



# wwPDB X-ray Structure Validation Summary Report ⓘ

Oct 9, 2023 – 07:45 AM EDT

PDB ID : 7U4H  
Title : Crystal Structure of Penicillin-binding protein 1A (Pbp1a) from *Chlamydia trachomatis*  
Authors : Seattle Structural Genomics Center for Infectious Disease (SSGCID)  
Deposited on : 2022-02-28  
Resolution : 3.10 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](mailto: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>.

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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  
Mogul : 1.8.5 (274361), CSD as541be (2020)  
Xtriage (Phenix) : 1.13  
EDS : 2.35.1  
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) : 2.35.1

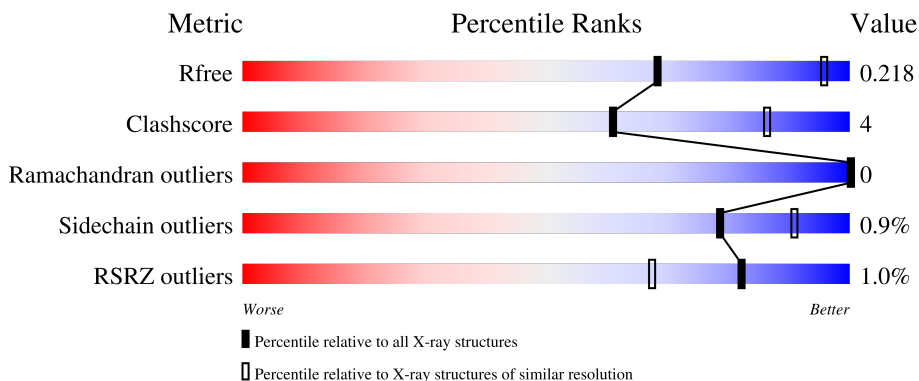
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 3.10 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  $\geq 3$ , 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	921	 55% 8% 37%
1	B	921	 % 54% 8% 38%

## 2 Entry composition [i](#)

There are 6 unique types of molecules in this entry. The entry contains 9067 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.

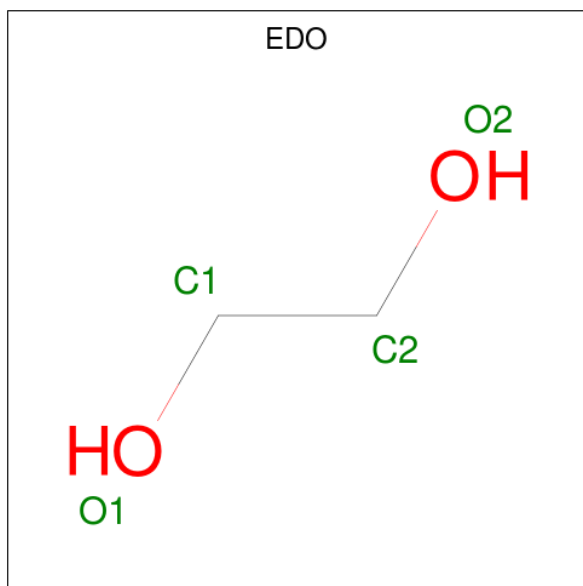
- Molecule 1 is a protein called Penicillin-binding protein 1A (Pbp1a).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	576	4477	2824	754	887	12	0	0	0
1	B	572	4406	2774	744	876	12	0	0	0

- Molecule 2 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

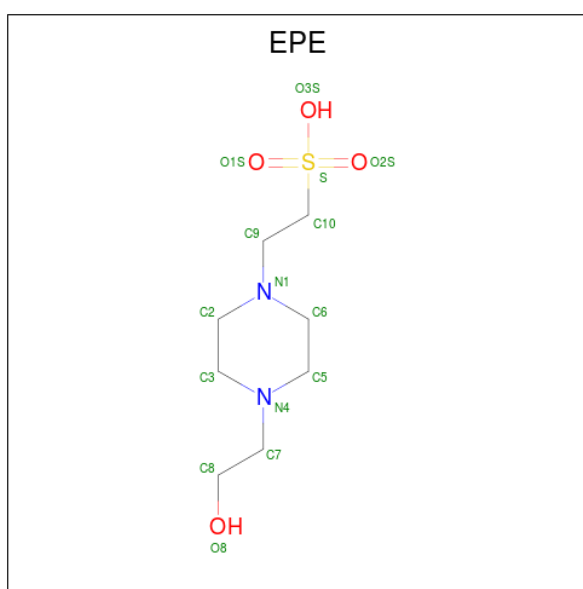
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	1	Total 1	Mg 1	0	0
2	B	1	Total 1	Mg 1	0	0

- Molecule 3 is 1,2-ETHANEDIOL (three-letter code: EDO) (formula: C<sub>2</sub>H<sub>6</sub>O<sub>2</sub>).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total C O 4 2 2	0	0
3	A	1	Total C O 4 2 2	0	0
3	B	1	Total C O 4 2 2	0	0
3	B	1	Total C O 4 2 2	0	0

- Molecule 4 is 4-(2-HYDROXYETHYL)-1-PIPERAZINE ETHANESULFONIC ACID (three-letter code: EPE) (formula: C<sub>8</sub>H<sub>18</sub>N<sub>2</sub>O<sub>4</sub>S).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	1	Total C N O S 15 8 2 4 1	0	0
4	B	1	Total C N O S 15 8 2 4 1	0	0

- Molecule 5 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	1	Total Cl 1 1	0	0
5	B	1	Total Cl 1 1	0	0

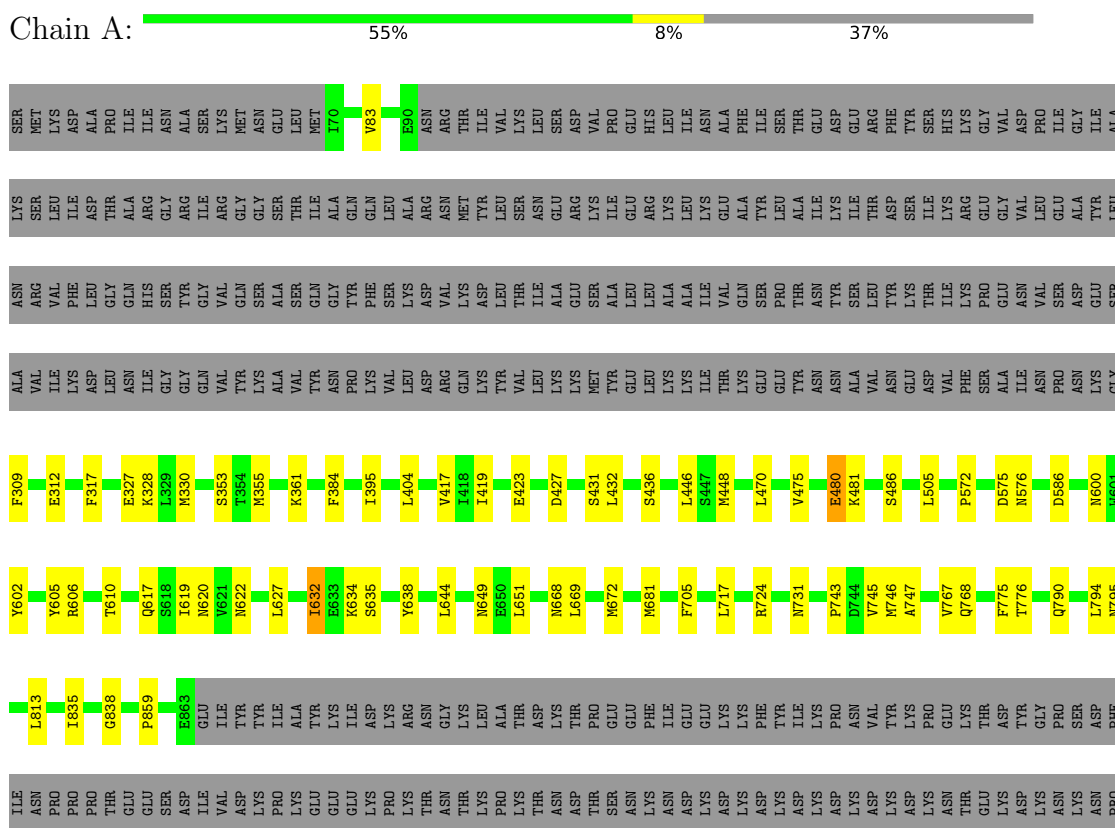
- Molecule 6 is water.

<b>Mol</b>	<b>Chain</b>	<b>Residues</b>	<b>Atoms</b>		<b>ZeroOcc</b>	<b>AltConf</b>
6	A	82	Total 82	O 82	0	0
6	B	52	Total 52	O 52	0	0

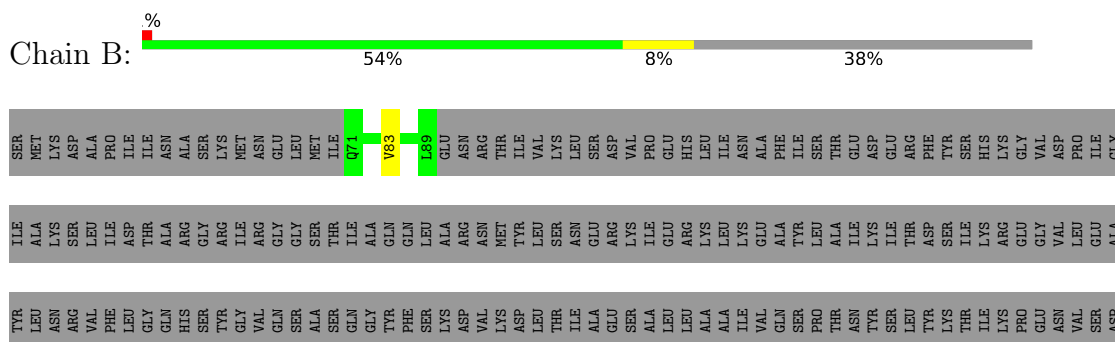
### 3 Residue-property plots

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: Penicillin-binding protein 1A (Pbp1a)



- Molecule 1: Penicillin-binding protein 1A (Pbp1a)



GLU	LYS	LYS	V767	ILE	ASP
SER	GLY	ILE	Q768	LYS	LYS
ALA	F309	ASN	F775	PRO	ASP
VAL	E312	THR	T776	VAL	LYS
ILE	F317	TYR	F787	TYR	LYS
LYS	K328	LYS	Q790	LYS	ASP
ASP	L329	N600	L794	GLU	LYS
LEU	M330	R606	N795	THR	ASP
ASN	S353	Q617	R810	TYR	LYS
LEU	T354	S618	L813	GLY	LYS
LEU	M355	I619	I813	PRO	ASN
GLY	K361	N620	I829	SER	LYS
GLM	Y367	V621	I830	ASP	LYS
VAL	F384	N622	K831	ASP	PRO
TYR	I418	L627	I835	ILE	PRO
ASN	G422	E633	I849	THR	PRO
PRO	E423	K634	K855	GLU	GLU
LYS	I426	S855	E863	GLU	SER
LEU	D427	K636	ILE	ILE	ASP
LYS	S428	E637	GLU	THR	ILE
LYS	S431	Y638	TYR	VAL	VAL
LYS	L432	F639	ILE	ASP	LYS
LYS	M435	N649	TYR	LYS	PRO
LEU	S436	E650	ILE	PRO	LYS
GLU	F468	L651	ALA	LYS	LYS
TYR	P471	N668	TYR	ARG	LYS
LYS	Q472	L669	LYS	ASN	THR
THR	Q473	M672	GLY	ASN	ASN
LYS	GLY	L684	LYS	LYS	THR
GLU	VAL	N700	LEU	THR	LYS
TYR	T476	F705	ALA	PRO	PRO
ASN	K481	L717	THR	LYS	LYS
ASN	S482	Q723	ASP	THR	THR
ALA	F483	THR	LYS	ASN	ASN
VAL	K484	PRO	THR	ASP	THR
ASN	I485	N731	GLU	SER	THR
GLU	S486	A732	GLU	ASN	ASN
ASP	V489	R736	PHE	LYS	ASN
VAL	L505	V745	ILE	ASN	ASN
PHE	Q521	M746	GLU	ASP	ASP
SER	K751	K751	LYS	LYS	LYS
ALA	L536		PHE	ASP	ASP
ILE			TYR	LYS	LYS
ASN					

## 4 Data and refinement statistics

Property	Value	Source
Space group	H 3 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	175.79Å 175.79Å 339.70Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	47.60 – 3.10 47.64 – 3.10	Depositor EDS
% Data completeness (in resolution range)	99.8 (47.60-3.10) 99.8 (47.64-3.10)	Depositor EDS
$R_{merge}$	0.11	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.96 (at 3.12Å)	Xtrriage
Refinement program	PHENIX 1.20.1	Depositor
R, $R_{free}$	0.192 , 0.216 0.193 , 0.218	Depositor DCC
$R_{free}$ test set	2016 reflections (5.47%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	59.2	Xtrriage
Anisotropy	0.130	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.31 , 34.5	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.34$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.93	EDS
Total number of atoms	9067	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	61.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.25% 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](#)

Bond lengths and bond angles in the following residue types are not validated in this section: MG, CL, EDO, EPE

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	0.26	0/4567	0.48	0/6199
1	B	0.26	0/4492	0.48	0/6101
All	All	0.26	0/9059	0.48	0/12300

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	4477	0	4270	39	0
1	B	4406	0	4174	39	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
3	A	8	0	12	0	0
3	B	8	0	12	0	0
4	A	15	0	17	0	0
4	B	15	0	17	0	0
5	A	1	0	0	0	0
5	B	1	0	0	0	0
6	A	82	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
6	B	52	0	0	0	0
All	All	9067	0	8502	78	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.

The worst 5 of 78 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:632:ILE:HG13	1:B:672:MET:HE3	1.73	0.70
1:B:835:ILE:HD11	1:B:849:ILE:HG12	1.75	0.69
1:B:576:ASN:HD21	1:B:634:LYS:HE2	1.60	0.67
1:A:627:LEU:HD23	1:A:669:LEU:HD23	1.79	0.64
1:A:610:THR:HG23	1:A:835:ILE:HG23	1.83	0.61

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	572/921 (62%)	541 (95%)	31 (5%)	0	100	100
1	B	566/921 (62%)	539 (95%)	27 (5%)	0	100	100
All	All	1138/1842 (62%)	1080 (95%)	58 (5%)	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	476/813 (58%)	471 (99%)	5 (1%)	73	89
1	B	465/813 (57%)	462 (99%)	3 (1%)	86	94
All	All	941/1626 (58%)	933 (99%)	8 (1%)	78	91

5 of 8 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	775	PHE
1	B	684	LEU
1	A	775	PHE
1	A	724	ARG
1	B	309	PHE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 8 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	768	GLN
1	B	700	ASN
1	B	372	ASN
1	A	768	GLN
1	B	576	ASN

### 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

Of 10 ligands modelled in this entry, 4 are monoatomic - leaving 6 for Mogul analysis.

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
4	EPE	A	1003	-	15,15,15	0.77	1 (6%)	18,20,20	2.01	5 (27%)
3	EDO	A	1005	-	3,3,3	0.51	0	2,2,2	0.38	0
3	EDO	B	1002	-	3,3,3	0.45	0	2,2,2	0.35	0
4	EPE	B	1003	-	15,15,15	0.77	1 (6%)	18,20,20	1.81	5 (27%)
3	EDO	B	1005	-	3,3,3	0.56	0	2,2,2	0.13	0
3	EDO	A	1002	-	3,3,3	0.47	0	2,2,2	0.22	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
4	EPE	A	1003	-	-	5/9/19/19	0/1/1/1
3	EDO	A	1005	-	-	0/1/1/1	-
3	EDO	B	1002	-	-	0/1/1/1	-
4	EPE	B	1003	-	-	2/9/19/19	0/1/1/1
3	EDO	B	1005	-	-	0/1/1/1	-
3	EDO	A	1002	-	-	0/1/1/1	-

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	B	1003	EPE	C10-S	2.57	1.81	1.77
4	A	1003	EPE	C10-S	2.49	1.81	1.77

The worst 5 of 10 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	1003	EPE	C5-N4-C3	5.51	121.23	108.83

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	B	1003	EPE	C5-N4-C3	4.06	117.97	108.83
4	A	1003	EPE	O2S-S-C10	3.29	110.88	106.92
4	B	1003	EPE	C7-N4-C3	3.23	119.51	111.23
4	B	1003	EPE	O2S-S-C10	2.93	110.45	106.92

There are no chirality outliers.

5 of 7 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	1003	EPE	C9-C10-S-O1S
4	B	1003	EPE	S-C10-C9-N1
4	A	1003	EPE	C8-C7-N4-C3
4	A	1003	EPE	C9-C10-S-O3S
4	A	1003	EPE	S-C10-C9-N1

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 [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, 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	576/921 (62%)	-0.35	0 <span style="border: 1px solid blue; padding: 2px;">100</span> <span style="border: 1px solid blue; padding: 2px;">100</span>	33, 54, 97, 130	0
1	B	572/921 (62%)	-0.14	11 (1%) <span style="border: 1px solid blue; padding: 2px;">66</span> <span style="border: 1px solid blue; padding: 2px;">46</span>	39, 58, 115, 151	0
All	All	1148/1842 (62%)	-0.25	11 (0%) <span style="border: 1px solid blue; padding: 2px;">82</span> <span style="border: 1px solid blue; padding: 2px;">67</span>	33, 56, 109, 151	0

The worst 5 of 11 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	471	PRO	4.0
1	B	431	SER	2.8
1	B	485	ILE	2.7
1	B	483	PHE	2.7
1	B	476	THR	2.5

### 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, 95<sup>th</sup> 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( $\text{\AA}^2$ )	Q<0.9
3	EDO	B	1005	4/4	0.85	0.27	60,61,62,67	0
3	EDO	A	1005	4/4	0.86	0.28	67,69,70,73	0
2	MG	A	1001	1/1	0.94	0.13	47,47,47,47	0
5	CL	A	1004	1/1	0.95	0.24	78,78,78,78	0
5	CL	B	1004	1/1	0.95	0.30	73,73,73,73	0
4	EPE	A	1003	15/15	0.96	0.24	50,55,70,71	0
2	MG	B	1001	1/1	0.96	0.06	62,62,62,62	0
3	EDO	A	1002	4/4	0.96	0.24	36,38,39,42	0
3	EDO	B	1002	4/4	0.97	0.22	42,43,44,47	0
4	EPE	B	1003	15/15	0.97	0.17	46,59,68,73	0

## 6.5 Other polymers [\(i\)](#)

There are no such residues in this entry.