



# wwPDB X-ray Structure Validation Summary Report ⓘ

Jun 15, 2020 – 05:22 am BST

PDB ID : 4P2F  
Title : Monomeric form of a single mutant (F363R) of Mycobacterial Adenylyl cyclase Rv1625c  
Authors : Barathy, D.V.; Mattoo, R.; Visweswariah, S.S.; Suguna, K.  
Deposited on : 2014-03-04  
Resolution : 2.05 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](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.

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The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.11
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)	:	2.11

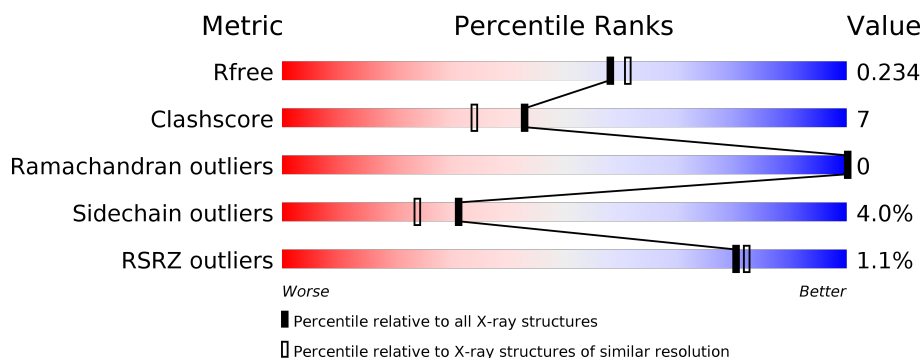
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 2.05 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	1692 (2.04-2.04)
Clashscore	141614	1773 (2.04-2.04)
Ramachandran outliers	138981	1752 (2.04-2.04)
Sidechain outliers	138945	1752 (2.04-2.04)
RSRZ outliers	127900	1672 (2.04-2.04)

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 on 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	273	<div> <div></div> <div>58%</div> <div>11%</div> <div>31%</div> </div>

## 2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 1631 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 Adenylate cyclase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	189	Total	C	N	O	S	0	1	0
			1454	914	256	280	4			

There are 42 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	171	MET	-	expression tag	UNP P0A4Y0
A	172	ARG	-	expression tag	UNP P0A4Y0
A	173	GLY	-	expression tag	UNP P0A4Y0
A	174	SER	-	expression tag	UNP P0A4Y0
A	175	HIS	-	expression tag	UNP P0A4Y0
A	176	HIS	-	expression tag	UNP P0A4Y0
A	177	HIS	-	expression tag	UNP P0A4Y0
A	178	HIS	-	expression tag	UNP P0A4Y0
A	179	HIS	-	expression tag	UNP P0A4Y0
A	180	HIS	-	expression tag	UNP P0A4Y0
A	181	GLY	-	expression tag	UNP P0A4Y0
A	182	MET	-	expression tag	UNP P0A4Y0
A	183	ALA	-	expression tag	UNP P0A4Y0
A	184	SER	-	expression tag	UNP P0A4Y0
A	185	MET	-	expression tag	UNP P0A4Y0
A	186	THR	-	expression tag	UNP P0A4Y0
A	187	GLY	-	expression tag	UNP P0A4Y0
A	188	GLY	-	expression tag	UNP P0A4Y0
A	189	GLN	-	expression tag	UNP P0A4Y0
A	190	GLN	-	expression tag	UNP P0A4Y0
A	191	MET	-	expression tag	UNP P0A4Y0
A	192	GLY	-	expression tag	UNP P0A4Y0
A	193	ARG	-	expression tag	UNP P0A4Y0
A	194	ASP	-	expression tag	UNP P0A4Y0
A	195	LEU	-	expression tag	UNP P0A4Y0
A	196	TYR	-	expression tag	UNP P0A4Y0
A	197	ASP	-	expression tag	UNP P0A4Y0

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Chain	Residue	Modelled	Actual	Comment	Reference
A	198	ASP	-	expression tag	UNP P0A4Y0
A	199	ASP	-	expression tag	UNP P0A4Y0
A	200	ASP	-	expression tag	UNP P0A4Y0
A	201	LYS	-	expression tag	UNP P0A4Y0
A	202	ASP	-	expression tag	UNP P0A4Y0
A	203	PRO	-	expression tag	UNP P0A4Y0
A	204	SER	-	expression tag	UNP P0A4Y0
A	205	SER	-	expression tag	UNP P0A4Y0
A	206	ARG	-	expression tag	UNP P0A4Y0
A	207	SER	-	expression tag	UNP P0A4Y0
A	208	ALA	-	expression tag	UNP P0A4Y0
A	209	ALA	-	expression tag	UNP P0A4Y0
A	210	GLY	-	expression tag	UNP P0A4Y0
A	211	THR	-	expression tag	UNP P0A4Y0
A	363	ARG	PHE	conflict	UNP P0A4Y0

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

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

- Molecule 3 is DI(HYDROXYETHYL)ETHER (three-letter code: PEG) (formula: C<sub>4</sub>H<sub>10</sub>O<sub>3</sub>).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	O	0	0
			7	4	3		

- 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		

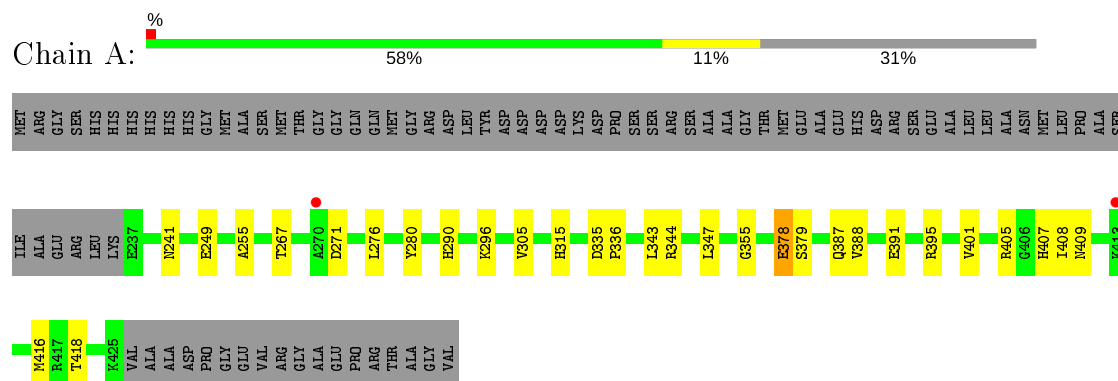
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	92	Total	O	0	0
			92	92		

### 3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA 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: Adenylate cyclase





## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	29.89Å 67.37Å 101.55Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	40.58 – 2.05 40.55 – 2.05	Depositor EDS
% Data completeness (in resolution range)	99.0 (40.58-2.05) 99.0 (40.55-2.05)	Depositor EDS
$R_{merge}$	0.08	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.29 (at 2.05Å)	Xtriage
Refinement program	REFMAC 5.7.0029	Depositor
R, $R_{free}$	0.179 , 0.233 0.179 , 0.234	Depositor DCC
$R_{free}$ test set	663 reflections (4.94%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	24.4	Xtriage
Anisotropy	0.047	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.37 , 58.6	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.47$ , $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	1631	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	25.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.35% 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, PEG, 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	0.69	0/1483	0.84	0/2016

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	1454	0	1404	18	0
2	A	72	0	108	6	0
3	A	7	0	10	3	0
4	A	6	0	8	0	0
5	A	92	0	0	2	0
All	All	1631	0	1530	21	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 7.

The worst 5 of 21 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:355:GLY:HA2	2:A:507:EDO:H22	1.74	0.69
1:A:280:TYR:HB3	2:A:517:EDO:H22	1.86	0.57
2:A:517:EDO:H21	5:A:677:HOH:O	2.10	0.51
1:A:267:THR:HG22	1:A:271:ASP:HB2	1.94	0.49
1:A:290:HIS:CD2	3:A:519:PEG:H32	2.50	0.47

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	188/273 (69%)	182 (97%)	6 (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	152/221 (69%)	145 (95%)	7 (5%)	27	19

5 of 7 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	378[A]	GLU
1	A	409	ASN

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Mol	Chain	Res	Type
1	A	378[B]	GLU
1	A	305	VAL
1	A	401	VAL

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

Mol	Chain	Res	Type
1	A	241	ASN
1	A	289	GLN
1	A	385	GLN
1	A	387	GLN

### 5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

There are no non-standard protein/DNA/RNA residues in this entry.

## 5.5 Carbohydrates ⓘ

There are no carbohydrates in this entry.

## 5.6 Ligand geometry ⓘ

20 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	$\# Z  > 2$
2	EDO	A	518	-	3,3,3	0.50	0	2,2,2	0.30	0
2	EDO	A	517	-	3,3,3	0.39	0	2,2,2	0.85	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
2	EDO	A	514	-	3,3,3	0.39	0	2,2,2	0.44	0
2	EDO	A	503	-	3,3,3	0.46	0	2,2,2	0.54	0
3	PEG	A	519	-	6,6,6	0.54	0	5,5,5	0.90	0
2	EDO	A	512	-	3,3,3	0.54	0	2,2,2	0.19	0
2	EDO	A	507	-	3,3,3	0.29	0	2,2,2	0.53	0
2	EDO	A	509	-	3,3,3	0.40	0	2,2,2	0.71	0
2	EDO	A	515	-	3,3,3	0.39	0	2,2,2	0.60	0
2	EDO	A	502	-	3,3,3	0.55	0	2,2,2	0.38	0
2	EDO	A	511	-	3,3,3	0.60	0	2,2,2	0.01	0
2	EDO	A	508	-	3,3,3	0.46	0	2,2,2	0.62	0
2	EDO	A	501	-	3,3,3	0.40	0	2,2,2	1.09	0
2	EDO	A	506	-	3,3,3	0.45	0	2,2,2	0.32	0
2	EDO	A	516	-	3,3,3	0.51	0	2,2,2	0.55	0
2	EDO	A	513	-	3,3,3	0.36	0	2,2,2	0.70	0
2	EDO	A	505	-	3,3,3	0.64	0	2,2,2	0.40	0
2	EDO	A	510	-	3,3,3	0.48	0	2,2,2	0.45	0
4	GOL	A	520	-	5,5,5	0.27	0	5,5,5	0.93	0
2	EDO	A	504	-	3,3,3	0.71	0	2,2,2	0.23	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
2	EDO	A	518	-	-	1/1/1/1	-
2	EDO	A	517	-	-	1/1/1/1	-
2	EDO	A	514	-	-	1/1/1/1	-
2	EDO	A	503	-	-	1/1/1/1	-
3	PEG	A	519	-	-	2/4/4/4	-
2	EDO	A	512	-	-	1/1/1/1	-
2	EDO	A	507	-	-	1/1/1/1	-
2	EDO	A	509	-	-	0/1/1/1	-
2	EDO	A	515	-	-	1/1/1/1	-
2	EDO	A	502	-	-	0/1/1/1	-
2	EDO	A	511	-	-	1/1/1/1	-
2	EDO	A	508	-	-	1/1/1/1	-
2	EDO	A	501	-	-	1/1/1/1	-
2	EDO	A	506	-	-	1/1/1/1	-
2	EDO	A	516	-	-	0/1/1/1	-
2	EDO	A	513	-	-	0/1/1/1	-
2	EDO	A	505	-	-	1/1/1/1	-

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	EDO	A	510	-	-	1/1/1/1	-
4	GOL	A	520	-	-	3/4/4/4	-
2	EDO	A	504	-	-	0/1/1/1	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

5 of 18 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	519	PEG	C4-C3-O2-C2
2	A	511	EDO	O1-C1-C2-O2
2	A	505	EDO	O1-C1-C2-O2
4	A	520	GOL	C1-C2-C3-O3
2	A	518	EDO	O1-C1-C2-O2

There are no ring outliers.

7 monomers are involved in 9 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	518	EDO	1	0
2	A	517	EDO	2	0
2	A	514	EDO	1	0
3	A	519	PEG	3	0
2	A	512	EDO	1	0
2	A	507	EDO	1	0
2	A	502	EDO	1	0

## 5.7 Other polymers ⓘ

There are no such residues in this entry.

## 5.8 Polymer linkage issues ⓘ

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, 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	189/273 (69%)	-0.37	2 (1%) 80 82	12, 21, 44, 67	0

All (2) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	270	ALA	2.6
1	A	413	LYS	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 carbohydrates 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(Å <sup>2</sup> )	Q<0.9
2	EDO	A	518	4/4	0.82	0.20	52,55,56,57	0
2	EDO	A	503	4/4	0.86	0.15	48,49,49,59	0
2	EDO	A	516	4/4	0.87	0.15	49,51,51,56	0
2	EDO	A	508	4/4	0.88	0.19	34,42,48,57	0
3	PEG	A	519	7/7	0.88	0.30	25,25,31,33	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
2	EDO	A	513	4/4	0.88	0.22	45,52,56,56	0
2	EDO	A	517	4/4	0.89	0.20	34,46,49,54	0
2	EDO	A	515	4/4	0.90	0.17	28,31,34,36	0
2	EDO	A	501	4/4	0.91	0.17	41,41,43,44	0
2	EDO	A	505	4/4	0.91	0.13	35,39,40,44	0
2	EDO	A	510	4/4	0.91	0.16	36,39,41,41	0
4	GOL	A	520	6/6	0.91	0.22	42,47,51,58	0
2	EDO	A	512	4/4	0.93	0.17	34,34,37,40	0
2	EDO	A	511	4/4	0.93	0.17	43,49,51,53	0
2	EDO	A	504	4/4	0.93	0.12	26,29,30,34	0
2	EDO	A	514	4/4	0.94	0.32	41,44,47,48	0
2	EDO	A	507	4/4	0.94	0.17	26,29,29,29	0
2	EDO	A	506	4/4	0.95	0.25	36,40,41,52	0
2	EDO	A	509	4/4	0.96	0.09	27,27,28,31	0
2	EDO	A	502	4/4	0.98	0.10	22,22,23,24	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.