



# Full wwPDB X-ray Structure Validation Report ⓘ

Jun 22, 2024 – 09:57 AM EDT

PDB ID : 6E8L  
Title : Crystal Structure of Alkyl hydroperoxidase D (AhpD) from *Streptococcus pneumoniae* (Strain D39/ NCTC 7466)  
Authors : Meng, Y.; Davies, J.; North, R.; Coombes, D.; Horne, C.; Hampton, M.; Dobson, R.  
Deposited on : 2018-07-30  
Resolution : 2.30 Å(reported)

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

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<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>.

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

MolProbity : 4.02b-467  
Xtriage (Phenix) : 1.20.1  
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

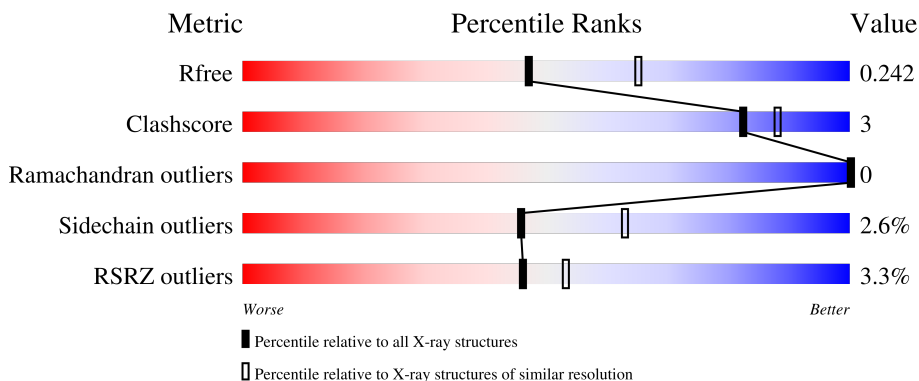
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.30 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.



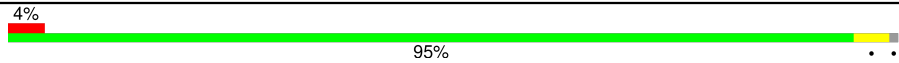
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
$R_{free}$	130704	5042 (2.30-2.30)
Clashscore	141614	5643 (2.30-2.30)
Ramachandran outliers	138981	5575 (2.30-2.30)
Sidechain outliers	138945	5575 (2.30-2.30)
RSRZ outliers	127900	4938 (2.30-2.30)

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  $\geq 3$ , 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	183	 89% 9%
1	B	183	 92% 7%
1	C	183	 95%
1	D	183	 90% 8%
1	E	183	 92% 7%

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Mol	Chain	Length	Quality of chain
1	F	183	 <p>A horizontal bar chart representing the quality of the chain. The bar is divided into three segments: a small red segment at the beginning labeled '4%', a large green segment in the middle labeled '95%', and a very small yellow segment at the end. The bar is contained within a rectangular box.</p>

## 2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 8513 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 Alkyl hydroperoxide reductase AhpD.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	180	1374	867	233	270	4	0	0	0
1	B	182	1388	876	235	273	4	0	0	0
1	C	182	1382	873	232	273	4	0	0	0
1	D	180	1374	867	233	270	4	0	0	0
1	E	181	1381	871	234	272	4	0	0	0
1	F	182	1388	876	235	273	4	0	0	0

There are 12 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	GLY	-	expression tag	UNP A0A0H2ZNM1
A	2	PRO	-	expression tag	UNP A0A0H2ZNM1
B	1	GLY	-	expression tag	UNP A0A0H2ZNM1
B	2	PRO	-	expression tag	UNP A0A0H2ZNM1
C	1	GLY	-	expression tag	UNP A0A0H2ZNM1
C	2	PRO	-	expression tag	UNP A0A0H2ZNM1
D	1	GLY	-	expression tag	UNP A0A0H2ZNM1
D	2	PRO	-	expression tag	UNP A0A0H2ZNM1
E	1	GLY	-	expression tag	UNP A0A0H2ZNM1
E	2	PRO	-	expression tag	UNP A0A0H2ZNM1
F	1	GLY	-	expression tag	UNP A0A0H2ZNM1
F	2	PRO	-	expression tag	UNP A0A0H2ZNM1

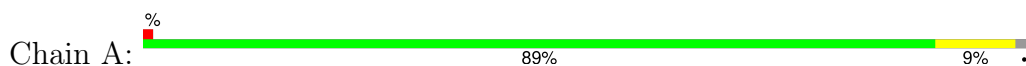
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	31	Total 31	O 31	0	0
2	B	38	Total 38	O 38	0	0
2	C	25	Total 25	O 25	0	0
2	D	51	Total 51	O 51	0	0
2	E	42	Total 42	O 42	0	0
2	F	39	Total 39	O 39	0	0

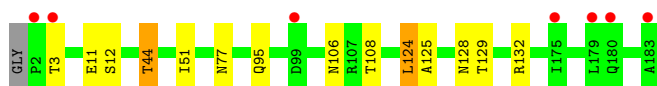
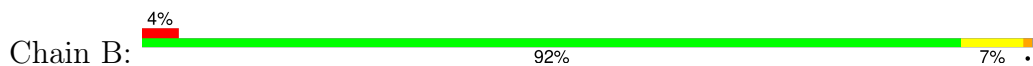
### 3 Residue-property plots [i](#)

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.

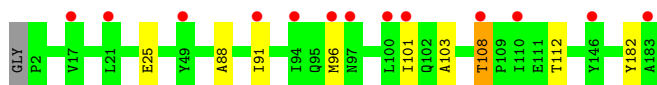
- Molecule 1: Alkyl hydroperoxide reductase AhpD



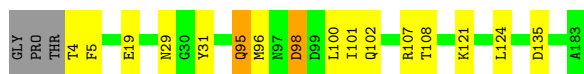
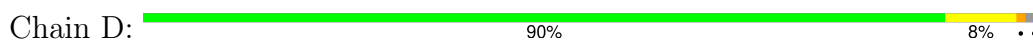
- Molecule 1: Alkyl hydroperoxide reductase AhpD



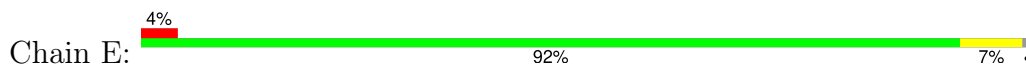
- Molecule 1: Alkyl hydroperoxide reductase AhpD



- Molecule 1: Alkyl hydroperoxide reductase AhpD

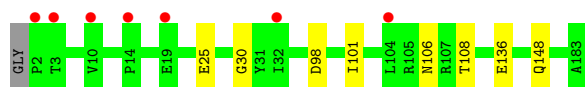


- Molecule 1: Alkyl hydroperoxide reductase AhpD



- Molecule 1: Alkyl hydroperoxide reductase AhpD

Chain F:  4% 95%



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	65.30Å 84.23Å 183.85Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	45.00 – 2.30 45.00 – 2.30	Depositor EDS
% Data completeness (in resolution range)	99.3 (45.00-2.30) 99.1 (45.00-2.30)	Depositor EDS
$R_{merge}$	0.10	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.50 (at 2.29Å)	Xtrriage
Refinement program	REFMAC 5.8.0158, PHENIX	Depositor
R, $R_{free}$	0.196 , 0.242 0.201 , 0.242	Depositor DCC
$R_{free}$ test set	2349 reflections (5.13%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	40.1	Xtrriage
Anisotropy	0.148	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.34 , 36.4	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.47$ , $\langle L^2 \rangle = 0.30$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	8513	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	46.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.24% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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](#)

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	0.80	0/1396	0.77	0/1907
1	B	0.72	0/1411	0.77	0/1928
1	C	0.76	0/1405	0.77	0/1921
1	D	0.82	0/1396	0.81	0/1907
1	E	0.88	0/1403	0.76	0/1917
1	F	0.78	0/1411	0.80	0/1928
All	All	0.80	0/8422	0.78	0/11508

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	1374	0	1376	13	0
1	B	1388	0	1391	10	0
1	C	1382	0	1380	4	0
1	D	1374	0	1376	8	0
1	E	1381	0	1383	7	0
1	F	1388	0	1391	7	0
2	A	31	0	0	2	0
2	B	38	0	0	1	0
2	C	25	0	0	0	0
2	D	51	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	E	42	0	0	1	0
2	F	39	0	0	0	0
All	All	8513	0	8297	42	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 3.

All (42) 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:125:ALA:O	1:B:129:THR:HG22	1.87	0.74
1:F:106:ASN:HB2	1:F:108:THR:HG23	1.73	0.70
1:E:100:LEU:HD12	1:E:100:LEU:O	1.98	0.63
1:A:57:ARG:NH1	1:D:19:GLU:OE2	2.33	0.62
1:E:96:MET:HB3	1:E:101:ILE:HD11	1.84	0.58
1:F:25:GLU:HG2	1:F:30:GLY:HA2	1.85	0.58
1:A:59:ASN:HB2	1:B:44:THR:HG21	1.86	0.56
2:A:204:HOH:O	1:B:44:THR:HG22	2.07	0.55
1:B:124:LEU:HD22	1:B:128:ASN:ND2	2.22	0.54
1:F:25:GLU:CG	1:F:30:GLY:HA2	2.37	0.54
1:B:129:THR:HG23	1:B:132:ARG:N	2.24	0.52
1:E:94:ILE:O	1:E:94:ILE:HG22	2.09	0.52
1:D:4:THR:O	1:F:148:GLN:NE2	2.38	0.52
1:A:52:VAL:HG13	1:A:156:PHE:CZ	2.44	0.52
1:A:78:GLY:O	1:B:132:ARG:NH2	2.43	0.51
1:A:51:ILE:HG21	1:B:51:ILE:HG21	1.92	0.50
1:B:106:ASN:HB3	1:B:108:THR:HG23	1.93	0.50
1:E:17:VAL:HG13	1:E:21:LEU:HD13	1.93	0.50
1:E:110:ILE:HG22	1:E:113:ASP:H	1.76	0.49
1:E:96:MET:HB3	1:E:101:ILE:CD1	2.43	0.49
1:B:11:GLU:HG2	1:B:12:SER:N	2.27	0.49
1:A:76:THR:OG1	2:A:201:HOH:O	2.20	0.48
1:E:107:ARG:CD	2:E:225:HOH:O	2.62	0.48
1:D:95:GLN:HE21	1:D:95:GLN:HA	1.78	0.48
1:C:103:ALA:HA	1:C:108:THR:HG22	1.94	0.48
1:A:107:ARG:NH1	1:A:124:LEU:HD13	2.30	0.47
1:A:93:GLN:NE2	1:A:93:GLN:HA	2.30	0.46
1:A:57:ARG:HD3	1:D:19:GLU:OE1	2.16	0.45
1:C:91:ILE:HG13	1:C:101:ILE:HD13	1.98	0.45
1:F:136:GLU:H	1:F:136:GLU:CD	2.10	0.44
1:F:98:ASP:HA	1:F:101:ILE:HG22	1.99	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:F:136:GLU:OE1	1:F:136:GLU:N	2.30	0.44
1:A:52:VAL:HG13	1:A:156:PHE:HZ	1.83	0.43
1:C:88:ALA:HB2	1:C:182:TYR:CD2	2.53	0.43
1:A:44:THR:HA	1:A:47:GLU:HG2	2.01	0.42
1:A:102:GLN:HG3	1:A:106:ASN:OD1	2.19	0.42
1:C:96:MET:SD	1:C:101:ILE:HG13	2.59	0.42
1:D:98:ASP:OD2	1:D:102:GLN:NE2	2.53	0.41
1:D:96:MET:CG	1:D:100:LEU:HD23	2.50	0.41
1:A:57:ARG:HD3	1:D:19:GLU:CD	2.41	0.41
1:D:4:THR:HG23	1:D:5:PHE:H	1.84	0.41
1:B:77:ASN:ND2	2:B:201:HOH:O	2.44	0.41

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	178/183 (97%)	177 (99%)	1 (1%)	0	100	100
1	B	180/183 (98%)	179 (99%)	1 (1%)	0	100	100
1	C	180/183 (98%)	180 (100%)	0	0	100	100
1	D	178/183 (97%)	178 (100%)	0	0	100	100
1	E	179/183 (98%)	178 (99%)	1 (1%)	0	100	100
1	F	180/183 (98%)	179 (99%)	1 (1%)	0	100	100
All	All	1075/1098 (98%)	1071 (100%)	4 (0%)	0	100	100

There are no Ramachandran outliers to report.

### 5.3.2 Protein sidechains

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	151/154 (98%)	148 (98%)	3 (2%)	55	72
1	B	153/154 (99%)	149 (97%)	4 (3%)	46	63
1	C	152/154 (99%)	149 (98%)	3 (2%)	55	72
1	D	151/154 (98%)	141 (93%)	10 (7%)	16	22
1	E	152/154 (99%)	148 (97%)	4 (3%)	46	63
1	F	153/154 (99%)	153 (100%)	0	100	100
All	All	912/924 (99%)	888 (97%)	24 (3%)	46	63

All (24) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	94	ILE
1	A	96	MET
1	A	108	THR
1	B	3	THR
1	B	44	THR
1	B	95	GLN
1	B	124	LEU
1	C	25	GLU
1	C	108	THR
1	C	112	THR
1	D	29	ASN
1	D	31	TYR
1	D	95	GLN
1	D	98	ASP
1	D	101	ILE
1	D	107	ARG
1	D	108	THR
1	D	121	LYS
1	D	124	LEU
1	D	135	ASP
1	E	3	THR
1	E	27	ASP

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Mol	Chain	Res	Type
1	E	67	GLU
1	E	108	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (13) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	56	HIS
1	A	93	GLN
1	B	95	GLN
1	B	102	GLN
1	B	128	ASN
1	C	29	ASN
1	D	29	ASN
1	D	95	GLN
1	D	102	GLN
1	D	180	GLN
1	E	56	HIS
1	E	97	ASN
1	F	56	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](#)

There are no ligands in this entry.

## 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<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	180/183 (98%)	0.13	1 (0%) 89 92	29, 40, 67, 90	0
1	B	182/183 (99%)	0.25	7 (3%) 40 47	31, 43, 69, 90	0
1	C	182/183 (99%)	0.24	13 (7%) 16 21	33, 47, 71, 89	0
1	D	180/183 (98%)	0.05	0 100 100	32, 42, 67, 77	0
1	E	181/183 (98%)	0.15	8 (4%) 34 41	33, 45, 68, 83	0
1	F	182/183 (99%)	0.21	7 (3%) 40 47	31, 42, 67, 96	0
All	All	1087/1098 (98%)	0.17	36 (3%) 46 53	29, 43, 69, 96	0

All (36) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	F	3	THR	6.1
1	B	183	ALA	4.0
1	E	100	LEU	3.7
1	C	110	ILE	3.7
1	F	2	PRO	3.4
1	C	96	MET	3.4
1	C	108	THR	3.4
1	C	17	VAL	3.0
1	F	10	VAL	3.0
1	C	100	LEU	2.9
1	E	143	GLU	2.8
1	B	179	LEU	2.7
1	E	112	THR	2.6
1	B	3	THR	2.6
1	C	94	ILE	2.6
1	B	180	GLN	2.5
1	E	87	THR	2.5
1	C	91	ILE	2.5
1	E	183	ALA	2.4

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Mol	Chain	Res	Type	RSRZ
1	C	49	TYR	2.4
1	E	99	ASP	2.3
1	B	175	ILE	2.3
1	C	183	ALA	2.3
1	E	10	VAL	2.3
1	E	113	ASP	2.3
1	C	101	ILE	2.3
1	C	21	LEU	2.2
1	B	99	ASP	2.2
1	C	97	ASN	2.1
1	F	32	ILE	2.1
1	F	19	GLU	2.1
1	B	2	PRO	2.1
1	F	14	PRO	2.1
1	A	183	ALA	2.0
1	C	146	TYR	2.0
1	F	104	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 monosaccharides in this entry.

## 6.4 Ligands [i](#)

There are no ligands in this entry.

## 6.5 Other polymers [i](#)

There are no such residues in this entry.