



Full wwPDB X-ray Structure Validation Report ⓘ

Jun 12, 2024 – 10:16 AM EDT

PDB ID : 1ZHH
Title : Crystal Structure of the Apo Form of Vibrio Harveyi LUXP Complexed with the Periplasmic Domain of LUXQ
Authors : Neiditch, M.B.; Federle, M.J.; Miller, S.T.; Bassler, B.L.; Hughson, F.M.
Deposited on : 2005-04-25
Resolution : 1.94 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
Mogul : 2022.3.0, CSD as543be (2022)
Xtriage (Phenix) : 1.20.1
EDS : 2.36.2
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) : 2.36.2

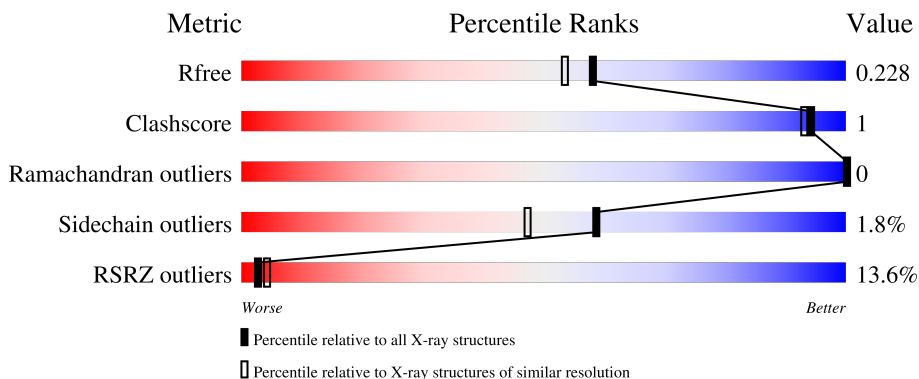
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.94 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	4310 (1.96-1.92)
Clashscore	141614	1023 (1.94-1.94)
Ramachandran outliers	138981	1007 (1.94-1.94)
Sidechain outliers	138945	1007 (1.94-1.94)
RSRZ outliers	127900	4250 (1.96-1.92)

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	344	 10% 95% 5%
2	B	242	 17% 77% 8% 14%

2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 4772 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 Autoinducer 2-binding periplasmic protein luxP.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	344	2775	1765	469	535	6	0	0	0

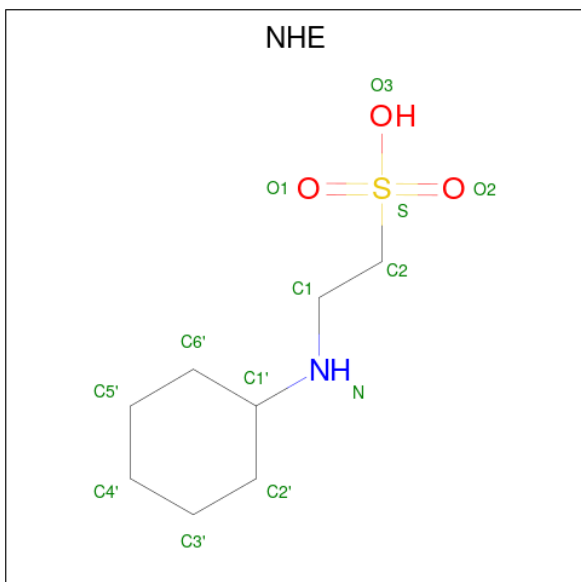
- Molecule 2 is a protein called Autoinducer 2 sensor kinase/phosphatase luxQ.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	208	1651	1048	278	321	4	0	0	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	37	GLY	-	See Remark 999	UNP P54302
B	38	SER	-	See Remark 999	UNP P54302

- Molecule 3 is 2-[N-CYCLOHEXYLAMINO]ETHANE SULFONIC ACID (three-letter code: NHE) (formula: C₈H₁₇NO₃S).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	S		
3	B	1	13	8	1	3	1	0	0

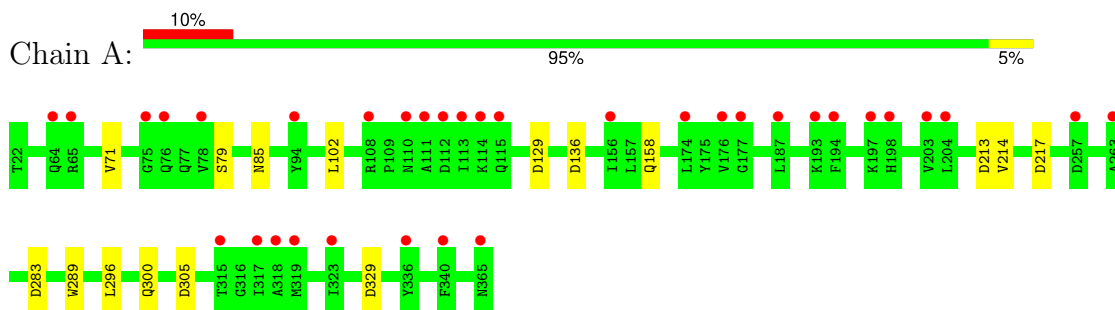
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	246	Total 246	O 246	0	0
4	B	87	Total 87	O 87	0	0

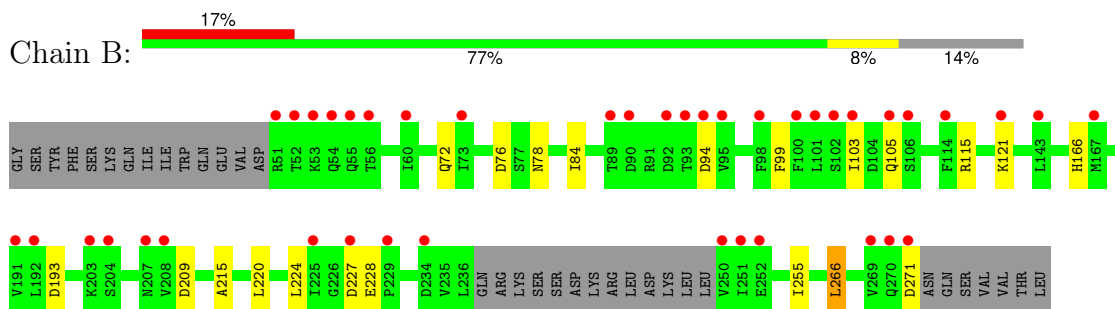
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA, DNA and oligosaccharide 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: Autoinducer 2-binding periplasmic protein luxP



- Molecule 2: Autoinducer 2 sensor kinase/phosphatase luxQ



4 Data and refinement statistics

Property	Value	Source
Space group	P 65	Depositor
Cell constants a, b, c, α , β , γ	128.47Å 128.47Å 95.67Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	50.00 – 1.94 31.58 – 1.94	Depositor EDS
% Data completeness (in resolution range)	(Not available) (50.00-1.94) 96.0 (31.58-1.94)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.94 (at 1.94Å)	Xtrriage
Refinement program	REFMAC 5.1.24	Depositor
R, R_{free}	0.206 , 0.222 0.216 , 0.228	Depositor DCC
R_{free} test set	3245 reflections (5.09%)	wwPDB-VP
Wilson B-factor (Å ²)	35.5	Xtrriage
Anisotropy	0.007	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.42 , 59.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	0.032 for h,-h-k,-l	Xtrriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	4772	wwPDB-VP
Average B, all atoms (Å ²)	42.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.61% 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: NHE

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	0.34	0/2840	0.69	6/3850 (0.2%)
2	B	0.35	0/1686	0.72	5/2299 (0.2%)
All	All	0.34	0/4526	0.71	11/6149 (0.2%)

There are no bond length outliers.

All (11) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	227	ASP	CB-CG-OD2	6.00	123.70	118.30
1	A	129	ASP	CB-CG-OD2	5.79	123.51	118.30
1	A	217	ASP	CB-CG-OD2	5.74	123.46	118.30
1	A	136	ASP	CB-CG-OD2	5.62	123.36	118.30
2	B	209	ASP	CB-CG-OD2	5.47	123.23	118.30
1	A	305	ASP	CB-CG-OD2	5.46	123.22	118.30
2	B	94	ASP	CB-CG-OD2	5.46	123.21	118.30
2	B	271	ASP	CB-CG-OD2	5.24	123.02	118.30
1	A	283	ASP	CB-CG-OD2	5.16	122.95	118.30
1	A	329	ASP	CB-CG-OD2	5.12	122.91	118.30
2	B	76	ASP	CB-CG-OD2	5.12	122.91	118.30

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	2775	0	2695	6	0
2	B	1651	0	1596	5	0
3	B	13	0	16	1	0
4	A	246	0	0	1	0
4	B	87	0	0	0	0
All	All	4772	0	4307	11	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 1.

All (11) 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:85:ASN:HD21	1:A:158:GLN:HE22	1.25	0.83
1:A:85:ASN:ND2	1:A:158:GLN:HE22	1.98	0.59
1:A:214:VAL:HG11	4:A:447:HOH:O	2.06	0.54
1:A:213:ASP:HB3	3:B:3256:NHE:H5'2	1.90	0.51
2:B:99:PHE:CZ	2:B:103:ILE:HD11	2.49	0.47
1:A:296:LEU:O	1:A:300:GLN:HG3	2.16	0.46
2:B:166:HIS:HD2	2:B:193:ASP:OD1	2.00	0.43
2:B:78:ASN:O	2:B:84:ILE:HD12	2.18	0.42
2:B:215:ALA:HB2	2:B:220:LEU:HD11	2.01	0.41
2:B:255:ILE:HD11	2:B:266:LEU:HD22	2.03	0.41
1:A:71:VAL:HG23	1:A:102:LEU:HD11	2.04	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	342/344 (99%)	335 (98%)	7 (2%)	0	100	100
2	B	204/242 (84%)	199 (98%)	5 (2%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
All	All	546/586 (93%)	534 (98%)	12 (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	299/299 (100%)	297 (99%)	2 (1%)	84	81
2	B	190/223 (85%)	183 (96%)	7 (4%)	34	19
All	All	489/522 (94%)	480 (98%)	9 (2%)	59	47

All (9) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	79	SER
1	A	289	TRP
2	B	72	GLN
2	B	105	GLN
2	B	115	ARG
2	B	121	LYS
2	B	224	LEU
2	B	228	GLU
2	B	266	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	85	ASN
1	A	224	ASN
2	B	166	HIS

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](#)

1 ligand is 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	NHE	B	3256	-	13,13,13	3.87	8 (61%)	16,17,17	3.06	8 (50%)

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
3	NHE	B	3256	-	-	1/7/15/15	0/1/1/1

All (8) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	3256	NHE	C1'-N	-6.08	1.31	1.48
3	B	3256	NHE	C3'-C2'	-5.90	1.38	1.53
3	B	3256	NHE	C6'-C1'	-5.61	1.39	1.52
3	B	3256	NHE	C2'-C1'	-5.44	1.39	1.52

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	3256	NHE	C5'-C6'	-5.26	1.40	1.53
3	B	3256	NHE	C4'-C5'	-3.31	1.39	1.51
3	B	3256	NHE	C4'-C3'	-3.21	1.40	1.51
3	B	3256	NHE	O2-S	2.26	1.51	1.45

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	3256	NHE	C6'-C1'-C2'	6.56	122.13	110.80
3	B	3256	NHE	C3'-C2'-C1'	4.77	119.64	111.09
3	B	3256	NHE	C4'-C5'-C6'	4.29	120.24	111.42
3	B	3256	NHE	C5'-C6'-C1'	3.80	117.91	111.09
3	B	3256	NHE	C4'-C3'-C2'	3.73	119.08	111.42
3	B	3256	NHE	O1-S-C2	3.54	112.08	106.73
3	B	3256	NHE	C5'-C4'-C3'	3.27	120.91	111.19
3	B	3256	NHE	C6'-C1'-N	2.15	121.29	110.56

There are no chirality outliers.

All (1) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	B	3256	NHE	C6'-C1'-N-C1

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	B	3256	NHE	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

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	344/344 (100%)	0.55	34 (9%) 7 11	28, 36, 49, 62	0
2	B	208/242 (85%)	1.01	41 (19%) 1 1	32, 47, 71, 96	0
All	All	552/586 (94%)	0.72	75 (13%) 3 4	28, 38, 64, 96	0

All (75) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	B	51	ARG	7.1
2	B	271	ASP	6.6
2	B	52	THR	6.4
1	A	78	VAL	6.3
2	B	98	PHE	5.6
2	B	207	ASN	5.6
2	B	94	ASP	5.0
1	A	365	ASN	4.9
1	A	64	GLN	4.3
2	B	54	GLN	4.3
2	B	53	LYS	4.1
2	B	250	VAL	3.9
2	B	270	GLN	3.9
1	A	113	ILE	3.7
2	B	55	GLN	3.6
1	A	76	GLN	3.5
1	A	108	ARG	3.4
1	A	111	ALA	3.4
2	B	103	ILE	3.4
2	B	60	ILE	3.4
1	A	174	LEU	3.4
1	A	156	ILE	3.3
2	B	92	ASP	3.3
1	A	110	ASN	3.2

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Mol	Chain	Res	Type	RSRZ
1	A	75	GLY	3.0
1	A	114	LYS	3.0
2	B	234	ASP	2.9
2	B	101	LEU	2.9
1	A	319	MET	2.8
2	B	89	THR	2.8
2	B	191	VAL	2.8
1	A	197	LYS	2.7
2	B	227	ASP	2.7
2	B	100	PHE	2.7
1	A	112	ASP	2.7
1	A	187	LEU	2.6
1	A	263	ALA	2.6
2	B	114	PHE	2.6
2	B	225	ILE	2.5
1	A	203	VAL	2.5
2	B	252	GLU	2.5
1	A	317	ILE	2.5
1	A	176	VAL	2.5
2	B	102	SER	2.5
2	B	90	ASP	2.5
1	A	65	ARG	2.4
2	B	192	LEU	2.4
2	B	106	SER	2.4
2	B	93	THR	2.4
1	A	318	ALA	2.4
1	A	204	LEU	2.3
2	B	251	ILE	2.3
1	A	94	TYR	2.3
1	A	340	PHE	2.3
2	B	229	PRO	2.3
1	A	323	ILE	2.2
1	A	194	PHE	2.2
2	B	56	THR	2.2
1	A	115	GLN	2.2
2	B	204	SER	2.2
1	A	336	TYR	2.2
2	B	203	LYS	2.2
1	A	257	ASP	2.2
2	B	95	VAL	2.2
2	B	208	VAL	2.2
2	B	269	VAL	2.2

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Mol	Chain	Res	Type	RSRZ
1	A	198	HIS	2.1
2	B	105	GLN	2.1
1	A	315	THR	2.1
1	A	193	LYS	2.1
2	B	167	MET	2.1
2	B	73	ILE	2.1
2	B	121	LYS	2.0
2	B	143	LEU	2.0
1	A	177	GLY	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(\AA^2)	Q<0.9
3	NHE	B	3256	13/13	0.81	0.19	41,44,49,49	0

6.5 Other polymers [i](#)

There are no such residues in this entry.