



Full wwPDB X-ray Structure Validation Report ⓘ

May 23, 2020 – 06:46 pm BST

PDB ID : 2H6B
Title : Crystal structure of oxidized CprK in complex with o-chlorophenolacetic acid
Authors : Joyce, M.G.; Levy, C.; Leys, D.
Deposited on : 2006-05-31
Resolution : 2.20 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

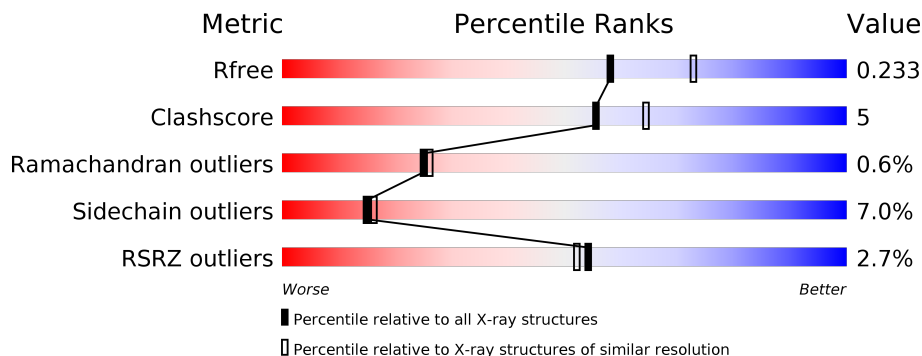
1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.20 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	4898 (2.20-2.20)
Clashscore	141614	5594 (2.20-2.20)
Ramachandran outliers	138981	5503 (2.20-2.20)
Sidechain outliers	138945	5504 (2.20-2.20)
RSRZ outliers	127900	4800 (2.20-2.20)

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 $\leq 5\%$. 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	250	<div style="display: flex; align-items: center;"> <div style="width: 3%; height: 10px; background-color: red; margin-right: 5px;"></div> <div style="width: 77%; height: 10px; background-color: green; margin-right: 5px;"></div> <div style="width: 14%; height: 10px; background-color: yellow; margin-right: 5px;"></div> <div style="width: 6%; height: 10px; background-color: orange; margin-right: 5px;"></div> <div style="width: 2%; height: 10px; background-color: grey;"></div> </div> <p style="margin-left: 10px;">3% 77% 14% • •</p>
1	B	250	<div style="display: flex; align-items: center;"> <div style="width: 2%; height: 10px; background-color: red; margin-right: 5px;"></div> <div style="width: 76%; height: 10px; background-color: green; margin-right: 5px;"></div> <div style="width: 16%; height: 10px; background-color: yellow; margin-right: 5px;"></div> <div style="width: 6%; height: 10px; background-color: orange; margin-right: 5px;"></div> <div style="width: 2%; height: 10px; background-color: grey;"></div> </div> <p style="margin-left: 10px;">2% 76% 16% • 6%</p>

2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 4061 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 ChloroPhenol Reduction gene K.

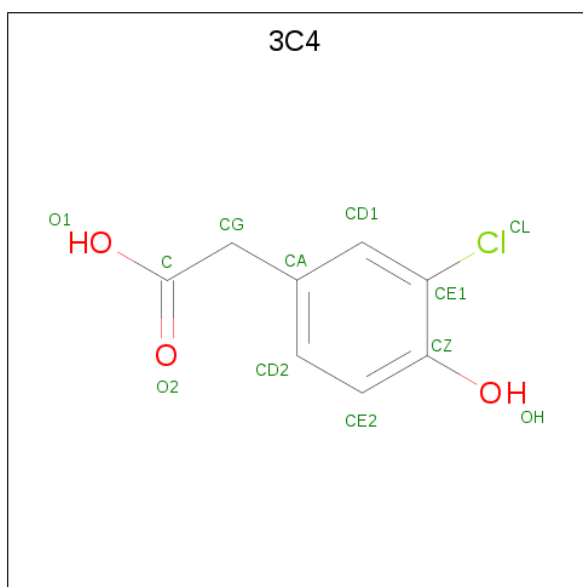
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	239	Total 1905	C 1222	N 315	O 356	S 12	0	3	0
1	B	235	Total 1894	C 1219	N 307	O 356	S 12	0	3	0

- Molecule 2 is SULFATE ION (three-letter code: SO4) (formula: O₄S).



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

- Molecule 3 is (3-CHLORO-4-HYDROXYPHENYL)ACETIC ACID (three-letter code: 3C4) (formula: C₈H₇ClO₃).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	Cl	O	0	0
			12	8	1	3		
3	B	1	Total	C	Cl	O	0	0
			12	8	1	3		

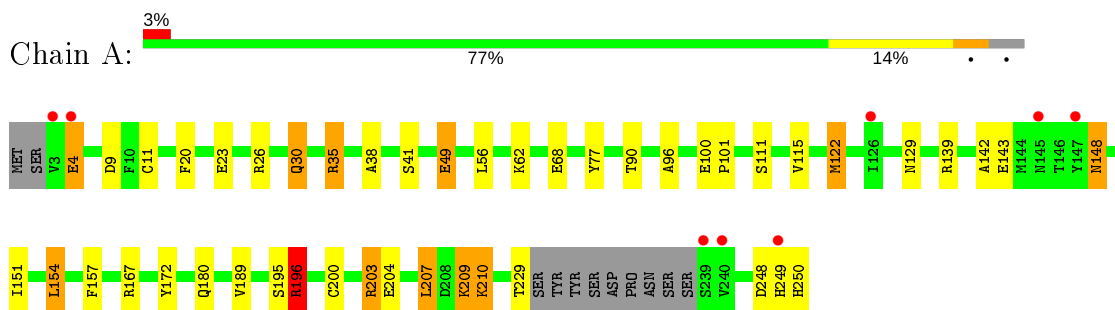
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	119	Total	O	0	0
			119	119		
4	B	109	Total	O	0	0
			109	109		

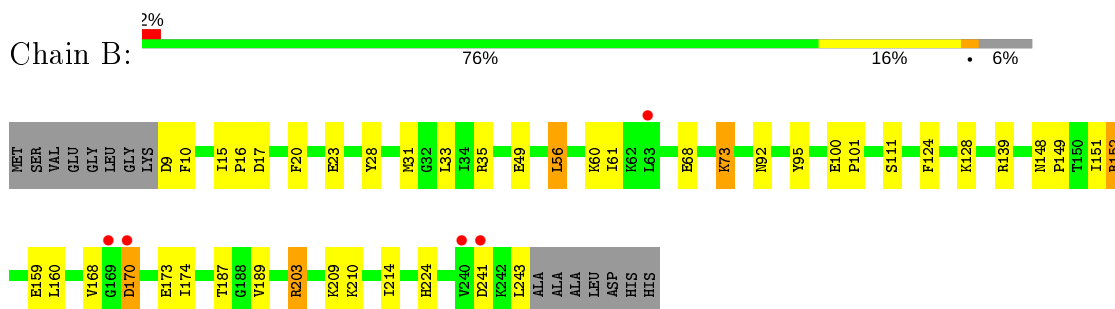
3 Residue-property plots [i](#)

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: ChloroPhenol Reduction gene K



- Molecule 1: ChloroPhenol Reduction gene K



4 Data and refinement statistics

Property	Value	Source
Space group	I 2 2 2	Depositor
Cell constants a, b, c, α , β , γ	104.44Å 112.19Å 119.50Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	19.92 – 2.20 19.92 – 2.20	Depositor EDS
% Data completeness (in resolution range)	100.0 (19.92-2.20) 97.9 (19.92-2.20)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.48 (at 2.21Å)	Xtrriage
Refinement program	REFMAC 5.2.0005	Depositor
R, R_{free}	0.183 , 0.229 0.193 , 0.233	Depositor DCC
R_{free} test set	1760 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å ²)	36.5	Xtrriage
Anisotropy	0.071	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 36.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	4061	wwPDB-VP
Average B, all atoms (Å ²)	43.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 7.32% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: 3C4, 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	1.14	7/1951 (0.4%)	1.05	8/2629 (0.3%)
1	B	1.10	4/1944 (0.2%)	1.05	7/2625 (0.3%)
All	All	1.12	11/3895 (0.3%)	1.05	15/5254 (0.3%)

All (11) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	68	GLU	CB-CG	9.13	1.69	1.52
1	A	68	GLU	CB-CG	8.38	1.68	1.52
1	B	23	GLU	CG-CD	7.89	1.63	1.51
1	A	200	CYS	CB-SG	-7.43	1.69	1.82
1	A	23	GLU	CG-CD	6.68	1.61	1.51
1	A	189	VAL	CB-CG2	-6.49	1.39	1.52
1	B	68	GLU	CG-CD	6.38	1.61	1.51
1	A	23	GLU	CD-OE2	5.50	1.31	1.25
1	A	129	ASN	CG-OD1	5.35	1.35	1.24
1	A	49	GLU	CG-CD	5.34	1.59	1.51
1	B	49	GLU	CB-CG	5.16	1.61	1.52

All (15) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	203	ARG	NE-CZ-NH1	13.09	126.85	120.30
1	B	203	ARG	NE-CZ-NH2	-11.66	114.47	120.30
1	A	122	MET	CG-SD-CE	9.05	114.69	100.20
1	A	35	ARG	NE-CZ-NH1	8.98	124.79	120.30
1	A	196	ARG	NE-CZ-NH1	8.81	124.71	120.30
1	B	139	ARG	NE-CZ-NH1	8.20	124.40	120.30
1	B	152	ARG	NE-CZ-NH1	7.38	123.99	120.30
1	A	154	LEU	CB-CG-CD2	6.30	121.70	111.00

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	159	GLU	OE1-CD-OE2	5.83	130.29	123.30
1	A	196	ARG	NE-CZ-NH2	-5.65	117.48	120.30
1	B	139	ARG	NE-CZ-NH2	-5.57	117.52	120.30
1	A	90	THR	C-N-CA	-5.51	110.72	122.30
1	A	26	ARG	CG-CD-NE	-5.48	100.30	111.80
1	B	35	ARG	NE-CZ-NH1	5.42	123.01	120.30
1	A	35	ARG	NE-CZ-NH2	-5.08	117.76	120.30

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts

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	1905	0	1913	23	0
1	B	1894	0	1892	17	0
2	A	5	0	0	1	0
2	B	5	0	0	1	0
3	A	12	0	6	0	0
3	B	12	0	6	1	0
4	A	119	0	0	5	0
4	B	109	0	0	2	0
All	All	4061	0	3817	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:148:ASN:HB3	1:A:151:ILE:HD12	1.59	0.84
1:B:168:VAL:HG21	1:B:173:GLU:OE1	1.77	0.83
1:A:30:GLN:H	1:A:30:GLN:HE21	1.30	0.78
1:A:249:HIS:ND1	4:A:419:HOH:O	2.22	0.72
1:A:249:HIS:CE1	4:A:419:HOH:O	2.42	0.72

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:229:THR:HG22	4:A:316:HOH:O	1.90	0.70
1:A:203:ARG:NH1	1:A:204:GLU:OE2	2.27	0.68
1:A:209:LYS:HE2	1:A:210:LYS:O	1.95	0.67
1:A:180:GLN:NE2	1:A:195:SER:OG	2.28	0.66
1:A:4:GLU:HB3	4:A:384:HOH:O	1.99	0.63
1:B:224:HIS:HE1	4:B:384:HOH:O	1.83	0.61
1:A:30:GLN:H	1:A:30:GLN:NE2	2.00	0.59
1:A:142:ALA:O	1:B:73:LYS:HE3	2.03	0.58
1:B:170:ASP:N	1:B:170:ASP:OD1	2.38	0.55
1:B:149:PRO:HA	1:B:152:ARG:HD3	1.88	0.53
1:A:157:PHE:CG	1:A:207:LEU:HD11	2.44	0.53
1:B:124:PHE:O	1:B:128:LYS:HG3	2.12	0.50
1:B:56:LEU:HD22	1:B:61:ILE:HD12	1.94	0.50
1:B:148:ASN:HD22	1:B:151:ILE:H	1.60	0.49
1:A:250:HIS:N	4:A:408:HOH:O	2.41	0.49
1:A:139:ARG:O	1:A:143:GLU:HB2	2.14	0.47
1:B:187:THR:OG1	1:B:189:VAL:HG13	2.15	0.47
1:B:203:ARG:HD2	4:B:366:HOH:O	2.15	0.47
1:A:62:LYS:O	1:A:96:ALA:HA	2.15	0.46
1:B:15:ILE:HG22	1:B:17:ASP:HB2	1.98	0.46
1:A:180:GLN:HG3	2:A:251:SO4:O3	2.14	0.46
1:A:4:GLU:H	1:A:4:GLU:HG2	1.66	0.45
1:B:100:GLU:HB2	1:B:101:PRO:HD2	1.99	0.44
1:B:28:TYR:HD2	1:B:31:MET:HE1	1.83	0.44
1:A:62:LYS:HG3	1:A:77:TYR:CE2	2.53	0.44
1:B:209:LYS:NZ	2:B:251:SO4:O3	2.52	0.43
1:B:174:ILE:HB	1:B:214:ILE:HB	2.01	0.42
1:A:196:ARG:HG2	1:A:196:ARG:HH11	1.84	0.42
1:A:38:ALA:O	1:A:41:SER:HB2	2.21	0.41
1:A:100:GLU:HB2	1:A:101:PRO:HD2	2.02	0.41
1:B:92:ASN:HB2	3:B:301:3C4:O2	2.21	0.41
1:A:111:SER:O	1:A:115:VAL:HG23	2.20	0.41
1:B:148:ASN:HA	1:B:149:PRO:HD3	1.84	0.40
1:A:167:ARG:HD3	1:A:172:TYR:CZ	2.56	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	238/250 (95%)	231 (97%)	6 (2%)	1 (0%)	34	37
1	B	236/250 (94%)	223 (94%)	11 (5%)	2 (1%)	19	19
All	All	474/500 (95%)	454 (96%)	17 (4%)	3 (1%)	25	26

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	20	PHE
1	B	20	PHE
1	B	16	PRO

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	208/220 (94%)	192 (92%)	16 (8%)	13	13
1	B	210/220 (96%)	196 (93%)	14 (7%)	16	18
All	All	418/440 (95%)	388 (93%)	30 (7%)	15	15

All (30) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	4	GLU
1	A	9	ASP
1	A	11	CYS

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Mol	Chain	Res	Type
1	A	30	GLN
1	A	35	ARG
1	A	49	GLU
1	A	56	LEU
1	A	122	MET
1	A	148	ASN
1	A	154	LEU
1	A	196	ARG
1	A	203	ARG
1	A	207	LEU
1	A	209	LYS
1	A	210	LYS
1	A	248	ASP
1	B	9	ASP
1	B	10	PHE
1	B	33[A]	LEU
1	B	33[B]	LEU
1	B	56	LEU
1	B	60	LYS
1	B	73	LYS
1	B	95	TYR
1	B	111	SER
1	B	160	LEU
1	B	170	ASP
1	B	210	LYS
1	B	241	ASP
1	B	243	LEU

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	27	ASN
1	A	30	GLN
1	A	148	ASN
1	A	180	GLN
1	B	30	GLN
1	B	148	ASN

5.3.3 RNA

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

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

5.5 Carbohydrates [i](#)

There are no carbohydrates in this entry.

5.6 Ligand geometry [i](#)

4 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
3	3C4	A	302	-	9,12,12	4.27	5 (55%)	12,16,16	3.34	5 (41%)
2	SO4	A	251	-	4,4,4	0.38	0	6,6,6	0.81	0
3	3C4	B	301	-	9,12,12	5.09	4 (44%)	12,16,16	2.35	3 (25%)
2	SO4	B	251	-	4,4,4	0.30	0	6,6,6	1.04	1 (16%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '2' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	3C4	A	302	-	-	0/2/4/4	0/1/1/1
3	3C4	B	301	-	-	0/2/4/4	0/1/1/1

All (9) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	301	3C4	CZ-CE1	12.81	1.51	1.39
3	A	302	3C4	CZ-CE1	10.07	1.49	1.39
3	A	302	3C4	CE2-CD2	-5.71	1.28	1.38
3	B	301	3C4	CE2-CD2	-5.51	1.28	1.38

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	301	3C4	CE2-CZ	5.22	1.48	1.39
3	A	302	3C4	CE2-CZ	3.58	1.45	1.39
3	A	302	3C4	OH-CZ	2.74	1.42	1.36
3	B	301	3C4	OH-CZ	2.48	1.41	1.36
3	A	302	3C4	CD2-CA	-2.32	1.33	1.38

All (9) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	302	3C4	CE2-CZ-CE1	-8.15	110.64	118.55
3	B	301	3C4	CE2-CZ-CE1	-6.81	111.95	118.55
3	A	302	3C4	CD2-CE2-CZ	5.86	126.52	120.50
3	A	302	3C4	CE1-CD1-CA	3.58	122.90	120.46
3	A	302	3C4	CD1-CE1-CZ	-2.99	119.18	120.91
3	B	301	3C4	CD2-CE2-CZ	2.42	122.99	120.50
3	B	301	3C4	OH-CZ-CE2	2.25	125.45	119.33
3	A	302	3C4	OH-CZ-CE1	2.14	124.69	119.27
2	B	251	SO4	O3-S-O2	-2.05	98.60	109.31

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

3 monomers are involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	251	SO4	1	0
3	B	301	3C4	1	0
2	B	251	SO4	1	0

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 [i](#)

6.1 Protein, DNA and RNA chains [i](#)

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, 95th 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	239/250 (95%)	-0.23	8 (3%) 46 44	31, 43, 58, 73	0
1	B	235/250 (94%)	-0.34	5 (2%) 63 61	31, 41, 63, 73	0
All	All	474/500 (94%)	-0.29	13 (2%) 54 52	31, 42, 61, 73	0

All (13) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	3	VAL	4.0
1	A	4	GLU	3.8
1	B	170	ASP	3.2
1	A	145	ASN	3.2
1	B	240	VAL	3.1
1	B	241	ASP	3.0
1	A	239	SER	2.9
1	A	249	HIS	2.8
1	B	169	GLY	2.8
1	A	126	ILE	2.5
1	A	240	VAL	2.3
1	A	147	TYR	2.1
1	B	63	LEU	2.0

6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

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

6.3 Carbohydrates [i](#)

There are no carbohydrates in this entry.

6.4 Ligands [i](#)

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, 95th 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	251	5/5	0.98	0.12	54,60,60,64	0
3	3C4	B	301	12/12	0.98	0.13	33,34,36,36	0
2	SO4	B	251	5/5	0.98	0.15	56,60,62,63	0
3	3C4	A	302	12/12	0.99	0.07	30,34,35,36	0

6.5 Other polymers [i](#)

There are no such residues in this entry.