



# Full wwPDB X-ray Structure Validation Report ⓘ

Mar 20, 2025 – 11:44 AM EDT

PDB ID : 3UW2  
Title : X-ray Crystal Structure of Phosphoglucosyltransferase/phosphomannomutase family protein (BTH\_I1489) from Burkholderia thailandensis  
Authors : Seattle Structural Genomics Center for Infectious Disease (SSGCID)  
Deposited on : 2011-11-30  
Resolution : 1.95 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](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>.

---

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)	:	1.21
EDS	:	3.0
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.004 (Gargrove)
Density-Fitness	:	1.0.11
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.41.4

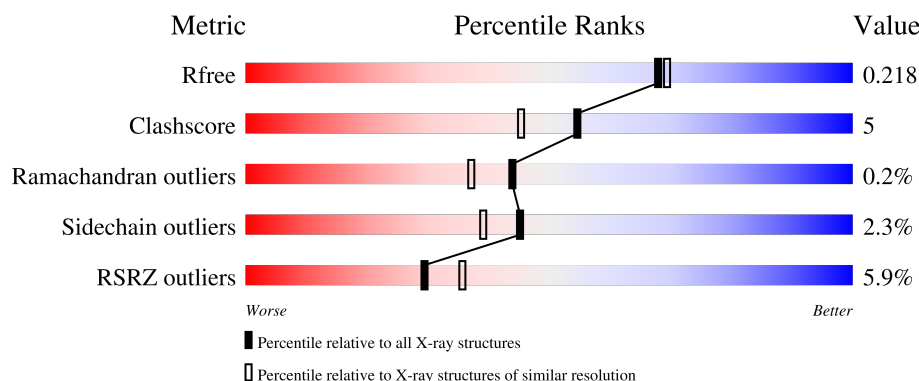
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.95 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))
$R_{free}$	164625	3187 (1.96-1.96)
Clashscore	180529	3412 (1.96-1.96)
Ramachandran outliers	177936	3390 (1.96-1.96)
Sidechain outliers	177891	3390 (1.96-1.96)
RSRZ outliers	164620	3186 (1.96-1.96)

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	485	

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
3	EDO	A	471	-	-	X	-

## 2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 3837 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 Phosphoglucomutase/phosphomannomutase family protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	458	Total	C	N	O	S	0	6	0
			3465	2191	608	657	9			

There are 21 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-20	MET	-	expression tag	UNP Q2SYG4
A	-19	ALA	-	expression tag	UNP Q2SYG4
A	-18	HIS	-	expression tag	UNP Q2SYG4
A	-17	HIS	-	expression tag	UNP Q2SYG4
A	-16	HIS	-	expression tag	UNP Q2SYG4
A	-15	HIS	-	expression tag	UNP Q2SYG4
A	-14	HIS	-	expression tag	UNP Q2SYG4
A	-13	HIS	-	expression tag	UNP Q2SYG4
A	-12	MET	-	expression tag	UNP Q2SYG4
A	-11	GLY	-	expression tag	UNP Q2SYG4
A	-10	THR	-	expression tag	UNP Q2SYG4
A	-9	LEU	-	expression tag	UNP Q2SYG4
A	-8	GLU	-	expression tag	UNP Q2SYG4
A	-7	ALA	-	expression tag	UNP Q2SYG4
A	-6	GLN	-	expression tag	UNP Q2SYG4
A	-5	THR	-	expression tag	UNP Q2SYG4
A	-4	GLN	-	expression tag	UNP Q2SYG4
A	-3	GLY	-	expression tag	UNP Q2SYG4
A	-2	PRO	-	expression tag	UNP Q2SYG4
A	-1	GLY	-	expression tag	UNP Q2SYG4
A	0	SER	-	expression tag	UNP Q2SYG4

- Molecule 2 is PHOSPHATE ION (three-letter code: PO4) (formula: O<sub>4</sub>P).



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

- 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	0	0
			4	2	2		
3	A	1	Total	C	O	0	0
			4	2	2		
3	A	1	Total	C	O	0	0
			4	2	2		

*Continued on next page...*

Continued from previous page...

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

- Molecule 4 is GLYCEROL (three-letter code: GOL) (formula:  $C_3H_8O_3$ ).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	C	O	0	0
			6	3	3		
4	A	1	Total	C	O	0	0
			6	3	3		

- Molecule 5 is ZINC ION (three-letter code: ZN) (formula:  $Zn$ ).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	1	Total	Zn	0	0
			1	1		

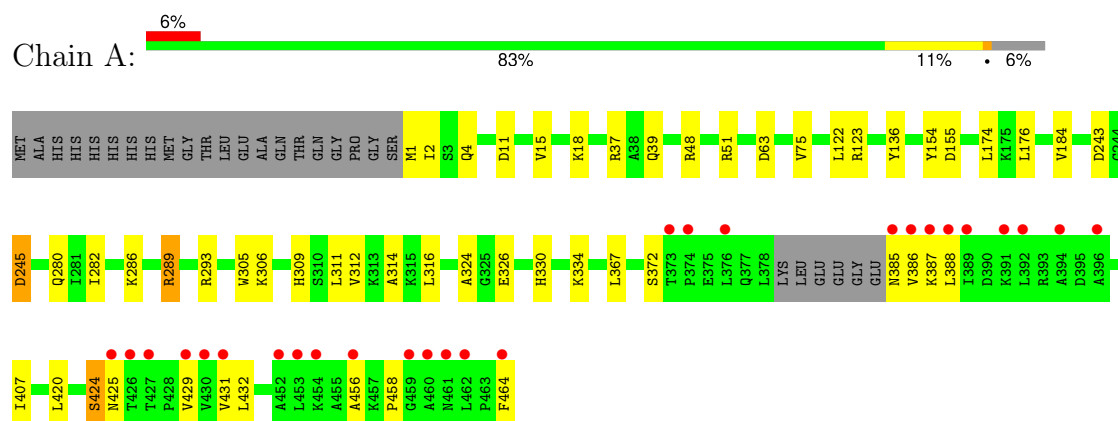
- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	331	Total	O	0	0
			331	331		

### 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: Phosphoglucomutase/phosphomannomutase family protein



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	67.38Å 75.23Å 104.42Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	61.04 – 1.95 61.04 – 1.95	Depositor EDS
% Data completeness (in resolution range)	99.2 (61.04-1.95) 99.2 (61.04-1.95)	Depositor EDS
$R_{merge}$	0.06	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.73 (at 1.95Å)	Xtriage
Refinement program	REFMAC 5.6.0117	Depositor
R, $R_{free}$	0.177 , 0.220 0.176 , 0.218	Depositor DCC
$R_{free}$ test set	1967 reflections (5.03%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	29.8	Xtriage
Anisotropy	0.811	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.34 , 45.8	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.97	EDS
Total number of atoms	3837	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	41.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.38% 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: GOL, PO4, ZN, 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	0.92	0/3549	0.97	14/4819 (0.3%)

There are no bond length outliers.

All (14) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	48	ARG	NE-CZ-NH1	7.96	124.28	120.30
1	A	48	ARG	NE-CZ-NH2	-7.76	116.42	120.30
1	A	245	ASP	CB-CG-OD2	6.82	124.44	118.30
1	A	37	ARG	NE-CZ-NH1	6.64	123.62	120.30
1	A	123	ARG	NE-CZ-NH2	-6.29	117.15	120.30
1	A	51	ARG	NE-CZ-NH2	-6.24	117.18	120.30
1	A	176	LEU	CA-CB-CG	6.24	129.64	115.30
1	A	243	ASP	CB-CG-OD2	-6.01	112.89	118.30
1	A	155	ASP	CB-CG-OD1	5.99	123.69	118.30
1	A	334	LYS	CD-CE-NZ	-5.69	98.61	111.70
1	A	243	ASP	CB-CG-OD1	5.68	123.41	118.30
1	A	316	LEU	CA-CB-CG	5.37	127.64	115.30
1	A	63	ASP	CB-CG-OD1	5.15	122.94	118.30
1	A	11	ASP	CB-CG-OD2	-5.04	113.76	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	3465	0	3409	33	0
2	A	4	0	0	0	0
3	A	24	0	36	6	0
4	A	12	0	16	2	0
5	A	1	0	0	0	0
6	A	331	0	0	2	0
All	All	3837	0	3461	33	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 5.

All (33) 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:305:TRP:HE1	3:A:471:EDO:H21	1.08	1.10
1:A:305:TRP:NE1	3:A:471:EDO:H21	1.88	0.89
1:A:309[B]:HIS:CD2	1:A:330:HIS:CD2	2.71	0.78
1:A:305:TRP:HE1	3:A:471:EDO:C2	1.95	0.77
1:A:289:ARG:HH21	1:A:289:ARG:HB3	1.54	0.72
1:A:314:ALA:HB3	3:A:471:EDO:H12	1.78	0.65
1:A:1:MET:HE2	1:A:2:ILE:HG22	1.85	0.58
1:A:293:ARG:NH1	6:A:799:HOH:O	2.38	0.57
1:A:432:LEU:HD13	1:A:464:PHE:HE1	1.72	0.55
1:A:385:ASN:O	1:A:387:LYS:N	2.41	0.53
1:A:311:LEU:HB3	3:A:471:EDO:H22	1.91	0.52
1:A:39:GLN:NE2	1:A:122:LEU:HD21	2.25	0.52
1:A:432:LEU:HD13	1:A:464:PHE:CE1	2.48	0.49
1:A:289:ARG:NH2	6:A:791:HOH:O	2.46	0.49
1:A:289:ARG:HH21	1:A:289:ARG:CB	2.23	0.48
1:A:420:LEU:O	1:A:432:LEU:HA	2.15	0.47
1:A:289:ARG:HB3	1:A:289:ARG:NH2	2.27	0.47
1:A:75:VAL:HA	1:A:154:TYR:O	2.16	0.46
1:A:367:LEU:HA	4:A:473:GOL:H32	1.98	0.46
1:A:309[B]:HIS:NE2	1:A:330:HIS:NE2	2.63	0.46
1:A:309[B]:HIS:HD2	1:A:326:GLU:OE1	2.00	0.44
1:A:15:VAL:HG11	1:A:18:LYS:HE2	2.00	0.43
1:A:424:SER:OG	1:A:425:ASN:N	2.50	0.43
1:A:367:LEU:HA	4:A:473:GOL:C3	2.50	0.42
1:A:456:ALA:O	1:A:458:PRO:HD3	2.19	0.42

*Continued on next page...*

*Continued from previous page...*

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:184:VAL:HG12	1:A:245:ASP:HA	2.02	0.41
1:A:282:ILE:O	1:A:324:ALA:HA	2.19	0.41
1:A:312:VAL:HG21	1:A:326:GLU:HG2	2.02	0.41
1:A:309[B]:HIS:NE2	1:A:330:HIS:CD2	2.89	0.41
1:A:305:TRP:CG	1:A:306:LYS:N	2.89	0.41
1:A:4:GLN:HB2	1:A:136:TYR:CZ	2.57	0.40
1:A:286:LYS:O	3:A:470:EDO:H11	2.21	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	460/485 (95%)	443 (96%)	16 (4%)	1 (0%)	44 37

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	386	VAL

### 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	352/380 (93%)	344 (98%)	8 (2%)	45 39

All (8) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	174	LEU
1	A	289	ARG
1	A	372	SER
1	A	388	LEU
1	A	407	ILE
1	A	424	SER
1	A	429	VAL
1	A	431	VAL

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 oligosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

Of 10 ligands modelled in this entry, 1 is monoatomic - leaving 9 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	GOL	A	473	-	5,5,5	1.21	1 (20%)	5,5,5	1.12	0
3	EDO	A	467	-	3,3,3	0.97	0	2,2,2	0.71	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
3	EDO	A	469	-	3,3,3	0.49	0	2,2,2	0.55	0
3	EDO	A	470	-	3,3,3	0.45	0	2,2,2	0.73	0
3	EDO	A	471	-	3,3,3	0.71	0	2,2,2	0.22	0
3	EDO	A	468	-	3,3,3	0.37	0	2,2,2	0.59	0
3	EDO	A	466	-	3,3,3	0.55	0	2,2,2	0.62	0
4	GOL	A	472	-	5,5,5	0.58	0	5,5,5	0.55	0
2	PO4	A	465	1,5	0,3,4	-	-	0,3,6	-	-

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	GOL	A	473	-	-	4/4/4/4	-
3	EDO	A	467	-	-	0/1/1/1	-
3	EDO	A	469	-	-	1/1/1/1	-
3	EDO	A	470	-	-	0/1/1/1	-
3	EDO	A	471	-	-	0/1/1/1	-
3	EDO	A	468	-	-	0/1/1/1	-
3	EDO	A	466	-	-	1/1/1/1	-
4	GOL	A	472	-	-	2/4/4/4	-

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	473	GOL	O2-C2	2.22	1.49	1.43

There are no bond angle outliers.

There are no chirality outliers.

All (8) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	472	GOL	O1-C1-C2-C3
4	A	473	GOL	O1-C1-C2-C3
4	A	473	GOL	C1-C2-C3-O3
4	A	473	GOL	O2-C2-C3-O3
4	A	472	GOL	O1-C1-C2-O2
4	A	473	GOL	O1-C1-C2-O2
3	A	469	EDO	O1-C1-C2-O2
3	A	466	EDO	O1-C1-C2-O2

There are no ring outliers.

3 monomers are involved in 8 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	473	GOL	2	0
3	A	470	EDO	1	0
3	A	471	EDO	5	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, 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	458/485 (94%)	-0.17	27 (5%)	29 36	18, 34, 101, 158	6 (1%)

All (27) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	429	VAL	5.5
1	A	374	PRO	3.7
1	A	461	ASN	3.6
1	A	460	ALA	3.6
1	A	376	LEU	3.4
1	A	386	VAL	3.3
1	A	387	LYS	3.3
1	A	462	LEU	3.3
1	A	388	LEU	3.1
1	A	459	GLY	3.0
1	A	389	ILE	3.0
1	A	431	VAL	2.9
1	A	453	LEU	2.9
1	A	396	ALA	2.7
1	A	373	THR	2.6
1	A	452	ALA	2.6
1	A	394	ALA	2.5
1	A	454	LYS	2.5
1	A	430	VAL	2.4
1	A	427	THR	2.4
1	A	456	ALA	2.3
1	A	426	THR	2.3
1	A	385	ASN	2.3
1	A	391	LYS	2.2
1	A	392	LEU	2.2
1	A	425	ASN	2.2
1	A	464	PHE	2.1

## 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
4	GOL	A	473	6/6	0.82	0.15	42,58,63,64	0
3	EDO	A	469	4/4	0.85	0.10	54,57,58,59	0
3	EDO	A	468	4/4	0.87	0.12	59,60,64,64	0
3	EDO	A	471	4/4	0.90	0.14	44,49,54,54	0
4	GOL	A	472	6/6	0.90	0.13	62,66,68,73	0
2	PO4	A	465	4/5	0.90	0.09	61,61,66,74	0
3	EDO	A	470	4/4	0.93	0.09	41,49,49,51	0
3	EDO	A	466	4/4	0.95	0.09	41,42,45,50	0
3	EDO	A	467	4/4	0.95	0.09	32,34,36,39	0
5	ZN	A	474	1/1	0.97	0.16	57,57,57,57	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.