



wwPDB X-ray Structure Validation Summary Report ⓘ

Nov 13, 2023 – 08:58 PM JST

PDB ID : 5Y52
Title : Crystal Structure of Highly Active BTUO Mutant P287G Improved by Humidity Control at 83% RH
Authors : Itoh, T.; Kishimoto, T.; Nishiya, Y.
Deposited on : 2017-08-07
Resolution : 1.63 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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 types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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 : 2.36
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) : 2.36

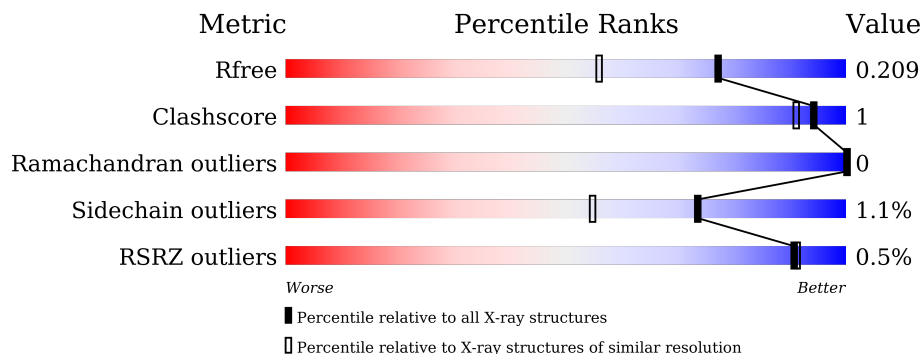
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.63 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	3122 (1.66-1.62)
Clashscore	141614	3268 (1.66-1.62)
Ramachandran outliers	138981	3215 (1.66-1.62)
Sidechain outliers	138945	3215 (1.66-1.62)
RSRZ outliers	127900	3079 (1.66-1.62)

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 of 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	331	 86% 11%
1	B	331	 84% 5% 11%
1	C	331	 87% 11%
1	D	331	 87% 11%

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 20235 atoms, of which 9291 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.

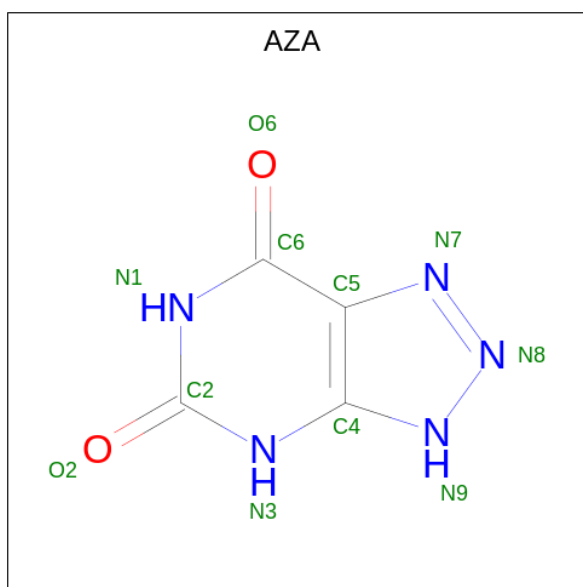
- Molecule 1 is a protein called Uric acid degradation bifunctional protein.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	H	N	O	S			
1	A	295	4654	1523	2291	390	446	4	0	2	0
1	B	296	4732	1539	2337	396	456	4	0	4	0
1	C	296	4693	1529	2318	393	449	4	0	1	0
1	D	295	4619	1516	2267	386	446	4	0	1	0

There are 4 discrepancies between the modelled and reference sequences:

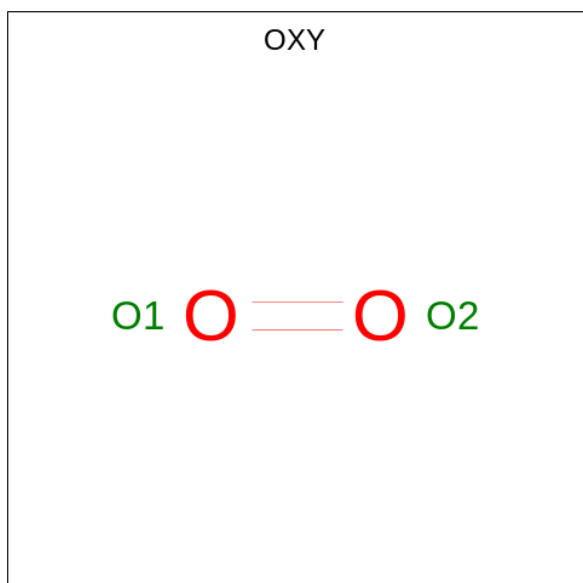
Chain	Residue	Modelled	Actual	Comment	Reference
A	287	GLY	PRO	engineered mutation	UNP Q45697
B	287	GLY	PRO	engineered mutation	UNP Q45697
C	287	GLY	PRO	engineered mutation	UNP Q45697
D	287	GLY	PRO	engineered mutation	UNP Q45697

- Molecule 2 is 8-AZAXANTHINE (three-letter code: AZA) (formula: C₄H₃N₅O₂).



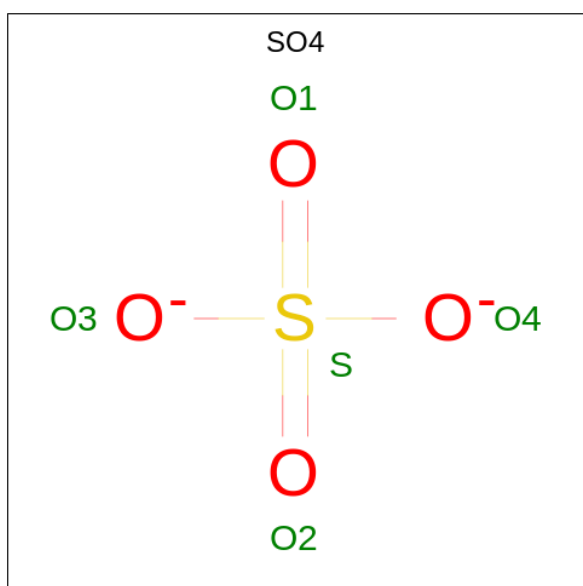
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	H	N	O		
2	A	1	Total	C	H	N	O	0	0
			14	4	3	5	2		
2	B	1	Total	C	H	N	O	0	0
			14	4	3	5	2		
2	C	1	Total	C	H	N	O	0	0
			14	4	3	5	2		
2	D	1	Total	C	H	N	O	0	0
			14	4	3	5	2		

- Molecule 3 is OXYGEN MOLECULE (three-letter code: OXY) (formula: O₂).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total O 2 2	0	0
3	B	1	Total O 2 2	0	0
3	C	1	Total O 2 2	0	0
3	D	1	Total O 2 2	0	0

- Molecule 4 is SULFATE ION (three-letter code: SO4) (formula: O₄S).



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

- Molecule 5 is 1,2-ETHANEDIOL (three-letter code: EDO) (formula: C₂H₆O₂).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
5	A	1	Total	C	H	O	0	0
			10	2	6	2		
5	B	1	Total	C	H	O	0	0
			10	2	6	2		
5	B	1	Total	C	H	O	0	0
			10	2	6	2		
5	B	1	Total	C	H	O	0	0
			10	2	6	2		
5	B	1	Total	C	H	O	0	0
			10	2	6	2		
5	C	1	Total	C	H	O	0	0
			10	2	6	2		
5	C	1	Total	C	H	O	0	0
			10	2	6	2		
5	C	1	Total	C	H	O	0	0
			10	2	6	2		
5	D	1	Total	C	H	O	0	0
			10	2	6	2		
5	D	1	Total	C	H	O	0	0
			10	2	6	2		

- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	302	Total	O	0	0
			302	302		

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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	B	368	Total 368	O 368	0	0
6	C	367	Total 367	O 367	0	0
6	D	316	Total 316	O 316	0	0

4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, α , β , γ	132.96Å 144.17Å 71.06Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	37.76 – 1.63 37.76 – 1.63	Depositor EDS
% Data completeness (in resolution range)	95.6 (37.76-1.63) 95.6 (37.76-1.63)	Depositor EDS
R_{merge}	0.12	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	4.24 (at 1.63Å)	Xtrriage
Refinement program	PHENIX (1.12_2829: ???)	Depositor
R, R_{free}	0.172 , 0.209 0.172 , 0.209	Depositor DCC
R_{free} test set	7787 reflections (4.78%)	wwPDB-VP
Wilson B-factor (Å ²)	14.2	Xtrriage
Anisotropy	0.023	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.43 , 58.0	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	20235	wwPDB-VP
Average B, all atoms (Å ²)	20.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 80.46 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 4.4470e-07. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

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: AZA, OXY, SO4, EDO

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	0.45	0/2418	0.62	0/3280
1	B	0.50	0/2450	0.69	0/3323
1	C	0.51	0/2430	0.67	0/3295
1	D	0.45	0/2407	0.61	0/3267
All	All	0.48	0/9705	0.65	0/13165

There are no bond length outliers.

There are no bond angle outliers.

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	2363	2291	2286	6	0
1	B	2395	2337	2330	11	0
1	C	2375	2318	2316	4	0
1	D	2352	2267	2265	4	0
2	A	11	3	3	1	0
2	B	11	3	3	1	0
2	C	11	3	3	1	0
2	D	11	3	3	1	0
3	A	2	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	B	2	0	0	1	0
3	C	2	0	0	0	0
3	D	2	0	0	0	0
4	A	5	0	0	0	0
4	D	5	0	0	0	0
5	A	4	6	6	0	0
5	B	16	24	24	0	0
5	C	16	24	24	0	0
5	D	8	12	12	0	0
6	A	302	0	0	3	0
6	B	368	0	0	4	4
6	C	367	0	0	2	3
6	D	316	0	0	1	0
All	All	10944	9291	9275	24	4

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 1.

The worst 5 of 24 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:C:269:GLU:OE1	6:C:501:HOH:O	2.00	0.78
1:B:132:ASN:OD1	6:B:501:HOH:O	2.06	0.73
1:C:132:ASN:OD1	6:C:502:HOH:O	2.10	0.69
1:D:201:ARG:HH12	2:D:402:AZA:HN3	1.41	0.66
1:C:201:ARG:HH12	2:C:401:AZA:HN3	1.44	0.66

All (4) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
6:B:737:HOH:O	6:C:713:HOH:O[2_565]	2.04	0.16
6:B:791:HOH:O	6:C:841:HOH:O[2_565]	2.04	0.16
6:B:658:HOH:O	6:C:755:HOH:O[2_565]	2.09	0.11
6:B:686:HOH:O	6:B:787:HOH:O[2_565]	2.14	0.06

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	293/331 (88%)	289 (99%)	4 (1%)	0	100	100
1	B	296/331 (89%)	291 (98%)	5 (2%)	0	100	100
1	C	293/331 (88%)	289 (99%)	4 (1%)	0	100	100
1	D	292/331 (88%)	287 (98%)	5 (2%)	0	100	100
All	All	1174/1324 (89%)	1156 (98%)	18 (2%)	0	100	100

There are no Ramachandran outliers to report.

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	251/295 (85%)	248 (99%)	3 (1%)	71	51
1	B	260/295 (88%)	258 (99%)	2 (1%)	81	68
1	C	256/295 (87%)	253 (99%)	3 (1%)	71	51
1	D	249/295 (84%)	246 (99%)	3 (1%)	71	51
All	All	1016/1180 (86%)	1005 (99%)	11 (1%)	73	55

5 of 11 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	241	PHE
1	D	77	LYS
1	D	241	PHE

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Mol	Chain	Res	Type
1	D	177	ILE
1	B	241	PHE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

5.3.3 RNA [i](#)

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 monosaccharides in this entry.

5.6 Ligand geometry [i](#)

21 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	AZA	D	402	-	9,12,12	1.16	1 (11%)	4,17,17	5.23	2 (50%)
3	OXY	C	402	-	1,1,1	0.95	0	-		
2	AZA	C	401	-	9,12,12	1.29	1 (11%)	4,17,17	4.79	4 (100%)
5	EDO	B	404	-	3,3,3	0.51	0	2,2,2	0.22	0
5	EDO	C	403	-	3,3,3	0.34	0	2,2,2	0.55	0
2	AZA	B	401	-	9,12,12	1.17	0	4,17,17	5.87	4 (100%)
5	EDO	C	406	-	3,3,3	0.47	0	2,2,2	0.24	0
5	EDO	A	404	-	3,3,3	0.38	0	2,2,2	0.56	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
5	EDO	C	404	-	3,3,3	0.38	0	2,2,2	0.13	0
2	AZA	A	401	-	9,12,12	1.35	1 (11%)	4,17,17	3.63	3 (75%)
5	EDO	B	405	-	3,3,3	0.42	0	2,2,2	0.30	0
5	EDO	D	405	-	3,3,3	0.31	0	2,2,2	0.59	0
3	OXY	A	402	-	1,1,1	0.98	0	-	-	-
5	EDO	D	401	-	3,3,3	0.57	0	2,2,2	0.16	0
5	EDO	C	405	-	3,3,3	0.41	0	2,2,2	0.36	0
4	SO4	A	403	-	4,4,4	0.17	0	6,6,6	0.50	0
4	SO4	D	404	-	4,4,4	0.17	0	6,6,6	0.26	0
5	EDO	B	403	-	3,3,3	0.27	0	2,2,2	0.54	0
3	OXY	D	403	-	1,1,1	0.67	0	-	-	-
3	OXY	B	402	-	1,1,1	0.97	0	-	-	-
5	EDO	B	406	-	3,3,3	0.38	0	2,2,2	0.44	0

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. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
5	EDO	C	404	-	-	0/1/1/1	-
5	EDO	D	405	-	-	0/1/1/1	-
2	AZA	D	402	-	-	-	0/2/2/2
5	EDO	B	403	-	-	0/1/1/1	-
2	AZA	C	401	-	-	-	0/2/2/2
5	EDO	B	404	-	-	0/1/1/1	-
5	EDO	C	403	-	-	0/1/1/1	-
5	EDO	D	401	-	-	1/1/1/1	-
5	EDO	B	405	-	-	0/1/1/1	-
5	EDO	B	406	-	-	0/1/1/1	-
2	AZA	A	401	-	-	-	0/2/2/2
2	AZA	B	401	-	-	-	0/2/2/2
5	EDO	C	405	-	-	0/1/1/1	-
5	EDO	C	406	-	-	0/1/1/1	-
5	EDO	A	404	-	-	0/1/1/1	-

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	402	AZA	C5-C6	-2.63	1.36	1.41
2	A	401	AZA	C2-N3	-2.18	1.33	1.38
2	C	401	AZA	C5-C4	-2.02	1.35	1.40

The worst 5 of 13 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	401	AZA	C2-N1-C6	10.51	124.02	115.14
2	D	402	AZA	C2-N1-C6	9.56	123.21	115.14
2	C	401	AZA	C2-N1-C6	8.55	122.36	115.14
2	A	401	AZA	C2-N1-C6	5.52	119.80	115.14
2	D	402	AZA	C5-C6-N1	-3.85	118.16	123.43

There are no chirality outliers.

All (1) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	D	401	EDO	O1-C1-C2-O2

There are no ring outliers.

5 monomers are involved in 5 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	D	402	AZA	1	0
2	C	401	AZA	1	0
2	B	401	AZA	1	0
2	A	401	AZA	1	0
3	B	402	OXY	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	295/331 (89%)	-0.35	2 (0%) 87 88	11, 20, 34, 47	0
1	B	296/331 (89%)	-0.61	0 100 100	8, 13, 25, 41	0
1	C	296/331 (89%)	-0.61	1 (0%) 94 94	8, 13, 25, 39	0
1	D	295/331 (89%)	-0.31	3 (1%) 82 83	12, 20, 34, 51	0
All	All	1182/1324 (89%)	-0.47	6 (0%) 91 91	8, 17, 31, 51	0

The worst 5 of 6 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	131	GLY	3.3
1	D	222	THR	3.3
1	A	222	THR	2.8
1	D	223	ASN	2.4
1	C	290	GLU	2.2

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 monosaccharides 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(\AA^2)	Q<0.9
5	EDO	D	405	4/4	0.78	0.17	28,35,45,45	0
5	EDO	D	401	4/4	0.85	0.13	20,29,40,40	0
5	EDO	B	404	4/4	0.86	0.11	37,44,53,53	0
5	EDO	A	404	4/4	0.92	0.09	24,30,38,43	0
5	EDO	C	403	4/4	0.92	0.10	19,25,30,30	0
5	EDO	C	406	4/4	0.93	0.08	32,42,49,50	0
2	AZA	D	402	11/11	0.95	0.09	9,12,14,17	0
4	SO4	A	403	5/5	0.95	0.12	33,33,45,52	0
4	SO4	D	404	5/5	0.95	0.12	42,43,54,57	0
5	EDO	B	405	4/4	0.96	0.10	11,18,28,28	0
5	EDO	B	403	4/4	0.96	0.09	18,21,24,25	0
5	EDO	C	405	4/4	0.96	0.08	13,19,31,31	0
5	EDO	C	404	4/4	0.97	0.09	11,26,29,31	0
2	AZA	C	401	11/11	0.97	0.06	10,12,14,16	0
2	AZA	A	401	11/11	0.97	0.05	9,13,16,17	0
5	EDO	B	406	4/4	0.97	0.09	12,21,25,25	0
2	AZA	B	401	11/11	0.97	0.06	10,12,16,17	0
3	OXY	B	402	2/2	0.98	0.11	4,4,4,11	0
3	OXY	C	402	2/2	0.98	0.09	3,3,3,11	0
3	OXY	D	403	2/2	0.98	0.09	4,4,4,15	0
3	OXY	A	402	2/2	0.98	0.09	3,3,3,10	0

6.5 Other polymers [i](#)

There are no such residues in this entry.