



# Full wwPDB X-ray Structure Validation Report ⓘ

May 13, 2020 – 05:23 am BST

PDB ID : 3R3V  
Title : Crystal Structure of the Fluoroacetate Dehalogenase RPA1163 - Asp110Asn/  
Fluoroacetate  
Authors : Chan, P.W.Y.; Yakunin, A.F.; Edwards, E.A.; Pai, E.F.  
Deposited on : 2011-03-16  
Resolution : 1.50 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](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

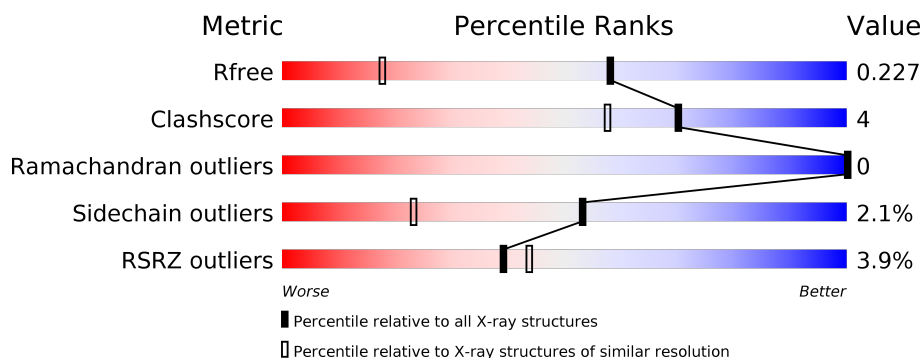
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 1.50 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	2936 (1.50-1.50)
Clashscore	141614	3144 (1.50-1.50)
Ramachandran outliers	138981	3066 (1.50-1.50)
Sidechain outliers	138945	3064 (1.50-1.50)
RSRZ outliers	127900	2884 (1.50-1.50)

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	306	<div> <div>3%</div> <div>87%</div> <div>9%</div> <div>•</div> </div>
1	B	306	<div> <div>5%</div> <div>82%</div> <div>11%</div> <div>• 5%</div> </div>

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
4	CL	B	305	-	-	X	-

## 2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 5134 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.

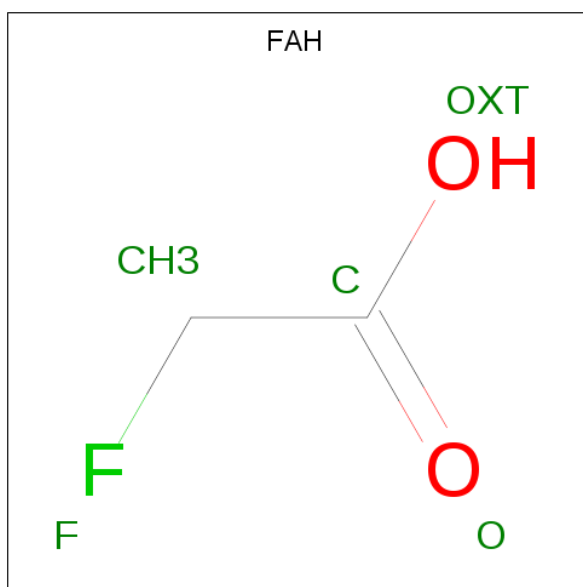
- Molecule 1 is a protein called Fluoroacetate dehalogenase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	296	Total	C	N	O	S	0	5	0
			2377	1531	416	420	10			
1	B	291	Total	C	N	O	S	0	3	0
			2344	1512	411	412	9			

There are 10 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-1	GLY	-	EXPRESSION TAG	UNP Q6NAM1
A	0	HIS	-	EXPRESSION TAG	UNP Q6NAM1
A	110	ASN	ASP	ENGINEERED MUTATION	UNP Q6NAM1
A	303	GLY	-	EXPRESSION TAG	UNP Q6NAM1
A	304	SER	-	EXPRESSION TAG	UNP Q6NAM1
B	-1	GLY	-	EXPRESSION TAG	UNP Q6NAM1
B	0	HIS	-	EXPRESSION TAG	UNP Q6NAM1
B	110	ASN	ASP	ENGINEERED MUTATION	UNP Q6NAM1
B	303	GLY	-	EXPRESSION TAG	UNP Q6NAM1
B	304	SER	-	EXPRESSION TAG	UNP Q6NAM1

- Molecule 2 is fluoroacetic acid (three-letter code: FAH) (formula: C<sub>2</sub>H<sub>3</sub>FO<sub>2</sub>).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	A	1	Total	C	F	O	0	0
			5	2	1	2		

- Molecule 3 is CALCIUM ION (three-letter code: CA) (formula: Ca).

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

- Molecule 4 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	B	2	Total	Cl	0	0
			2	2		
4	A	2	Total	Cl	0	0
			2	2		

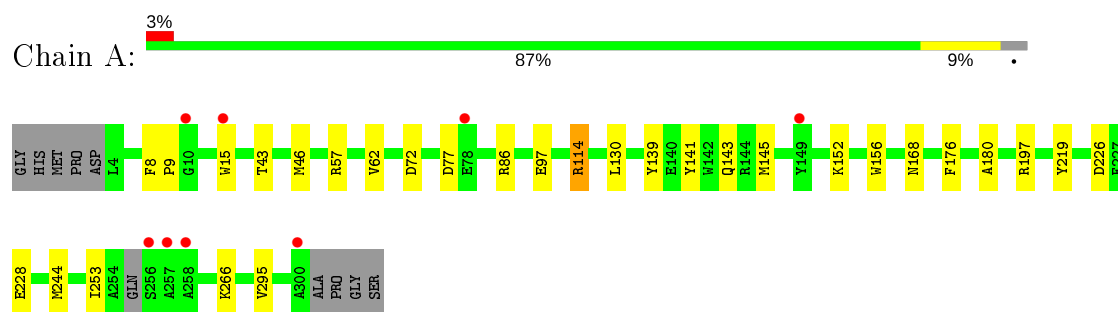
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	254	Total	O	0	0
			254	254		
5	B	149	Total	O	0	0
			149	149		

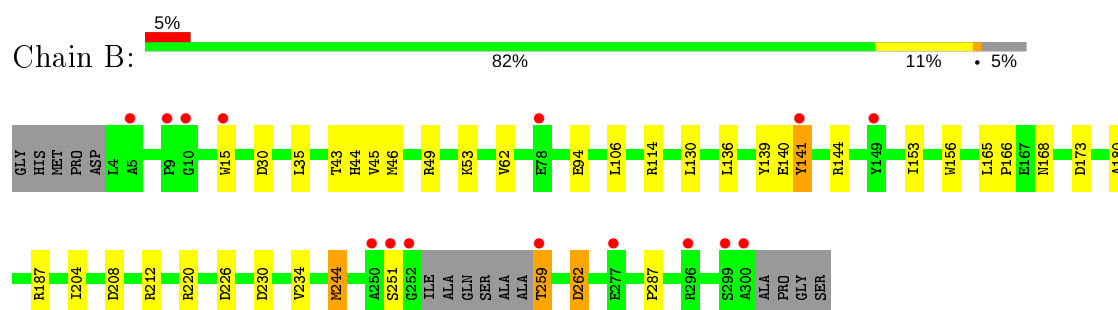
### 3 Residue-property plots [i](#)

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: Fluoroacetate dehalogenase



- Molecule 1: Fluoroacetate dehalogenase



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	41.89 Å   79.32 Å   84.96 Å 90.00°   103.43°   90.00°	Depositor
Resolution (Å)	19.08 – 1.50 19.07 – 1.50	Depositor EDS
% Data completeness (in resolution range)	95.8 (19.08-1.50) 95.8 (19.07-1.50)	Depositor EDS
$R_{merge}$	0.09	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.67 (at 1.50 Å)	Xtriage
Refinement program	REFMAC 5.5.0102	Depositor
R, $R_{free}$	0.184   ,   0.223 0.190   ,   0.227	Depositor DCC
$R_{free}$ test set	4127 reflections (4.99%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	13.0	Xtriage
Anisotropy	0.395	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.40   ,   42.4	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.026 for h,-k,-h-l	Xtriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	5134	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	15.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.89% 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

### 5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: CA, FAH, CL

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	1.21	4/2454 (0.2%)	1.14	10/3338 (0.3%)
1	B	1.18	2/2421 (0.1%)	1.11	9/3293 (0.3%)
All	All	1.20	6/4875 (0.1%)	1.13	19/6631 (0.3%)

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	3

All (6) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	62	VAL	CB-CG2	6.16	1.65	1.52
1	B	94	GLU	CG-CD	5.66	1.60	1.51
1	A	97	GLU	CB-CG	-5.65	1.41	1.52
1	A	97	GLU	CG-CD	5.27	1.59	1.51
1	A	228	GLU	CD-OE1	5.15	1.31	1.25
1	B	234	VAL	CB-CG1	-5.07	1.42	1.52

All (19) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	220	ARG	NE-CZ-NH2	8.46	124.53	120.30
1	A	114	ARG	NE-CZ-NH1	-7.73	116.43	120.30
1	B	262	ASP	CB-CG-OD2	7.25	124.83	118.30
1	B	220	ARG	NE-CZ-NH1	-7.12	116.74	120.30
1	A	77	ASP	CB-CG-OD2	6.61	124.25	118.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	226	ASP	CB-CG-OD2	-6.60	112.36	118.30
1	B	208	ASP	CB-CG-OD1	5.87	123.58	118.30
1	A	130	LEU	CB-CG-CD2	5.85	120.94	111.00
1	B	208	ASP	CB-CG-OD2	-5.55	113.31	118.30
1	A	197	ARG	NE-CZ-NH2	-5.38	117.61	120.30
1	A	244	MET	CG-SD-CE	-5.36	91.63	100.20
1	A	86	ARG	NE-CZ-NH1	-5.32	117.64	120.30
1	B	212	ARG	NE-CZ-NH1	-5.30	117.65	120.30
1	B	244	MET	CG-SD-CE	-5.30	91.72	100.20
1	A	72	ASP	CB-CG-OD1	-5.29	113.54	118.30
1	A	226	ASP	CB-CG-OD2	-5.19	113.63	118.30
1	A	219	TYR	CB-CG-CD2	5.13	124.08	121.00
1	A	145	MET	CG-SD-CE	5.12	108.39	100.20
1	B	187	ARG	NE-CZ-NH2	5.10	122.85	120.30

There are no chirality outliers.

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	114	ARG	Sidechain
1	A	8	PHE	Mainchain

## 5.2 Too-close contacts ⓘ

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	2377	0	2295	15	0
1	B	2344	0	2262	19	0
2	A	5	0	2	0	0
3	A	1	0	0	0	0
4	A	2	0	0	0	0
4	B	2	0	0	2	0
5	A	254	0	0	3	0
5	B	149	0	0	5	0
All	All	5134	0	4559	33	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 (33) 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:180:ALA:HB3	5:B:407:HOH:O	1.66	0.95
1:A:176[B]:PHE:HE2	5:B:431:HOH:O	1.67	0.76
1:A:176[B]:PHE:CE2	5:A:426:HOH:O	2.43	0.70
1:B:259:THR:HG23	1:B:262:ASP:CG	2.14	0.68
1:A:176[B]:PHE:CE2	5:B:431:HOH:O	2.44	0.67
1:A:9[A]:PRO:HG3	5:A:548:HOH:O	1.96	0.65
1:B:259:THR:HG23	1:B:262:ASP:HB2	1.79	0.64
1:B:259:THR:HG23	1:B:262:ASP:CB	2.32	0.59
1:B:114:ARG:NH1	4:B:305:CL:CL	2.71	0.58
1:B:44:HIS:HB2	1:B:62:VAL:HG12	1.87	0.56
1:A:176[B]:PHE:CD2	1:B:168:ASN:ND2	2.74	0.56
1:A:139:TYR:CZ	1:A:143:GLN:HG3	2.44	0.52
1:B:259:THR:CG2	1:B:262:ASP:CG	2.77	0.52
1:A:139:TYR:CE2	1:A:143:GLN:HG3	2.44	0.51
1:B:140:GLU:OE1	1:B:144[B]:ARG:NH1	2.44	0.50
1:B:49:ARG:HD3	1:B:287:PRO:HG3	1.94	0.49
4:B:305:CL:CL	5:B:448:HOH:O	2.57	0.48
1:B:139:TYR:HB2	1:B:230:ASP:HB3	1.95	0.47
1:A:180:ALA:HB3	5:A:416:HOH:O	2.12	0.47
1:A:141:TYR:CD2	1:A:156:TRP:CE3	3.02	0.47
1:A:43:THR:O	1:A:46[A]:MET:HG3	2.15	0.47
1:A:57:ARG:HD3	1:A:295:VAL:HG13	1.96	0.47
1:B:165:LEU:HB3	1:B:166:PRO:HD3	1.97	0.47
1:A:57:ARG:CD	1:A:295:VAL:HG13	2.46	0.46
1:B:130:LEU:O	1:B:244:MET:HA	2.16	0.45
1:B:35:LEU:HD23	1:B:106:LEU:HD13	2.00	0.43
1:A:253:ILE:O	1:A:253:ILE:HG22	2.16	0.43
1:B:30:ASP:OD2	5:B:459:HOH:O	2.21	0.42
1:B:153:ILE:HG22	1:B:156:TRP:CD1	2.55	0.42
1:B:136:LEU:HB2	1:B:141[B]:TYR:CE2	2.54	0.42
1:A:168[B]:ASN:HD21	1:B:173:ASP:HB3	1.85	0.41
1:A:253:ILE:CG2	1:A:253:ILE:O	2.67	0.41
1:B:43:THR:OG1	1:B:45:VAL:HG22	2.21	0.41

There are no symmetry-related clashes.

## 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	297/306 (97%)	291 (98%)	6 (2%)	0	100	100
1	B	290/306 (95%)	284 (98%)	6 (2%)	0	100	100
All	All	587/612 (96%)	575 (98%)	12 (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	239/242 (99%)	236 (99%)	3 (1%)	69	44
1	B	236/242 (98%)	228 (97%)	8 (3%)	37	9
All	All	475/484 (98%)	464 (98%)	11 (2%)	53	20

All (11) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	15	TRP
1	A	152	LYS
1	A	266	LYS
1	B	15	TRP
1	B	46	MET
1	B	53	LYS
1	B	141[A]	TYR
1	B	141[B]	TYR

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Mol	Chain	Res	Type
1	B	204	ILE
1	B	251	SER
1	B	259	THR

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	168	ASN

### 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 carbohydrates in this entry.

## 5.6 Ligand geometry [i](#)

Of 6 ligands modelled in this entry, 5 are monoatomic - leaving 1 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	FAH	A	305	-	1,4,4	1.30	0	1,4,4	3.00	1 (100%)

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	FAH	A	305	-	-	0/0/2/2	-

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed( $^{\circ}$ )	Ideal( $^{\circ}$ )
2	A	305	FAH	F-CH3-C	-3.00	104.49	111.41

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

### 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, 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	296/306 (96%)	0.05	8 (2%) 54 59	5, 11, 23, 33	0
1	B	291/306 (95%)	0.40	15 (5%) 27 30	7, 16, 31, 38	0
All	All	587/612 (95%)	0.22	23 (3%) 39 44	5, 13, 30, 38	0

All (23) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	257	ALA	5.5
1	B	300	ALA	4.2
1	B	15	TRP	4.1
1	A	149	TYR	4.0
1	A	15	TRP	3.9
1	B	251	SER	3.9
1	B	5	ALA	3.8
1	B	9	PRO	3.7
1	A	258	ALA	3.7
1	B	149	TYR	3.7
1	B	10	GLY	3.6
1	B	259	THR	3.3
1	B	78	GLU	3.3
1	B	250	ALA	2.8
1	B	296	ARG	2.7
1	B	252	GLY	2.6
1	A	300	ALA	2.4
1	A	256	SER	2.3
1	A	10[A]	GLY	2.3
1	B	141[A]	TYR	2.3
1	A	78	GLU	2.1
1	B	299	SER	2.0
1	B	277	GLU	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 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( $\text{\AA}^2$ )	Q<0.9
4	CL	B	305	1/1	0.96	0.09	22,22,22,22	1
4	CL	B	306	1/1	0.96	0.17	10,10,10,10	1
2	FAH	A	305	5/5	0.97	0.07	13,13,17,18	0
3	CA	A	306	1/1	0.98	0.05	17,17,17,17	1
4	CL	A	308	1/1	0.98	0.04	18,18,18,18	0
4	CL	A	307	1/1	0.99	0.05	19,19,19,19	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.