



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 7, 2026 – 06:12 AM UTC

PDB ID : 3SQ8 / pdb_00003sq8
Title : Crystal Structure Analysis of the Yeast Tyrosyl-DNA Phosphodiesterase 1
H432R Mutant (SCAN1 Mutant)
Authors : Gajewski, S.; White, S.W.
Deposited on : 2011-07-05
Resolution : 2.10 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

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

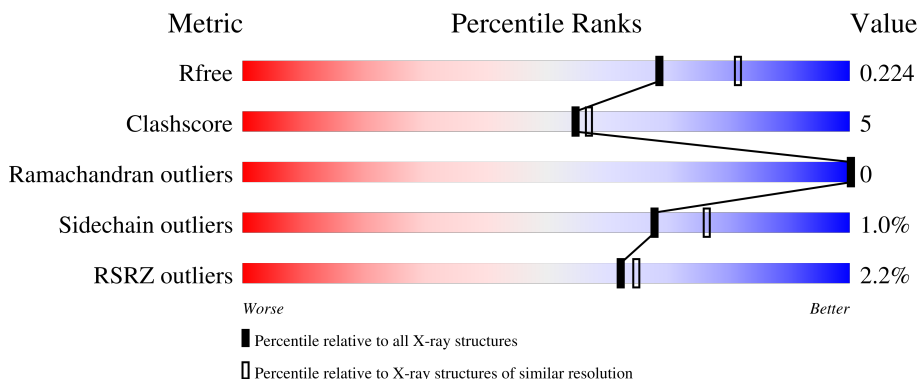
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.10 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}	180053	6658 (2.10-2.10)
Clashscore	190562	7164 (2.10-2.10)
Ramachandran outliers	187476	7099 (2.10-2.10)
Sidechain outliers	187428	7100 (2.10-2.10)
RSRZ outliers	180081	6662 (2.10-2.10)

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 ≥ 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	470	0% 81% 9% 10%
1	B	470	0% 79% 11% 10%
1	C	470	2% 79% 11% 10%
1	D	470	3% 80% 10% 10%

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 14246 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 Tyrosyl-DNA phosphodiesterase 1.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	422	Total	C	N	O	P	S	0	0	0
			3430	2223	564	622	1	20			
1	B	423	Total	C	N	O	P	S	0	1	0
			3450	2235	570	624	1	20			
1	C	423	Total	C	N	O	P	S	0	0	0
			3437	2227	565	624	1	20			
1	D	425	Total	C	N	O	P	S	0	1	0
			3457	2241	569	626	1	20			

There are 40 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	78	MET	-	initiating methionine	UNP P38319
A	432	ARG	HIS	engineered mutation	UNP P38319
A	540	LEU	-	expression tag	UNP P38319
A	541	HIS	-	expression tag	UNP P38319
A	542	HIS	-	expression tag	UNP P38319
A	543	HIS	-	expression tag	UNP P38319
A	544	HIS	-	expression tag	UNP P38319
A	545	HIS	-	expression tag	UNP P38319
A	546	HIS	-	expression tag	UNP P38319
A	547	HIS	-	expression tag	UNP P38319
B	78	MET	-	initiating methionine	UNP P38319
B	432	ARG	HIS	engineered mutation	UNP P38319
B	540	LEU	-	expression tag	UNP P38319
B	541	HIS	-	expression tag	UNP P38319
B	542	HIS	-	expression tag	UNP P38319
B	543	HIS	-	expression tag	UNP P38319
B	544	HIS	-	expression tag	UNP P38319
B	545	HIS	-	expression tag	UNP P38319
B	546	HIS	-	expression tag	UNP P38319
B	547	HIS	-	expression tag	UNP P38319
C	78	MET	-	initiating methionine	UNP P38319

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Chain	Residue	Modelled	Actual	Comment	Reference
C	432	ARG	HIS	engineered mutation	UNP P38319
C	540	LEU	-	expression tag	UNP P38319
C	541	HIS	-	expression tag	UNP P38319
C	542	HIS	-	expression tag	UNP P38319
C	543	HIS	-	expression tag	UNP P38319
C	544	HIS	-	expression tag	UNP P38319
C	545	HIS	-	expression tag	UNP P38319
C	546	HIS	-	expression tag	UNP P38319
C	547	HIS	-	expression tag	UNP P38319
D	78	MET	-	initiating methionine	UNP P38319
D	432	ARG	HIS	engineered mutation	UNP P38319
D	540	LEU	-	expression tag	UNP P38319
D	541	HIS	-	expression tag	UNP P38319
D	542	HIS	-	expression tag	UNP P38319
D	543	HIS	-	expression tag	UNP P38319
D	544	HIS	-	expression tag	UNP P38319
D	545	HIS	-	expression tag	UNP P38319
D	546	HIS	-	expression tag	UNP P38319
D	547	HIS	-	expression tag	UNP P38319

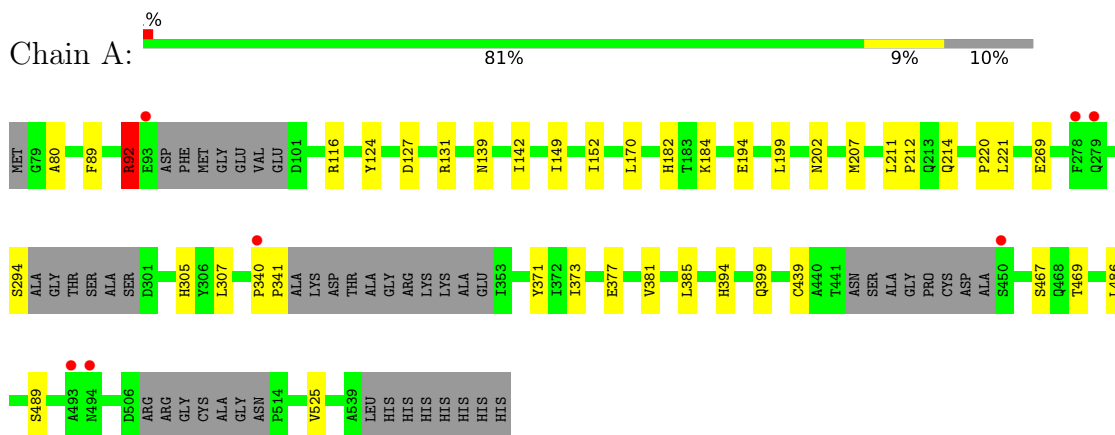
- Molecule 2 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	168	Total O 168 168	0	0
2	B	146	Total O 146 146	0	0
2	C	95	Total O 95 95	0	0
2	D	63	Total O 63 63	0	0

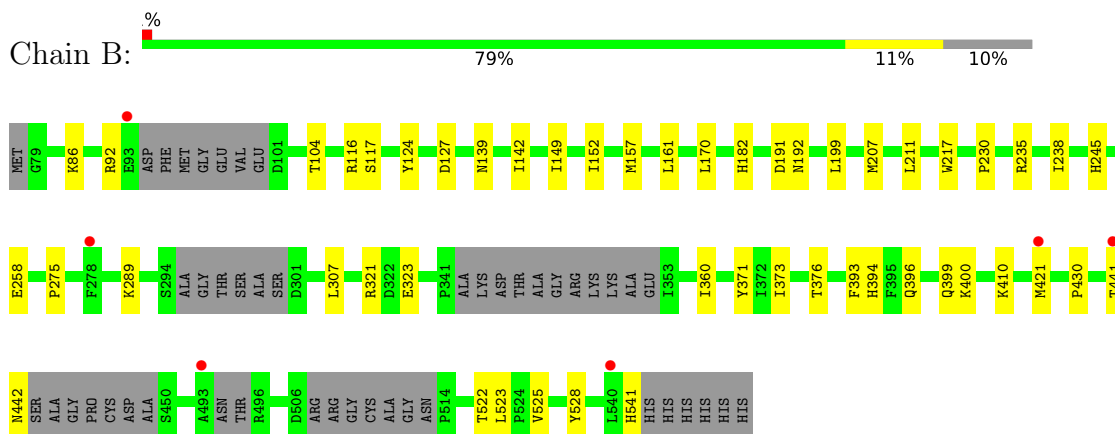
3 Residue-property plots

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.

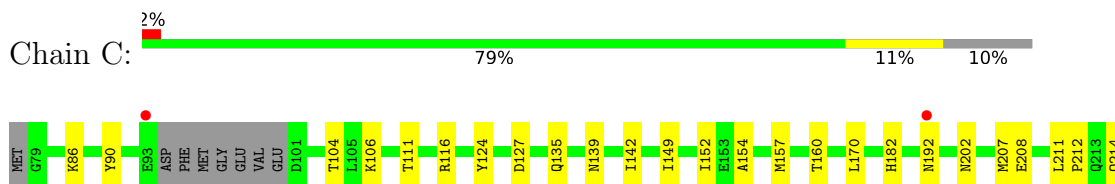
• Molecule 1: Tyrosyl-DNA phosphodiesterase 1

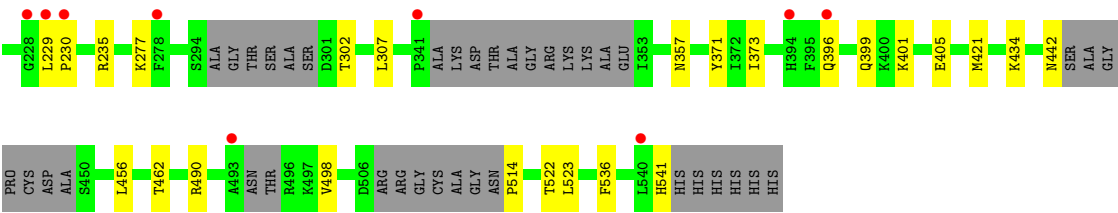


• Molecule 1: Tyrosyl-DNA phosphodiesterase 1

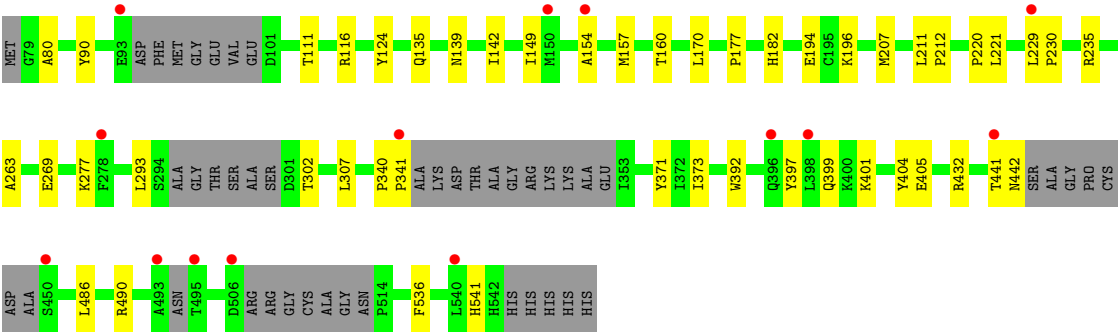
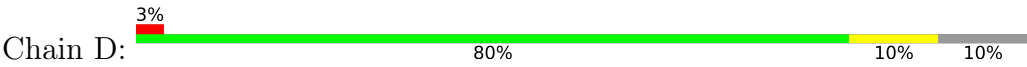


• Molecule 1: Tyrosyl-DNA phosphodiesterase 1





● Molecule 1: Tyrosyl-DNA phosphodiesterase 1



4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α , β , γ	63.87Å 81.49Å 96.79Å 89.52° 84.90° 67.82°	Depositor
Resolution (Å)	24.79 – 2.10 24.79 – 2.10	Depositor EDS
% Data completeness (in resolution range)	93.4 (24.79-2.10) 93.4 (24.79-2.10)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.38 (at 2.10Å)	Xtriage
Refinement program	REFMAC 5.5.0109	Depositor
R, R_{free}	0.187 , 0.226 0.183 , 0.224	Depositor DCC
R_{free} test set	4912 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å ²)	34.7	Xtriage
Anisotropy	0.259	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 38.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.003 for -h,-h+k,-l	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	14246	wwPDB-VP
Average B, all atoms (Å ²)	49.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.82% 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: NEP

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	0.79	1/3501 (0.0%)	0.87	1/4734 (0.0%)
1	B	0.82	0/3525	0.89	2/4765 (0.0%)
1	C	0.74	0/3508	0.84	0/4743
1	D	0.70	0/3532	0.83	2/4776 (0.0%)
All	All	0.77	1/14066 (0.0%)	0.86	5/19018 (0.0%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	394	HIS	CG-CD2	5.04	1.41	1.35

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	191	ASP	N-CA-C	5.98	118.59	111.71
1	D	263	ALA	CA-C-N	-5.68	114.25	119.82
1	D	263	ALA	C-N-CA	-5.68	114.25	119.82
1	B	92	ARG	N-CA-C	5.67	117.26	111.14
1	A	92	ARG	N-CA-C	5.16	116.59	110.97

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	3430	0	3419	30	0
1	B	3450	0	3436	43	0
1	C	3437	0	3418	33	0
1	D	3457	0	3438	40	0
2	A	168	0	0	2	0
2	B	146	0	0	2	0
2	C	95	0	0	3	0
2	D	63	0	0	1	0
All	All	14246	0	13711	132	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.

The worst 5 of 132 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:207:MET:HE2	1:D:541:HIS:HE1	1.01	1.12
1:B:541:HIS:HE1	1:D:207:MET:HE2	1.15	1.08
1:B:207:MET:HE2	1:D:541:HIS:CE1	1.88	1.07
1:B:149:ILE:HD13	1:B:170:LEU:HD11	1.44	0.96
1:D:149:ILE:HD13	1:D:170:LEU:HD11	1.48	0.96

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	409/470 (87%)	398 (97%)	11 (3%)	0	100	100
1	B	409/470 (87%)	401 (98%)	8 (2%)	0	100	100
1	C	408/470 (87%)	398 (98%)	10 (2%)	0	100	100
1	D	411/470 (87%)	403 (98%)	8 (2%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
All	All	1637/1880 (87%)	1600 (98%)	37 (2%)	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	383/422 (91%)	379 (99%)	4 (1%)	68	76
1	B	386/422 (92%)	383 (99%)	3 (1%)	73	81
1	C	384/422 (91%)	379 (99%)	5 (1%)	61	69
1	D	386/422 (92%)	382 (99%)	4 (1%)	68	76
All	All	1539/1688 (91%)	1523 (99%)	16 (1%)	68	76

5 of 16 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	D	371	TYR
1	D	196	LYS
1	C	111	THR
1	D	111	THR
1	C	106	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 19 such sidechains are listed below:

Mol	Chain	Res	Type
1	C	288	ASN
1	D	288	ASN
1	D	541	HIS
1	D	139	ASN
1	B	288	ASN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

4 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	NEP	D	182	1	11,14,15	1.42	1 (9%)	8,20,22	1.31	1 (12%)
1	NEP	A	182	1	11,14,15	1.51	2 (18%)	8,20,22	1.82	3 (37%)
1	NEP	C	182	1	11,14,15	1.67	3 (27%)	8,20,22	1.47	1 (12%)
1	NEP	B	182	1	11,14,15	1.61	3 (27%)	8,20,22	1.81	2 (25%)

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	NEP	D	182	1	-	2/5/12/14	0/1/1/1
1	NEP	A	182	1	-	0/5/12/14	0/1/1/1
1	NEP	C	182	1	-	1/5/12/14	0/1/1/1
1	NEP	B	182	1	-	1/5/12/14	0/1/1/1

The worst 5 of 9 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	182	NEP	CD2-CG	3.27	1.41	1.36
1	A	182	NEP	P-O3P	2.75	1.50	1.46
1	B	182	NEP	P-O3P	2.74	1.50	1.46
1	C	182	NEP	P-O3P	2.73	1.50	1.46
1	C	182	NEP	CD2-CG	2.68	1.41	1.36

The worst 5 of 7 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	182	NEP	CE1-ND1-CG	3.22	110.96	105.80
1	B	182	NEP	O1P-P-O3P	-2.99	105.60	112.95
1	A	182	NEP	O1P-P-O3P	-2.67	106.38	112.95
1	B	182	NEP	O2P-P-O3P	-2.49	106.81	112.95
1	C	182	NEP	O1P-P-O3P	-2.15	107.65	112.95

There are no chirality outliers.

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	D	182	NEP	CA-CB-CG-CD2
1	B	182	NEP	CA-CB-CG-ND1
1	C	182	NEP	CA-CB-CG-ND1
1	D	182	NEP	CA-CB-CG-ND1

There are no ring outliers.

No monomer is involved in short contacts.

5.5 Carbohydrates [i](#)

There are no oligosaccharides 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 [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, 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	421/470 (89%)	-0.30	7 (1%) 69 71	25, 39, 68, 104	0
1	B	422/470 (89%)	-0.29	6 (1%) 73 75	23, 40, 72, 103	1 (0%)
1	C	422/470 (89%)	-0.01	11 (2%) 57 60	32, 51, 81, 132	0
1	D	424/470 (90%)	0.12	14 (3%) 49 51	26, 54, 89, 142	1 (0%)
All	All	1689/1880 (89%)	-0.12	38 (2%) 62 65	23, 46, 80, 142	2 (0%)

The worst 5 of 38 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	230	PRO	4.1
1	C	341	PRO	3.9
1	D	493	ALA	3.6
1	D	93	GLU	3.3
1	C	278	PHE	3.2

6.2 Non-standard residues in protein, DNA, RNA chains [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(Å ²)	Q<0.9
1	NEP	B	182	14/15	0.95	0.06	27,29,31,37	4
1	NEP	A	182	14/15	0.96	0.06	27,31,32,39	4
1	NEP	C	182	14/15	0.96	0.07	34,35,37,42	4
1	NEP	D	182	14/15	0.96	0.06	38,40,41,47	4

6.3 Carbohydrates [i](#)

There are no oligosaccharides 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.