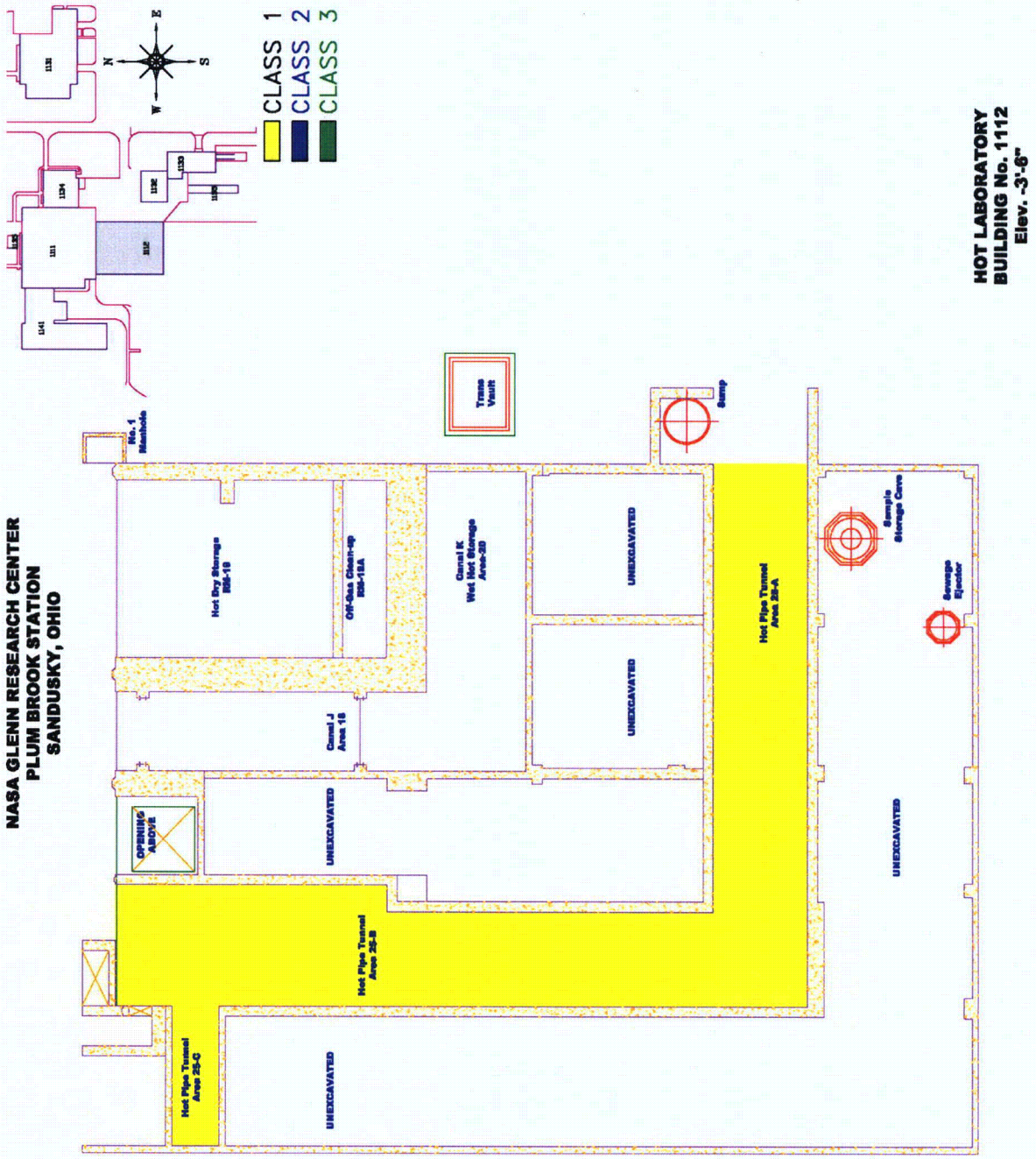

Figure D-10 – Hot Laboratory Building -3'-6" Elevation

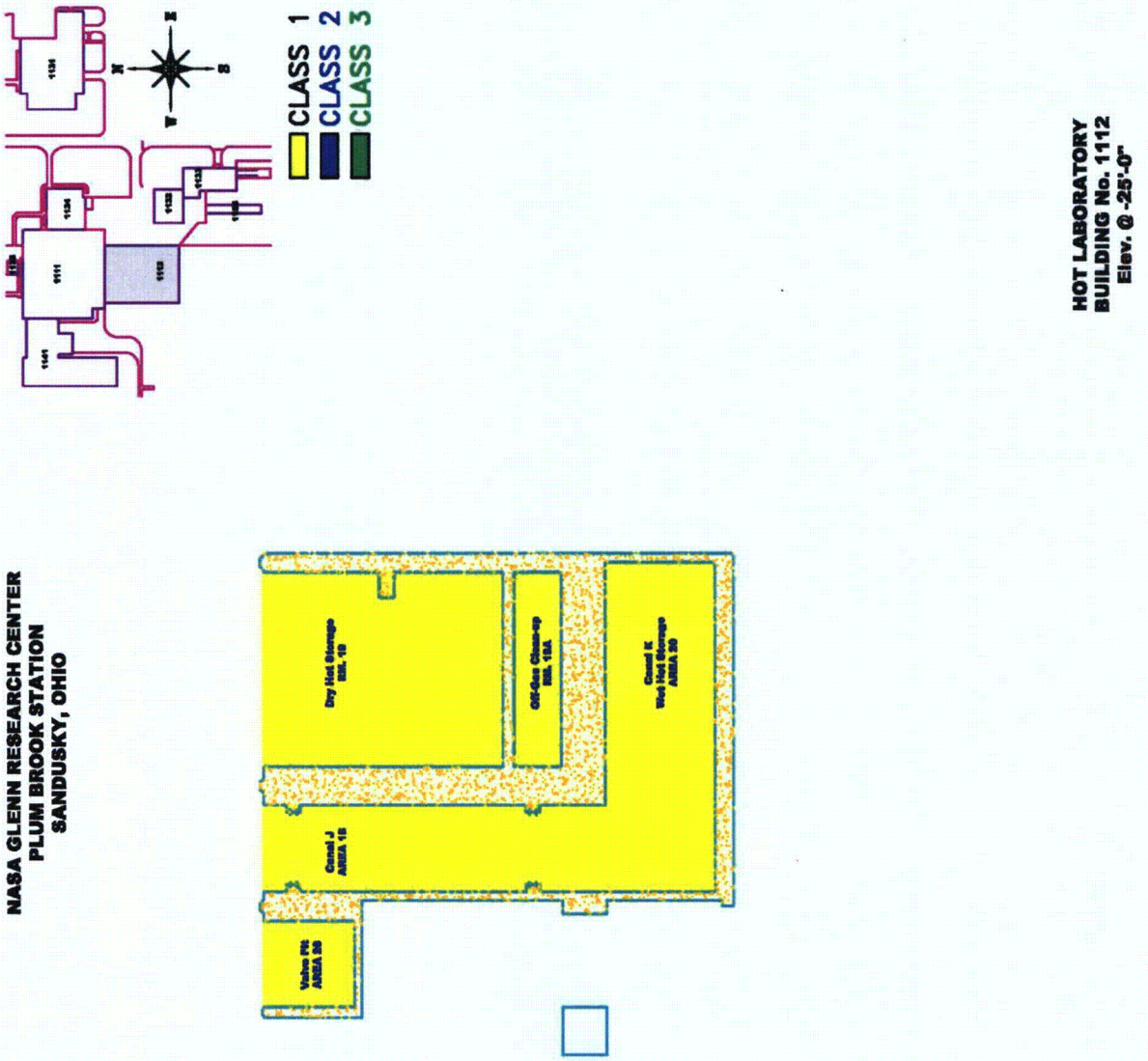

Figure D-11 – Hot Laboratory Building -25'-0" Elevation

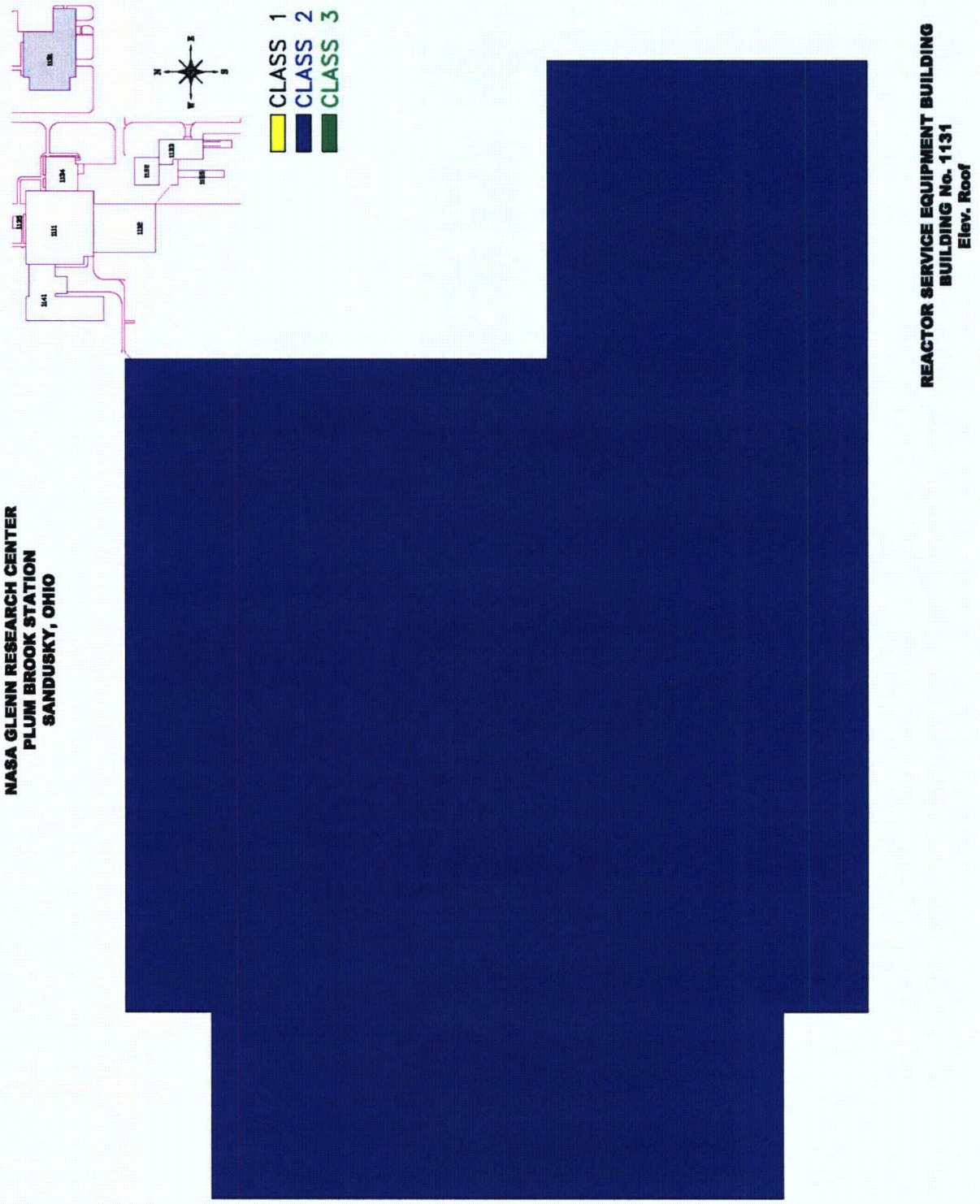

Figure D-12 – Service Equipment Building Roof Elevation

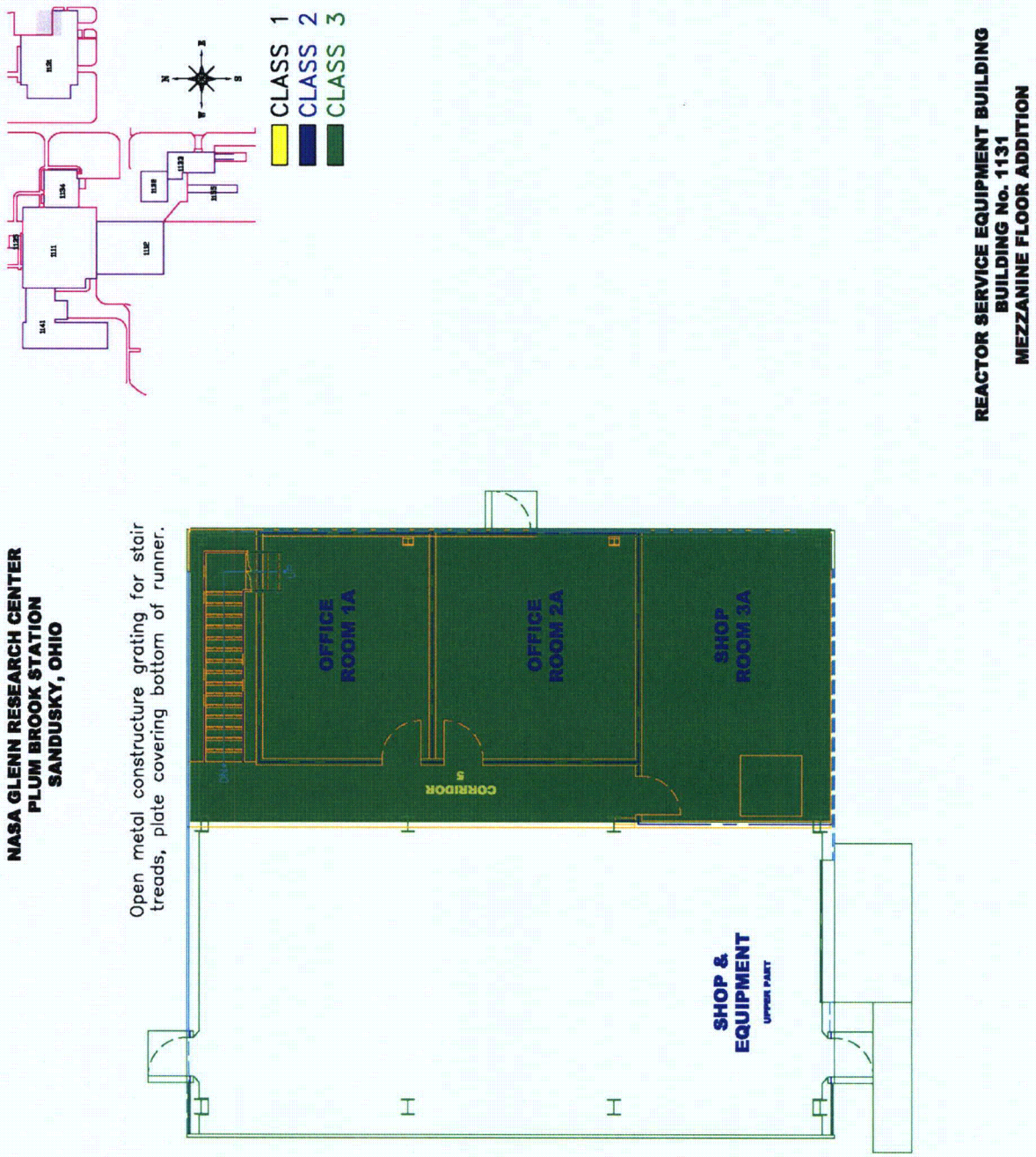

Figure D-13 – Service Equipment Building Mezzanine over Addition

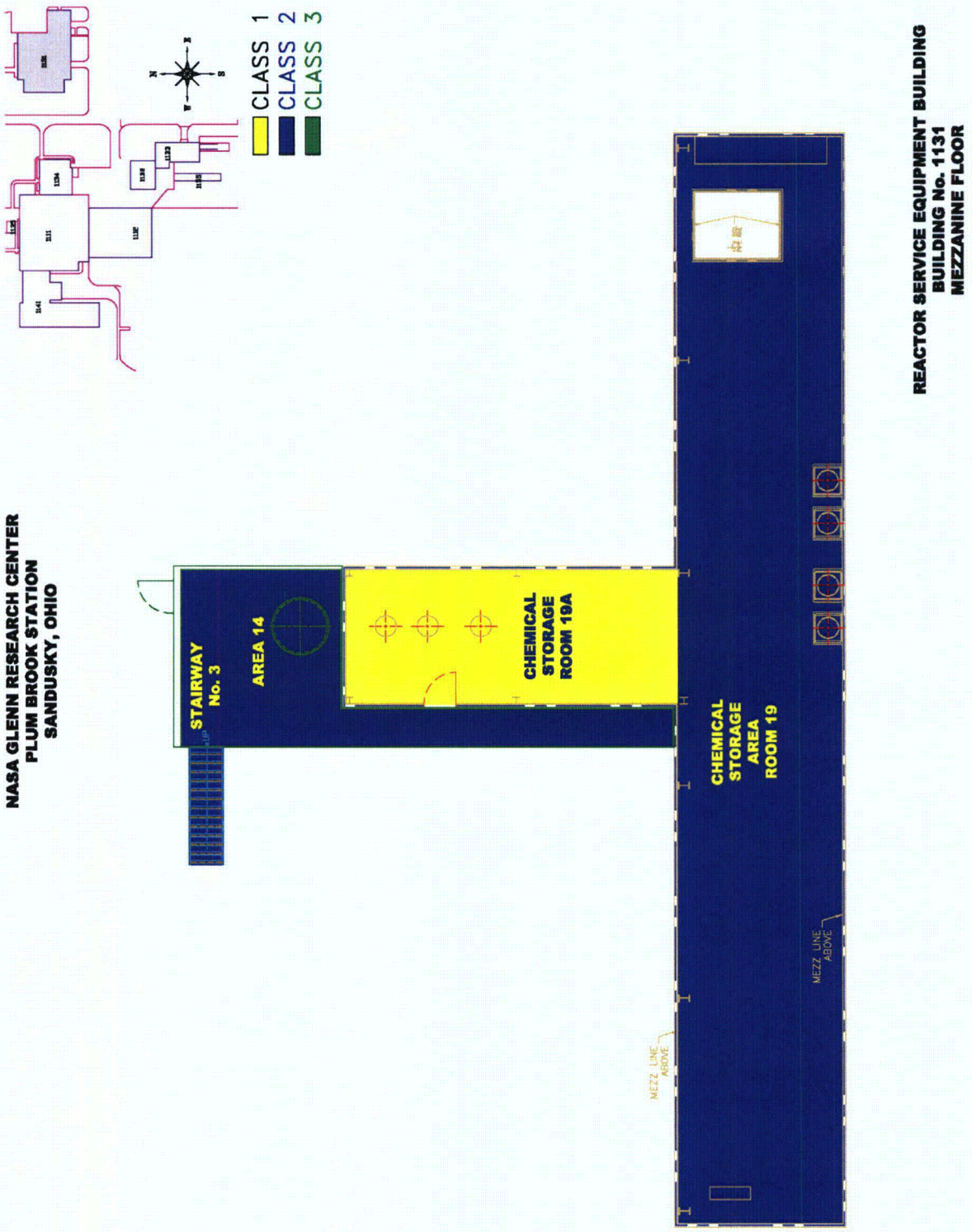

Figure D-14 – Service Equipment Building Mezzanine Elevation

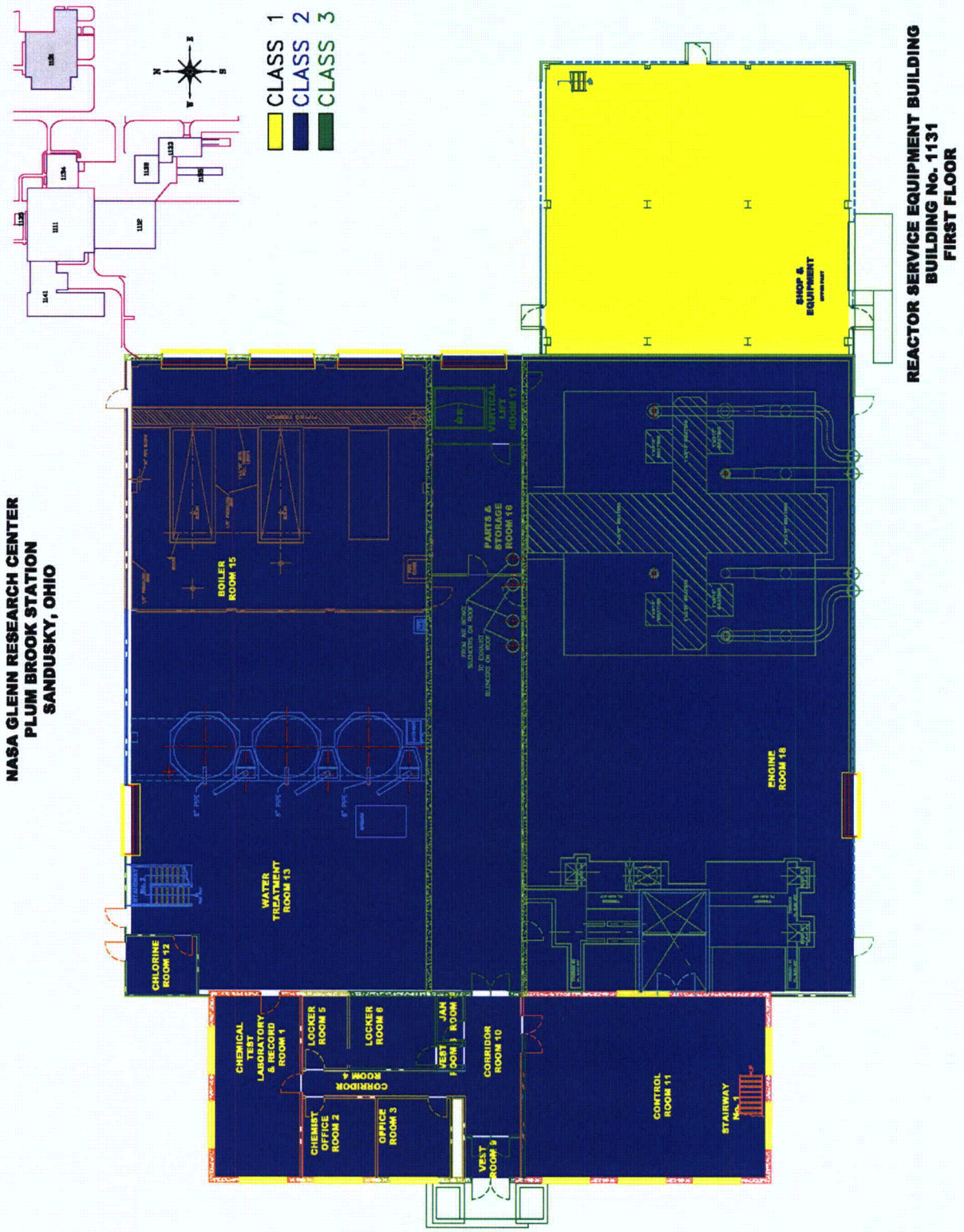

Figure D-15 – Service Equipment Building First Floor Elevation

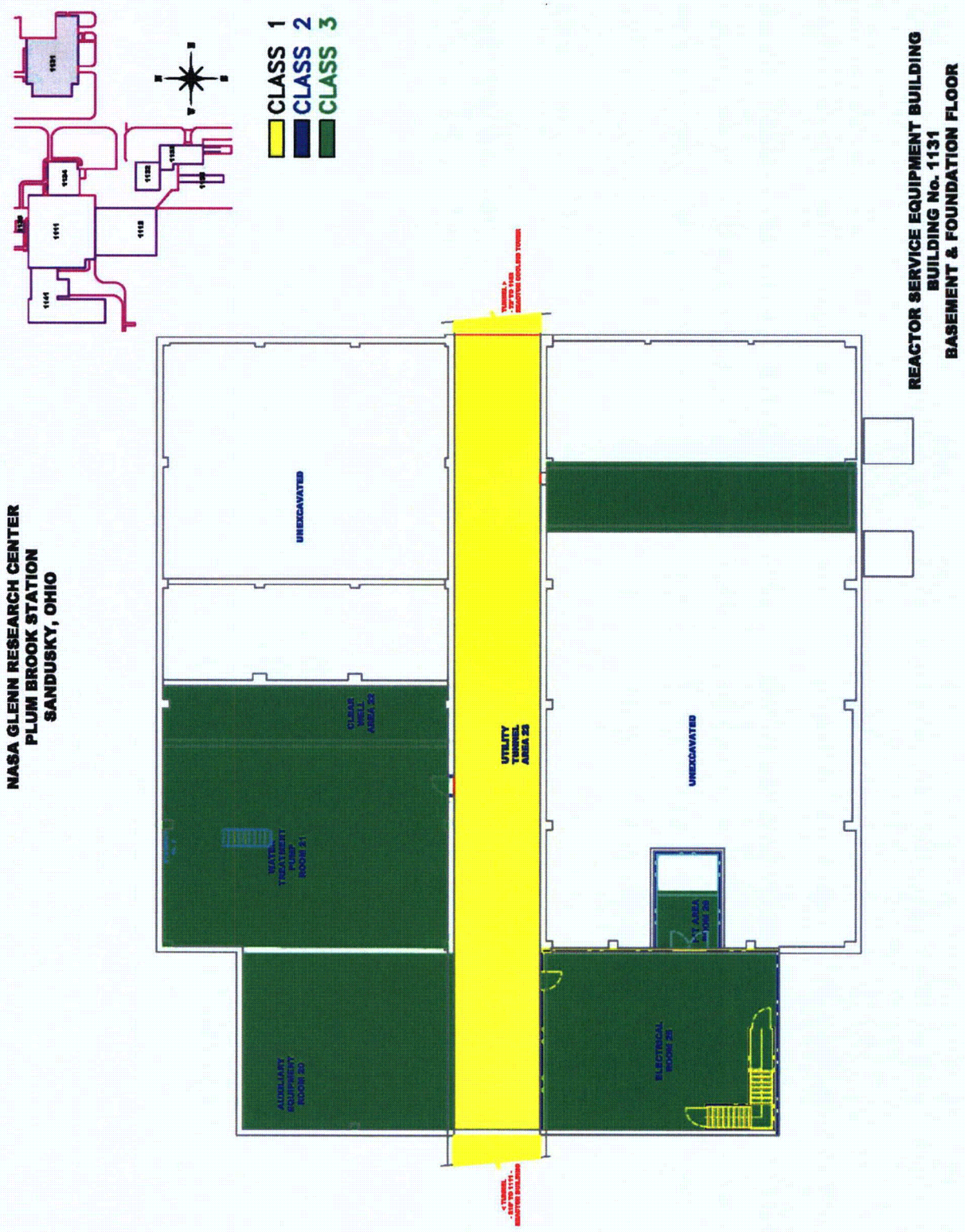

Figure D-16 – Service Equipment Building Basement Elevation

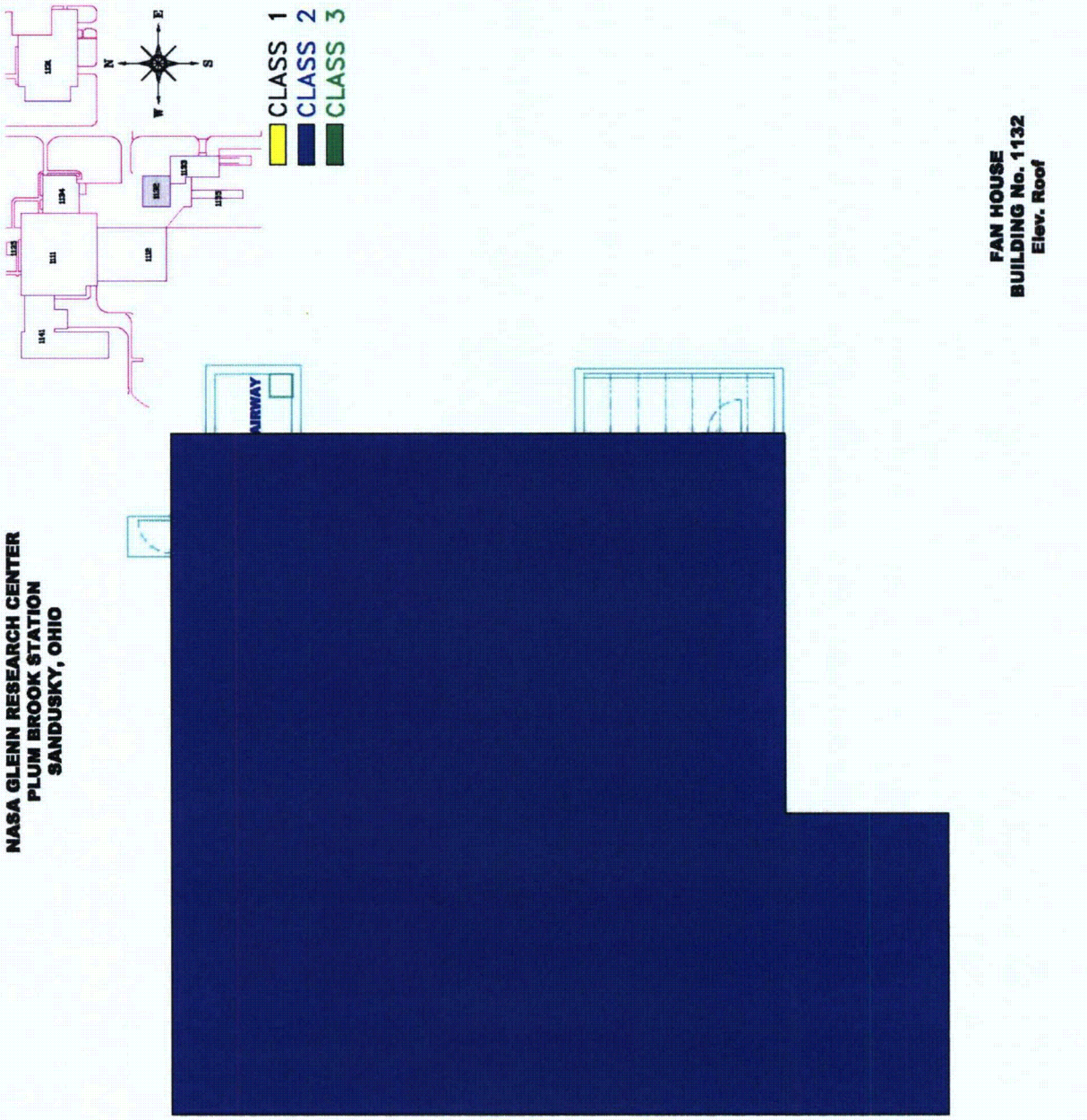

Figure D-17 – Fan House 0'-0" Elevation

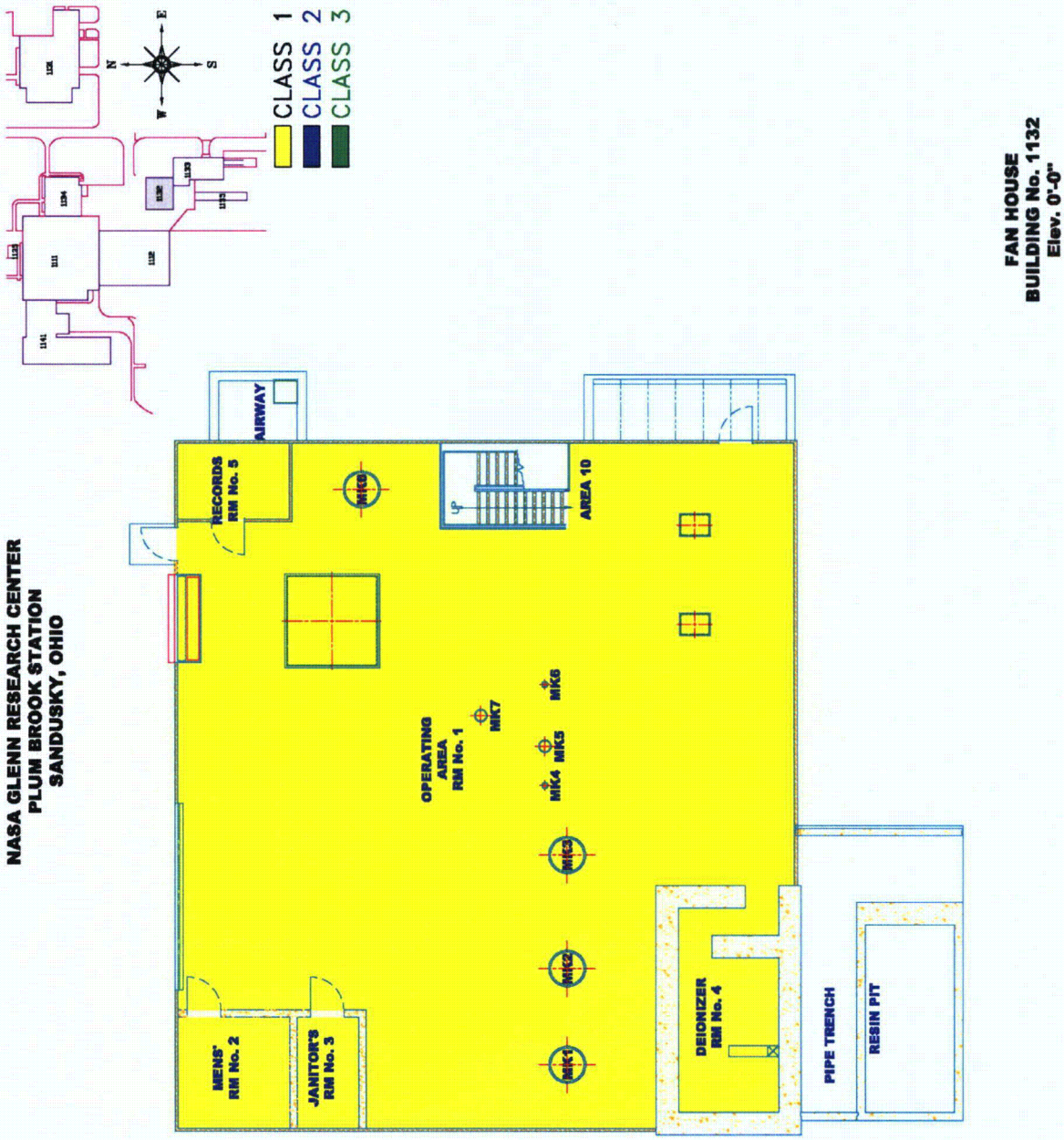

Figure D-18 – Fan House 0'-0" Elevation

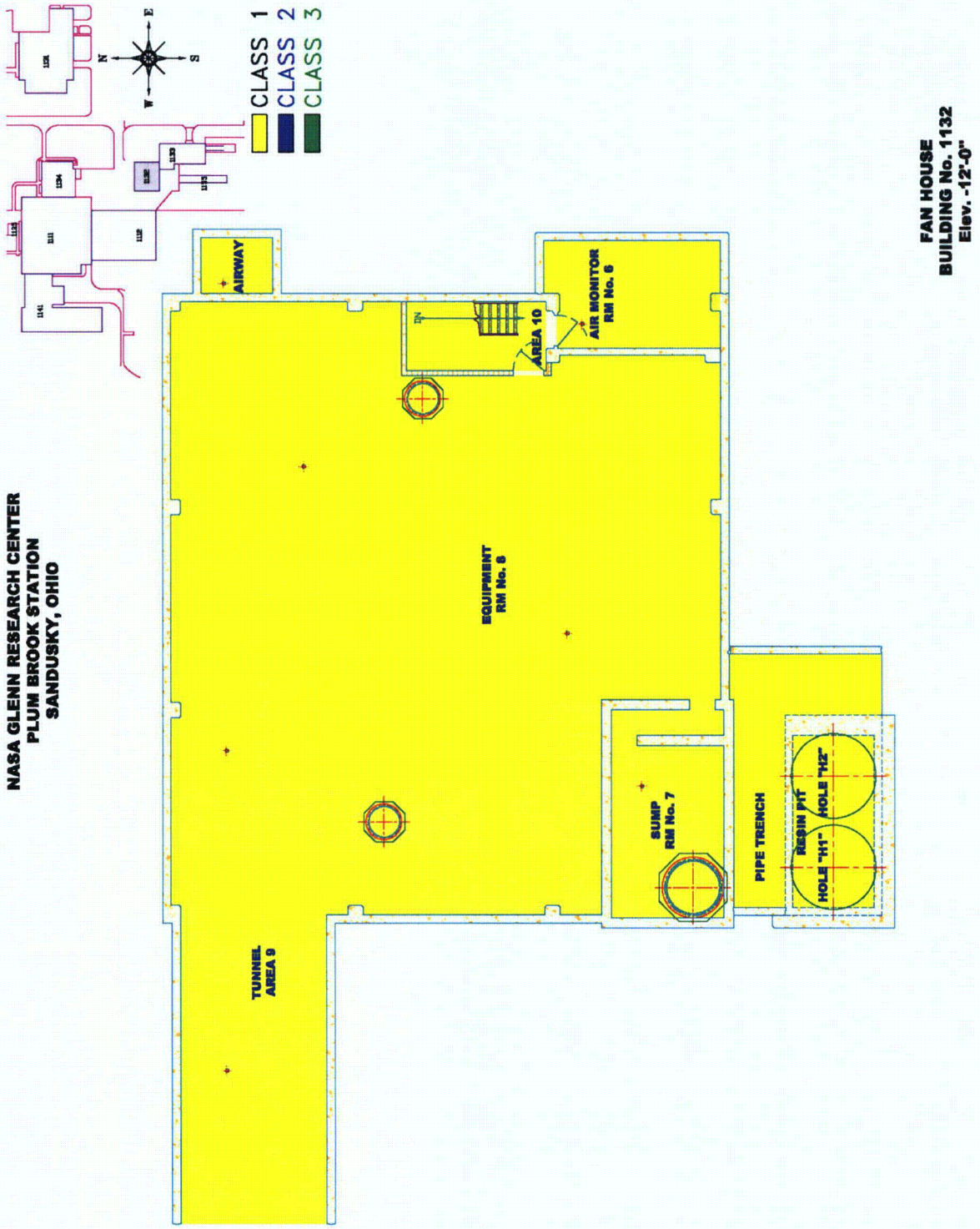

Figure D-19 – Fan House -12'-6" Elevation

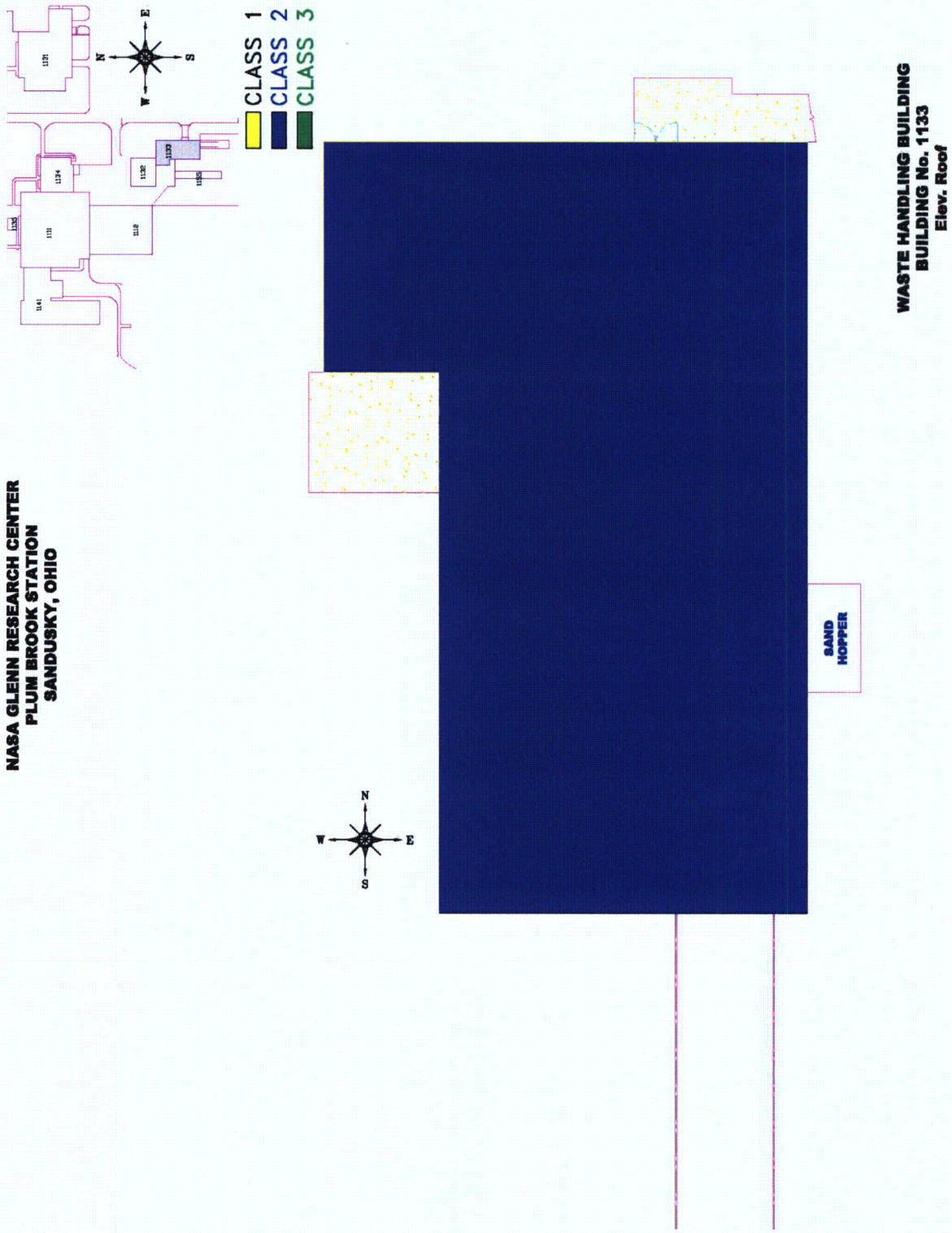

Figure D-20 – Waste Handling Building Roof Elevation

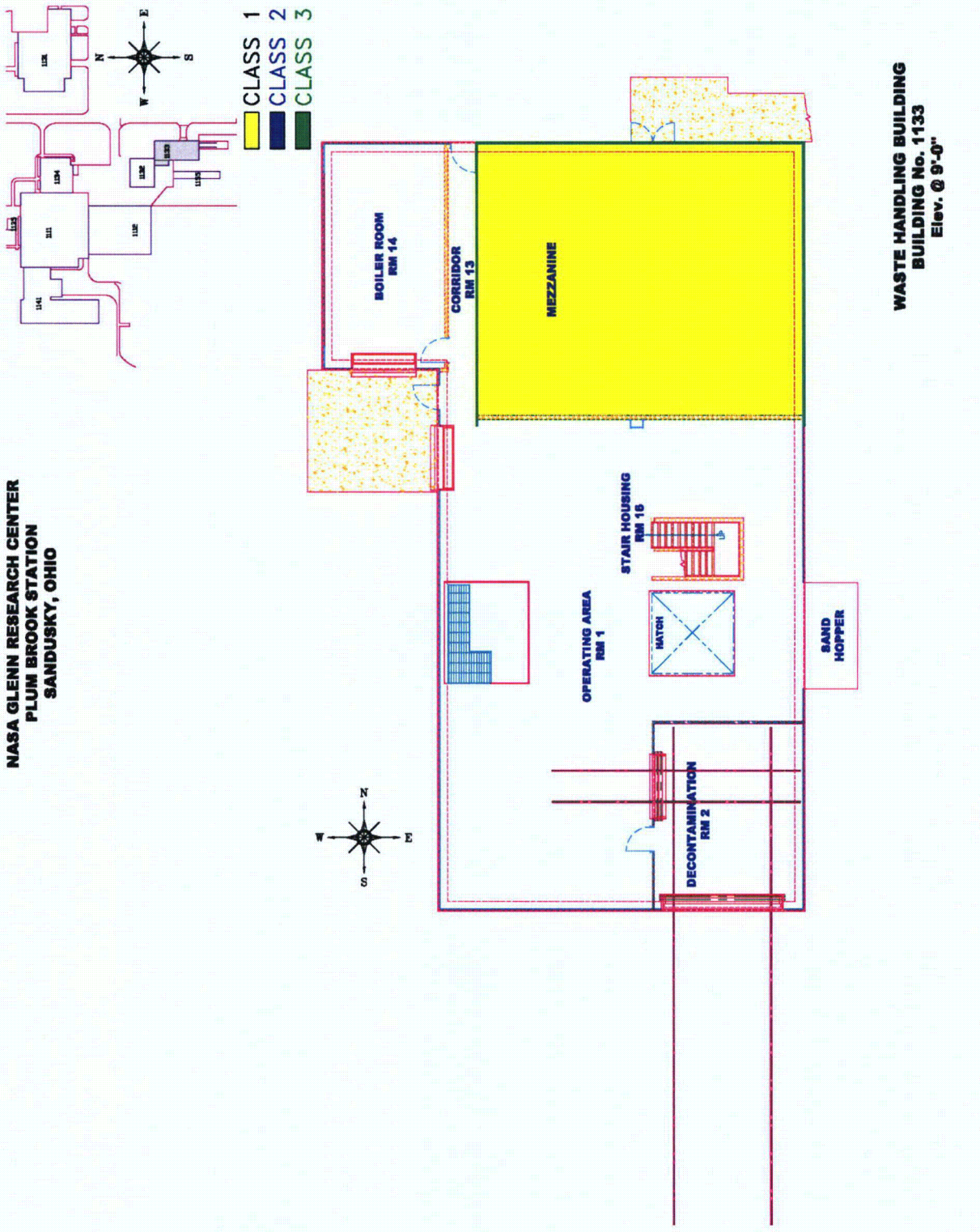

Figure D-21 – Waste Handling Building +9'-0" Elevation

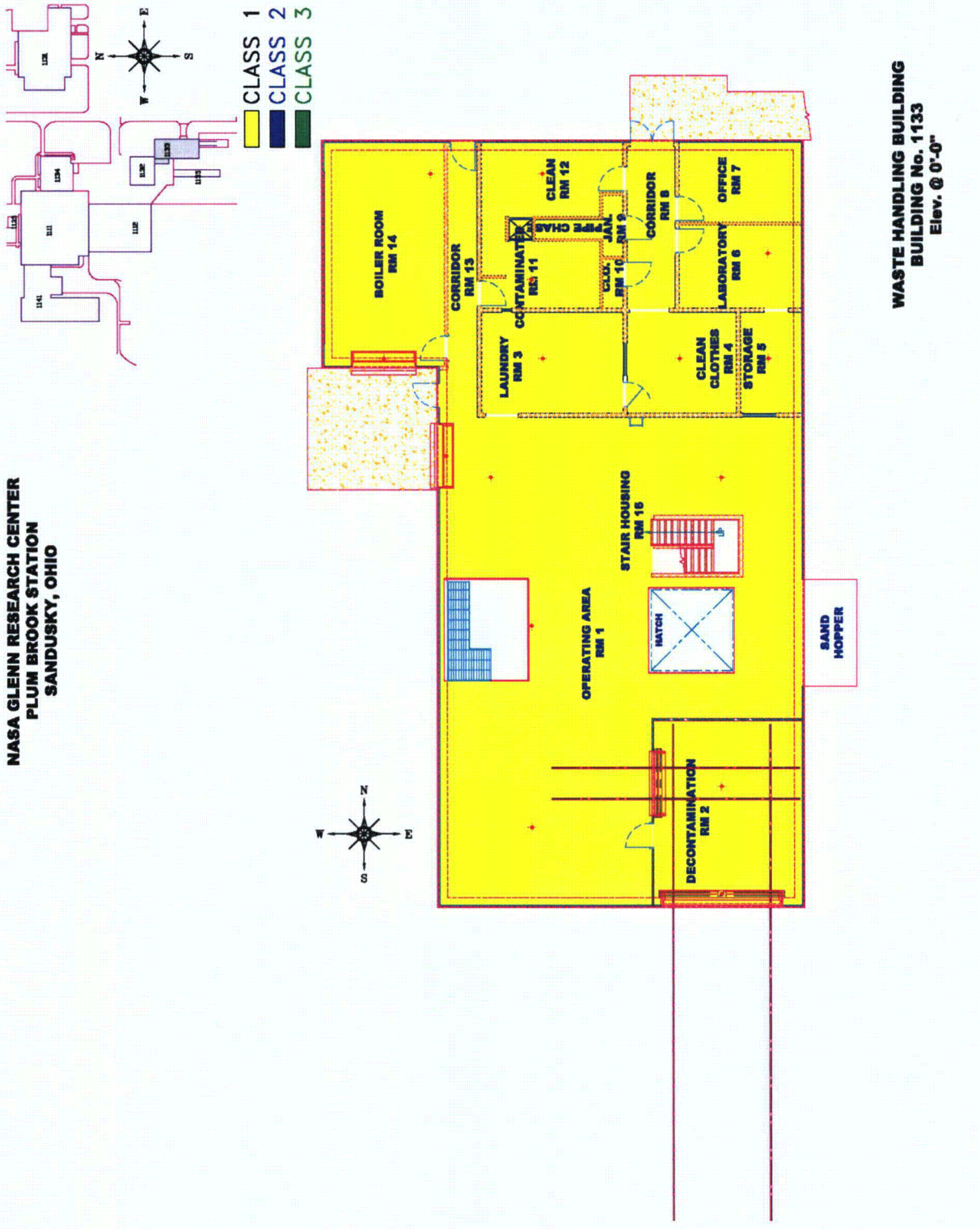

Figure D-22 – Waste Handling Building 0'-0" Elevation

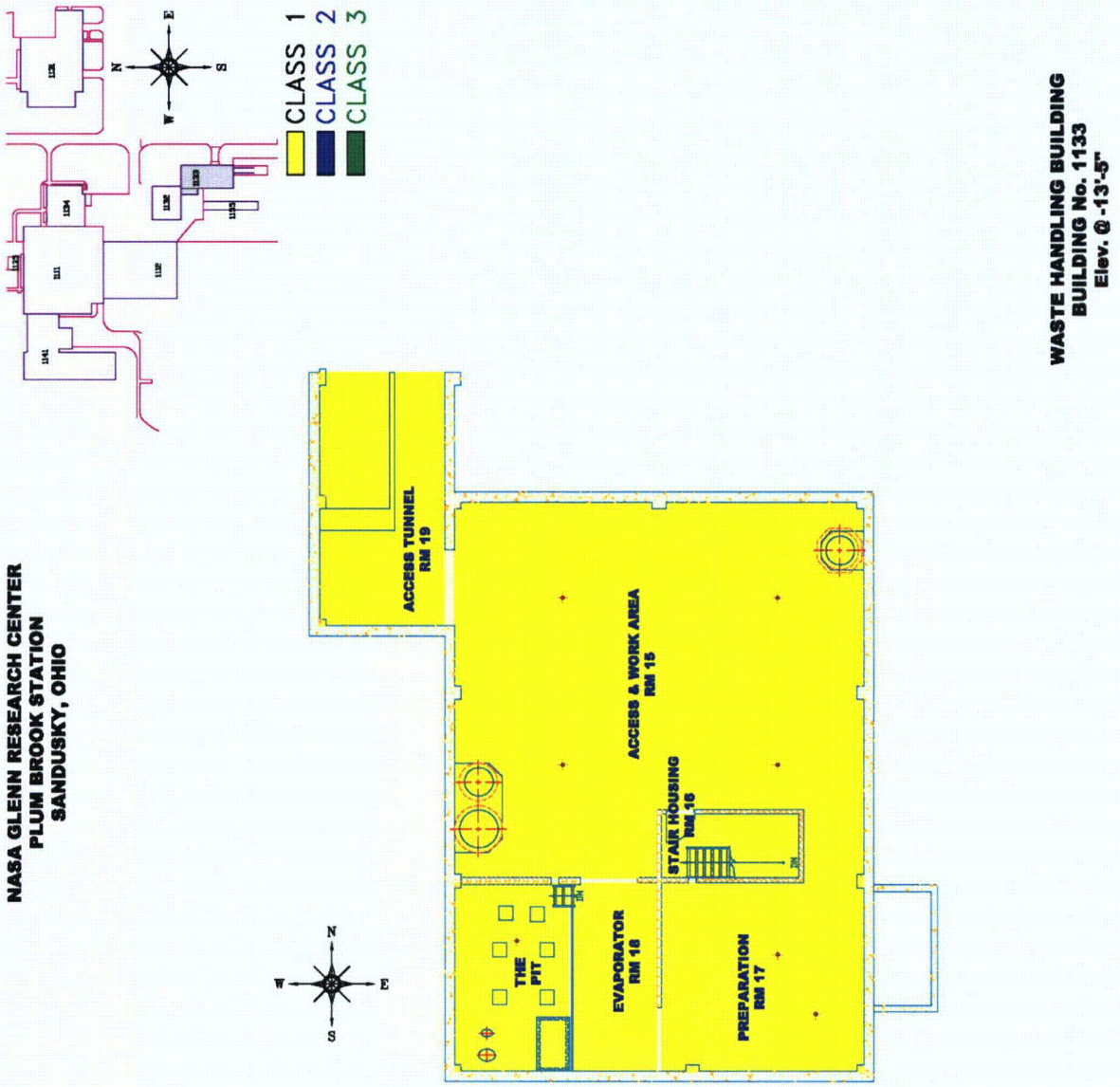

Figure D-23 – Waste Handling Building -13'-5" Elevation

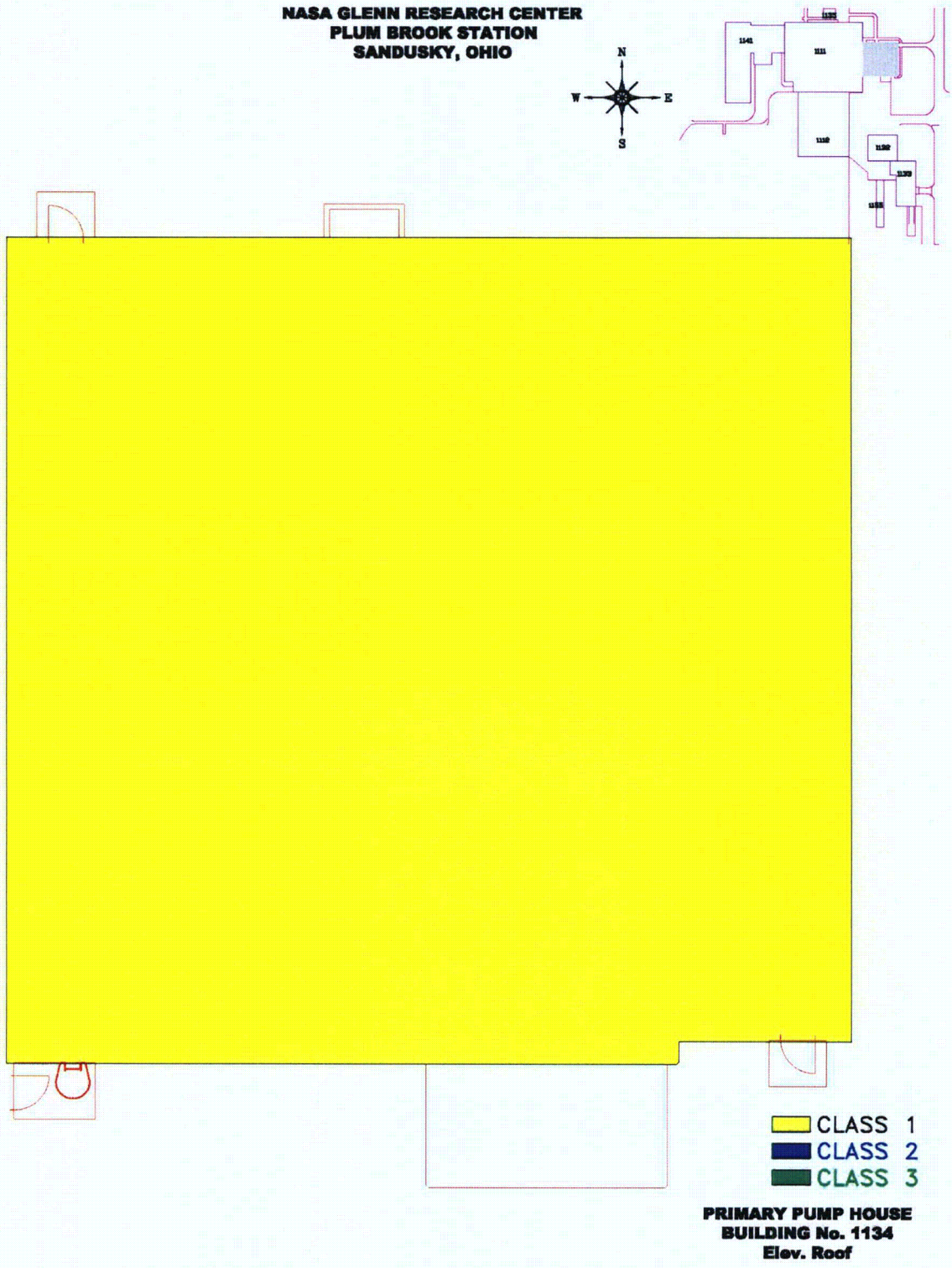

Figure D-24 – Primary Pump House Roof Elevation

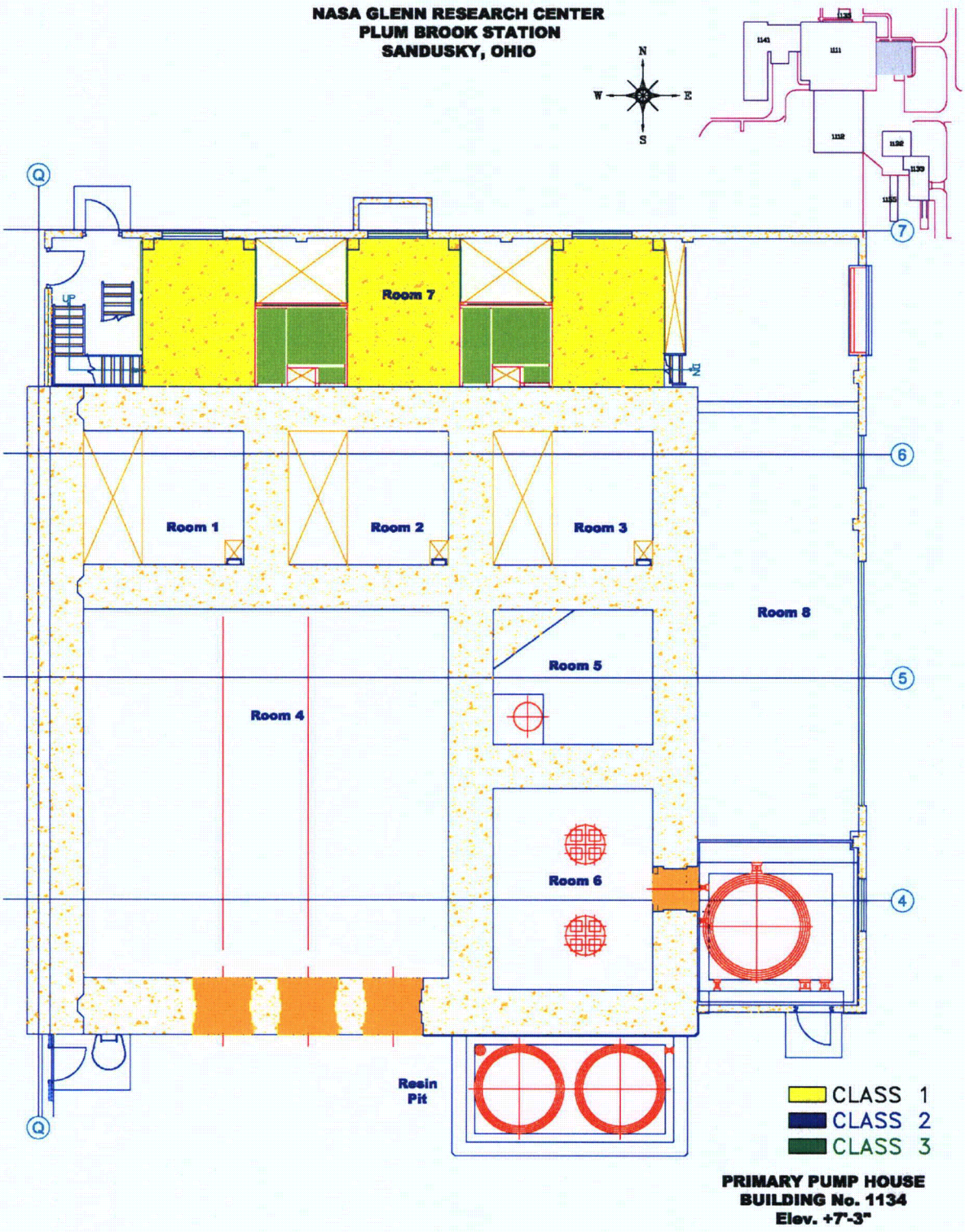

Figure D-25 – Primary Pump House +7'-3" Elevation

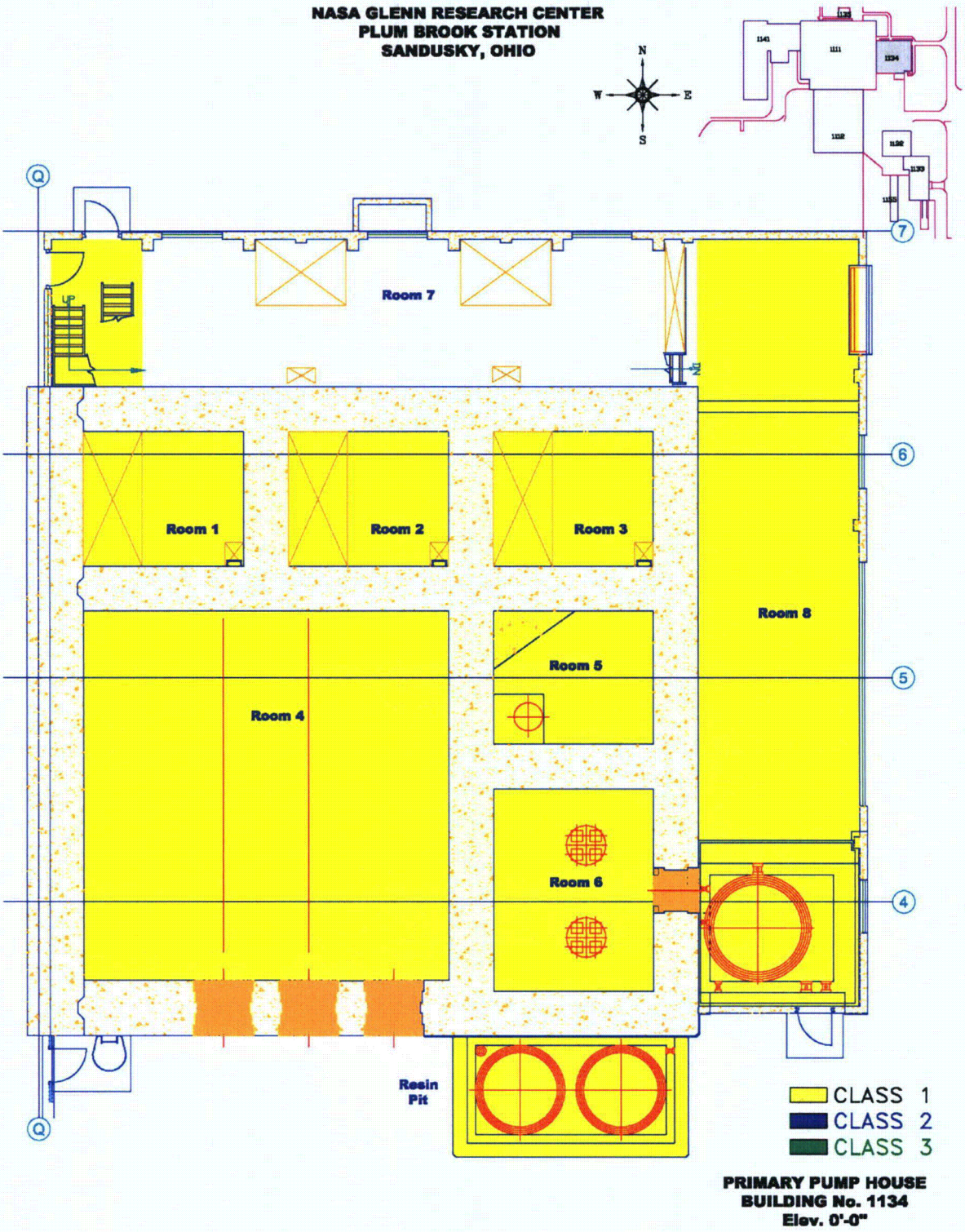

Figure D-26 – Primary Pump House 0'-0" Elevation

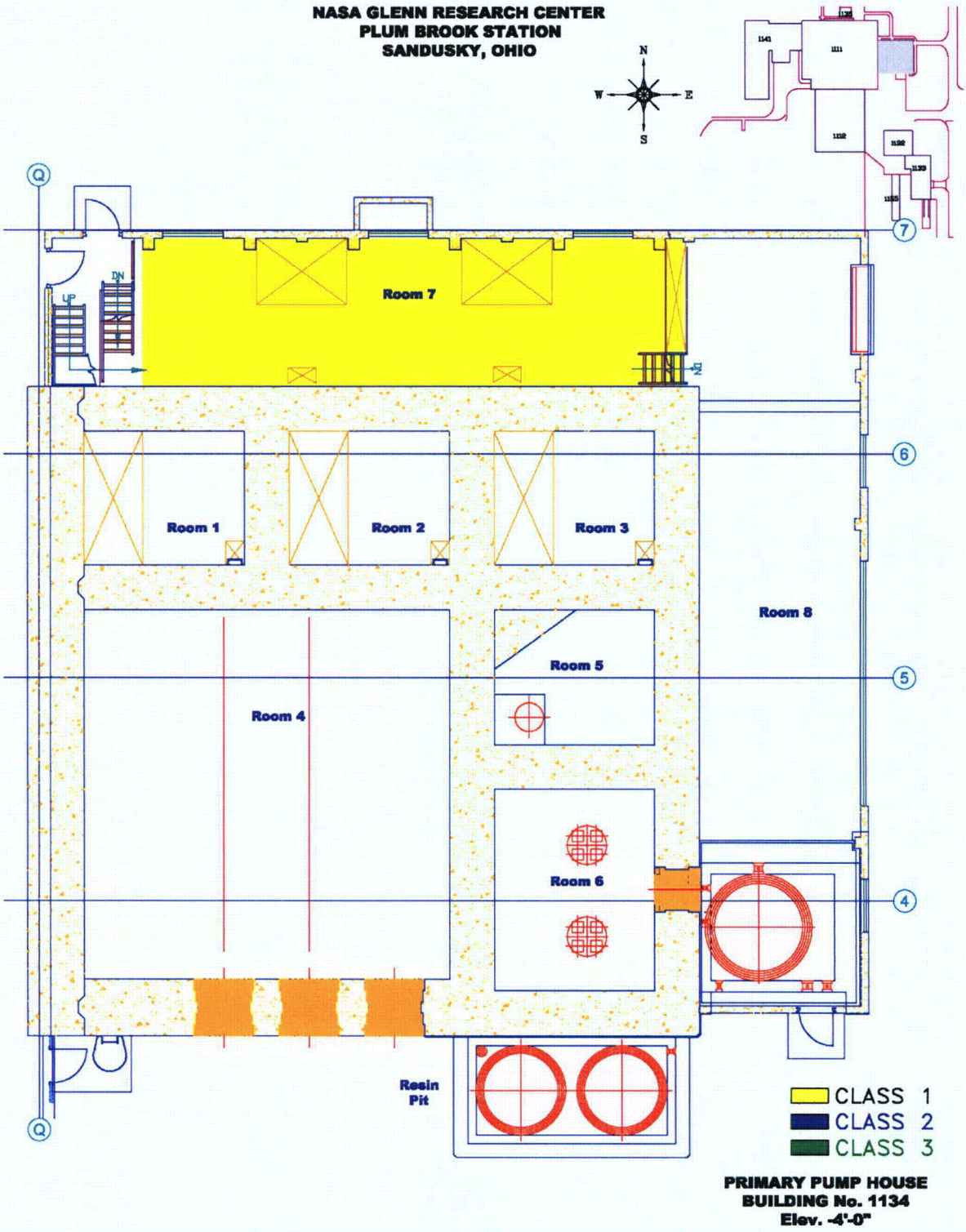

Figure D-27 – Primary Pump House -4'-0" Elevation

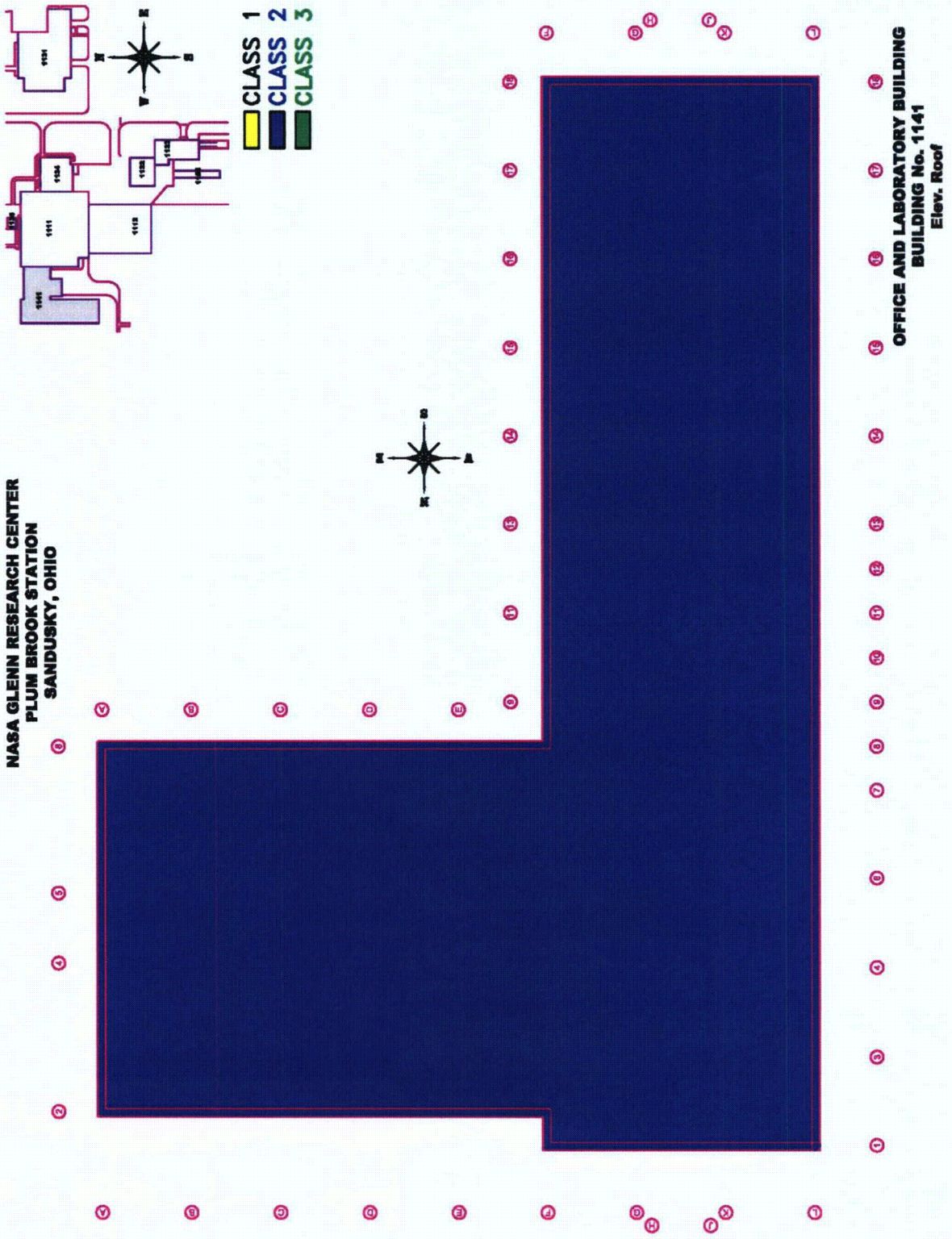

Figure D-28 – Reactor Office and Laboratory Building Roof Elevation

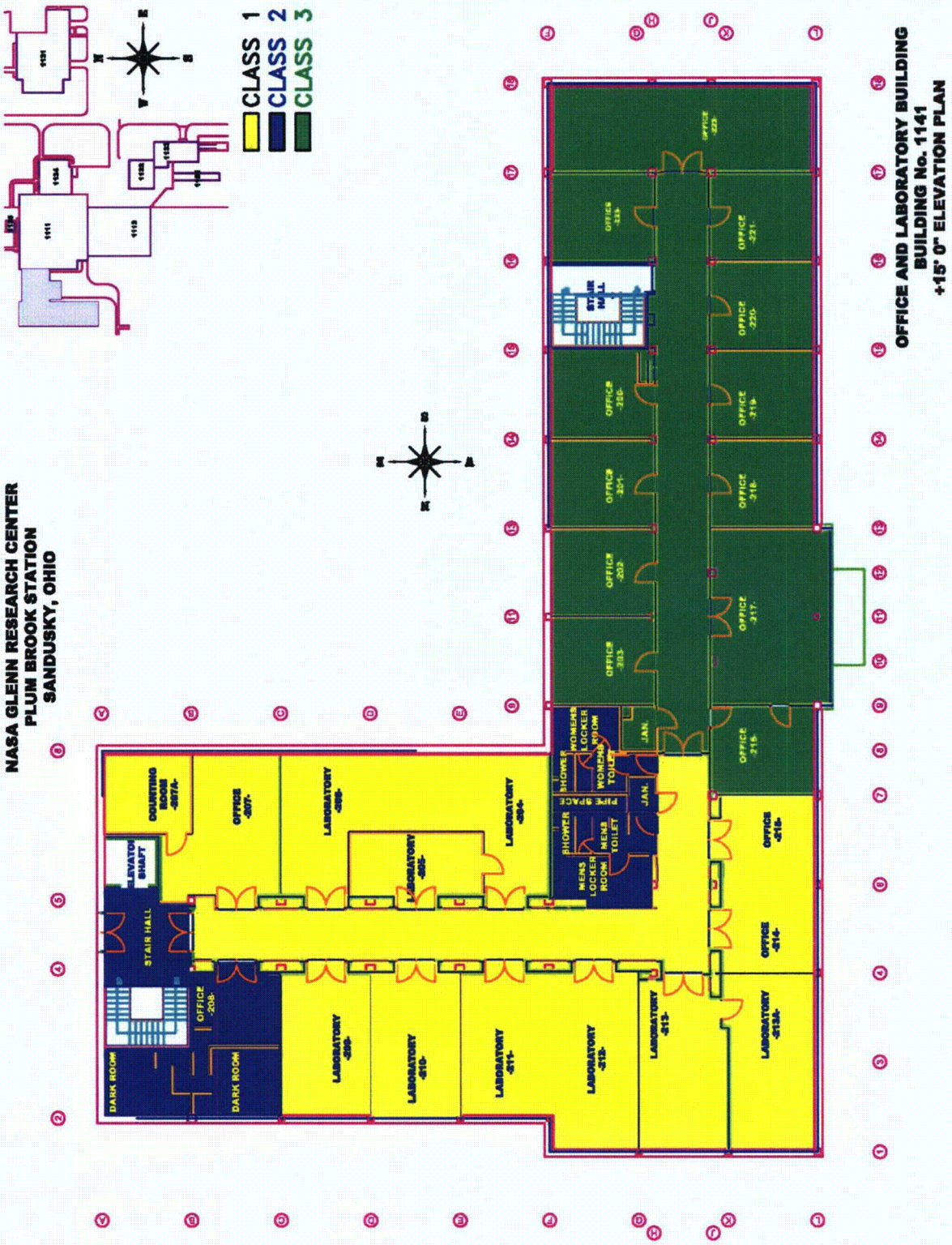

Figure D-29 – Reactor Office and Laboratory Building 2nd Floor Elevation

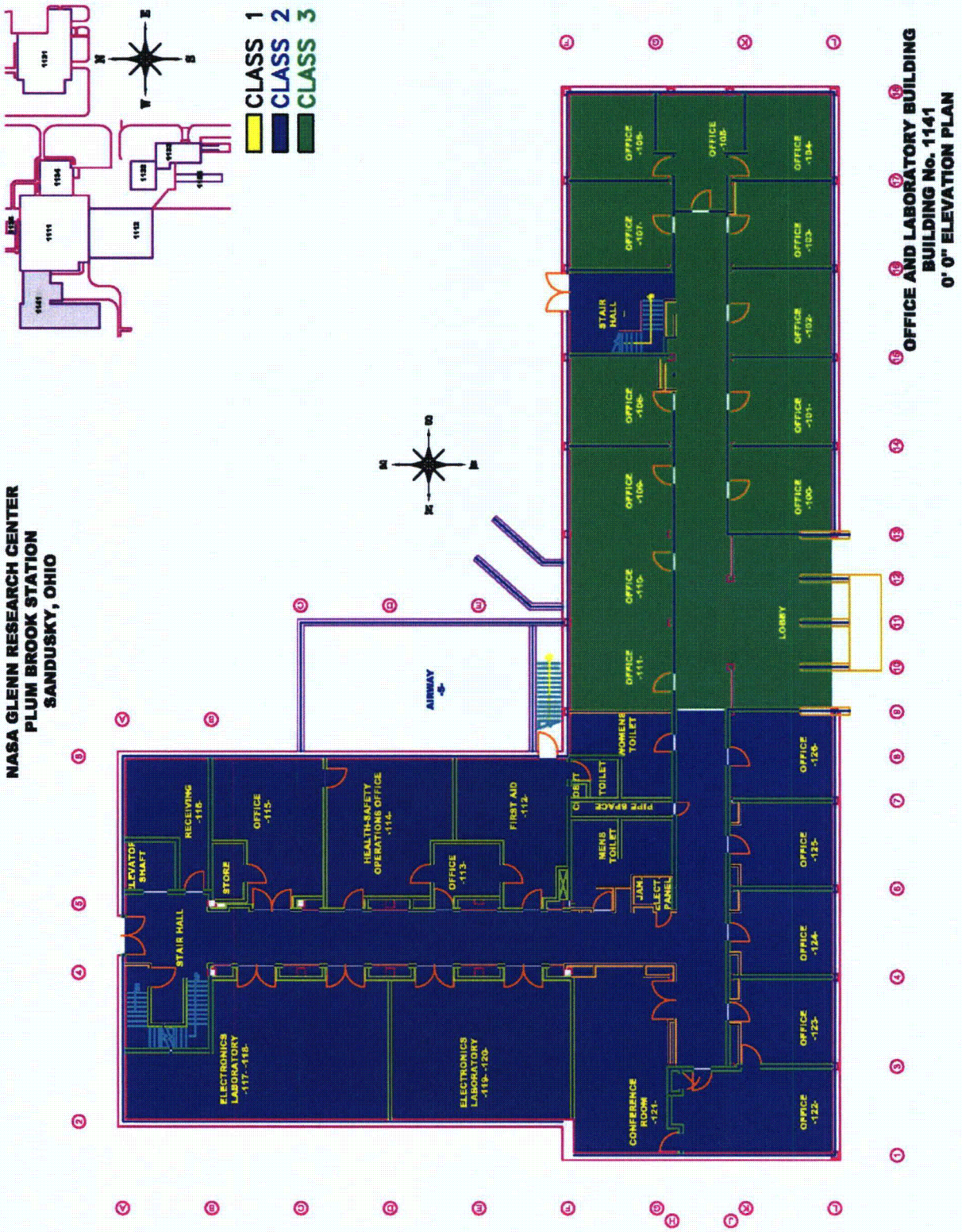

Figure D-30 – Reactor Office and Laboratory Building 1st Floor Elevation

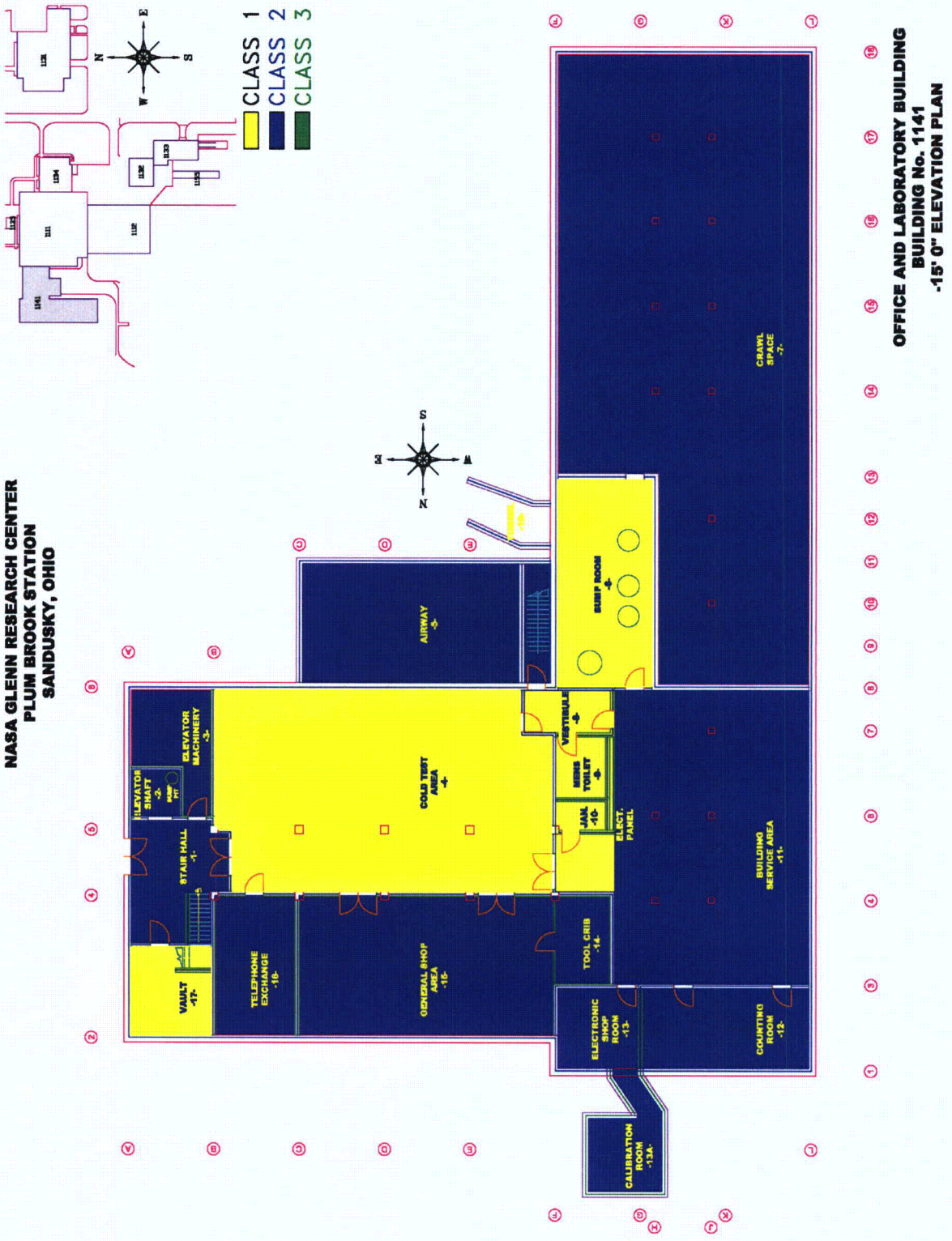

Figure D-31 – Reactor Office and Laboratory Building Basement Elevation

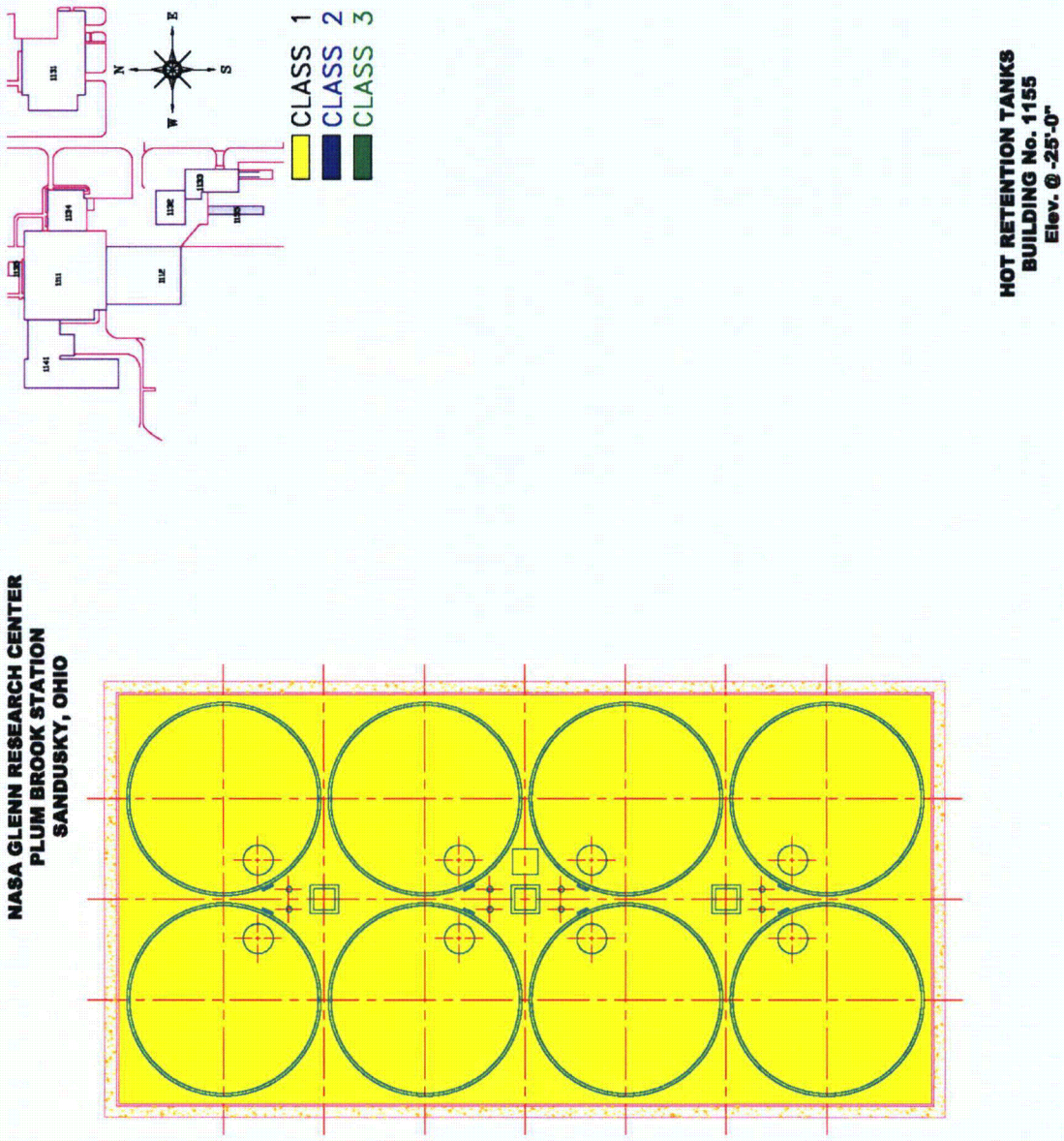

Figure D-32 – Hot Retention Area

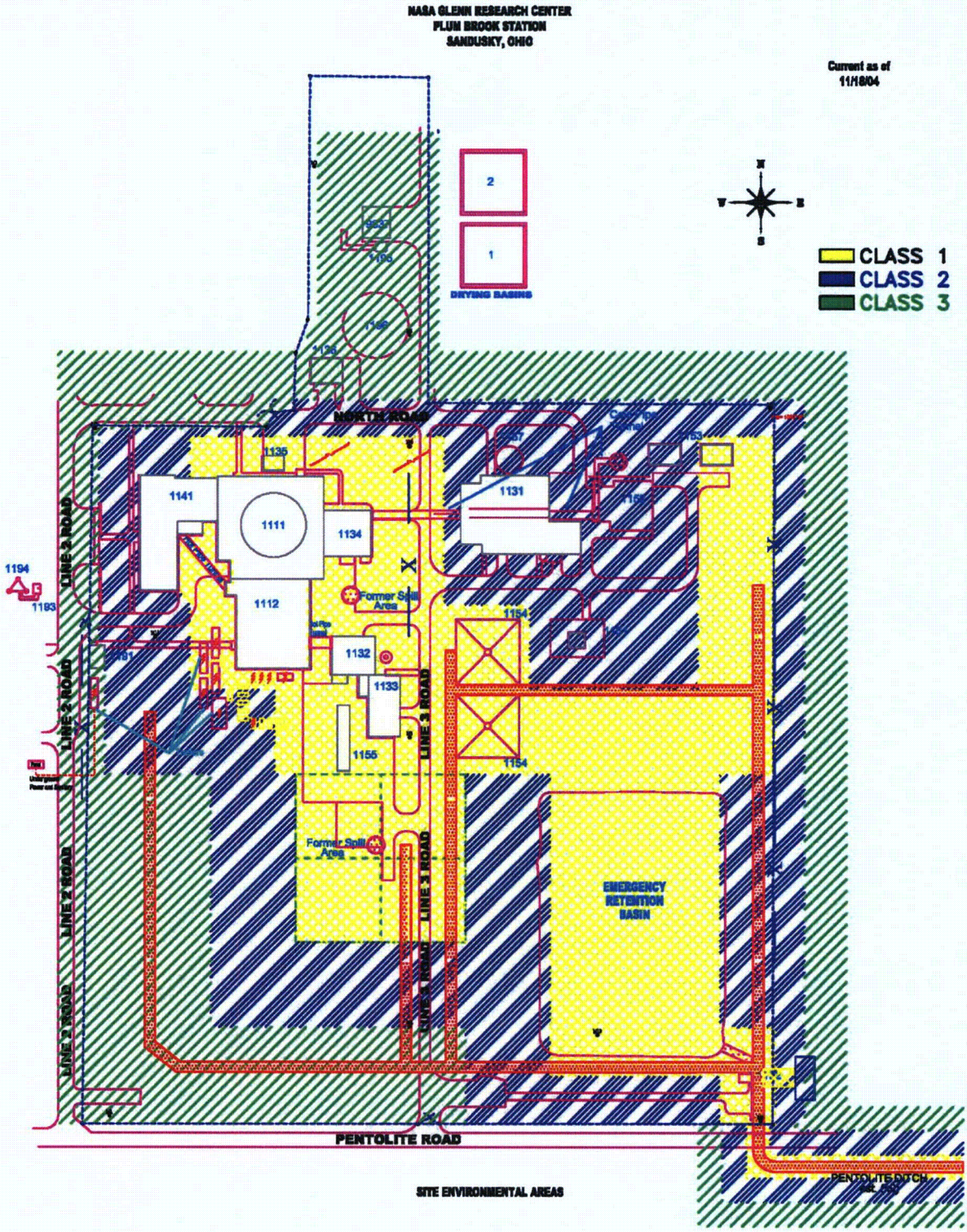

Figure D-33 – PBRF Environmental Areas