



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2026 – 11:23 AM UTC

PDB ID : 5T8P / pdb_00005t8p
Title : Crystal structure of murine NF-kappaB inducing kinase (NIK) bound to benzoxepin compound 2
Authors : Smith, M.A.; McEwan, P.A.
Deposited on : 2016-09-08
Resolution : 2.32 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 ⓘ 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 ⓘ](#)) were used in the production of this report:

MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

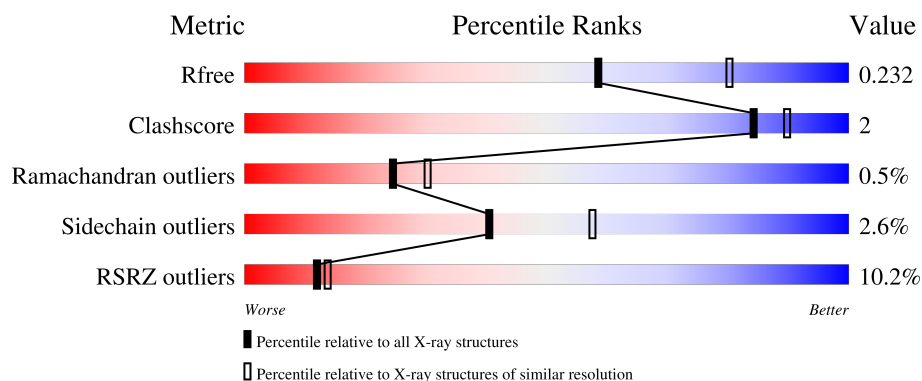
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.32 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}	180053	7754 (2.34-2.30)
Clashscore	190562	8383 (2.34-2.30)
Ramachandran outliers	187476	8303 (2.34-2.30)
Sidechain outliers	187428	8303 (2.34-2.30)
RSRZ outliers	180081	7760 (2.34-2.30)

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 $\leq 5\%$. 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	349	11% 86% 7% 6%
1	B	349	8% 87% 6% 6%

2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 5278 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.

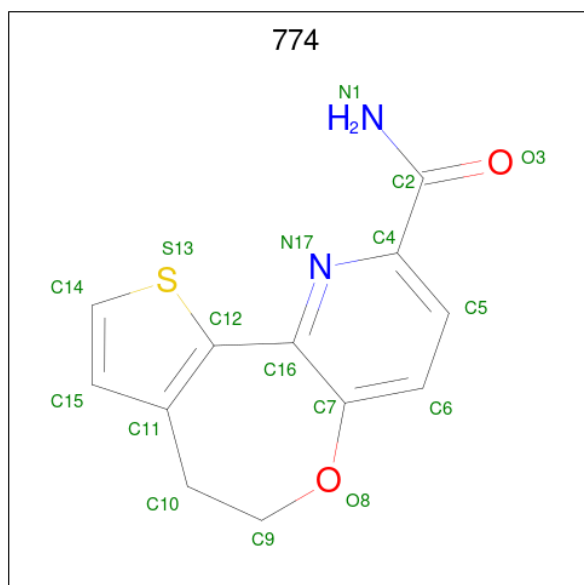
- Molecule 1 is a protein called Mitogen-activated protein kinase kinase kinase 14.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	327	Total	C	N	O	S	0	1	0
			2547	1615	449	462	21			
1	B	328	Total	C	N	O	S	0	0	0
			2547	1612	451	463	21			

There are 4 discrepancies between the modelled and reference sequences:

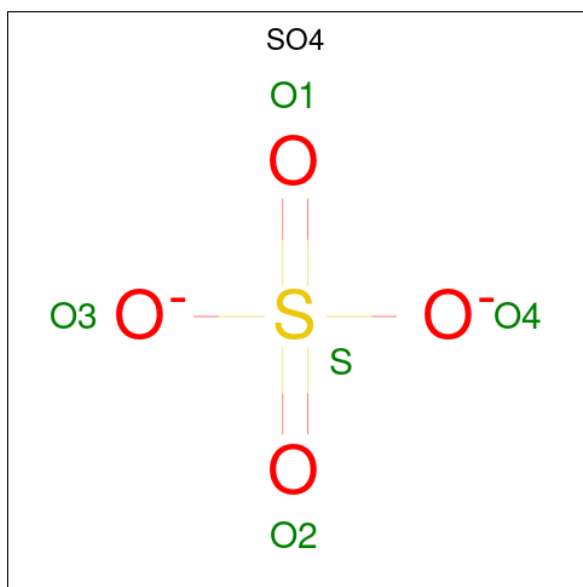
Chain	Residue	Modelled	Actual	Comment	Reference
A	327	GLY	-	expression tag	UNP Q9WUL6
A	328	SER	-	expression tag	UNP Q9WUL6
B	327	GLY	-	expression tag	UNP Q9WUL6
B	328	SER	-	expression tag	UNP Q9WUL6

- Molecule 2 is 6,7-dihydrothieno[4,5]oxepino[1,2- {c}]pyridine-2-carboxamide (CCD ID: 774) (formula: C₁₂H₁₀N₂O₂S).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	N	O	S	0	0
			17	12	2	2	1		
2	B	1	Total	C	N	O	S	0	0
			17	12	2	2	1		

- Molecule 3 is SULFATE ION (CCD ID: SO4) (formula: O₄S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	O	S	0	0
			5	4	1		
3	A	1	Total	O	S	0	0
			5	4	1		
3	B	1	Total	O	S	0	0
			5	4	1		
3	B	1	Total	O	S	0	0
			5	4	1		

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	67	Total	O	0	0
			67	67		
4	B	63	Total	O	0	0
			63	63		

4 Data and refinement statistics

Property	Value	Source
Space group	P 43	Depositor
Cell constants a, b, c, α , β , γ	142.85Å 142.85Å 45.26Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	71.43 – 2.32 71.43 – 2.32	Depositor EDS
% Data completeness (in resolution range)	99.9 (71.43-2.32) 99.9 (71.43-2.32)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	0.09	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.79 (at 2.32Å)	Xtriage
Refinement program	REFMAC 5.8.0103	Depositor
R, R_{free}	0.181 , 0.232 0.185 , 0.232	Depositor DCC
R_{free} test set	1920 reflections (4.77%)	wwPDB-VP
Wilson B-factor (Å ²)	45.7	Xtriage
Anisotropy	0.067	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.37 , 38.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	0.029 for h,-k,-l	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	5278	wwPDB-VP
Average B, all atoms (Å ²)	53.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.63% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical 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: SO4, 774

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	0.77	0/2610	0.93	0/3530
1	B	0.77	0/2607	0.90	0/3525
All	All	0.77	0/5217	0.92	0/7055

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

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	2547	0	2544	15	0
1	B	2547	0	2551	9	0
2	A	17	0	0	0	0
2	B	17	0	0	0	0
3	A	10	0	0	0	0
3	B	10	0	0	0	0
4	A	67	0	0	0	0
4	B	63	0	0	0	0
All	All	5278	0	5095	24	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 2.

All (24) 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:544:GLN:HB2	1:A:546:ASP:OD2	1.91	0.71
1:B:506:GLU:O	1:B:510:THR:HG23	2.03	0.57
1:B:514:LEU:HD11	1:B:579:VAL:HG22	1.88	0.56
1:B:514:LEU:HD11	1:B:579:VAL:CG2	2.36	0.55
1:A:548:LEU:N	1:A:548:LEU:HD13	2.24	0.51
1:A:548:LEU:N	1:A:548:LEU:CD1	2.75	0.49
1:A:544:GLN:CB	1:A:546:ASP:OD2	2.60	0.48
1:A:647:MET:HE2	1:A:651:ARG:NH2	2.27	0.48
1:A:546:ASP:CG	1:A:547:GLY:N	2.73	0.47
1:A:351:GLN:HB2	1:A:353:HIS:CD2	2.50	0.47
1:A:545:PRO:O	1:A:546:ASP:C	2.58	0.46
1:B:355:LEU:HD11	1:B:460:ALA:HB3	1.98	0.45
1:A:598:TRP:HB3	1:A:606:LEU:HD11	2.00	0.44
1:A:570:VAL:HG13	1:A:607:CYS:HB2	1.99	0.44
1:A:455:VAL:HG21	1:A:524:LEU:HD12	2.00	0.43
1:B:334:PRO:O	1:B:337:GLU:HB3	2.18	0.43
1:A:552:LEU:HD13	1:A:575:CYS:HB2	2.02	0.42
1:A:488:CYS:SG	1:A:672:LYS:HB3	2.60	0.41
1:A:552:LEU:HD13	1:A:575:CYS:CB	2.50	0.41
1:B:419:MET:HE3	1:B:420:LYS:C	2.45	0.41
1:B:557:TYR:CE2	1:B:559:PRO:HA	2.55	0.41
1:B:455:VAL:HG21	1:B:524:LEU:HD12	2.04	0.40
1:B:588:MET:HA	1:B:591:MET:HE3	2.03	0.40
1:A:336:GLU:O	1:A:337:GLU:C	2.65	0.40

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	322/349 (92%)	309 (96%)	11 (3%)	2 (1%)	21	25
1	B	324/349 (93%)	311 (96%)	12 (4%)	1 (0%)	36	45
All	All	646/698 (93%)	620 (96%)	23 (4%)	3 (0%)	24	30

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	552	LEU
1	A	600	GLN
1	B	553	LEU

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	274/290 (94%)	267 (97%)	7 (3%)	40	57
1	B	274/290 (94%)	267 (97%)	7 (3%)	40	57
All	All	548/580 (94%)	534 (97%)	14 (3%)	40	57

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

Mol	Chain	Res	Type
1	A	410	ARG
1	A	419	MET
1	A	437	VAL
1	A	548	LEU
1	A	583	SER
1	A	618	ARG
1	A	641	VAL
1	B	336	GLU
1	B	339	LEU
1	B	340	VAL
1	B	351	GLN
1	B	484	LYS
1	B	510	THR

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Mol	Chain	Res	Type
1	B	600	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	630	GLN
1	A	658	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](#)

6 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	774	A	701	-	19,19,19	1.24	3 (15%)	21,27,27	1.97	9 (42%)
3	SO4	A	703	-	4,4,4	0.42	0	6,6,6	0.41	0
3	SO4	B	702	-	4,4,4	0.48	0	6,6,6	0.14	0
3	SO4	B	701	-	4,4,4	0.43	0	6,6,6	0.19	0
2	774	B	703	-	19,19,19	1.34	3 (15%)	21,27,27	1.66	4 (19%)
3	SO4	A	702	-	4,4,4	0.50	0	6,6,6	0.10	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	774	A	701	-	-	0/4/14/14	0/3/3/3
2	774	B	703	-	-	0/4/14/14	0/3/3/3

All (6) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	703	774	C10-C11	-3.60	1.46	1.51
2	A	701	774	C4-C2	-2.95	1.47	1.50
2	A	701	774	C10-C11	-2.95	1.47	1.51
2	B	703	774	C2-N1	2.73	1.38	1.33
2	A	701	774	C2-N1	2.72	1.38	1.33
2	B	703	774	C4-C2	-2.56	1.47	1.50

All (13) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	703	774	O8-C7-C16	3.87	125.17	118.86
2	A	701	774	C9-O8-C7	-3.82	109.78	116.13
2	A	701	774	O8-C7-C16	3.40	124.41	118.86
2	A	701	774	C4-C2-N1	-3.26	113.02	116.22
2	A	701	774	C11-C12-S13	-2.85	109.65	111.20
2	B	703	774	C11-C12-S13	-2.49	109.84	111.20
2	A	701	774	C14-S13-C12	2.26	94.33	90.81
2	B	703	774	C9-O8-C7	-2.19	112.49	116.13
2	A	701	774	C5-C4-N17	2.15	125.43	122.92
2	A	701	774	O3-C2-C4	2.14	121.44	119.65
2	B	703	774	C4-C2-N1	-2.02	114.23	116.22
2	A	701	774	C15-C14-S13	-2.01	109.25	112.86
2	A	701	774	O3-C2-N1	2.00	125.51	122.62

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, 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	327/349 (93%)	0.44	38 (11%) 9 10	29, 47, 96, 122	1 (0%)
1	B	328/349 (93%)	0.37	29 (8%) 15 17	33, 48, 88, 106	0
All	All	655/698 (93%)	0.40	67 (10%) 12 14	29, 47, 92, 122	1 (0%)

All (67) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	408	VAL	7.4
1	A	548	LEU	7.1
1	A	335	VAL	6.8
1	B	335	VAL	5.8
1	A	553	LEU	5.2
1	B	334	PRO	5.1
1	B	408	VAL	5.0
1	A	552	LEU	4.9
1	A	406	PRO	4.6
1	A	557	TYR	4.6
1	B	669	GLY	4.5
1	B	548	LEU	4.3
1	B	552	LEU	4.0
1	A	334	PRO	4.0
1	B	406	PRO	4.0
1	B	550	LYS	3.9
1	B	553	LEU	3.9
1	A	333	VAL	3.9
1	B	407	ARG	3.7
1	A	545	PRO	3.6
1	A	667	TRP	3.4
1	A	602	PHE	3.4
1	A	551	SER	3.4
1	A	338	TYR	3.4

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Mol	Chain	Res	Type	RSRZ
1	A	547	GLY	3.4
1	B	545	PRO	3.2
1	B	544	GLN	3.2
1	B	339	LEU	3.1
1	A	363	SER	3.1
1	A	556	ASP	3.1
1	A	407	ARG	3.0
1	A	555	GLY	3.0
1	B	667	TRP	3.0
1	A	337	GLU	3.0
1	A	410	ARG	3.0
1	B	341	HIS	2.9
1	A	675	ARG	2.9
1	B	556	ASP	2.8
1	A	336	GLU	2.8
1	A	409	GLY	2.8
1	A	558	ILE	2.7
1	A	386	GLU	2.7
1	B	338	TYR	2.7
1	A	669	GLY	2.7
1	B	555	GLY	2.7
1	A	604	GLY	2.7
1	B	557	TYR	2.6
1	A	402	MET	2.5
1	B	402	MET	2.5
1	A	353	HIS	2.5
1	B	405	GLN	2.5
1	A	607	CYS	2.4
1	A	601	TYR	2.4
1	B	675	ARG	2.4
1	B	404	HIS	2.3
1	A	542	CYS	2.2
1	A	404	HIS	2.2
1	B	603	ARG	2.2
1	B	599	THR	2.2
1	A	605	PRO	2.2
1	B	336	GLU	2.2
1	B	409	GLY	2.2
1	A	426[A]	PHE	2.1
1	B	549	GLY	2.1
1	B	551	SER	2.1
1	A	575	CYS	2.0

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Mol	Chain	Res	Type	RSRZ
1	A	422	LYS	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 oligosaccharides 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
3	SO4	A	702	5/5	0.78	0.17	89,89,93,94	0
3	SO4	A	703	5/5	0.85	0.12	71,77,80,82	0
3	SO4	B	702	5/5	0.86	0.13	70,72,78,84	0
2	774	A	701	17/17	0.92	0.11	52,55,57,58	0
3	SO4	B	701	5/5	0.94	0.09	62,66,69,71	0
2	774	B	703	17/17	0.95	0.08	45,48,52,55	0

6.5 Other polymers [i](#)

There are no such residues in this entry.