



# Full wwPDB X-ray Structure Validation Report ⓘ

Jun 16, 2024 – 07:58 AM EDT

PDB ID : 2DHD  
Title : CRYSTALLOGRAPHIC ANALYSIS OF THE CATALYTIC MECHANISM OF HALOALKANE DEHALOGENASE  
Authors : Verschueren, K.H.G.; Dijkstra, B.W.  
Deposited on : 1993-09-08  
Resolution : 2.13 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.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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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 : 2022.3.0, CSD as543be (2022)  
Xtrriage (Phenix) : **NOT EXECUTED**  
EDS : **NOT EXECUTED**  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.37.1

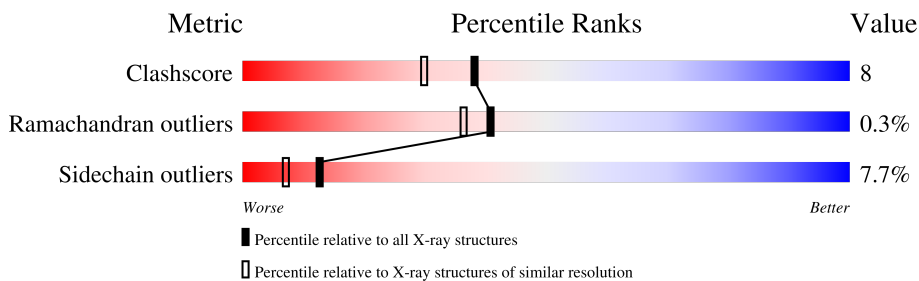
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.13 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	141614	2653 (2.16-2.12)
Ramachandran outliers	138981	2618 (2.16-2.12)
Sidechain outliers	138945	2617 (2.16-2.12)

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  $\geq 3$ , 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  $\leq 5\%$ .

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	310	

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
1	0AK	A	124	-	X	-	-

## 2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 2634 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 HALOALKANE DEHALOGENASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace	
			Total	C	Cl	N	O				S
1	A	310	2482	1598	1	406	462	15	0	0	0

- Molecule 2 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	1	Total	Cl	0	0
			1	1		

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	151	Total	O	0	0
			151	151		

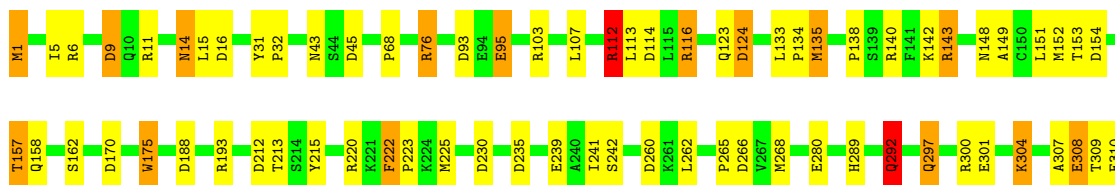
### 3 Residue-property plots [i](#)

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: HALOALKANE DEHALOGENASE

Chain A:  77% 18% 5%



## 4 Data and refinement statistics

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

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	94.80Å 72.80Å 41.40Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	15.00 – 2.13	Depositor
% Data completeness (in resolution range)	(Not available) (15.00-2.13)	Depositor
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
Refinement program	TNT	Depositor
R, $R_{free}$	0.189 , (Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	2634	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	12.0	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: CL, OAK

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	0/2543	1.51	41/3456 (1.2%)

There are no bond length outliers.

All (41) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	143	ARG	NE-CZ-NH1	10.45	125.52	120.30
1	A	45	ASP	CB-CG-OD2	-8.66	110.50	118.30
1	A	193	ARG	NE-CZ-NH1	8.32	124.46	120.30
1	A	212	ASP	CB-CG-OD1	8.15	125.64	118.30
1	A	230	ASP	CB-CG-OD1	8.11	125.60	118.30
1	A	170	ASP	CB-CG-OD1	8.10	125.59	118.30
1	A	193	ARG	NE-CZ-NH2	-8.10	116.25	120.30
1	A	188	ASP	CB-CG-OD2	-8.06	111.05	118.30
1	A	212	ASP	CB-CG-OD2	-8.04	111.07	118.30
1	A	140	ARG	NE-CZ-NH1	7.89	124.25	120.30
1	A	9	ASP	CB-CG-OD2	-7.68	111.39	118.30
1	A	188	ASP	CB-CG-OD1	7.66	125.19	118.30
1	A	6	ARG	NE-CZ-NH2	7.29	123.94	120.30
1	A	235	ASP	CB-CG-OD1	6.96	124.57	118.30
1	A	76	ARG	NE-CZ-NH2	6.87	123.74	120.30
1	A	114	ASP	CB-CG-OD2	-6.59	112.36	118.30
1	A	11	ARG	NE-CZ-NH1	6.39	123.50	120.30
1	A	268	MET	CG-SD-CE	6.26	110.22	100.20
1	A	292	GLN	N-CA-CB	6.20	121.76	110.60
1	A	116	ARG	NE-CZ-NH2	6.19	123.39	120.30
1	A	149	ALA	CB-CA-C	-6.10	100.95	110.10
1	A	235	ASP	CB-CG-OD2	-6.08	112.83	118.30
1	A	260	ASP	CB-CG-OD1	5.98	123.69	118.30
1	A	93	ASP	CB-CG-OD2	-5.91	112.98	118.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	11	ARG	NE-CZ-NH2	-5.86	117.37	120.30
1	A	152	MET	CG-SD-CE	5.86	109.57	100.20
1	A	135	MET	CG-SD-CE	5.80	109.48	100.20
1	A	68	PRO	N-CA-CB	5.79	110.25	103.30
1	A	16	ASP	CB-CG-OD1	5.76	123.48	118.30
1	A	300	ARG	NE-CZ-NH1	5.70	123.15	120.30
1	A	265	PRO	N-CA-CB	5.67	110.10	103.30
1	A	230	ASP	CB-CG-OD2	-5.61	113.25	118.30
1	A	1	MET	CG-SD-CE	5.61	109.17	100.20
1	A	45	ASP	CB-CG-OD1	5.51	123.26	118.30
1	A	112	ARG	NE-CZ-NH1	5.45	123.03	120.30
1	A	225	MET	CG-SD-CE	5.40	108.83	100.20
1	A	223	PRO	N-CA-CB	5.38	109.76	103.30
1	A	175	TRP	CA-CB-CG	5.37	123.90	113.70
1	A	114	ASP	CB-CG-OD1	5.27	123.04	118.30
1	A	300	ARG	NE-CZ-NH2	-5.04	117.78	120.30
1	A	16	ASP	CB-CG-OD2	-5.04	113.76	118.30

There are no chirality outliers.

There are no planarity outliers.

## 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	2482	0	2380	37	0
2	A	1	0	0	0	0
3	A	151	0	0	7	0
All	All	2634	0	2380	37	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 8.

All (37) 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:292:GLN:HE21	1:A:292:GLN:H	1.23	0.84
1:A:220:ARG:HD3	3:A:471:HOH:O	1.88	0.74
1:A:309:THR:O	1:A:309:THR:HG22	1.95	0.66
1:A:124:0AK:H1C1	1:A:175:TRP:CZ2	2.31	0.65
1:A:292:GLN:H	1:A:292:GLN:NE2	1.95	0.63
1:A:124:0AK:C1	1:A:289:HIS:HE2	2.09	0.63
1:A:262:LEU:HD23	3:A:414:HOH:O	1.99	0.62
1:A:112:ARG:HG3	1:A:112:ARG:HH11	1.67	0.58
1:A:280:GLU:HG2	3:A:451:HOH:O	2.05	0.56
1:A:142:LYS:HG2	1:A:143:ARG:HG3	1.89	0.54
1:A:124:0AK:OD2	1:A:289:HIS:NE2	2.32	0.54
1:A:307:ALA:C	1:A:309:THR:H	2.09	0.54
1:A:292:GLN:HE21	1:A:292:GLN:N	1.99	0.53
1:A:262:LEU:HB3	3:A:414:HOH:O	2.08	0.52
1:A:154:ASP:CG	1:A:157:THR:HG23	2.32	0.50
1:A:151:LEU:HD13	1:A:241:ILE:HG13	1.92	0.50
1:A:308:GLU:CG	1:A:308:GLU:O	2.61	0.49
1:A:124:0AK:C1	1:A:289:HIS:NE2	2.76	0.48
1:A:153:THR:HG21	1:A:158:GLN:HB2	1.95	0.47
1:A:304:LYS:HE3	1:A:304:LYS:HB2	1.57	0.47
1:A:31:TYR:N	1:A:32:PRO:CD	2.78	0.46
1:A:222:PHE:HD1	1:A:222:PHE:HA	1.67	0.45
1:A:309:THR:O	1:A:310:GLU:HG2	2.16	0.45
1:A:154:ASP:OD2	1:A:157:THR:CG2	2.65	0.44
1:A:107:LEU:CD2	3:A:551:HOH:O	2.65	0.43
1:A:95:GLU:HG2	3:A:548:HOH:O	2.17	0.43
1:A:14:ASN:O	1:A:14:ASN:ND2	2.52	0.43
1:A:103:ARG:HH11	1:A:103:ARG:HD3	1.70	0.43
1:A:43:ASN:O	1:A:76:ARG:HB2	2.19	0.42
1:A:133:LEU:HB2	1:A:134:PRO:HD3	2.01	0.42
1:A:154:ASP:OD2	1:A:157:THR:HG23	2.19	0.42
1:A:135:MET:SD	1:A:239:GLU:HG2	2.59	0.42
1:A:124:0AK:CG	3:A:413:HOH:O	2.68	0.41
1:A:5:ILE:HD12	1:A:215:TYR:CE1	2.55	0.41
1:A:297:GLN:O	1:A:301:GLU:HG2	2.20	0.41
1:A:154:ASP:OD1	1:A:157:THR:HG23	2.21	0.40
1:A:308:GLU:O	1:A:308:GLU:HG2	2.20	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	307/310 (99%)	292 (95%)	14 (5%)	1 (0%)	41 36

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	148	ASN

### 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	261/261 (100%)	241 (92%)	20 (8%)	13 7

All (20) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	1	MET
1	A	9	ASP
1	A	14	ASN
1	A	15	LEU
1	A	95	GLU
1	A	112	ARG
1	A	113	LEU
1	A	116	ARG
1	A	123	GLN
1	A	138	PRO

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Mol	Chain	Res	Type
1	A	157	THR
1	A	162	SER
1	A	213	THR
1	A	222	PHE
1	A	242	SER
1	A	266	ASP
1	A	292	GLN
1	A	297	GLN
1	A	304	LYS
1	A	308	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	14	ASN
1	A	104	ASN
1	A	123	GLN
1	A	292	GLN
1	A	297	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](#)

1 non-standard protein/DNA/RNA residue is 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	OAK	A	124	1	9,10,11	3.02	3 (33%)	7,11,13	4.73	5 (71%)

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	0AK	A	124	1	-	7/9/10/12	-

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	124	0AK	OD2-C1	-7.62	1.23	1.45
1	A	124	0AK	OD2-CG	-3.85	1.22	1.33
1	A	124	0AK	OD1-CG	2.27	1.29	1.22

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	124	0AK	OD2-C1-C2	7.64	125.58	107.71
1	A	124	0AK	OD2-CG-CB	6.84	123.78	111.17
1	A	124	0AK	OD1-CG-CB	-5.23	112.50	124.65
1	A	124	0AK	CA-CB-CG	3.48	120.23	112.78
1	A	124	0AK	C1-OD2-CG	3.45	127.68	116.90

There are no chirality outliers.

All (7) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	A	124	0AK	O-C-CA-CB
1	A	124	0AK	C2-C1-OD2-CG
1	A	124	0AK	OD1-CG-OD2-C1
1	A	124	0AK	CB-CG-OD2-C1
1	A	124	0AK	OD2-C1-C2-CL
1	A	124	0AK	CA-CB-CG-OD1
1	A	124	0AK	CA-CB-CG-OD2

There are no ring outliers.

1 monomer is involved in 5 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
1	A	124	0AK	5	0

## 5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

Of 1 ligands modelled in this entry, 1 is 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

### 6.1 Protein, DNA and RNA chains

EDS was not executed - this section is therefore empty.

### 6.2 Non-standard residues in protein, DNA, RNA chains

EDS was not executed - this section is therefore empty.

### 6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

### 6.4 Ligands

EDS was not executed - this section is therefore empty.

### 6.5 Other polymers

EDS was not executed - this section is therefore empty.