Full wwPDB X-ray Structure Validation Report (i)

Sep 29, 2024 – 03:35 AM EDT

PDB ID	:	1S96
Title	:	The 2.0 A X-ray structure of Guanylate Kinase from E.coli
Authors	:	Kreusch, A.; Spraggon, G.; Klock, H.E.; McMullan, D.; Vincent, J.; Rodrigues, K.; Lesley, S.A.
Deposited on	:	2004-02-03
Resolution	:	2.00 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 (i) 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 (i)) were used in the production of this report:

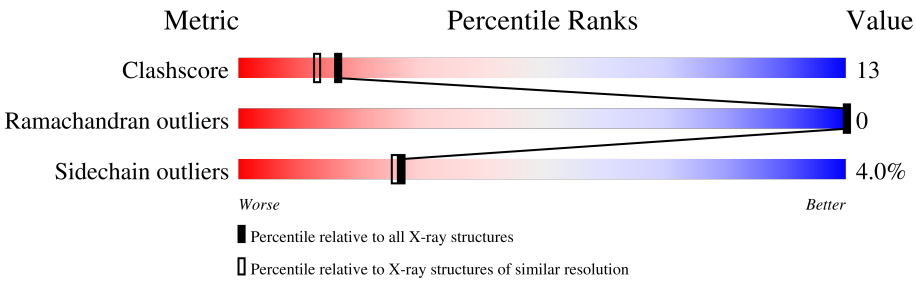
MolProbity	:	4.02b-467
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.39

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 2.00 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))
Clashscore	180529	10737 (2.00-2.00)
Ramachandran outliers	177936	10628 (2.00-2.00)
Sidechain outliers	177891	10627 (2.00-2.00)

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 <=5%

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	219	68% 23% • 6%
1	B	219	72% 19% • 7%

2 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 3611 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 Guanylate kinase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	Se			
1	A	205	1649	1035	296	313	5	0	0	0
1	B	204	1640	1031	295	309	5	0	0	0

There are 36 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-11	MSE	-	expression tag	UNP P60546
A	-10	GLY	-	expression tag	UNP P60546
A	-9	SER	-	expression tag	UNP P60546
A	-8	ASP	-	expression tag	UNP P60546
A	-7	LYS	-	expression tag	UNP P60546
A	-6	ILE	-	expression tag	UNP P60546
A	-5	HIS	-	expression tag	UNP P60546
A	-4	HIS	-	expression tag	UNP P60546
A	-3	HIS	-	expression tag	UNP P60546
A	-2	HIS	-	expression tag	UNP P60546
A	-1	HIS	-	expression tag	UNP P60546
A	0	HIS	-	expression tag	UNP P60546
A	1	MSE	MET	modified residue	UNP P60546
A	65	MSE	MET	modified residue	UNP P60546
A	115	MSE	MET	modified residue	UNP P60546
A	150	MSE	MET	modified residue	UNP P60546
A	157	MSE	MET	modified residue	UNP P60546
A	190	MSE	MET	modified residue	UNP P60546
B	-11	MSE	-	expression tag	UNP P60546
B	-10	GLY	-	expression tag	UNP P60546
B	-9	SER	-	expression tag	UNP P60546
B	-8	ASP	-	expression tag	UNP P60546
B	-7	LYS	-	expression tag	UNP P60546
B	-6	ILE	-	expression tag	UNP P60546
B	-5	HIS	-	expression tag	UNP P60546

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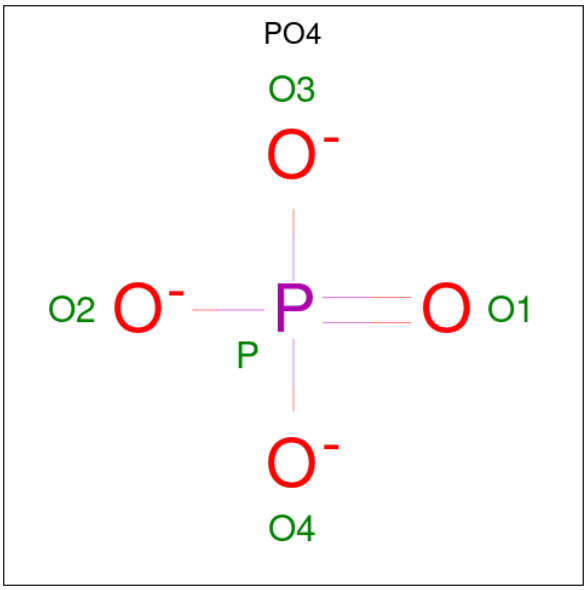
Chain	Residue	Modelled	Actual	Comment	Reference
B	-4	HIS	-	expression tag	UNP P60546
B	-3	HIS	-	expression tag	UNP P60546
B	-2	HIS	-	expression tag	UNP P60546
B	-1	HIS	-	expression tag	UNP P60546
B	0	HIS	-	expression tag	UNP P60546
B	1	MSE	MET	modified residue	UNP P60546
B	65	MSE	MET	modified residue	UNP P60546
B	115	MSE	MET	modified residue	UNP P60546
B	150	MSE	MET	modified residue	UNP P60546
B	157	MSE	MET	modified residue	UNP P60546
B	190	MSE	MET	modified residue	UNP P60546

- Molecule 2 is PHOSPHATE ION (three-letter code: PO4) (formula: O_4P).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	O	P		
2	A	1	5	4	1	0	0
			Total	O	P		
2	B	1	5	4	1	0	0

- Molecule 3 is UNKNOWN ATOM OR ION (three-letter code: UNX) (formula: X).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	X		
3	A	1	1	1	0	0

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
4	A	147	147	147	0	0
			Total	O		
4	B	164	164	164	0	0

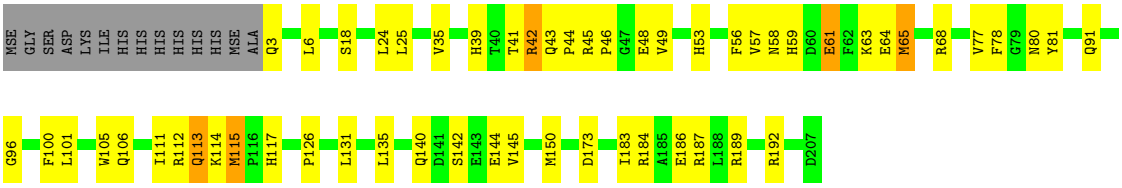
3 Residue-property plots (i)

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. 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. 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.

Note EDS was not executed.

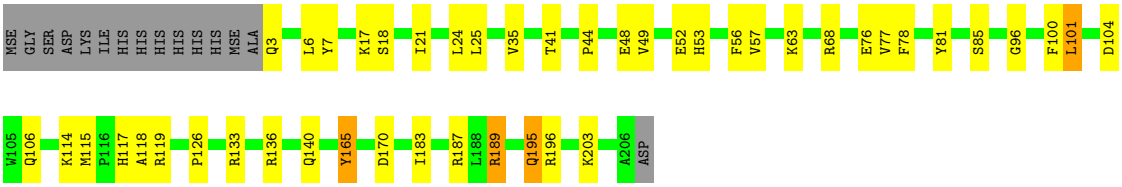
• Molecule 1: Guanylate kinase

Chain A:



• Molecule 1: Guanylate kinase

Chain B:



4 Data and refinement statistics (i)

Xtriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 21 3	Depositor
Cell constants a, b, c, α, β, γ	124.55Å 124.55Å 124.55Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	34.55 – 2.00	Depositor
% Data completeness (in resolution range)	100.0 (34.55-2.00)	Depositor
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	CNS	Depositor
R, R_{free}	0.195 , 0.247	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	3611	wwPDB-VP
Average B, all atoms (Å^2)	35.0	wwPDB-VP

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: PO4, UNX

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	1.06	2/1676 (0.1%)	1.04	3/2253 (0.1%)
1	B	1.03	2/1667 (0.1%)	1.06	4/2242 (0.2%)
All	All	1.04	4/3343 (0.1%)	1.05	7/4495 (0.2%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand.A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	1

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	150	MSE	CG-SE	5.44	2.13	1.95
1	B	165	TYR	CD1-CE1	5.43	1.47	1.39
1	A	186	GLU	CB-CG	5.32	1.62	1.52
1	B	35	VAL	CB-CG2	-5.26	1.41	1.52

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	65	MSE	CG-SE-CE	8.49	117.59	98.90
1	B	115	MSE	CG-SE-CE	-6.85	83.84	98.90
1	A	115	MSE	CG-SE-CE	-5.14	87.58	98.90
1	A	112	ARG	CG-CD-NE	-5.10	101.08	111.80
1	B	133	ARG	NE-CZ-NH2	-5.08	117.76	120.30
1	B	136	ARG	NE-CZ-NH2	-5.04	117.78	120.30
1	B	189	ARG	NE-CZ-NH2	-5.01	117.80	120.30

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	81	TYR	Sidechain

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	1649	0	1625	51	0
1	B	1640	0	1621	37	0
2	A	5	0	0	0	0
2	B	5	0	0	0	0
3	A	1	0	0	0	0
4	A	147	0	0	5	0
4	B	164	0	0	9	0
All	All	3611	0	3246	84	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 13.

All (84) 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:189:ARG:HH22	1:B:189:ARG:NH2	1.45	1.15
1:A:189:ARG:NH2	1:B:189:ARG:HH22	1.55	1.03
1:B:49:VAL:H	1:B:53:HIS:HD2	1.06	0.95
1:A:45:ARG:HB3	1:A:46:PRO:HD2	1.52	0.91
1:B:49:VAL:H	1:B:53:HIS:CD2	1.91	0.88
1:B:6:LEU:C	1:B:6:LEU:HD13	2.01	0.79
1:A:18:SER:HB2	4:A:482:HOH:O	1.82	0.79
1:A:77:VAL:HG12	1:A:78:PHE:CD1	2.21	0.76
1:A:117:HIS:HB2	4:A:456:HOH:O	1.84	0.75
1:A:58:ASN:OD1	1:A:61:GLU:HG2	1.89	0.72
1:A:39:HIS:CD2	1:A:65:MSE:HE1	2.27	0.70
1:A:189:ARG:HH22	1:B:189:ARG:HH22	0.74	0.68
1:A:189:ARG:NH2	1:B:189:ARG:NH2	2.28	0.65

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:3:GLN:HB3	1:A:96:GLY:HA2	1.78	0.64
1:A:105:TRP:CZ3	1:A:106:GLN:HG2	2.34	0.63
1:A:58:ASN:H	1:A:61:GLU:HG3	1.62	0.63
1:B:117:HIS:HB3	4:B:653:HOH:O	1.97	0.63
1:A:41:THR:HA	1:A:57:VAL:O	2.00	0.62
1:B:3:GLN:HB3	1:B:96:GLY:HA2	1.83	0.60
1:A:42:ARG:CG	1:A:42:ARG:HH11	2.15	0.60
1:A:142:SER:OG	1:A:145:VAL:HG23	2.03	0.59
1:A:25:LEU:HD11	1:A:35:VAL:CG1	2.34	0.58
1:A:41:THR:OG1	1:A:80:ASN:ND2	2.28	0.57
1:A:44:PRO:HA	1:A:56:PHE:CZ	2.39	0.57
1:A:42:ARG:HG2	1:A:42:ARG:NH1	2.19	0.57
1:A:45:ARG:HB3	1:A:46:PRO:CD	2.30	0.57
1:A:113:GLN:HG2	1:A:114:LYS:N	2.20	0.56
1:A:42:ARG:HH11	1:A:42:ARG:HG2	1.70	0.55
1:A:58:ASN:N	1:A:61:GLU:HG3	2.22	0.54
1:A:25:LEU:HD11	1:A:35:VAL:HG13	1.90	0.53
1:A:105:TRP:CH2	1:A:106:GLN:HG2	2.44	0.53
1:B:48:GLU:HA	1:B:53:HIS:CD2	2.44	0.53
1:B:6:LEU:HD12	1:B:118:ALA:HB1	1.92	0.52
1:A:106:GLN:HB2	4:A:531:HOH:O	2.10	0.52
1:B:21:ILE:O	1:B:25:LEU:HD13	2.09	0.51
1:A:24:LEU:HD21	1:A:183:ILE:HD11	1.93	0.50
1:A:44:PRO:HG3	1:A:56:PHE:CG	2.47	0.50
1:A:24:LEU:HD21	1:A:183:ILE:CD1	2.41	0.49
1:B:6:LEU:HD13	1:B:7:TYR:N	2.27	0.49
1:A:59:HIS:O	1:A:63:LYS:HG3	2.13	0.49
1:A:61:GLU:O	1:A:65:MSE:HG3	2.13	0.49
1:A:184:ARG:HG2	4:B:626:HOH:O	2.12	0.48
1:B:6:LEU:C	1:B:6:LEU:CD1	2.75	0.48
1:B:44:PRO:HG3	1:B:56:PHE:CG	2.49	0.48
1:A:48:GLU:OE1	1:A:56:PHE:HZ	1.96	0.48
1:A:100:PHE:CZ	1:A:183:ILE:HD11	2.49	0.48
1:B:187:ARG:NE	4:B:577:HOH:O	2.46	0.48
1:A:42:ARG:CG	1:A:42:ARG:NH1	2.76	0.48
1:B:104:ASP:OD2	1:B:106:GLN:HB3	2.15	0.47
1:A:187:ARG:HD3	4:A:493:HOH:O	2.14	0.47
1:B:76:GLU:HG3	1:B:81:TYR:CE1	2.51	0.46
1:B:77:VAL:HG12	1:B:78:PHE:CD1	2.51	0.45
1:B:187:ARG:CD	4:B:577:HOH:O	2.65	0.45
1:B:41:THR:HA	1:B:57:VAL:O	2.15	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:115:MSE:HB3	1:A:115:MSE:HE3	1.55	0.45
1:B:165:TYR:OH	4:B:583:HOH:O	2.20	0.45
1:B:195:GLN:HG3	1:B:196:ARG:N	2.31	0.45
1:B:100:PHE:CZ	1:B:183:ILE:HD11	2.53	0.44
1:B:187:ARG:HD3	4:B:577:HOH:O	2.18	0.44
1:A:64:GLU:OE2	1:A:68:ARG:NH1	2.50	0.44
1:B:49:VAL:N	1:B:53:HIS:CD2	2.73	0.44
1:B:49:VAL:HB	1:B:52:GLU:HB3	2.00	0.43
1:A:6:LEU:CD2	1:A:115:MSE:HE2	2.49	0.43
1:A:6:LEU:HD22	1:A:115:MSE:HE2	2.00	0.43
1:B:63:LYS:NZ	4:B:622:HOH:O	2.51	0.43
1:B:85:SER:HB3	4:B:532:HOH:O	2.17	0.43
1:B:114:LYS:HE2	4:B:647:HOH:O	2.17	0.42
1:B:101:LEU:C	1:B:101:LEU:HD12	2.40	0.42
1:B:195:GLN:HE21	1:B:195:GLN:HB2	1.64	0.42
1:B:17:LYS:HB3	1:B:17:LYS:HE3	1.84	0.42
1:B:119:ARG:HG2	1:B:119:ARG:HH11	1.84	0.42
1:A:25:LEU:HD11	1:A:35:VAL:HG11	2.01	0.42
1:A:113:GLN:HG2	1:A:114:LYS:HG3	2.01	0.42
1:B:126:PRO:HG3	1:B:170:ASP:HA	2.01	0.42
1:A:49:VAL:HG23	1:A:53:HIS:CE1	2.54	0.42
1:A:44:PRO:HA	1:A:56:PHE:CE1	2.55	0.41
1:A:101:LEU:HD13	1:A:111:ILE:HD13	2.01	0.41
1:A:192:ARG:NH2	4:A:530:HOH:O	2.17	0.41
1:A:42:ARG:HD2	1:A:45:ARG:NH2	2.36	0.41
1:A:43:GLN:O	1:A:44:PRO:C	2.58	0.41
1:A:77:VAL:CG1	1:A:78:PHE:CD1	2.99	0.41
1:A:131:LEU:O	1:A:135:LEU:HG	2.21	0.41
1:B:24:LEU:HD21	1:B:183:ILE:CD1	2.51	0.41
1:B:25:LEU:N	1:B:25:LEU:CD1	2.84	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	203/219 (93%)	193 (95%)	10 (5%)	0	100	100
1	B	202/219 (92%)	199 (98%)	3 (2%)	0	100	100
All	All	405/438 (92%)	392 (97%)	13 (3%)	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	176/181 (97%)	168 (96%)	8 (4%)	23	21
1	B	175/181 (97%)	169 (97%)	6 (3%)	32	32
All	All	351/362 (97%)	337 (96%)	14 (4%)	27	26

All (14) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	42	ARG
1	A	61	GLU
1	A	91	GLN
1	A	113	GLN
1	A	126	PRO
1	A	140	GLN
1	A	144	GLU
1	A	173	ASP
1	B	18	SER
1	B	68	ARG
1	B	101	LEU
1	B	140	GLN
1	B	195	GLN
1	B	203	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (6) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	80	ASN
1	A	113	GLN
1	A	140	GLN
1	B	53	HIS
1	B	80	ASN
1	B	195	GLN

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 3 ligands modelled in this entry, 1 is unknown - leaving 2 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	$\#\|Z\| > 2$
2	PO4	B	501	-	4,4,4	1.25	1 (25%)	6,6,6	0.36	0
2	PO4	A	401	-	4,4,4	1.05	0	6,6,6	0.53	0

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	501	PO4	P-O3	-2.11	1.48	1.54

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

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)

EDS was not executed - this section is therefore empty.

6.2 Non-standard residues in protein, DNA, RNA chains (i)

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates (i)

EDS was not executed - this section is therefore empty.

6.4 Ligands (i)

EDS was not executed - this section is therefore empty.

6.5 Other polymers (i)

EDS was not executed - this section is therefore empty.