



Full wwPDB X-ray Structure Validation Report ⓘ

Jun 24, 2024 – 04:03 PM EDT

PDB ID : 8TWR
Title : Influenza A virus (A/Aichi/2/1968(H3N2) nucleoprotein mutant - 2-7 deleted, P283S, R416A
Authors : Yoon, J.; Zhang, Y.M.; Grant, R.A.; Shoulders, M.D.
Deposited on : 2023-08-21
Resolution : 3.09 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 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
Xtriage (Phenix) : 1.13
EDS : 2.37.1
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) : 2.37.1

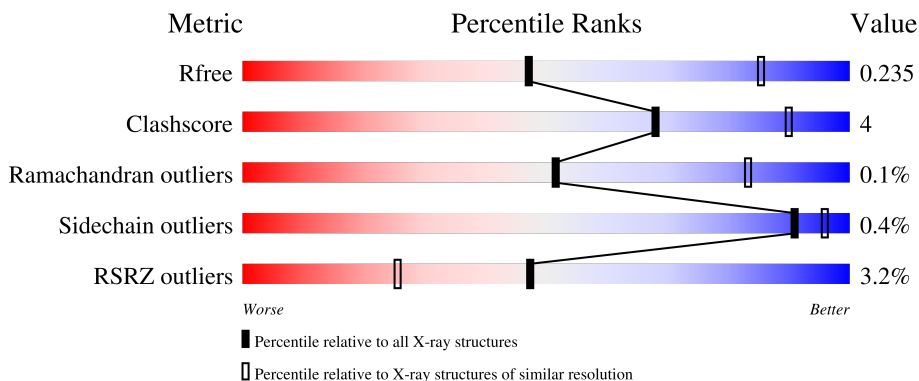
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.09 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	1094 (3.10-3.10)
Clashscore	141614	1184 (3.10-3.10)
Ramachandran outliers	138981	1141 (3.10-3.10)
Sidechain outliers	138945	1141 (3.10-3.10)
RSRZ outliers	127900	1067 (3.10-3.10)

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	500	 3% 83% 8% 9%
1	B	500	 4% 82% 9% 9%
1	C	500	 2% 80% 10% 9%

2 Entry composition i

There are 2 unique types of molecules in this entry. The entry contains 10738 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 Nucleoprotein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	C	453	3567	2210	658	670	29	0	0	0
1	A	455	3587	2225	661	672	29	0	0	0
1	B	455	3583	2222	660	672	29	0	0	0

There are 33 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	7	MET	-	initiating methionine	UNP I6TAH8
C	283	SER	PRO	engineered mutation	UNP I6TAH8
C	416	ALA	ARG	engineered mutation	UNP I6TAH8
C	499	LEU	-	expression tag	UNP I6TAH8
C	500	GLU	-	expression tag	UNP I6TAH8
C	501	HIS	-	expression tag	UNP I6TAH8
C	502	HIS	-	expression tag	UNP I6TAH8
C	503	HIS	-	expression tag	UNP I6TAH8
C	504	HIS	-	expression tag	UNP I6TAH8
C	505	HIS	-	expression tag	UNP I6TAH8
C	506	HIS	-	expression tag	UNP I6TAH8
A	7	MET	-	initiating methionine	UNP I6TAH8
A	283	SER	PRO	engineered mutation	UNP I6TAH8
A	416	ALA	ARG	engineered mutation	UNP I6TAH8
A	499	LEU	-	expression tag	UNP I6TAH8
A	500	GLU	-	expression tag	UNP I6TAH8
A	501	HIS	-	expression tag	UNP I6TAH8
A	502	HIS	-	expression tag	UNP I6TAH8
A	503	HIS	-	expression tag	UNP I6TAH8
A	504	HIS	-	expression tag	UNP I6TAH8
A	505	HIS	-	expression tag	UNP I6TAH8
A	506	HIS	-	expression tag	UNP I6TAH8
B	7	MET	-	initiating methionine	UNP I6TAH8

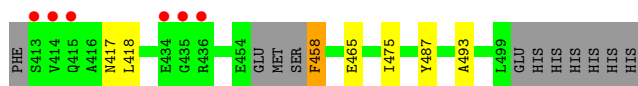
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Chain	Residue	Modelled	Actual	Comment	Reference
B	283	SER	PRO	engineered mutation	UNP I6TAH8
B	416	ALA	ARG	engineered mutation	UNP I6TAH8
B	499	LEU	-	expression tag	UNP I6TAH8
B	500	GLU	-	expression tag	UNP I6TAH8
B	501	HIS	-	expression tag	UNP I6TAH8
B	502	HIS	-	expression tag	UNP I6TAH8
B	503	HIS	-	expression tag	UNP I6TAH8
B	504	HIS	-	expression tag	UNP I6TAH8
B	505	HIS	-	expression tag	UNP I6TAH8
B	506	HIS	-	expression tag	UNP I6TAH8

- Molecule 2 is SODIUM ION (three-letter code: NA) (formula: Na).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	B	1	Total Na 1 1	0	0



4 Data and refinement statistics i

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, α , β , γ	163.42Å 285.22Å 116.90Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	48.92 – 3.09 48.92 – 3.09	Depositor EDS
% Data completeness (in resolution range)	99.6 (48.92-3.09) 99.6 (48.92-3.09)	Depositor EDS
R_{merge}	0.14	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	0.95 (at 3.07Å)	Xtrriage
Refinement program	PHENIX 1.17.1	Depositor
R, R_{free}	0.218 , 0.235 0.220 , 0.235	Depositor DCC
R_{free} test set	2005 reflections (4.00%)	wwPDB-VP
Wilson B-factor (Å ²)	93.6	Xtrriage
Anisotropy	0.421	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 59.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.34$	Xtrriage
Estimated twinning fraction	0.000 for 1/2*h-1/2*k,-3/2*h-1/2*k,-l 0.000 for 1/2*h+1/2*k,3/2*h-1/2*k,-l	Xtrriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	10738	wwPDB-VP
Average B, all atoms (Å ²)	97.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.71% 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: NA

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	0.24	0/3647	0.44	1/4900 (0.0%)
1	B	0.24	0/3643	0.42	1/4896 (0.0%)
1	C	0.27	0/3626	0.46	3/4873 (0.1%)
All	All	0.25	0/10916	0.44	5/14669 (0.0%)

There are no bond length outliers.

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	204	ARG	NE-CZ-NH1	-7.57	116.52	120.30
1	C	417	ASN	C-N-CA	7.33	140.04	121.70
1	A	417	ASN	C-N-CA	7.29	139.94	121.70
1	B	417	ASN	C-N-CA	6.66	138.35	121.70
1	C	204	ARG	CA-CB-CG	-5.37	101.59	113.40

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	3587	0	3557	24	0
1	B	3583	0	3546	32	0
1	C	3567	0	3535	31	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	B	1	0	0	0	0
All	All	10738	0	10638	82	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 4.

All (82) 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:B:146:THR:HG22	1:B:337:ALA:HB2	1.59	0.83
1:A:146:THR:HG22	1:A:337:ALA:HB2	1.61	0.82
1:C:121:ARG:HD2	1:A:75:ARG:HD3	1.61	0.82
1:C:146:THR:HG22	1:C:337:ALA:HB2	1.61	0.80
1:C:106:ARG:HE	1:C:371:MET:HE3	1.47	0.80
1:B:355:ARG:HD3	1:B:493:ALA:HB2	1.67	0.77
1:A:355:ARG:HD3	1:A:493:ALA:HB2	1.67	0.76
1:A:106:ARG:HE	1:A:371:MET:HE3	1.50	0.76
1:B:106:ARG:HE	1:B:371:MET:HE3	1.50	0.75
1:C:355:ARG:HD3	1:C:493:ALA:HB2	1.70	0.73
1:C:190:VAL:HG13	1:C:256:LEU:HB3	1.73	0.71
1:A:190:VAL:HG13	1:A:256:LEU:HB3	1.74	0.70
1:B:190:VAL:HG13	1:B:256:LEU:HB3	1.73	0.69
1:A:465:GLU:HG2	1:A:475:ILE:HD11	1.79	0.63
1:B:465:GLU:HG2	1:B:475:ILE:HD11	1.81	0.62
1:A:317:ARG:NH2	1:A:362:GLY:O	2.33	0.61
1:A:274:SER:OG	1:A:389:ARG:NH2	2.33	0.61
1:B:274:SER:OG	1:B:389:ARG:NH2	2.34	0.61
1:C:210:GLU:HG2	1:C:213:ARG:HH21	1.66	0.60
1:C:317:ARG:NH2	1:C:362:GLY:O	2.34	0.59
1:A:422:LYS:NZ	1:B:164:CYS:SG	2.73	0.59
1:C:340:ASP:OD2	1:C:342:ARG:NH1	2.36	0.58
1:B:317:ARG:NH2	1:B:362:GLY:O	2.38	0.56
1:B:186:VAL:HG13	1:B:226:LEU:HD11	1.90	0.54
1:C:465:GLU:HG2	1:C:475:ILE:HD11	1.89	0.54
1:A:419:PRO:HG3	1:B:493:ALA:O	2.09	0.53
1:A:481:MET:HG3	1:B:361:ARG:HG3	1.91	0.53
1:B:355:ARG:HD3	1:B:493:ALA:CB	2.37	0.52
1:C:186:VAL:HG13	1:C:226:LEU:HD11	1.92	0.51
1:A:341:LEU:HD11	1:A:487:TYR:HA	1.92	0.51
1:A:186:VAL:HG13	1:A:226:LEU:HD11	1.93	0.51
1:C:206:PHE:O	1:C:212:GLY:HA2	2.12	0.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:216:ARG:NH2	1:A:243:ARG:O	2.44	0.50
1:C:145:ASP:O	1:C:355:ARG:NH2	2.44	0.50
1:A:145:ASP:O	1:A:355:ARG:NH2	2.46	0.49
1:C:341:LEU:HD11	1:C:487:TYR:HA	1.95	0.49
1:A:355:ARG:HD3	1:A:493:ALA:CB	2.39	0.49
1:C:274:SER:OG	1:C:389:ARG:NH2	2.46	0.48
1:B:145:ASP:O	1:B:355:ARG:NH2	2.47	0.48
1:C:355:ARG:HD3	1:C:493:ALA:CB	2.43	0.48
1:B:68:LEU:HB2	1:B:79:LEU:HD23	1.94	0.47
1:B:342:ARG:NH1	1:B:418:LEU:HD13	2.29	0.47
1:C:121:ARG:HD2	1:A:75:ARG:CD	2.40	0.47
1:B:340:ASP:OD2	1:B:342:ARG:NH1	2.48	0.47
1:C:159:MET:HE2	1:C:194:ILE:HD12	1.97	0.47
1:B:458:PHE:HD1	1:B:458:PHE:O	1.98	0.47
1:B:72:ASP:OD1	1:B:77:LYS:N	2.43	0.46
1:B:341:LEU:HD11	1:B:487:TYR:HA	1.98	0.45
1:C:68:LEU:HB2	1:C:79:LEU:HD23	1.98	0.44
1:C:465:GLU:CG	1:C:475:ILE:HD11	2.47	0.44
1:C:26:ARG:NH2	1:C:302:ASP:OD2	2.50	0.44
1:C:305:LYS:NZ	1:C:469:GLU:OE2	2.33	0.44
1:C:342:ARG:NH1	1:C:418:LEU:HD13	2.32	0.44
1:B:157:THR:HG21	1:B:191:MET:HG3	1.98	0.44
1:C:366:ALA:HB3	1:C:369:GLU:HG3	1.98	0.44
1:A:26:ARG:NH2	1:A:302:ASP:OD2	2.51	0.44
1:B:68:LEU:HD22	1:B:78:TYR:HB3	2.00	0.43
1:B:80:GLU:OE2	1:B:174:ARG:HG3	2.19	0.43
1:A:342:ARG:NH1	1:A:418:LEU:HD13	2.33	0.43
1:A:68:LEU:HB2	1:A:79:LEU:HD23	2.00	0.43
1:C:355:ARG:HB2	1:C:487:TYR:CZ	2.54	0.42
1:A:340:ASP:OD2	1:A:342:ARG:NH1	2.51	0.42
1:B:106:ARG:NH2	1:B:369:GLU:O	2.52	0.42
1:A:168:GLN:HG3	1:A:338:PHE:CD1	2.55	0.42
1:A:208:ARG:HG3	1:A:208:ARG:HH11	1.83	0.42
1:C:82:HIS:CG	1:C:83:PRO:HD2	2.54	0.42
1:C:117:ARG:O	1:C:121:ARG:HG3	2.19	0.42
1:A:82:HIS:CG	1:A:83:PRO:HD2	2.54	0.42
1:C:106:ARG:NH2	1:C:369:GLU:O	2.53	0.42
1:B:366:ALA:HB3	1:B:369:GLU:HG3	2.01	0.41
1:B:82:HIS:CG	1:B:83:PRO:HD2	2.55	0.41
1:B:355:ARG:HB2	1:B:487:TYR:CZ	2.55	0.41
1:C:216:ARG:NH2	1:C:243:ARG:O	2.54	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:157:THR:HG21	1:C:191:MET:HG3	2.01	0.41
1:B:159:MET:HE2	1:B:194:ILE:HD12	2.02	0.41
1:B:345:SER:HA	1:B:352:VAL:HG23	2.03	0.41
1:C:80:GLU:OE2	1:C:174:ARG:HG3	2.21	0.41
1:B:69:SER:HB2	1:B:79:LEU:HD21	2.02	0.40
1:B:342:ARG:HH11	1:B:418:LEU:HD13	1.85	0.40
1:B:180:GLY:O	1:B:184:LYS:HG3	2.21	0.40
1:B:159:MET:HE2	1:B:190:VAL:HG12	2.04	0.40
1:C:168:GLN:HG3	1:C:338:PHE:CD1	2.55	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	449/500 (90%)	440 (98%)	8 (2%)	1 (0%)	47	79
1	B	449/500 (90%)	438 (98%)	11 (2%)	0	100	100
1	C	447/500 (89%)	438 (98%)	9 (2%)	0	100	100
All	All	1345/1500 (90%)	1316 (98%)	28 (2%)	1 (0%)	51	83

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	177	GLY

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	380/420 (90%)	378 (100%)	2 (0%)	88	94
1	B	379/420 (90%)	378 (100%)	1 (0%)	92	96
1	C	378/420 (90%)	376 (100%)	2 (0%)	88	94
All	All	1137/1260 (90%)	1132 (100%)	5 (0%)	91	96

All (5) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	67	VAL
1	C	210	GLU
1	A	67	VAL
1	A	452	LYS
1	B	458	PHE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	311	GLN
1	B	311	GLN

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](#)

Of 1 ligands modelled in this entry, 1 is monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

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, 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	455/500 (91%)	0.04	14 (3%)	49 26	61, 85, 147, 169	0
1	B	455/500 (91%)	0.15	18 (3%)	38 19	78, 104, 152, 176	0
1	C	453/500 (90%)	-0.00	11 (2%)	59 37	63, 86, 137, 161	0
All	All	1363/1500 (90%)	0.06	43 (3%)	47 25	61, 91, 148, 176	0

All (43) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	85	ALA	6.0
1	B	435	GLY	5.1
1	B	434	GLU	4.8
1	C	84	SER	4.7
1	B	415	GLN	4.6
1	C	436	ARG	4.0
1	C	22	ALA	3.8
1	A	436	ARG	3.7
1	A	82	HIS	3.7
1	C	86	GLY	3.7
1	A	437	THR	3.6
1	A	413	SER	3.4
1	A	84	SER	3.3
1	B	246	ARG	3.3
1	A	391	ARG	3.3
1	A	453	PRO	3.0
1	B	84	SER	3.0
1	A	85	ALA	3.0
1	C	21	ASN	3.0
1	A	83	PRO	2.8
1	C	435	GLY	2.7
1	B	413	SER	2.6
1	B	85	ALA	2.6

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Mol	Chain	Res	Type	RSRZ
1	B	207	TRP	2.6
1	C	415	GLN	2.6
1	A	435	GLY	2.6
1	B	436	ARG	2.6
1	B	86	GLY	2.5
1	B	205	ASN	2.5
1	B	116	ILE	2.5
1	B	82	HIS	2.4
1	B	87	LYS	2.4
1	B	22	ALA	2.3
1	B	414	VAL	2.2
1	C	414	VAL	2.2
1	A	210	GLU	2.2
1	A	417	ASN	2.1
1	C	87	LYS	2.1
1	B	83	PRO	2.1
1	A	22	ALA	2.1
1	A	459	GLN	2.1
1	B	248	PRO	2.0
1	C	437	THR	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 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(Å ²)	Q<0.9
2	NA	B	601	1/1	0.95	0.43	73,73,73,73	0

6.5 Other polymers [i](#)

There are no such residues in this entry.