FSRU di PORTO TORRES
e
OPERE CONNESSE

Rapporto Preliminare di Sicurezza ai sensi del D.Lgs. 105/15

ALLEGATO C.4.2_1

ELABORATI DI CALCOLO
4R

Firmato digitalmente da:
Giovanni Romano
Data: 05/08/2024 15:37:28

Rev.	Descrizione	Elaborato	Verificato	Approvato	Data
0	Emissione per permessi	A.VISIGOTI	V.ROMANO	G.ROMANO	AGOSTO 2024

Input Report

Workspace: 1RiempFSRU-4R

Riempimento FSRU-ME4

Study
1RiempFSRU-4R

Tab	Group	Field	Value
Context of calculations	Selection of context	Weathers to use for this study	Weather folder
		Parameters to use for this study	Parameter set ME4
		Obstructions to use for this study	Multi-Energy obstruction set
Bund, building and terrain	Terrain and bund definition	Type of terrain for dispersion	Default terrain
		Type of pool substrate and bunds	No bund
Toxic parameters	Indoor toxic calculations	Specify the downwind building type	Unselected
		Building type (downwind building type)	Buildings\Building type

4R Linee di caricamento serbatoi GNL

Pressure vessel

1RiempFSRU-4R\Riempimento FSRU-ME4

Tab	Group	Field	Value	Units
Material	Material	Material	GAS NATURALE	
		Specify volume inventory?	Yes	
		Mass inventory	3355,7	kg
		Volume inventory	7,38	m3
		Material to track	GAS NATURALE	
	Phase	Specified condition	Pressure/temperature	
		Temperature	-160	degC
		Pressure (gauge)	0,25	bar
		Fluid state	Liquid	
		Liquid mole fraction	1	fraction
Scenario	Pipe dimensions	Pipe length		m
	Release location	Elevation	17	m
		Tank head	0	m
	Direction	Outdoor release direction	Horizontal	
		Outdoor release angle	0	deg
Discharge parameters	Model settings	Atmospheric expansion method	DNV recommended	
		Phase change upstream of orifice?	Disallow liquid phase change only (metastable liquid)	
	Droplet break-up mechanism	Droplet break-up mechanism - instantaneous	Use flashing correlation	
		Droplet break-up mechanism - continuous	Do not force correlation	
Short pipe	Pipe	Pipe roughness	0,045	mm

	characteristics			
	Frequencies	Frequency of bends in pipe	0	/m
		Frequency of couplings in pipe	0	/m
		Frequency of junctions in pipe	0	/m
	Frequencies of valves	Frequency of excess flow valves	0	/m
		Frequency of non-return valves	0	/m
		Frequency of shut-off valves	0	/m
	Velocity head losses	Excess flow valve velocity head losses	0	
		Non-return valve velocity head losses	0	
		Shut-off valve velocity head losses	0	
Time varying releases	Modelling of time-varying leaks and line ruptures	Vacuum relief valve	Operating	
		Vacuum relief valve set point	0	bar
	Inventory data for time-varying releases	Tank volume	7,38	m3
		Tank vapour volume	0	m3
		Tank liquid volume	7,38	m3
		Tank liquid level	0	m
		Maximum vapour release height	0	m

		Minimum mass inventory	0,1	kg
		Maximum mass inventory	1E+09	kg
	Safety system modelling for time-varying releases	Safety system modelling (isolation and blowdown)	No	
Dispersion	User-defined dispersion scope (N.B Based on the material to track)	Concentrations of interest		ppm
		Distances of interest		m
		Averaging time for concentrations and distances of interest		
		Specify user-defined averaging time	No	
		User defined averaging time		s
Bund, building and terrain	Terrain and bund definition	Type of terrain for dispersion	Default terrain	
		Type of pool substrate and bunds	No bund	
	Building definition	Release building		
		In-building release?	Outdoor	
		Building wake effect	None	
		Wind or release angle from North	0	deg
		Handling of	Trapped	

		droplets		
		Indoor mass modification factor	3	
Explosion parameters	Explosion method (Consequence calculations only)	Explosion method	Multi-Energy: Uniform confined	
	Ignition	Supply late ignition location	No ignition location	
		Location of late ignition		m
	Vapour liquid method	Use explosion mass modification factor	Yes	
		Explosion mass modification factor	3	
Fireball	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4; 12,5; 37,5	kW/m2
		Probit levels	2,73; 3,72; 7,5	
		Dose levels	1,27E+06; 5,8E+06; 2,51E+07	
		Lethality levels	0,01; 0,1; 0,99	fraction
	Parameters	Mass modification factor	3	
		Fireball maximum exposure duration	20	s
	Calculation method	Fireball model	Martinsen time varying	
		TNO model flame temperature	1726,85	degC
Jet fire	Jet fire method	Selection for jet fire method	Automatic selection / DNV recommended	

	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	5	
		Intensity levels	3; 5; 7; 12,5; 37,5	kW/m2
		Probit levels	2,73; 3,72; 7,5	
		Dose levels	1,27E+06; 5,8E+06; 2,51E+07	
		Lethality levels	0,01; 0,1; 0,99	fraction
	Parameters	Rate modification factor	3	
		Jet fire maximum exposure duration	20	s
	Cone model data	Horizontal options	Use standard method	
		Correlation	Recommended	
		Flame-shape adjustment if grounded	Yes	
	Surface emissive power	Calculation method for surface emissive power	Calculate SEP	
		Flame emissive power		kW/m2
		Emissivity fraction		fraction
Pool fire	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	5	
		Intensity levels	3; 5; 7; 12,5; 37,5	kW/m2
		Probit levels	2,73; 3,72; 7,5	
		Dose levels	1,27E+06; 5,8E+06; 2,51E+07	

		Lethality levels	0,01; 0,1; 0,99	fraction
	Parameters	Radiative fraction for general fires	0,4	fraction
		Pool fire maximum exposure duration	20	s
Geometry	Geometry	East	0	m
		North	0	m

80mm

Leak

1RiempFSRU-4R\Riempimento FSRU-ME4\4R Linee di caricamento serbatoi GNL

Tab	Group	Field	Value	Units
Scenario	Hole	Orifice diameter	80	mm
		Use specified discharge coefficient?	Yes	
		Discharge coefficient	0,62	fraction
	Release location	Elevation	17	m
		Tank head	0	m
	Direction	Outdoor release direction	Down - impinging on the ground	
		Outdoor release angle	0	deg
Material	Material	Material characteristics	Flammable only	
		Material to track	GAS NATURALE	
		Type of risk effects to model	Flammable only	
	Phase	Phase to be released	Liquid	
Discharge parameters	Model settings	Atmospheric expansion method	DNV recommended	
		Phase change upstream of orifice?	Disallow liquid phase change only (metastable liquid)	
	Droplet break-up mechanism	Droplet break-up mechanism - continuous	Do not force correlation	
Dispersion	User-defined dispersion scope (N.B Based on the material to track)	Concentrations of interest		ppm
		Distances of interest		m
		Averaging time for		

		concentrations and distances of interest		
		Specify user-defined averaging time	No	
		User defined averaging time		s
Bund, building and terrain	Terrain and bund definition	Type of terrain for dispersion	Default terrain	
		Type of pool substrate and bunds	No bund	
Explosion parameters	Explosion method	Explosion method	Multi-Energy: Uniform confined	
	Ignition	Supply late ignition location	No ignition location	
		Location of late ignition		m
	Vapour liquid method	Use explosion mass modification factor	Yes	
		Explosion mass modification factor	3	
Fireball	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4; 12,5; 37,5	kW/m2
		Probit levels	2,73; 3,72; 7,5	
		Dose levels	1,27E+06; 5,8E+06; 2,51E+07	
		Lethality levels	0,01; 0,1; 0,99	fraction
	Parameters	Mass modification factor	3	
		Fireball maximum exposure duration	20	s
	Calculation method	Fireball model	Martinsen time varying	

		TNO model flame temperature	1726,85	degC
Jet fire	Jet fire method	Selection for jet fire method	Automatic selection / DNV recommended	
	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	5	
		Intensity levels	3; 5; 7; 12,5; 37,5	kW/m2
		Probit levels	2,73; 3,72; 7,5	
		Dose levels	1,27E+06; 5,8E+06; 2,51E+07	
		Lethality levels	0,01; 0,1; 0,99	fraction
	Parameters	Rate modification factor	3	
		Jet fire maximum exposure duration	20	s
	Cone model data	Correlation	Recommended	
		Horizontal options	Use standard method	
		Flame-shape adjustment if grounded	Yes	
	Surface emissive power	Calculation method for surface emissive power	Calculate SEP	
		Flame emissive power		kW/m2
		Emissivity fraction		fraction
Pool fire	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input	5	

		radiation levels		
		Intensity levels	3; 5; 7; 12,5; 37,5	kW/m2
		Probit levels	2,73; 3,72; 7,5	
		Dose levels	1,27E+06; 5,8E+06; 2,51E+07	
		Lethality levels	0,01; 0,1; 0,99	fraction
	Parameters	Radiative fraction for general fires	0,4	fraction
		Pool fire maximum exposure duration	20	s

Discharge Report

Workspace: 1RiempFSRU-4R

Study: Riempimento FSRU-ME4

Equipment Item: 4R Linee di caricamento serbatoi GNL

1RiempFSRU-4R\Riempimento FSRU-ME4\4R Linee di caricamento serbatoi GNL

Material	**GAS NATURALE**	
East	0	m
North	0	m

Scenario (Leak) : 80mm

1RiempFSRU-4R\Riempimento FSRU-ME4\4R Linee di caricamento serbatoi GNL\80mm

Weather: Category 2/F

INPUT DATA

Inventory data

Mass in vessel	**3355,7**	kg

Stagnation Data (upstream end for long pipe)

Initial pressure (gauge)	**0,25**	bar
Initial temperature	**-160**	degC
Fluid state	**Non-saturated liquid**	

Scenario data

Phase to be released	Liquid	
Tank head	0	m
Hole diameter	**80**	mm
Discharge coefficient	**0,62**	fraction

OUTPUT DATA

Mass flow rate	14,8647	kg/s
Release duration	225,75	s

Orifice or pipe exit data (before atmospheric expansion)

Pressure	1,01325	bar
Temperature	-160,006	degC
Liquid mass fraction	**1**	fraction
Velocity at vena contracta (at exit for pipe releases)	10,4896	m/s
Discharge coefficient	0,62	

Final Data (after atmospheric expansion)

Temperature	-160,343	degC
Liquid mass fraction	0,99789	fraction
Droplet diameter	557,652	um
Expanded diameter	**0,0763289**	m
Velocity	10,4896	m/s

Weather: Category 5/D

INPUT DATA

Inventory data

Mass in vessel	**3355,7**	kg

Stagnation Data (upstream end for long pipe)

Initial pressure (gauge)	**0,25**	bar
Initial temperature	**-160**	degC
Fluid state	**Non-saturated liquid**	

Scenario data

Phase to be released	Liquid	
Tank head	0	m
Hole diameter	**80**	mm
Discharge coefficient	**0,62**	fraction

OUTPUT DATA

Mass flow rate	14,8647	kg/s
Release duration	225,75	s

Orifice or pipe exit data (before atmospheric expansion)

Pressure	1,01325	bar
Temperature	-160,006	degC
Liquid mass fraction	**1**	fraction
Velocity at vena contracta (at exit for pipe releases)	10,4896	m/s
Discharge coefficient	0,62	

Final Data (after atmospheric expansion)

Temperature	-160,343	degC
Liquid mass fraction	0,99789	fraction
Droplet diameter	557,652	um
Expanded diameter	**0,0763289**	m

Velocity	10,4896	m/s

Dispersion Report

Workspace: 1RiempFSRU-4R

Study: Riempimento FSRU-ME4

Equipment Item: 4R Linee di caricamento serbatoi GNL

1RiempFSRU-4R\Riempimento FSRU-ME4\4R Linee di caricamento serbatoi GNL

Material	**GAS NATURALE**	
East	0	m
North	0	m

Scenario (Leak) : 80mm

1RiempFSRU-4R\Riempimento FSRU-ME4\4R Linee di caricamento serbatoi GNL\80mm

Material to track	**GAS NATURALE**

Weather: Category 2/F

Wind speed [m/s]	**2**
Pasquill stability	**F stable - night with moderate clouds and light/moderate wind**
Atmospheric temperature [degC]	**25**
Relative humidity [fraction]	**0,75**
Solar radiation flux [kW/m2]	0,5
Mixing layer height [m]	100

Observer Release Data and Observer Mass Data

					Masses or mass rates			
Observer number	**Release type**	**Start time [s]**	**Start downwind distance [m]**	**Unit**	**Release**	**Rainout**	**Pool vapour pick-up**	**Final**
1	Continuous	0	0	kg/s	14,8647	14,8333		0,0313637

2	Continuous	0,22	-0,246382	kg/s	14,8647	14,8333		4,09
3	Continuous	42,3982	-6,06009	kg/s	14,8647	14,8333		11,1057
4	Continuous	75,1349	-7,30819	kg/s	14,8647	14,8333		11,88
5	Continuous	105,964	-8,13166	kg/s	14,8647	14,8333		12,3086
6	Continuous	135,815	-8,76608	kg/s	14,8647	14,8333		12,5702
7	Continuous	164,968	-9,27866	kg/s	14,8647	14,8333		12,8031
8	Continuous	193,657	-9,71535	kg/s	14,8647	14,8333		12,5263
9	Continuous	204,453	-9,86145	kg/s	14,8647	14,8333		11,1027
10	Continuous	204,454	-9,86145	kg/s	0	0	11,0714	11,0714
11	Continuous	216,305	-10,0218	kg/s	0	0		8,90198
12	Continuous	222,008	-10,099	kg/s	0	0		7,8451
13	Continuous	270,129	-10,1391	kg/s	0	0		3,67483
14	Continuous	489,438	-10,1391	kg/s	0	0		0,366534

Weather: Category 5/D

Wind speed [m/s]	**5**
Pasquill stability	**D neutral - little sun and high wind or overcast/windy night**
Atmospheric temperature [degC]	25
Relative humidity [fraction]	0,75
Solar radiation flux [kW/m2]	0,5
Mixing layer height [m]	800

Observer Release Data and Observer Mass Data

					Masses or mass rates			
Observer number	**Release type**	**Start time [s]**	**Start downwind distance [m]**	**Unit**	**Release**	**Rainout**	**Pool vapour pick-up**	**Final**
1	Continuous	0	0	kg/s	14,8647	14,8333		0,0313637
2	Continuous	0,22	-0,246407	kg/s	14,8647	14,8333		0,805221
3	Continuous	42,0039	-5,98326	kg/s	14,8647	14,8333		10,9249
4	Continuous	74,3561	-7,18172	kg/s	14,8647	14,8333		11,858
5	Continuous	104,824	-7,96508	kg/s	14,8647	14,8333		12,3117
6	Continuous	134,311	-8,56091	kg/s	14,8647	14,8333		12,6235
7	Continuous	163,137	-9,0425	kg/s	14,8647	14,8333		12,9081
8	Continuous	191,493	-9,448	kg/s	14,8647	14,8333		13,0684
9	Continuous	219,496	-9,79893	kg/s	14,8647	14,8333		12,9576
10	Continuous	221,199	-9,82027	kg/s	14,8647	14,8333		12,5053

11	Continuous	221,2	-9,82027	kg/s	0	0	12,4739	12,4739
12	Continuous	233,051	-9,87172	kg/s	0	0		8,60954
13	Continuous	262,25	-9,87172	kg/s	0	0		5,12307
14	Continuous	452,98	-9,87172	kg/s	0	0		0,466634

Early Pool Fire Report

Workspace: 1RiempFSRU-4R

Study: Riempimento FSRU-ME4

Equipment Item: 4R Linee di caricamento serbatoi GNL

1RiempFSRU-4R\Riempimento FSRU-ME4\4R Linee di caricamento serbatoi GNL

Material	**GAS NATURALE**	
East	0	m
North	0	m

Scenario (Leak) : 80mm

1RiempFSRU-4R\Riempimento FSRU-ME4\4R Linee di caricamento serbatoi GNL\80mm

Weather: Category 2/F

Wind speed [m/s]	**2**
Pasquill stability	**F stable - night with moderate clouds and light/moderate wind**
Atmospheric temperature [degC]	**25**
Relative humidity [fraction]	**0,75**
Solar radiation flux [kW/m2]	0,5

Pool fire model results

Early pool fires are assumed to occur at a time when the initial PVAP rainout rate equals the pool fire burn rate, unless the thus calculated pool fire radius exceeds the maximum PVAP pool radius. For the latter case the early pool fire radius is assumed to be the maximum PVAP pool radius. The pool fire centre is located at the rainout point.

INPUT DATA

Correlation Type: Thomas / Johnson

Surface type	Land	
Pool fire elevation	0	m
Maximum exposure duration	20	s
Downwind distance of liquid rainout	0	m
Use two zone pool fire model	No	

OUTPUT DATA

Pool fire diameter	14,0091	m
Downwind distance of pool fire centre	0	m
Pool fire flame length	26,1024	m
Angle between pool fire axis and vertical	32,089	deg
Flame emissive power	189,05	kW/m2
Total burn rate	12,8339	kg/s
Radiative fraction	0,389223	fraction

Radiation Intensity Ellipse Results

INPUT DATA

For ellipses 'observer direction' refers to whether inclination is 'fixed' or 'variable'. Orientation is always variable.

Observer direction	Variable	
Exposure duration	20	s
Height of interest	**1,7**	m

OUTPUT DATA

Radiation intensity

Incident radiation [kW/m2]	Lethality [%]	View factor	Probit	Dose [(W/m2)^ProbitN.s]	Ellipse half-length [m]	Ellipse half-width [m]	Ellipse centre downwind distance [m]	Effect downwind distance [m]	Ellipse area [m2]
3	0	0,0158688	-1,38321	865.119	68,8312	70,7344	9,49743	78,3287	15295,6
5	0,000174704	0,026448	0,360367	1.709.491	53,8697	55,2849	9,30316	63,1728	9356,22
7	0,02405	0,0370272	1,50883	2.677.313	45,6688	46,8025	9,07672	54,7456	6714,89
12,5	6,52536	0,0661	3,487	5.800.162	34,46	34,66	8,89581	43,3629	3753,

		2	89		71	31			38
37,5	98,7381	0,19836	7,23773	25.094.924	19,1594	17,956	6,60301	25,7624	1080,79

Radiation v Distance Results

INPUT DATA

Maximum distance	78,3287	m
Angle from wind direction	0	deg
Observer direction	Variable	
Height of interest	**1,7**	m

OUTPUT DATA

Downwind distance [m]	Maximum incident radiation [kW/m2]	Lethality level [fraction]
0	189,05	1
1,59854	189,05	1
3,19709	189,05	1
4,79563	189,05	1
6,39418	189,05	1
7,99272	189,05	1
9,59127	133,991	1
11,1898	107,945	1
12,7884	90,8215	1
14,3869	78,4849	0,999999
15,9854	69,2696	0,999993
17,584	61,9722	0,999961
19,1825	56,0217	0,999846
20,7811	51,0966	0,999506
22,3796	46,4543	0,998504
23,9782	42,0253	0,995688
25,5767	37,9492	0,988648
27,1753	34,2318	0,972979
28,7738	30,8606	0,942097
30,3723	27,8179	0,88845

31,9709	25,0833	0,806515
33,5694	22,6346	0,696551
35,168	20,4485	0,566638
36,7665	18,5011	0,431026
38,3651	16,769	0,305277
39,9636	15,2294	0,201016
41,5622	13,861	0,123156
43,1607	12,6441	0,0703772
44,7592	11,5609	0,0376459
46,3578	10,5954	0,018931
47,9563	9,7334	0,00899114
49,5549	8,96235	0,00405235
51,1534	8,27125	0,00174136
52,752	7,65048	0,00071668
54,3505	7,11874	0,000297687
55,9491	6,65398	0,000124086
57,5476	6,22946	5,03021E-05
59,1461	5,84112	1,98863E-05
60,7447	5,48533	7,68671E-06
62,3432	5,15883	2,91188E-06
63,9418	4,85874	1,08343E-06
65,5403	4,58247	3,9672E-07
67,1389	4,32773	1,43225E-07
68,7374	4,09246	5,10659E-08
70,3359	3,87484	1,80085E-08
71,9345	3,67324	0
73,533	3,48619	0
75,1316	3,31239	0
76,7301	3,15068	0
78,3287	2,99999	0

Weather: Category 5/D

Wind speed [m/s]	**5**
Pasquill stability	**D neutral - little sun and high wind or overcast/windy night**
Atmospheric temperature [degC]	25
Relative humidity [fraction]	0,75
Solar radiation flux [kW/m2]	0,5

Pool fire model results

Early pool fires are assumed to occur at a time when the initial PVAP rainout rate equals the pool fire burn rate, unless the thus calculated pool fire radius exceeds the maximum PVAP pool radius. For the latter case the early pool fire radius is assumed to be the maximum PVAP pool radius. The pool fire centre is located at the rainout point.

INPUT DATA

Correlation Type: Thomas / Johnson

Surface type	Land	
Pool fire elevation	0	m
Maximum exposure duration	20	s
Downwind distance of liquid rainout	0	m
Use two zone pool fire model	No	

OUTPUT DATA

Pool fire diameter	14,0091	m
Downwind distance of pool fire centre	0	m
Pool fire flame length	26,1024	m
Angle between pool fire axis and vertical	49,3903	deg
Flame emissive power	189,05	kW/m2
Total burn rate	12,8339	kg/s
Radiative fraction	0,389223	fraction

Radiation Intensity Ellipse Results

INPUT DATA

For ellipses 'observer direction' refers to whether inclination is 'fixed' or 'variable'. Orientation is always variable.

Observer direction	Variable	
Exposure duration	20	s
Height of interest	**1,7**	m

OUTPUT DATA

Radiation intensity

Incident radiation [kW/m2]	Lethality [%]	View factor	Probit	Dose [(W/m2)^ProbitN.s]	Ellipse half-length [m]	Ellipse half-width [m]	Ellipse centre downwind distance [m]	Effect downwind distance [m]	Ellipse area [m2]
3	0	0,0158688	-1,38321	865.119	64,9815	69,2609	13,2662	78,2478	14139,3
5	0,000174704	0,026448	0,360367	1.709.491	51,5132	54,501	13,0912	64,6044	8820,09
7	0,02405	0,0370272	1,50883	2.677.313	44,2411	46,4312	12,879	57,1201	6453,36
12,5	6,52536	0,06612	3,48789	5.800.162	34,0612	34,941	12,207	46,2682	3738,91
37,5	98,7381	0,19836	7,23773	25.094.924	21,2583	19,1006	9,90001	31,1583	1275,63

Radiation v Distance Results

INPUT DATA

Maximum distance	78,2478	m
Angle from wind direction	0	deg
Observer direction	Variable	
Height of interest	**1,7**	m

OUTPUT DATA

Downwind distance [m]	Maximum incident	Lethality level [fraction]

	radiation [kW/m2]	
0	189,05	1
1,59689	189,05	1
3,19379	189,05	1
4,79068	189,05	1
6,38757	189,05	1
7,98446	189,05	1
9,58136	145,687	1
11,1783	120,559	1
12,7751	104,769	1
14,372	92,8289	1
15,9689	83,0653	1
17,5658	75,7637	0,999998
19,1627	69,883	0,999994
20,7596	64,5055	0,999978
22,3565	59,9643	0,999938
23,9534	55,9552	0,999843
25,5503	52,3487	0,999633
27,1472	49,0989	0,999205
28,7441	44,6376	0,99769
30,341	39,882	0,992816
31,9379	35,2894	0,97884
33,5348	31,0442	0,944406
35,1316	27,227	0,873904
36,7285	23,8588	0,756253
38,3254	20,9247	0,597315
39,9223	18,3897	0,422941
41,5192	16,6554	0,297194
43,1161	15,0988	0,192862
44,713	13,7079	0,115605
46,3099	12,4695	0,0641981
47,9068	11,3684	0,0331783
49,5037	10,3896	0,0160447
51,1006	9,51898	0,00730278
52,6975	8,74344	0,00314679

54,2944	8,05132	0,00129104
55,8913	7,4323	0,000507029
57,4881	6,87736	0,000191562
59,085	6,37863	6,99434E-05
60,6819	5,92929	2,47824E-05
62,2788	5,52341	8,55305E-06
63,8757	5,15587	2,88496E-06
65,4726	4,82222	9,53903E-07
67,0695	4,51861	3,10018E-07
68,6664	4,24167	9,92727E-08
70,2633	3,98849	3,13883E-08
71,8602	3,75651	9,8182E-09
73,4571	3,54352	0
75,054	3,34754	0
76,6509	3,16688	0
78,2478	3,00001	0