Full wwPDB X-ray Structure Validation Report ⓘ

May 16, 2020 – 04:04 pm BST

PDB ID	:	2QPN
Title	:	GES-1 beta-lactamase
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Deposited on	:	2007-07-24
Resolution	:	1.10 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at *validation@mail.wwpdb.org*
A user guide is available at
https://www.wwpdb.org/validation/2017/XrayValidationReportHelp
with specific help available everywhere you see the ⓘ symbol.

The following versions of software and data (see references ⓘ) were used in the production of this report:

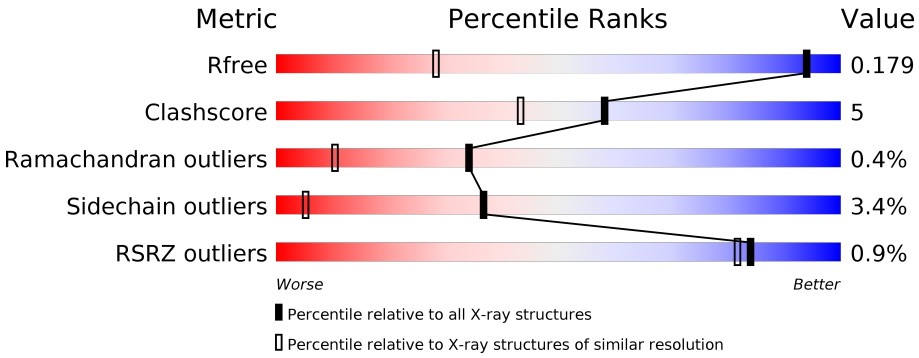
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.11
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.11

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 1.10 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	1619 (1.14-1.06)
Clashscore	141614	1671 (1.14-1.06)
Ramachandran outliers	138981	1615 (1.14-1.06)
Sidechain outliers	138945	1613 (1.14-1.06)
RSRZ outliers	127900	1588 (1.14-1.06)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments on the lower bar indicate the fraction of residues that contain outliers for >=3, 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions <=5% The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	287	% 78% 11% • • 8%
1	B	287	% 80% 11% • 7%

2 Entry composition

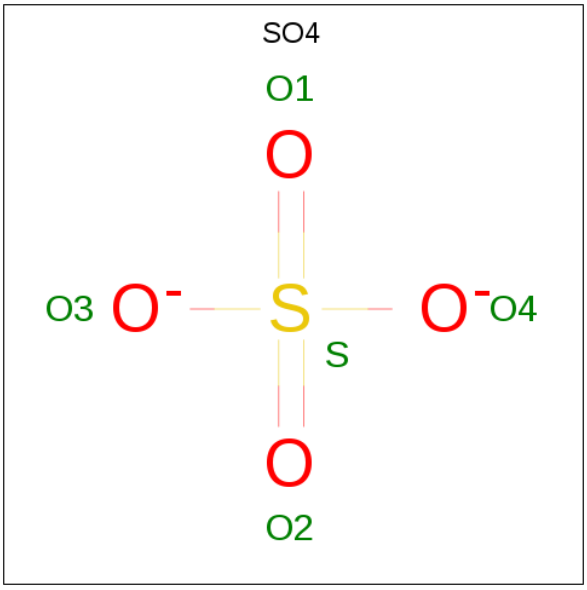
There are 3 unique types of molecules in this entry. The entry contains 4873 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called Beta-lactamase GES-1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	265	Total	C	N	O	S	0	15	0
			2074	1297	366	401	10			
1	B	266	Total	C	N	O	S	0	10	0
			2061	1288	363	397	13			

- Molecule 2 is SULFATE ION (three-letter code: SO4) (formula: O_4S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	O	S	0	0
			5	4	1		
2	B	1	Total	O	S	0	0
			5	4	1		

- Molecule 3 is water.

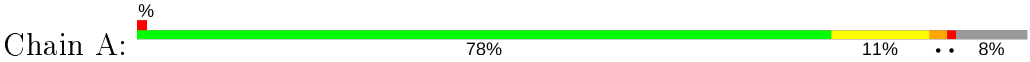
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	358	Total O 358 358	0	0
3	B	370	Total O 370 370	0	0

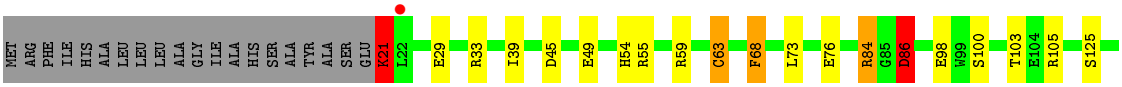
3 Residue-property plots (i)

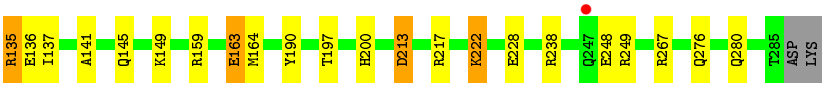
These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density (RSRZ > 2). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

- Molecule 1: Beta-lactamase GES-1

Chain A:

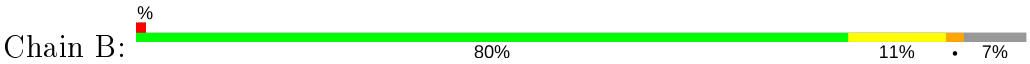


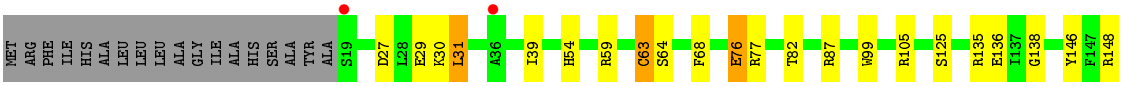


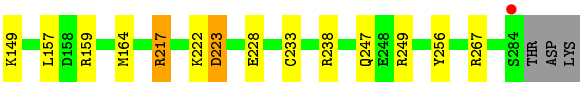


- Molecule 1: Beta-lactamase GES-1

Chain B:







4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	42.41Å 80.82Å 71.44Å 90.00° 101.43° 90.00°	Depositor
Resolution (Å)	10.00 – 1.10 19.54 – 1.10	Depositor EDS
% Data completeness (in resolution range)	(Not available) (10.00-1.10) 94.4 (19.54-1.10)	Depositor EDS
R_{merge}	0.05	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	3.81 (at 1.10Å)	Xtriage
Refinement program	SHELXL-97	Depositor
R, R_{free}	0.133 , 0.182 0.141 , 0.179	Depositor DCC
R_{free} test set	9114 reflections (5.06%)	wwPDB-VP
Wilson B-factor (Å^2)	10.6	Xtriage
Anisotropy	0.228	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.30 , 52.8	EDS
L-test for twinning[2]	$< \|L\| > = 0.46$, $< L^2 > = 0.29$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.98	EDS
Total number of atoms	4873	wwPDB-VP
Average B, all atoms (Å^2)	18.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.03% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: SO4

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	#$\|Z\|>5$	RMSZ	#$\|Z\|>5$
1	A	0.67	0/2173	1.60	33/2939 (1.1%)
1	B	0.68	0/2140	1.45	30/2894 (1.0%)
All	All	0.68	0/4313	1.53	63/5833 (1.1%)

There are no bond length outliers.

All (63) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	135	ARG	NE-CZ-NH2	31.07	135.83	120.30
1	B	59	ARG	NE-CZ-NH1	19.70	130.15	120.30
1	A	135	ARG	NE-CZ-NH1	-14.90	112.85	120.30
1	A	59[A]	ARG	NE-CZ-NH1	-13.07	113.77	120.30
1	A	59[B]	ARG	NE-CZ-NH1	-13.07	113.77	120.30
1	B	217[A]	ARG	NE-CZ-NH1	12.41	126.50	120.30
1	B	217[B]	ARG	NE-CZ-NH1	12.41	126.50	120.30
1	B	148	ARG	NE-CZ-NH1	12.05	126.33	120.30
1	A	21	LYS	N-CA-CB	11.41	131.13	110.60
1	B	238	ARG	NE-CZ-NH1	10.68	125.64	120.30
1	B	223	ASP	CB-CG-OD1	10.63	127.87	118.30
1	B	249	ARG	CD-NE-CZ	10.48	138.28	123.60
1	B	59	ARG	CD-NE-CZ	9.65	137.10	123.60
1	A	135	ARG	CA-CB-CG	9.40	134.08	113.40
1	A	68	PHE	CB-CG-CD2	9.09	127.16	120.80
1	B	68	PHE	CB-CG-CD2	8.99	127.09	120.80
1	A	68	PHE	CB-CG-CD1	-8.93	114.55	120.80
1	B	249	ARG	CG-CD-NE	8.50	129.64	111.80
1	A	238	ARG	NE-CZ-NH1	8.41	124.50	120.30
1	B	135	ARG	NE-CZ-NH1	8.11	124.36	120.30
1	A	217	ARG	NE-CZ-NH1	-7.78	116.41	120.30
1	B	105	ARG	NE-CZ-NH2	7.71	124.16	120.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	77	ARG	NE-CZ-NH1	7.66	124.13	120.30
1	A	59[A]	ARG	NE-CZ-NH2	7.62	124.11	120.30
1	A	59[B]	ARG	NE-CZ-NH2	7.62	124.11	120.30
1	A	59[A]	ARG	CD-NE-CZ	7.57	134.20	123.60
1	A	59[B]	ARG	CD-NE-CZ	7.57	134.20	123.60
1	A	55	ARG	NE-CZ-NH1	7.39	123.99	120.30
1	A	135	ARG	NH1-CZ-NH2	-7.37	111.30	119.40
1	A	217	ARG	NE-CZ-NH2	7.20	123.90	120.30
1	A	213	ASP	CB-CG-OD2	7.14	124.73	118.30
1	A	163	GLU	CA-CB-CG	6.91	128.59	113.40
1	B	148	ARG	NE-CZ-NH2	-6.89	116.86	120.30
1	B	59	ARG	NH1-CZ-NH2	-6.68	112.06	119.40
1	B	77	ARG	NE-CZ-NH2	-6.55	117.02	120.30
1	A	84[A]	ARG	NE-CZ-NH1	6.55	123.58	120.30
1	A	84[B]	ARG	NE-CZ-NH1	6.55	123.58	120.30
1	A	238	ARG	NE-CZ-NH2	-6.31	117.14	120.30
1	A	86[A]	ASP	CB-CG-OD2	5.90	123.61	118.30
1	A	86[B]	ASP	CB-CG-OD2	5.90	123.61	118.30
1	B	223	ASP	CB-CG-OD2	-5.86	113.03	118.30
1	B	31	LEU	CB-CG-CD1	5.81	120.88	111.00
1	A	159	ARG	NE-CZ-NH2	-5.76	117.42	120.30
1	B	105	ARG	NH1-CZ-NH2	-5.71	113.11	119.40
1	B	238	ARG	NH1-CZ-NH2	-5.67	113.16	119.40
1	B	27	ASP	CB-CG-OD1	5.67	123.40	118.30
1	B	135	ARG	NE-CZ-NH2	-5.66	117.47	120.30
1	A	49	GLU	OE1-CD-OE2	-5.52	116.68	123.30
1	A	190	TYR	CB-CG-CD1	-5.49	117.70	121.00
1	A	105	ARG	NE-CZ-NH1	5.32	122.96	120.30
1	B	267	ARG	NE-CZ-NH1	5.29	122.94	120.30
1	B	68	PHE	CB-CG-CD1	-5.22	117.14	120.80
1	B	256	TYR	CB-CG-CD2	5.19	124.11	121.00
1	A	84[A]	ARG	CD-NE-CZ	5.17	130.84	123.60
1	A	84[B]	ARG	CD-NE-CZ	5.17	130.84	123.60
1	B	135	ARG	CD-NE-CZ	5.16	130.82	123.60
1	B	99	TRP	CA-CB-CG	-5.15	103.91	113.70
1	B	159	ARG	CD-NE-CZ	5.15	130.81	123.60
1	B	146	TYR	CB-CG-CD1	-5.12	117.93	121.00
1	A	267	ARG	NE-CZ-NH1	5.05	122.83	120.30
1	B	59	ARG	NE-CZ-NH2	-5.03	117.78	120.30
1	A	84[A]	ARG	NH1-CZ-NH2	-5.00	113.90	119.40
1	A	84[B]	ARG	NH1-CZ-NH2	-5.00	113.90	119.40

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts (i)

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	2074	0	2072	23	0
1	B	2061	0	2050	16	0
2	A	5	0	0	0	0
2	B	5	0	0	0	0
3	A	358	0	0	14	0
3	B	370	0	0	5	0
All	All	4873	0	4122	39	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 5.

All (39) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:141:ALA:O	1:A:145[A]:GLN:HG3	1.87	0.74
1:B:157:LEU:HD11	1:B:164[B]:MET:HE1	1.71	0.72
1:A:280[B]:GLN:HG3	3:A:477:HOH:O	1.89	0.71
1:A:197[B]:THR:HG23	3:A:457:HOH:O	1.95	0.67
1:A:21:LYS:HE2	3:A:406:HOH:O	1.94	0.66
1:A:213:ASP:OD1	3:A:650:HOH:O	2.14	0.66
1:A:222[B]:LYS:HE2	3:A:495:HOH:O	1.99	0.61
1:A:249:ARG:HG3	3:A:466:HOH:O	2.02	0.60
1:B:63[A]:CYS:SG	1:B:233:CYS:CB	2.90	0.60
1:B:29:GLU:OE2	1:B:54:HIS:HE1	1.85	0.60
1:B:217[A]:ARG:HG3	3:B:309:HOH:O	2.01	0.58
1:B:30:LYS:HD3	3:B:611:HOH:O	2.03	0.57
1:B:39:ILE:O	1:B:54:HIS:HD2	1.87	0.57
1:B:63[B]:CYS:SG	1:B:64:SER:N	2.79	0.55
1:B:138:GLY:HA2	3:B:643:HOH:O	2.06	0.55
1:A:248:GLU:HB2	3:A:652:HOH:O	2.07	0.54
1:A:136:GLU:HG2	3:A:367:HOH:O	2.07	0.53
1:B:63[A]:CYS:SG	1:B:233:CYS:HB3	2.49	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:135:ARG:NH1	3:A:367:HOH:O	2.45	0.49
1:B:63[B]:CYS:SG	1:B:233:CYS:HB3	2.53	0.48
1:A:145[B]:GLN:HG2	3:A:483:HOH:O	2.13	0.48
1:B:63[B]:CYS:CB	1:B:64:SER:N	2.77	0.48
1:A:100:SER:HB3	1:A:103[B]:THR:OG1	2.14	0.48
1:A:276:GLN:O	1:A:280[B]:GLN:HG2	2.15	0.46
1:A:63[B]:CYS:HA	1:A:164:MET:SD	2.56	0.46
1:A:76:GLU:OE1	1:A:149:LYS:HE2	2.16	0.46
1:A:39:ILE:O	1:A:54:HIS:HD2	1.99	0.45
1:B:76[B]:GLU:OE1	1:B:149:LYS:NZ	2.49	0.45
1:A:98:GLU:HG2	3:A:462:HOH:O	2.17	0.45
1:A:84[B]:ARG:NH2	3:A:580:HOH:O	2.49	0.44
1:A:73[B]:LEU:CD2	1:A:137:ILE:HD13	2.48	0.42
1:B:247:GLN:HB2	3:B:465:HOH:O	2.19	0.42
1:A:84[A]:ARG:NH1	1:A:86[A]:ASP:OD1	2.48	0.42
1:A:200:HIS:HD2	3:A:606:HOH:O	2.03	0.41
1:A:29:GLU:O	1:A:33:ARG:HG3	2.21	0.41
1:A:135:ARG:HG3	3:A:367:HOH:O	2.20	0.41
1:B:87:ARG:NE	1:B:136:GLU:OE2	2.54	0.41
1:B:87:ARG:NH1	3:B:547:HOH:O	2.54	0.40

There are no symmetry-related clashes.

5.3 Torsion angles (i)

5.3.1 Protein backbone (i)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
1	A	279/287 (97%)	273 (98%)	4 (1%)	2 (1%)	22 4
1	B	275/287 (96%)	269 (98%)	3 (1%)	3 (1%)	14 1
All	All	554/574 (96%)	542 (98%)	7 (1%)	5 (1%)	34 2

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	63[A]	CYS
1	B	63[C]	CYS
1	B	63[B]	CYS
1	A	63[A]	CYS
1	A	63[B]	CYS

5.3.2 Protein sidechains (i)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
1	A	224/227 (99%)	214 (96%)	10 (4%)	27 3
1	B	220/227 (97%)	213 (97%)	7 (3%)	39 7
All	All	444/454 (98%)	427 (96%)	17 (4%)	37 4

All (17) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	21	LYS
1	A	45	ASP
1	A	68	PHE
1	A	86[A]	ASP
1	A	86[B]	ASP
1	A	125	SER
1	A	163	GLU
1	A	222[A]	LYS
1	A	222[B]	LYS
1	A	228	GLU
1	B	31	LEU
1	B	76[A]	GLU
1	B	76[B]	GLU
1	B	125	SER
1	B	222	LYS
1	B	223	ASP
1	B	228	GLU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (6) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	54	HIS
1	A	167	ASN
1	A	210	GLN
1	B	38	GLN
1	B	54	HIS
1	B	167	ASN

5.3.3 RNA

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates

There are no carbohydrates in this entry.

5.6 Ligand geometry

2 ligands are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\| > 2$	Counts	RMSZ	$\#\|Z\| > 2$
2	SO4	A	300	-	4,4,4	1.61	2 (50%)	6,6,6	1.50	1 (16%)
2	SO4	B	300	-	4,4,4	1.69	2 (50%)	6,6,6	1.41	1 (16%)

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	300	SO4	O2-S	-2.49	1.32	1.46
2	A	300	SO4	O2-S	-2.25	1.33	1.46

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	300	SO4	O3-S	-2.15	1.30	1.47
2	A	300	SO4	O3-S	-2.09	1.30	1.47

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	A	300	SO4	O4-S-O1	2.94	124.63	109.31
2	B	300	SO4	O4-S-O1	2.75	123.66	109.31

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

5.7 Other polymers (i)

There are no such residues in this entry.

5.8 Polymer linkage issues (i)

There are no chain breaks in this entry.

6 Fit of model and data

6.1 Protein, DNA and RNA chains

In the following table, the column labelled '#RSRZ> 2' contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95^{th} percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled 'Q< 0.9' lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2			OWAB(Å^2)	Q<0.9
1	A	265/287 (92%)	-0.16	2 (0%)	86	84	8, 14, 28, 42	8 (3%)
1	B	266/287 (92%)	-0.17	3 (1%)	80	77	7, 14, 27, 38	11 (4%)
All	All	531/574 (92%)	-0.16	5 (0%)	84	82	7, 14, 28, 42	19 (3%)

All (5) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	22	LEU	2.9
1	B	284	SER	2.9
1	A	247	GLN	2.8
1	B	19	SER	2.6
1	B	36	ALA	2.0

6.2 Non-standard residues in protein, DNA, RNA chains

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates

There are no carbohydrates in this entry.

6.4 Ligands

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
2	SO4	A	300	5/5	0.96	0.09	14,15,30,31	5
2	SO4	B	300	5/5	0.97	0.07	15,17,28,33	5

6.5 Other polymers (i)

There are no such residues in this entry.