Full wwPDB X-ray Structure Validation Report (i)

Jun 15, 2024 – 03:19 PM EDT

PDB ID	:	2ESV
Title	:	Structure of the HLA-E-VMAPRTLIL/KK50.4 TCR complex
Authors	:	Hoare, H.L.; Rossjohn, J.
Deposited on	:	2005-10-27
Resolution	:	2.60 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 (1)) were used in the production of this report:

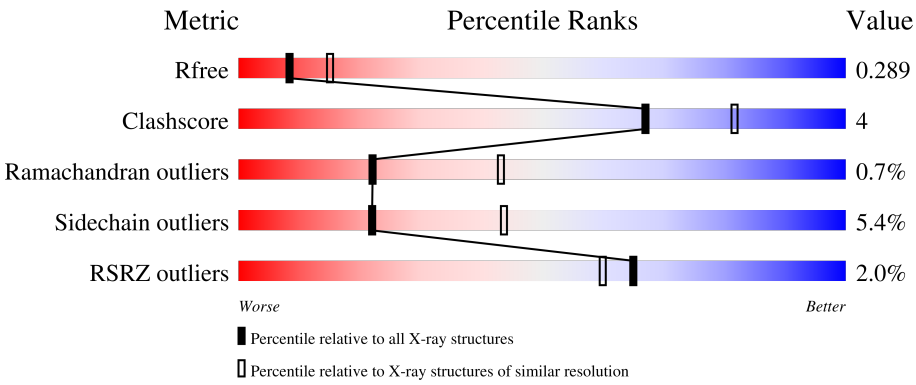
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.20.1
EDS	:	2.37.1
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.37.1

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 2.60 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	3163 (2.60-2.60)
Clashscore	141614	3518 (2.60-2.60)
Ramachandran outliers	138981	3455 (2.60-2.60)
Sidechain outliers	138945	3455 (2.60-2.60)
RSRZ outliers	127900	3104 (2.60-2.60)

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% 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	275	4% 89% 8% •
2	B	100	% 83% 16% •
3	P	9	78% 11% 11%
4	D	199	2% 84% 14% •
5	E	240	86% 13% •

2 Entry composition (i)

There are 7 unique types of molecules in this entry. The entry contains 6777 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 HLA class I histocompatibility antigen, alpha chain E.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	268	2199	1379	394	419	7	0	0	0

- Molecule 2 is a protein called Beta-2-microglobulin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	100	837	533	141	159	4	0	0	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	0	MET	-	INITIATING METHIONINE	UNP P61769

- Molecule 3 is a protein called VMAPRTLIL peptide from CMV gpUL40.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	P	9	70	46	12	11	1	0	0	0

- Molecule 4 is a protein called KK50.4 T cell receptor alpha chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
4	D	199	1557	967	265	315	10	0	0	0

- Molecule 5 is a protein called KK50.4 T cell receptor beta chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
5	E	240	1924	1212	336	369	7	0	0	0

- Molecule 6 is IODIDE ION (three-letter code: IOD) (formula: I).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	B	1	Total I 1 1	0	0
6	D	1	Total I 1 1	0	0
6	E	3	Total I 3 3	0	0

- Molecule 7 is water.

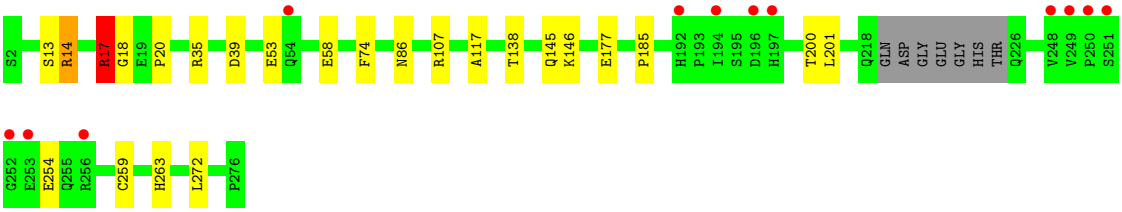
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	A	51	Total O 51 51	0	0
7	B	21	Total O 21 21	0	0
7	P	3	Total O 3 3	0	0
7	D	53	Total O 53 53	0	0
7	E	57	Total O 57 57	0	0

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 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.

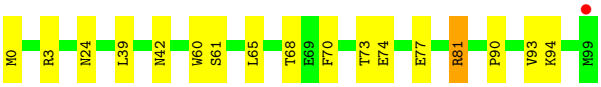
• Molecule 1: HLA class I histocompatibility antigen, alpha chain E

Chain A:



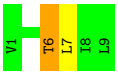
• Molecule 2: Beta-2-microglobulin

Chain B:



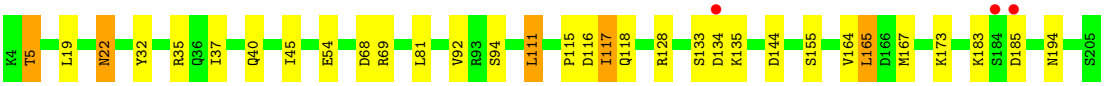
• Molecule 3: VMAPRTLIL peptide from CMV gpUL40

Chain P:



• Molecule 4: KK50.4 T cell receptor alpha chain

Chain D:



• Molecule 5: KK50.4 T cell receptor beta chain

Chain E:

G3
E14
Q17
T18
V19
T20
L21
H29
D30
N31
R37
L47
H48
S53
K54
N62
T70
T73
Y74
S75
T76
L77
K78
V79
Q80
P81
Q96
T112
T115
L120
P133
S134
E135
K143
H157
L180
R196
L197
R198
W204
Y218
R230
D247

4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α, β, γ	235.10Å 41.46Å 112.47Å 90.00° 114.66° 90.00°	Depositor
Resolution (Å)	36.40 – 2.60 36.43 – 2.60	Depositor EDS
% Data completeness (in resolution range)	93.7 (36.40-2.60) 93.8 (36.43-2.60)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.08 (at 2.61Å)	Xtriage
Refinement program	REFMAC 5.2.0005	Depositor
R, R_{free}	0.214 , 0.292 0.226 , 0.289	Depositor DCC
R_{free} test set	1467 reflections (5.04%)	wwPDB-VP
Wilson B-factor (Å^2)	37.8	Xtriage
Anisotropy	0.194	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.33 , 34.3	EDS
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.91	EDS
Total number of atoms	6777	wwPDB-VP
Average B, all atoms (Å^2)	29.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.93% of the height of the origin peak. No significant pseudotranslation is detected.*

[1]Intensities estimated from amplitudes.

[2]Theoretical values of $< |L| >$, $< L^2 >$ 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: IOD

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	0.36	0/2264	0.52	0/3077
2	B	0.35	0/860	0.48	0/1162
3	P	0.33	0/70	0.64	0/93
4	D	0.36	0/1590	0.55	0/2159
5	E	0.37	0/1976	0.53	0/2685
All	All	0.36	0/6760	0.53	0/9176

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	2199	0	2053	9	0
2	B	837	0	803	7	0
3	P	70	0	85	4	0
4	D	1557	0	1489	17	0
5	E	1924	0	1830	17	0
6	B	1	0	0	0	0
6	D	1	0	0	1	0
6	E	3	0	0	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
7	A	51	0	0	0	0
7	B	21	0	0	0	0
7	D	53	0	0	2	0
7	E	57	0	0	2	0
7	P	3	0	0	0	0
All	All	6777	0	6260	50	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.

All (50) 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:74:PHE:HE1	3:P:6:THR:HG21	1.41	0.83
5:E:21:LEU:HD22	5:E:112:THR:HG21	1.71	0.73
4:D:35:ARG:HB3	4:D:45:ILE:HD11	1.75	0.69
4:D:128:ARG:HB3	4:D:135:LYS:HD3	1.77	0.67
2:B:3:ARG:HH21	2:B:61:SER:HB3	1.61	0.65
5:E:14:GLU:HG3	5:E:120:LEU:HG	1.79	0.64
3:P:6:THR:HG22	3:P:7:LEU:H	1.63	0.63
1:A:74:PHE:CE1	3:P:6:THR:HG21	2.28	0.63
2:B:24:ASN:HB3	2:B:65:LEU:HD11	1.82	0.61
4:D:5:THR:HA	4:D:22:ASN:O	2.02	0.60
1:A:201:LEU:HD11	1:A:254:GLU:HB3	1.84	0.59
4:D:115:PRO:HG3	4:D:164:VAL:HG11	1.85	0.58
1:A:117:ALA:HB2	2:B:60:TRP:CE2	2.40	0.56
5:E:3:GLY:N	7:E:1015:HOH:O	2.37	0.56
4:D:116:ASP:HB2	7:D:1024:HOH:O	2.06	0.55
5:E:29:HIS:HA	5:E:96:GLN:HE21	1.72	0.55
1:A:259:CYS:HB3	1:A:272:LEU:HB2	1.90	0.54
4:D:81:LEU:HD11	4:D:173:LYS:HD3	1.91	0.53
5:E:230:ARG:HD3	6:E:1004:IOD:I	2.79	0.52
4:D:116:ASP:OD1	4:D:117:ILE:N	2.37	0.52
5:E:143:LYS:HE2	7:E:1009:HOH:O	2.08	0.52
1:A:13:SER:HA	1:A:20:PRO:HB3	1.91	0.52
5:E:14:GLU:H	5:E:17:GLN:HE21	1.58	0.51
5:E:47:LEU:HD23	5:E:48:HIS:N	2.25	0.51
5:E:47:LEU:HD21	5:E:54:LYS:HG2	1.94	0.49
4:D:117:ILE:HG21	4:D:144:ASP:HA	1.95	0.48
6:D:1001:IOD:I	5:E:37:ARG:HD2	2.84	0.48
4:D:92:VAL:HG22	7:D:1026:HOH:O	2.14	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:D:37:ILE:O	4:D:40:GLN:HG2	2.16	0.46
2:B:81:ARG:HD3	2:B:90:PRO:HB2	1.98	0.45
2:B:42:ASN:ND2	2:B:77:GLU:H	2.14	0.45
4:D:165:LEU:O	4:D:173:LYS:HA	2.18	0.44
5:E:157:HIS:HB3	5:E:218:TYR:HB2	1.98	0.44
4:D:32:TYR:CE1	4:D:92:VAL:HB	2.53	0.43
4:D:165:LEU:HD12	4:D:167:MET:HG3	2.00	0.43
2:B:39:LEU:HD13	2:B:68:THR:HG22	2.00	0.43
4:D:19:LEU:HD21	4:D:111:LEU:HG	2.01	0.43
1:A:185:PRO:HD3	1:A:263:HIS:CD2	2.54	0.42
3:P:6:THR:HG22	3:P:7:LEU:N	2.33	0.42
5:E:133:PRO:HD2	5:E:204:TRP:CZ2	2.54	0.42
4:D:68:ASP:O	4:D:69:ARG:HB2	2.21	0.41
5:E:115:THR:HG1	5:E:157:HIS:CE1	2.39	0.41
5:E:80:GLN:HA	5:E:81:PRO:HA	1.86	0.41
1:A:17:ARG:HB3	1:A:18:GLY:H	1.53	0.41
2:B:73:THR:HG22	2:B:74:GLU:N	2.36	0.41
4:D:165:LEU:HD11	5:E:198:ARG:HB3	2.04	0.40
5:E:31:ASN:HB3	5:E:48:HIS:NE2	2.36	0.40
1:A:14:ARG:HB3	1:A:17:ARG:HB2	2.04	0.40
5:E:73:THR:HB	5:E:74:TYR:H	1.65	0.40
4:D:115:PRO:HG3	4:D:164:VAL:CG1	2.48	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	264/275 (96%)	252 (96%)	11 (4%)	1 (0%)	34 57
2	B	98/100 (98%)	94 (96%)	4 (4%)	0	100 100
3	P	7/9 (78%)	7 (100%)	0	0	100 100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
4	D	197/199 (99%)	180 (91%)	13 (7%)	4 (2%)	7	14
5	E	238/240 (99%)	226 (95%)	11 (5%)	1 (0%)	34	57
All	All	804/823 (98%)	759 (94%)	39 (5%)	6 (1%)	22	43

All (6) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
4	D	5	THR
4	D	134	ASP
1	A	17	ARG
4	D	133	SER
5	E	70	THR
4	D	117	ILE

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	233/238 (98%)	220 (94%)	13 (6%)	21	42
2	B	95/95 (100%)	90 (95%)	5 (5%)	22	45
3	P	8/8 (100%)	7 (88%)	1 (12%)	4	8
4	D	180/180 (100%)	170 (94%)	10 (6%)	21	42
5	E	211/211 (100%)	201 (95%)	10 (5%)	26	50
All	All	727/732 (99%)	688 (95%)	39 (5%)	22	44

All (39) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	14	ARG
1	A	17	ARG
1	A	35	ARG
1	A	39	ASP
1	A	53	GLU

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Mol	Chain	Res	Type
1	A	58	GLU
1	A	86	ASN
1	A	107	ARG
1	A	138	THR
1	A	145	GLN
1	A	146	LYS
1	A	177	GLU
1	A	200	THR
2	B	0	MET
2	B	70	PHE
2	B	81	ARG
2	B	93	VAL
2	B	94	LYS
3	P	6	THR
4	D	22	ASN
4	D	54	GLU
4	D	94	SER
4	D	111	LEU
4	D	118	GLN
4	D	155	SER
4	D	165	LEU
4	D	183	LYS
4	D	185	ASP
4	D	194	ASN
5	E	19	VAL
5	E	31	ASN
5	E	53	SER
5	E	62	ASN
5	E	76	THR
5	E	78	LYS
5	E	135	GLU
5	E	180	LEU
5	E	196	ARG
5	E	230	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (19) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	54	GLN
1	A	99	HIS
1	A	127	ASN
1	A	141	GLN

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Mol	Chain	Res	Type
1	A	218	GLN
1	A	260	HIS
1	A	263	HIS
2	B	13	HIS
2	B	42	ASN
4	D	146	GLN
4	D	194	ASN
5	E	10	HIS
5	E	17	GLN
5	E	29	HIS
5	E	31	ASN
5	E	62	ASN
5	E	80	GLN
5	E	96	GLN
5	E	236	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 monosaccharides in this entry.

5.6 Ligand geometry (i)

Of 5 ligands modelled in this entry, 5 are monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

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)

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	268/275 (97%)	0.20	12 (4%) 33 26	15, 29, 51, 59	0
2	B	100/100 (100%)	0.08	1 (1%) 82 80	14, 31, 44, 56	0
3	P	9/9 (100%)	0.15	0 100 100	21, 23, 27, 31	0
4	D	199/199 (100%)	-0.01	3 (1%) 73 70	13, 26, 43, 48	0
5	E	240/240 (100%)	-0.23	0 100 100	15, 26, 41, 49	0
All	All	816/823 (99%)	0.01	16 (1%) 65 60	13, 27, 49, 59	0

All (16) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
4	D	185	ASP	4.3
1	A	197	HIS	3.9
2	B	99	MET	3.6
1	A	252	GLY	3.4
4	D	184	SER	3.2
1	A	196	ASP	3.2
1	A	248	VAL	3.1
1	A	253	GLU	3.1
1	A	54	GLN	3.0
1	A	194	ILE	2.7
1	A	256	ARG	2.7
4	D	134	ASP	2.6
1	A	249	VAL	2.5
1	A	251	SER	2.3
1	A	192	HIS	2.1
1	A	250	PRO	2.0

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, 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
6	IOD	E	1004	1/1	0.90	0.10	60,60,60,60	1
6	IOD	E	1003	1/1	0.94	0.10	46,46,46,46	1
6	IOD	B	1005	1/1	0.97	0.12	30,30,30,30	1
6	IOD	D	1001	1/1	0.98	0.11	34,34,34,34	1
6	IOD	E	1002	1/1	0.98	0.14	44,44,44,44	1

6.5 Other polymers (i)

There are no such residues in this entry.