ENDF6-Transformation of the MENDL-2 and WIND transmutation libraries

A. J. Koning
Netherlands Energy Research Foundation ECN,
BU - Nuclear Energy, P.O. Box 1, 1755 ZG Petten, The Netherlands

Abstract

The MENDL [1] and WIND [2] transmutation libraries have been transformed to the ENDF6-format. A drawback of the original form of these libraries was that they were not processable due to an alternative method to store the residual production cross sections. The new representation of the data is outlined. The transformed library has been checked with the ENDF6 preprocessing tools CHECKR, FIZCON and PSYCHE. In the process of transformation, several errors have been corrected.

This report has also been published as an NEA document.

I. INTRODUCTION

The Medium Energy Nuclear Data Library, MENDL [1], contains residual production cross sections for neutrons with energies up to 100 MeV incident on stable and unstable nuclei. In total, 57,000 threshold reactions are included for elements ranging from Aluminium to Polonium. MENDL has been created by Shubin, Lunev, Konobeyev and Dityuk. The Waste Incineration Nuclear Data library, WIND [2], contains fission and residual production cross sections for neutrons up to 100 MeV for Uranium, Neptunium and Plutonium isotopes. WIND is made by Konobeyev, Korovin, Preslavtsev, Plyaskin and Stankovsky. Both libraries, are important for activation studies on Accelerator-Driven Systems. They serve as a good starting point for extension of the present activation libraries to higher energies, as requested by the applied community.

A drawback of these libraries, in their original format, is that they are not represented in the commonly used ENDF6-format. A huge extension of the ENDF6-format is employed in the original version of WIND and MENDL (see Appendix A) and it is not probable that the connection with applied calculations can be achieved with a processing code like NJOY. The importance of these data calls for a transformation to a representation in which they can be applied.

The ENDF6-representation of the data is as proposed in a NEA report [3]. The library has been checked with the ENDF6 preprocessing tools CHECKR, FIZCON and PSYCHE [4].

II. DATA TRANSFORMATION

A. The original file

In appendix A, the original MENDL-file for Fe-56 is given. In the MENDL formalism detailed reaction paths, such as (n,2n), (n,3n), etc., as specified in the ENDF6-format, have been retained as much as possible. For production of other nuclides, vacant MT-numbers have been used to store the residual production cross section. At the same time, reaction paths are lumped to obtain the same residual nucleus.

B. The new file

In the new file, see appendix B, all information is stored in MT5 of MF3 and MF6. We have constructed a total reaction cross section σ_{reaction} by adding all partial residual production cross sections of the original MENDL-2 evaluation and have stored the results in MF3/MT5. The yields $Y(Z,A)$ of each produced residual nucleus are given in MF6/MT5. These can be multiplied with MF3/MT5 to obtain the (original) residual production cross sections $\sigma(Z,A)$:

$$\sigma(Z,A) = Y(Z,A) * \sigma_{\text{reaction}} \tag{2.1}$$

We have used a boundary condition for inclusion of a residual nucleus in the new file: If, for a certain residual nuclide, the highest production cross section of the whole energy grid

is smaller than 1.10^{-10}, the corresponding subsection in MF6/MT5 is not included in the present file. This automatically limits the total number of residual nuclides (subsections) to a maximum of 100, which is the ENDF6-limit. Also accuracy problems in the (pre-)processing are avoided.

For the actinides in the WIND library, the method is the same. The only extra addition is MF3/MT18, where the fission cross sections are stored. With regard to the physics in the MENDL and WIND libraries, we stress again that we have created reaction cross sections by adding all partial cross sections, i.e. they do not originate from an independent source.

III. ERRORS

In the process of transforming the libraries, we have found several errors in the original MENDL. We will list them here so that such errors can be prevented in future work.

- The number of energy points did not correspond with the actual number of energies given in the table. This occurred for:
  - Fe-53, MT103 and MT175.
  - Fe-56, MT175.
  - Ni-56, MT103 and MT175.
- Br-82: the maximum energy runs to 74 MeV instead of 100 MeV.
- For several nuclides the energy order is wrong. The first case where this occurs is Al-27, MT177 (Na-22 production).

Apart from the case of Br-82 (all sections still run to 74 MeV), these errors have been corrected in the new version.

IV. CHECKING

The new MENDL and WIND libraries have been checked with CHECKR, FIZCON and PSYCHE. In Appendix C, the employed input files are given. Apart from expected comments from these codes (such as the omission of MF2 and MF4) no errors have been detected.

V. CONCLUSION

The MENDL and WIND libraries have been transformed to ENDF6-format and have been checked with ENDF6 utility codes. The new libraries are available at the NEA Data Bank. The size is 52.3 Mb (MENDL) and 0.8 Mb (WIND), respectively. A possible next step is to combine these data with low-energy (i.e. < 20 MeV) activation libraries such as ECNAF [5]. This would require a transformation from the data of ECNAF to the format as described in this paper, using MF6 for isomeric branching.

REFERENCES

[1] Yu.N. Shubin, V.P. Lunev, A.Yu. Konobeyev and A.I. Dityuk, Cross-Section Data Library MENDL-2 to Study Activation and Transmutation of Materials Irradiated by Nucleons of Intermediate Energies, IAEA report, INDC(CCP)-385, May 1995.

[2] A. Yu. Konobeyev, Yu. A. Korovin, P.E. Pereslavtsev, V.I. Plyaskin and A. Yu. Stankovsky, Nuclear Data Library for Transactinides at Energies up to 100 MeV, IAEA report, INDC(CCP)-384, July 1995.

[3] A.J. Koning, Requirements for an Evaluated Nuclear Data File for Accelerator-Based Transmutation, NEA/NSC/DOC(93) 6.

[4] C. Dunford, ENDF Utility Codes Release 6.10, IAEA report, IAEA-NDS-29, November 1995.

[5] D.W. Muir and A.J. Koning, "Validation of the ECNAF neutron activation cross-section library", *Second International Conference on Accelerator-Driven Transmutation Technologies and Applications*, Kalmar, Sweden, June 3-7 1996.

APPENDIX A: ORIGINAL MENDL-FILE FOR FE-56

```
FE- 56    MENDL-2                                                    3333 0  0     0
 2.6056E+04 5.6000E+01          -1           0          49          12656 1451    1
 0.0000E+00 0.0000E+00           0           0           0          62656 1451    2
 1.0000E+00 0.0000E+00           0           0          10          22656 1451    3
 0.0000E+00 0.0000E+00           0           0         122         962656 1451    4
 26-FE- 56 IPPE       EVAL-YUL94 YU.N.SHUBIN ET.AL.                  2656 1451    5
                      DIST-SEP94                                     2656 1451    6
 ----MENDL-2          MATERIAL 2656                                  2656 1451    7
 -----INCIDENT NEUTRON DATA                                          2656 1451    8
 -------ENDF-6 FORMAT                                               2656 1451    9
 AUTHORS OF EVALUATION: YU.N.SHUBIN, V.P.LUNEV, A.YU.KONOBEYEV,      2656 1451   10
                        A.I.DITYUK                                   2656 1451   11
                                                                     2656 1451   12
  FILE OF INTERMEDIATE DATA LIBRARY MENDL                            2656 1451   13
  ENERGY OF PROJECTILE: 0-100 MEV                                    2656 1451   14
  REFERENCE: REPORT IPPE, 1994                                       2656 1451   15
                                                                     2656 1451   16
 CONTENT OF FILE:                                                    2656 1451   17
                                                                     2656 1451   18
 MF = 1  GENERAL INFORMATION                                         2656 1451   19
                                                                     2656 1451   20
  MT = 451  COMMENTS AND DICTIONARY                                  2656 1451   21
                                                                     2656 1451   22
 MF = 3  NEUTRON CROSS-SECTIONS                                      2656 1451   23
                                                                     2656 1451   24
   MT=16,17,37,103,111 ARE STANDARD ENDF-6 SECTIONS,                 2656 1451   25
 OTHER MT NUMBERS ARE NEW ASSIGNED                                   2656 1451   26
   IN FOLLOWING DESCRIPTION "(N,X)" MEANS SUM CROSS-SECTIONS OF      2656 1451   27
 ALL REACTIONS RESULTED IN THE SAME RESIDUAL NUCLEUS WITHOUT         2656 1451   28
 RADIOACTIVE DECAY TAKEN INTO ACCOUNT                                2656 1451   29
                                                                     2656 1451   30
   MT = 16 (N,2N)          CROSS-SECTION  ( FE 55 PRODUCTION )       2656 1451   31
   MT = 17 (N,3N)          CROSS-SECTION  ( FE 54 PRODUCTION )       2656 1451   32
   MT = 37 (N,4N)          CROSS-SECTION  ( FE 53 PRODUCTION )       2656 1451   33
   MT =103 (N,P)           CROSS-SECTION  ( MN 56 PRODUCTION )       2656 1451   34
   MT =111 (N,2P)          CROSS-SECTION  ( CR 55 PRODUCTION )       2656 1451   35
   MT =121 (N,5N)          CROSS-SECTION  ( FE 52 PRODUCTION )       2656 1451   36
   MT =122 (N,6N)          CROSS-SECTION  ( FE 51 PRODUCTION )       2656 1451   37
   MT =123 (N,7N)          CROSS-SECTION  ( FE 50 PRODUCTION )       2656 1451   38
   MT =124 (N,8N)          CROSS-SECTION  ( FE 49 PRODUCTION )       2656 1451   39
   MT =153 (N,NP)+(N,D)    CROSS-SECTION  ( MN 55 PRODUCTION )       2656 1451   40
   MT =154 (N,2NP)+(N,ND)  CROSS-SECTION  ( MN 54 PRODUCTION )       2656 1451   41
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MT =155	(N,3NP)+(N,2ND)	CROSS-SECTION	(MN 53 PRODUCTION)	2656 1451	42
MT =156	(N,4NP)+(N,3ND)	CROSS-SECTION	(MN 52 PRODUCTION)	2656 1451	43
MT =157	(N,5NP)+(N,4ND)	CROSS-SECTION	(MN 51 PRODUCTION)	2656 1451	44
MT =158	(N,6NP)+(N,5ND)	CROSS-SECTION	(MN 50 PRODUCTION)	2656 1451	45
MT =159	(N,7NP)+(N,6ND)	CROSS-SECTION	(MN 49 PRODUCTION)	2656 1451	46
MT =160	(N,8NP)+(N,7ND)	CROSS-SECTION	(MN 48 PRODUCTION)	2656 1451	47
MT =174	(N,N2P)+(N,1PD)	CROSS-SECTION	(CR 54 PRODUCTION)	2656 1451	48
MT =175	(N,2N2P)+(N,X)	CROSS-SECTION	(CR 53 PRODUCTION)	2656 1451	49
MT =176	(N,3N2P)+(N,X)	CROSS-SECTION	(CR 52 PRODUCTION)	2656 1451	50
MT =177	(N,4N2P)+(N,X)	CROSS-SECTION	(CR 51 PRODUCTION)	2656 1451	51
MT =178	(N,5N2P)+(N,X)	CROSS-SECTION	(CR 50 PRODUCTION)	2656 1451	52
MT =179	(N,6N2P)+(N,X)	CROSS-SECTION	(CR 49 PRODUCTION)	2656 1451	53
MT =180	(N,7N2P)+(N,X)	CROSS-SECTION	(CR 48 PRODUCTION)	2656 1451	54
MT =181	(N,8N2P)+(N,X)	CROSS-SECTION	(CR 47 PRODUCTION)	2656 1451	55
MT =182	(N,9N2P)+(N,X)	CROSS-SECTION	(CR 46 PRODUCTION)	2656 1451	56
MT =219	(N,3P)	CROSS-SECTION	(V 54 PRODUCTION)	2656 1451	57
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MT =221	(N,2N3P)+(N,X)	CROSS-SECTION	(V 52 PRODUCTION)	2656 1451	59
MT =222	(N,3N3P)+(N,X)	CROSS-SECTION	(V 51 PRODUCTION)	2656 1451	60
MT =223	(N,4N3P)+(N,X)	CROSS-SECTION	(V 50 PRODUCTION)	2656 1451	61
MT =224	(N,5N3P)+(N,X)	CROSS-SECTION	(V 49 PRODUCTION)	2656 1451	62
MT =225	(N,6N3P)+(N,X)	CROSS-SECTION	(V 48 PRODUCTION)	2656 1451	63
MT =226	(N,7N3P)+(N,X)	CROSS-SECTION	(V 47 PRODUCTION)	2656 1451	64
MT =227	(N,8N3P)+(N,X)	CROSS-SECTION	(V 46 PRODUCTION)	2656 1451	65
MT =228	(N,9N3P)+(N,X)	CROSS-SECTION	(V 45 PRODUCTION)	2656 1451	66
MT =254	(N,4P)	CROSS-SECTION	(TI 53 PRODUCTION)	2656 1451	67
MT =255	(N,N4P)+(N,3PD)	CROSS-SECTION	(TI 52 PRODUCTION)	2656 1451	68
MT =256	(N,2N4P)+(N,X)	CROSS-SECTION	(TI 51 PRODUCTION)	2656 1451	69
MT =257	(N,3N4P)+(N,X)	CROSS-SECTION	(TI 50 PRODUCTION)	2656 1451	70
MT =258	(N,4N4P)+(N,X)	CROSS-SECTION	(TI 49 PRODUCTION)	2656 1451	71
MT =259	(N,5N4P)+(N,X)	CROSS-SECTION	(TI 48 PRODUCTION)	2656 1451	72
MT =260	(N,6N4P)+(N,X)	CROSS-SECTION	(TI 47 PRODUCTION)	2656 1451	73
MT =261	(N,7N4P)+(N,X)	CROSS-SECTION	(TI 46 PRODUCTION)	2656 1451	74
MT =262	(N,8N4P)+(N,X)	CROSS-SECTION	(TI 45 PRODUCTION)	2656 1451	75
MT =263	(N,9N4P)+(N,X)	CROSS-SECTION	(TI 44 PRODUCTION)	2656 1451	76
MT =264	(N,10N4P)+(N,X)	CROSS-SECTION	(TI 43 PRODUCTION)	2656 1451	77
MT =275	(N,5P)	CROSS-SECTION	(SC 52 PRODUCTION)	2656 1451	78
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MT =277	(N,2N5P)+(N,X)	CROSS-SECTION	(SC 50 PRODUCTION)	2656 1451	80
MT =278	(N,3N5P)+(N,X)	CROSS-SECTION	(SC 49 PRODUCTION)	2656 1451	81
MT =279	(N,4N5P)+(N,X)	CROSS-SECTION	(SC 48 PRODUCTION)	2656 1451	82
MT =280	(N,5N5P)+(N,X)	CROSS-SECTION	(SC 47 PRODUCTION)	2656 1451	83
MT =281	(N,6N5P)+(N,X)	CROSS-SECTION	(SC 46 PRODUCTION)	2656 1451	84
MT =282	(N,7N5P)+(N,X)	CROSS-SECTION	(SC 45 PRODUCTION)	2656 1451	85
MT =283	(N,8N5P)+(N,X)	CROSS-SECTION	(SC 44 PRODUCTION)	2656 1451	86

MT =284 (N,9N5P)+(N,X)	CROSS-SECTION	(SC 43 PRODUCTION)	2656 1451	87
MT =285 (N,10N5P)+(N,X)	CROSS-SECTION	(SC 42 PRODUCTION)	2656 1451	88
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MT =470 (N,3N6P)+(N,X)	CROSS-SECTION	(CA 48 PRODUCTION)	2656 1451	92
MT =471 (N,4N6P)+(N,X)	CROSS-SECTION	(CA 47 PRODUCTION)	2656 1451	93
MT =472 (N,5N6P)+(N,X)	CROSS-SECTION	(CA 46 PRODUCTION)	2656 1451	94
MT =473 (N,6N6P)+(N,X)	CROSS-SECTION	(CA 45 PRODUCTION)	2656 1451	95
MT =474 (N,7N6P)+(N,X)	CROSS-SECTION	(CA 44 PRODUCTION)	2656 1451	96
MT =475 (N,8N6P)+(N,X)	CROSS-SECTION	(CA 43 PRODUCTION)	2656 1451	97
MT =476 (N,9N6P)+(N,X)	CROSS-SECTION	(CA 42 PRODUCTION)	2656 1451	98
MT =477 (N,10N6P)+(N,X)	CROSS-SECTION	(CA 41 PRODUCTION)	2656 1451	99
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MT =479 (N,12N6P)+(N,X)	CROSS-SECTION	(CA 39 PRODUCTION)	2656 1451	101
MT =573 (N,7P)	CROSS-SECTION	(K 50 PRODUCTION)	2656 1451	102
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MT =576 (N,3N7P)+(N,X)	CROSS-SECTION	(K 47 PRODUCTION)	2656 1451	105
MT =577 (N,4N7P)+(N,X)	CROSS-SECTION	(K 46 PRODUCTION)	2656 1451	106
MT =578 (N,5N7P)+(N,X)	CROSS-SECTION	(K 45 PRODUCTION)	2656 1451	107
MT =579 (N,6N7P)+(N,X)	CROSS-SECTION	(K 44 PRODUCTION)	2656 1451	108
MT =580 (N,7N7P)+(N,X)	CROSS-SECTION	(K 43 PRODUCTION)	2656 1451	109
MT =581 (N,8N7P)+(N,X)	CROSS-SECTION	(K 42 PRODUCTION)	2656 1451	110
MT =582 (N,9N7P)+(N,X)	CROSS-SECTION	(K 41 PRODUCTION)	2656 1451	111
MT =583 (N,10N7P)+(N,X)	CROSS-SECTION	(K 40 PRODUCTION)	2656 1451	112
MT =584 (N,11N7P)+(N,X)	CROSS-SECTION	(K 39 PRODUCTION)	2656 1451	113
MT =873 (N,2N8P)+(N,X)	CROSS-SECTION	(AR 47 PRODUCTION)	2656 1451	114
MT =874 (N,3N8P)+(N,X)	CROSS-SECTION	(AR 46 PRODUCTION)	2656 1451	115
MT =875 (N,4N8P)+(N,X)	CROSS-SECTION	(AR 45 PRODUCTION)	2656 1451	116
MT =876 (N,5N8P)+(N,X)	CROSS-SECTION	(AR 44 PRODUCTION)	2656 1451	117
MT =877 (N,6N8P)+(N,X)	CROSS-SECTION	(AR 43 PRODUCTION)	2656 1451	118
MT =878 (N,7N8P)+(N,X)	CROSS-SECTION	(AR 42 PRODUCTION)	2656 1451	119
MT =879 (N,8N8P)+(N,X)	CROSS-SECTION	(AR 41 PRODUCTION)	2656 1451	120
MT =880 (N,9N8P)+(N,X)	CROSS-SECTION	(AR 40 PRODUCTION)	2656 1451	121
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MT =882 (N,11N8P)+(N,X)	CROSS-SECTION	(AR 38 PRODUCTION)	2656 1451	123
MT =883 (N,12N8P)+(N,X)	CROSS-SECTION	(AR 37 PRODUCTION)	2656 1451	124
MT =884 (N,13N8P)+(N,X)	CROSS-SECTION	(AR 36 PRODUCTION)	2656 1451	125
			2656 1451	126
	1 451	222	12656 1451	127
	3 16	26	12656 1451	128
	3 17	21	12656 1451	129
	3 37	17	12656 1451	130
	3 103	30	12656 1451	131

3	111	24	12656	1451	132
3	121	13	12656	1451	133
3	122	10	12656	1451	134
3	123	8	12656	1451	135
3	124	5	12656	1451	136
3	153	27	12656	1451	137
3	154	22	12656	1451	138
3	155	18	12656	1451	139
3	156	14	12656	1451	140
3	157	12	12656	1451	141
3	158	9	12656	1451	142
3	159	7	12656	1451	143
3	160	4	12656	1451	144
3	174	22	12656	1451	145
3	175	31	12656	1451	146
3	176	25	12656	1451	147
3	177	20	12656	1451	148
3	178	17	12656	1451	149
3	179	13	12656	1451	150
3	180	11	12656	1451	151
3	181	8	12656	1451	152
3	182	6	12656	1451	153
3	219	18	12656	1451	154
3	220	17	12656	1451	155
3	221	23	12656	1451	156
3	222	21	12656	1451	157
3	223	17	12656	1451	158
3	224	14	12656	1451	159
3	225	11	12656	1451	160
3	226	10	12656	1451	161
3	227	7	12656	1451	162
3	228	5	12656	1451	163
3	254	14	12656	1451	164
3	255	13	12656	1451	165
3	256	19	12656	1451	166
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3	258	23	12656	1451	168
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3	260	16	12656	1451	170
3	261	13	12656	1451	171
3	262	10	12656	1451	172
3	263	9	12656	1451	173
3	264	6	12656	1451	174
3	275	11	12656	1451	175
3	276	10	12656	1451	176

3	277	14	12656	1451	177
3	278	13	12656	1451	178
3	279	18	12656	1451	179
3	280	16	12656	1451	180
3	281	13	12656	1451	181
3	282	11	12656	1451	182
3	283	9	12656	1451	183
3	284	7	12656	1451	184
3	285	5	12656	1451	185
3	467	8	12656	1451	186
3	468	8	12656	1451	187
3	469	11	12656	1451	188
3	470	11	12656	1451	189
3	471	14	12656	1451	190
3	472	13	12656	1451	191
3	473	18	12656	1451	192
3	474	15	12656	1451	193
3	475	12	12656	1451	194
3	476	11	12656	1451	195
3	477	9	12656	1451	196
3	478	7	12656	1451	197
3	479	5	12656	1451	198
3	573	5	12656	1451	199
3	574	5	12656	1451	200
3	575	8	12656	1451	201
3	576	8	12656	1451	202
3	577	11	12656	1451	203
3	578	10	12656	1451	204
3	579	13	12656	1451	205
3	580	12	12656	1451	206
3	581	10	12656	1451	207
3	582	9	12656	1451	208
3	583	7	12656	1451	209
3	584	6	12656	1451	210
3	873	6	12656	1451	211
3	874	6	12656	1451	212
3	875	8	12656	1451	213
3	876	8	12656	1451	214
3	877	11	12656	1451	215
3	878	10	12656	1451	216
3	879	13	12656	1451	217
3	880	12	12656	1451	218
3	881	10	12656	1451	219
3	882	9	12656	1451	220
3	883	7	12656	1451	221

```
                                    3         884           5          12656 1451  222
                                                                         2656 1   0  223
                                                                         2656 0   0  224
 2.6056E+04 5.6000E+01                0           0           0          02656 3 16  225
-1.1198E+07-1.1198E+07                0           0           1         672656 3 16  226
         67           2                                                  2656 3 16  227
 1.1400E+07 0.0000E+00 1.2000E+07 5.6700E-02 1.2500E+07 1.9800E-012656 3 16  228
 1.3000E+07 3.7200E-01 1.3500E+07 5.3900E-01 1.4000E+07 6.8100E-012656 3 16  229
 1.4500E+07 7.6300E-01 1.5000E+07 8.1700E-01 1.6000E+07 9.5600E-012656 3 16  230
 1.7000E+07 9.9500E-01 1.8000E+07 9.6600E-01 1.9000E+07 9.5600E-012656 3 16  231
 2.0000E+07 9.4600E-01 2.1000E+07 9.2200E-01 2.2000E+07 8.9100E-012656 3 16  232
 2.3000E+07 8.1900E-01 2.4000E+07 7.2200E-01 2.5000E+07 6.2100E-012656 3 16  233
 2.6000E+07 5.2100E-01 2.7000E+07 4.3800E-01 2.8000E+07 3.7100E-012656 3 16  234
 2.9000E+07 3.3200E-01 3.0000E+07 2.9100E-01 3.1000E+07 2.5700E-012656 3 16  235
 3.2000E+07 2.3000E-01 3.3000E+07 2.1000E-01 3.4000E+07 1.9400E-012656 3 16  236
 3.5000E+07 1.7800E-01 3.6000E+07 1.6900E-01 3.7000E+07 1.6000E-012656 3 16  237
 3.8000E+07 1.5300E-01 3.9000E+07 1.4700E-01 4.0000E+07 1.4200E-012656 3 16  238
 4.1000E+07 1.3800E-01 4.2000E+07 1.3400E-01 4.3000E+07 1.3000E-012656 3 16  239
 4.4000E+07 1.2600E-01 4.5000E+07 1.2200E-01 4.6000E+07 1.1500E-012656 3 16  240
 4.7000E+07 1.1200E-01 4.8000E+07 1.0900E-01 5.0000E+07 1.0300E-012656 3 16  241
 5.2000E+07 9.8100E-02 5.4000E+07 9.4100E-02 5.6000E+07 9.0000E-022656 3 16  242
 5.8000E+07 8.6600E-02 6.0000E+07 8.4610E-02 6.2000E+07 8.2630E-022656 3 16  243
 6.4000E+07 8.0640E-02 6.6000E+07 7.8660E-02 6.8000E+07 7.6670E-022656 3 16  244
 7.0000E+07 7.4690E-02 7.2000E+07 7.2700E-02 7.4000E+07 7.0500E-022656 3 16  245
 7.6000E+07 6.6870E-02 7.8000E+07 6.3230E-02 8.0000E+07 5.9600E-022656 3 16  246
 8.2000E+07 5.7800E-02 8.4000E+07 5.6000E-02 8.6000E+07 5.4600E-022656 3 16  247
 8.8000E+07 5.3000E-02 9.0000E+07 5.5400E-02 9.2000E+07 5.4300E-022656 3 16  248
 9.4000E+07 5.2800E-02 9.6000E+07 5.1300E-02 9.8000E+07 4.9900E-022656 3 16  249
 1.0000E+08 4.8700E-02                                                  2656 3 16  250
                                                                        2656 3  0  251
 2.6056E+04 5.6000E+01                0           0           0          02656 3 17  252
-2.0496E+07-2.0496E+07                0           0           1         542656 3 17  253
         54           2                                                  2656 3 17  254
 2.0862E+07 0.0000E+00 2.2000E+07 2.5700E-03 2.3000E+07 5.3400E-022656 3 17  255
 2.4000E+07 1.0600E-01 2.5000E+07 1.8600E-01 2.6000E+07 2.5200E-012656 3 17  256
 2.7000E+07 2.9700E-01 2.8000E+07 3.2300E-01 2.9000E+07 3.2800E-012656 3 17  257
 3.0000E+07 3.3300E-01 3.1000E+07 3.3000E-01 3.2000E+07 3.2100E-012656 3 17  258
 3.3000E+07 3.1000E-01 3.4000E+07 3.0700E-01 3.5000E+07 2.9060E-012656 3 17  259
 3.6000E+07 2.7420E-01 3.7000E+07 2.5780E-01 3.8000E+07 2.4140E-012656 3 17  260
 3.9000E+07 2.2500E-01 4.0000E+07 2.2200E-01 4.1000E+07 2.0567E-012656 3 17  261
 4.2000E+07 1.8933E-01 4.3000E+07 1.7300E-01 4.4000E+07 1.6400E-012656 3 17  262
 4.5000E+07 1.5400E-01 4.6000E+07 1.4700E-01 4.7000E+07 1.3400E-012656 3 17  263
 4.8000E+07 1.2700E-01 5.0000E+07 1.1700E-01 5.2000E+07 1.0700E-012656 3 17  264
 5.4000E+07 1.0100E-01 5.6000E+07 9.1300E-02 5.8000E+07 8.0700E-022656 3 17  265
 6.0000E+07 7.4550E-02 6.2000E+07 6.8400E-02 6.4000E+07 6.4800E-022656 3 17  266
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