



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 20, 2026 – 08:04 AM UTC

PDB ID : 5BX6 / pdb_00005bx6
Title : PKA in complex with a halogenated phthalazinone fragment compound.
Authors : Narayanan, D.; Alam, K.A.; Engh, R.A.
Deposited on : 2015-06-08
Resolution : 1.89 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	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

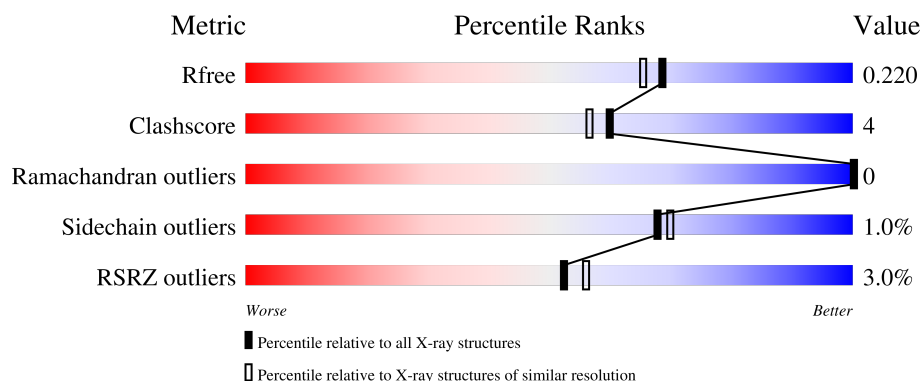
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.89 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}	180053	7789 (1.90-1.90)
Clashscore	190562	8410 (1.90-1.90)
Ramachandran outliers	187476	8333 (1.90-1.90)
Sidechain outliers	187428	8333 (1.90-1.90)
RSRZ outliers	180081	7790 (1.90-1.90)

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	351	3% 90% 8% ..
2	B	20	10% 90% 10%

2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 3290 atoms, of which 14 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.

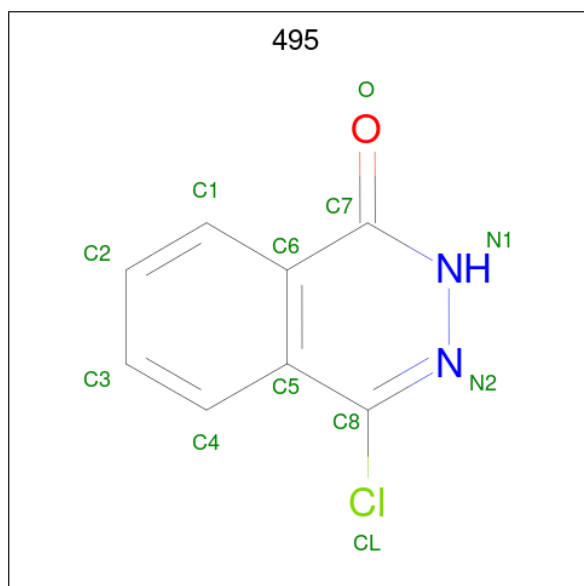
- Molecule 1 is a protein called cAMP-dependent protein kinase catalytic subunit alpha.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	346	Total	C	N	O	P	S	0	3	0
			2858	1846	479	522	3	8			

- Molecule 2 is a protein called cAMP-dependent protein kinase inhibitor alpha.

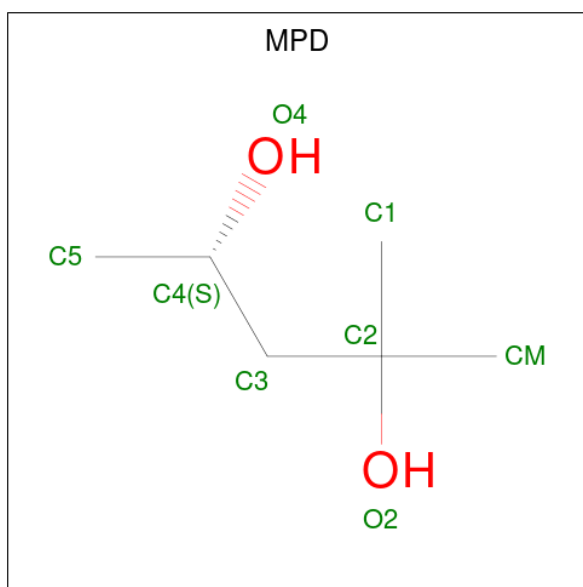
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
2	B	20	Total	C	N	O	0	0	0
			156	94	32	30			

- Molecule 3 is 4-chlorophthalazin-1(2H)-one (CCD ID: 495) (formula: C₈H₅ClN₂O).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	A	1	Total	C	Cl	N	O	0	0
			12	8	1	2	1		

- Molecule 4 is (4S)-2-METHYL-2,4-PENTANEDIOL (CCD ID: MPD) (formula: C₆H₁₄O₂).



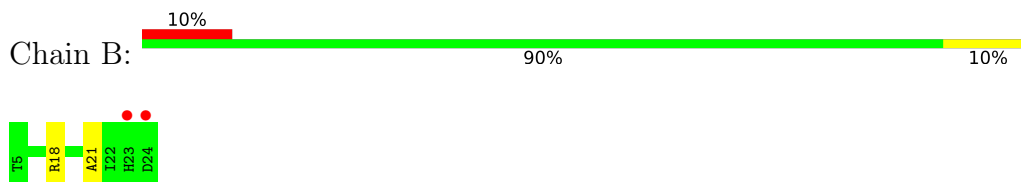
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	A	1	Total	C	O		0	0
			8	6	2			
4	A	1	Total	C	O		0	0
			8	6	2			
4	A	1	Total	C	H	O	0	0
			22	6	14	2		

- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	207	Total	O	0	0
			207	207		
5	B	19	Total	O	0	0
			19	19		

i

- Molecule 1: cAMP-dependent protein kinase catalytic subunit alpha



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	72.35Å 75.31Å 80.48Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	36.17 – 1.89 36.17 – 1.89	Depositor EDS
% Data completeness (in resolution range)	99.3 (36.17-1.89) 99.3 (36.17-1.89)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.08 (at 1.89Å)	Xtriage
Refinement program	PHENIX 1.9_1692	Depositor
R, R_{free}	0.170 , 0.218 0.173 , 0.220	Depositor DCC
R_{free} test set	1840 reflections (5.12%)	wwPDB-VP
Wilson B-factor (Å ²)	20.7	Xtriage
Anisotropy	0.055	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 38.0	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.021 for k,h,-l	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	3290	wwPDB-VP
Average B, all atoms (Å ²)	26.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.94% 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: 495, SEP, TPO, MPD

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	0.44	0/2897	0.69	2/3900 (0.1%)
2	B	0.46	0/158	0.66	0/212
All	All	0.44	0/3055	0.69	2/4112 (0.0%)

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	206	ALA	CA-C-N	5.02	125.04	119.32
1	A	206	ALA	C-N-CA	5.02	125.04	119.32

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	2858	0	2822	23	0
2	B	156	0	146	2	0
3	A	12	0	5	1	0
4	A	24	14	42	4	0
5	A	207	0	0	6	1
5	B	19	0	0	1	0
All	All	3276	14	3015	26	1

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 (26) 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:183:THR:OG1	3:A:401:495:CL	2.35	0.81
1:A:7:LYS:NZ	5:A:502:HOH:O	2.16	0.78
1:A:54:PHE:HB2	1:A:74:LEU:HD22	1.65	0.78
4:A:404:MPD:O4	5:A:501:HOH:O	2.04	0.76
1:A:54:PHE:CZ	1:A:84:GLN:HG3	2.25	0.71
1:A:134:ARG:HD3	4:A:404:MPD:H53	1.80	0.64
1:A:54:PHE:HZ	1:A:84:GLN:HG3	1.66	0.60
1:A:56:ARG:NH2	1:A:333:GLU:HB3	2.20	0.56
1:A:285:LYS:HE3	1:A:286:ASN:OD1	2.06	0.56
1:A:189:LYS:HG2	1:A:191:VAL:CG2	2.36	0.56
1:A:216:ASN:HB2	5:A:639:HOH:O	2.06	0.56
1:A:176:GLN:NE2	1:A:318:PHE:HB2	2.21	0.55
2:B:18:ARG:NH2	5:B:101:HOH:O	2.43	0.52
1:A:285:LYS:HG3	1:A:286:ASN:N	2.25	0.51
1:A:142:HIS:ND1	5:A:503:HOH:O	2.35	0.49
4:A:403:MPD:O4	4:A:403:MPD:H12	2.11	0.49
1:A:163:ILE:HG22	1:A:165:ARG:HG3	1.95	0.48
1:A:217:LYS:HD3	5:A:679:HOH:O	2.13	0.47
1:A:131:HIS:ND1	4:A:404:MPD:H4	2.31	0.45
1:A:189:LYS:HG2	1:A:191:VAL:HG23	1.97	0.45
1:A:187:PHE:HE2	2:B:21:ALA:HB1	1.83	0.43
1:A:238:PHE:CE1	1:A:255:VAL:HG22	2.54	0.43
1:A:189:LYS:NZ	1:A:197:TPO:O1P	2.52	0.42
1:A:176:GLN:NE2	5:A:515:HOH:O	2.54	0.41
1:A:238:PHE:CZ	1:A:255:VAL:HG22	2.56	0.41
1:A:211:LEU:HB2	1:A:213:LYS:HD3	2.03	0.41

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
5:A:701:HOH:O	5:A:702:HOH:O[2_555]	2.19	0.01

5.3 Torsion angles

5.3.1 Protein backbone

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	344/351 (98%)	334 (97%)	10 (3%)	0	100	100
2	B	18/20 (90%)	18 (100%)	0	0	100	100
All	All	362/371 (98%)	352 (97%)	10 (3%)	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	300/303 (99%)	297 (99%)	3 (1%)	68	70
2	B	15/15 (100%)	15 (100%)	0	100	100
All	All	315/318 (99%)	312 (99%)	3 (1%)	68	70

All (3) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	176	GLN
1	A	198	LEU
1	A	331	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	67	ASN
1	A	176	GLN
1	A	245	GLN
1	A	271	ASN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

3 non-standard protein/DNA/RNA residues are 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
1	SEP	A	10	1	8,9,10	1.64	1 (12%)	7,12,14	1.44	1 (14%)
1	SEP	A	338	1	8,9,10	1.49	1 (12%)	7,12,14	1.59	2 (28%)
1	TPO	A	197	1	8,10,11	1.05	0	10,14,16	1.98	2 (20%)

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
1	SEP	A	10	1	-	5/6/8/10	-
1	SEP	A	338	1	-	3/6/8/10	-
1	TPO	A	197	1	-	0/9/11/13	-

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	10	SEP	P-O1P	3.61	1.61	1.50
1	A	338	SEP	P-O1P	3.20	1.60	1.50

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	197	TPO	P-OG1-CB	-4.97	109.82	123.33
1	A	338	SEP	OG-CB-CA	3.50	111.55	108.14
1	A	10	SEP	OG-CB-CA	3.27	111.33	108.14
1	A	197	TPO	CG2-CB-CA	-2.90	107.62	113.26
1	A	338	SEP	O2P-P-OG	2.08	112.10	106.67

There are no chirality outliers.

All (8) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	A	10	SEP	N-CA-CB-OG
1	A	10	SEP	C-CA-CB-OG
1	A	10	SEP	CB-OG-P-O1P
1	A	10	SEP	CB-OG-P-O2P
1	A	10	SEP	CB-OG-P-O3P
1	A	338	SEP	CA-CB-OG-P
1	A	338	SEP	N-CA-CB-OG
1	A	338	SEP	C-CA-CB-OG

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
1	A	197	TPO	1	0

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

4 ligands are 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
4	MPD	A	404	-	7,7,7	0.33	0	9,10,10	0.41	0
4	MPD	A	402	-	7,7,7	0.27	0	9,10,10	0.20	0
3	495	A	401	-	12,13,13	2.01	4 (33%)	17,18,18	1.91	3 (17%)
4	MPD	A	403	-	7,7,7	0.33	0	9,10,10	0.45	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	MPD	A	404	-	-	0/5/5/5	-
4	MPD	A	402	-	-	0/5/5/5	-
3	495	A	401	-	-	-	0/2/2/2
4	MPD	A	403	-	-	3/5/5/5	-

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	401	495	C6-C7	-4.02	1.40	1.47
3	A	401	495	C7-N1	3.19	1.40	1.35
3	A	401	495	C5-C8	-3.17	1.39	1.46
3	A	401	495	N1-N2	-2.99	1.29	1.38

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	401	495	C7-N1-N2	-5.69	121.63	127.98
3	A	401	495	C8-N2-N1	3.26	121.82	117.77
3	A	401	495	C6-C7-N1	3.01	118.51	115.04

There are no chirality outliers.

All (3) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	403	MPD	C1-C2-C3-C4
4	A	403	MPD	O2-C2-C3-C4
4	A	403	MPD	CM-C2-C3-C4

There are no ring outliers.

3 monomers are involved in 5 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	404	MPD	3	0
3	A	401	495	1	0
4	A	403	MPD	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	343/351 (97%)	-0.28	9 (2%) 57 61	9, 22, 45, 81	3 (0%)
2	B	20/20 (100%)	0.21	2 (10%) 12 13	16, 20, 69, 83	0
All	All	363/371 (97%)	-0.25	11 (3%) 52 56	9, 22, 46, 83	3 (0%)

All (11) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	B	24	ASP	5.7
1	A	54	PHE	5.2
1	A	9	GLY	5.0
1	A	6	ALA	4.3
2	B	23	HIS	4.1
1	A	8	LYS	3.1
1	A	318	PHE	3.1
1	A	55	GLY	3.0
1	A	5	ALA	2.7
1	A	7	LYS	2.7
1	A	193	GLY	2.0

6.2 Non-standard residues in protein, DNA, RNA chains

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
1	SEP	A	10	10/11	0.77	0.17	45,63,84,90	0
1	SEP	A	338	10/11	0.96	0.07	25,29,32,34	0
1	TPO	A	197	11/12	0.99	0.04	15,18,19,21	0

6.3 Carbohydrates [i](#)

There are no oligosaccharides 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($\text{\AA}^2$)	Q<0.9
4	MPD	A	404	8/8	0.71	0.22	45,55,58,66	22
4	MPD	A	403	8/8	0.89	0.11	30,35,39,39	0
4	MPD	A	402	8/8	0.93	0.09	33,35,37,38	0
3	495	A	401	12/12	0.95	0.07	20,23,26,45	1

6.5 Other polymers [i](#)

There are no such residues in this entry.