APPENDIX A
Air Emissions

APPENDIX A

2015 AIR EMISSIONS ASSESSMENT

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ASSESSMENT OF US ECOLOGY WASHINGTON AIR EMISSIONS

Summary

This appendix evaluates air emissions from the US Ecology Washington (USEW) Facility to verify compliance with Clean Air Act emissions standards. Air sampling results and the waste's isotopic distributions are used to develop an upper bound source term. This source term is input to the US Environmental Protection Agency (EPA) "Comply" Code and National Council on Radiation Protection and Measurements (NCRP) Commentary 3, "Screening Techniques for Determining Compliance with Environmental Standards" to demonstrate compliance. In spite of a number of conservative assumptions and the conservative nature of the models themselves, the dose contribution for USEW operations is negligible.

Description of Facility

All of the waste received at USEW is already packaged in closed containers with exterior surfaces below Department of Transportation (DOT) contamination levels. A majority of these packages are placed in trenches and covered with soil without opening the containers; therefore, there is very little potential for air emissions. However, a fraction of these packages must be opened for inspection, and a few burial containers are transported in shipping casks that may have contamination inside the cask. USEW also monitors these evolutions for airborne radionuclide emissions.

Most package inspections (PI) are conducted in a concrete block room in the south end of the USEW laboratory building. The room is approximately 16' by 23' with a 12' ceiling. Packages are placed inside an enclosed see-through tent located in the center of the room. The tent is 11' wide by 12' long and approximately 12' tall. The tent has flexible sides of heavy gauge plastic sheets. Two 1000-cfm axial fans (one normally operating) ventilate the inspection tent.

The ventilation system draws air from under the inspection tent skirt, around the package and up to an exhaust duct located in the top-center. The air then passes through roughing, charcoal and HEPA filters before entering the exhaust fans. Downstream of the fans, the air exits the building through a 16" square duct attached to louvers on the east side of the building. The vent is approximately 4 meters from the ground. The lab building is 7 meters high, 8 meters wide and 16 meters long. The ventilation system has filters installed, but they are not abatement technology. No filters are considered in the dose assessment.

Normal operation involves placing a package inside the tent for waste form verification. Waste form verification may include opening and/or punching a hole in the package, and inspection of package contents. The package is closed and patched as necessary before disposal.

Portable air samplers are used to monitor airborne activity during inspections. One air sampler is located inside the tent (the compliance sampler), one is in the inspection room outside the tent (background sampler), and one is at the air exhaust on the side of the building. Samplers are started before the package is opened and are changed and counted after the evolution is complete. Inspections for iodine containing material have an additional iodine cartridge, which is counted separately. The MDA for iodine is 7e-12 µCi/cc. The iodine sampling occurs only when the total inspection package iodine concentration exceeds 1 mCi. The MDA for gross alpha is approximately 2E-13µCi/ml and 3E-13µCi/ml for gross beta.

Occasionally, a large package which cannot fit inside the inspection tent is inspected at its restricted area storage location. Non-inspection events that may have airborne potential are also

monitored (such as decontamination, or internally contaminated shipping cask offloads). These events are monitored using a portable air sampler placed downwind from the evolution. These samplers start before the evolution starts and are changed and counted after the evolution is complete. An additional upwind sample may be collected to account for background radioactivity.

In 2015, 54 inspections were conducted; 53 were conducted inside the PI Facility tent and 1 outside near the disposal trench (Bates 24658). In addition, there were no cask offload activities deemed to have potential for release. Table A-1 lists the airborne radioactivity concentrations for each of the inspections conducted.

The average emission flow rate is 1000 cfm, and the total air volume is 1000 cfm * 54 inspection * 1 hr per inspection * 60 min/hr = 3.2E6 Cubic feet.

Table A-1- Potential Air Emissions Airborne Radioactivity Concentrations (Units are E-14 µCi/cc)

Date of inspection	BATES #		Alpha	Alpha Error	Beta	Beta Error	Iodine	Iodine Error
1/6/2015	24614	Vent Exhaust	8.29	3.11	28.00	5.14	-40.70	61.60
1/21/2015	24616	Vent Exhaust	5.45	3.13	22.10	62.50	-63.20	114.00
2/10/2015	24619	Vent Exhaust	18.90	11.80	81.30	22.50	NA	NA
2/11/2015	24621	Vent Exhaust	21.00	8.33	87.20	15.80	NA	NA
2/18/2015	24622	Vent Exhaust	5.79	6.57	43.70	10.00	NA	NA
2/26/2015	24623	Vent Exhaust	10.60	5.29	31.60	85.60	NA	NA
3/26/2015	24628	Vent Exhaust	0.00	3.77	23.80	8.36	NA	NA
5/11/2015	24633	Vent Exhaust	7.00	2.98	26.80	5.49	NA	NA
5/18/2015	24634	Vent Exhaust	7.56	4.19	36.80	9.19	NA	NA
5/28/2015	24635	Vent Exhaust	9.92	8.74	63.20	16.60	NA	NA
6/9/2015	24636	Vent Exhaust	3.07	3.51	17.20	10.30	NA	NA
6/24/2015	24638	Vent Exhaust	7.31	4.38	32.10	8.13	NA	NA
6/29/2015	24640	Vent Exhaust	15.00	6.56	71.90	12.20	NA	NA
7/16/2015	24641	Vent Exhaust	1.72	3.38	22.70	8.24	NA	NA
7/29/2015	24647	Vent Exhaust	8.53	4.92	39.90	9.49	NA	NA
8/4/2015	24648	Vent Exhaust	2.84	3.21	28.70	8.09	NA	NA
8/27/2015	24649	Vent Exhaust	6.03	6.83	45.20	14.00	NA	NA
9/3/2015	24650	Vent Exhaust	-3.42	4.38	21.10	10.10	NA	NA
9/14/2015	24652	Vent Exhaust	4.85	3.78	21.00	9.98	NA	NA
9/24/2015	24658	Out side	7.43	7.75	49.60	18.30	NA	NA
10/1/2015	24661	Vent Exhaust	-2.84	3.94	17.20	7.52	NA	NA
10/26/2015	24664	Vent Exhaust	2.11	4.18	25.50	7.34	-1.92	12.00
11/3/2015	24666	Vent Exhaust	3.83	4.16	33.20	7.67	NA	NA
11/10/2015	24667	Vent Exhaust	4.60	5.20	49.70	11.80	NA	NA
12/7/2015	24671	Vent Exhaust	-0.51	3.80	23.00	7.63	NA	NA
12/9/2015	24673	Vent Exhaust	7.56	5.55	32.20	9.38	NA	NA
12/22/2016	24677	Vent Exhaust	2.30	4.94	35.60	11.70	NA	NA

Source Term Evaluation

Airborne monitoring results and the manifested isotopic content of the inspected packages are used to determine the source term input into the Comply or CAP88 computer code. Isotopic concentrations for alpha and beta emitters are calculated from the average concentration adjusted to the isotopes percentage in the inspected waste. These isotopes and their fraction of manifested waste are provided in Table A-2.

In 2015, 11 PIs were manifested with iodine and 3 of those contained equal or greater than one mCi. No vent exhaust's iodine air concentrations were above our detection limits.

In 2015, one PI packages contained noble gases. Nobel gasses are assumed to be released at a fraction of 1E-3, based on the waste form of the material that contains them (solid).

In 2015, PI packages contained a total of 0.242 Ci of Class A unstable tritium. Unstable tritium is assumed to be released at a release fraction of 1E-3. No Class B Stable tritium packages were inspected. The class B tritium is placed in a metal container which is welded closed, then the metal container is solidified in concrete. The package inspection is limited to verifying that the concrete has solidified properly using non-destructive testing (impact hammer). The inner packages are not opened, and no tritium is thought to be released during these inspections. It is assumed that no tritium is released during normal class B tritium package inspections.

Release Concentrations

Releases were calculated as a one-hour release at the average concentrations of the isotopes listed in Table A-2:

Table A-2 Particulate Annual Release

Isotope	Isotope fraction	Decay Type	Annual Avg. Concentration (µCi/ml)	Ft3/min	Min. per Insp	Number per Year	cc/Ft3	Ci/µCi	Ci/Yr
Am-241		Alpha	5.92E-14	1000	60	26	28300	1.00E-06	0.000E+00
Bi-212		Alpha	5.92E-14	1000	60	26	28300	1.00E-06	0.000E+00
Cm-243		Alpha	5.92E-14	1000	60	26	28300	1.00E-06	0.000E+00
Cm-244		Alpha	5.92E-14	1000	60	26	28300	1.00E-06	0.000E+00
Np-237		Alpha	5.92E-14	1000	60	26	28300	1.00E-06	0.000E+00
Pb-210	3.228E-03	Alpha	5.92E-14	1000	60	26	28300	1.00E-06	8.438E-12
Po-210	4.979E-03	Alpha	5.92E-14	1000	60	26	28300	1.00E-06	1.301E-11
Pu-239/40	9.233E-04	Alpha	5.92E-14	1000	60	26	28300	1.00E-06	2.413E-12
Pu-241	8.798E-03	Alpha	5.92E-14	1000	60	26	28300	1.00E-06	2.299E-11
Ra-224		Alpha	5.92E-14	1000	60	26	28300	1.00E-06	0.000E+00
Ra-226	1.579E-01	Alpha	5.92E-14	1000	60	26	28300	1.00E-06	4.127E-10
Ra-226/Be	1.026E-02	Alpha	5.92E-14	1000	60	26	28300	1.00E-06	2.680E-11
Ra-228		Alpha	5.92E-14	1000	60	26	28300	1.00E-06	0.000E+00
Th-nat	6.391E-03	Alpha	5.92E-14	1000	60	26	28300	1.00E-06	1.670E-11
Th-227		Alpha	5.92E-14	1000	60	26	28300	1.00E-06	0.000E+00
Th-232	4.485E-04	Alpha	5.92E-14	1000	60	26	28300	1.00E-06	1.172E-12
U-dep	7.215E-01	Alpha	5.92E-14	1000	60	26	28300	1.00E-06	1.886E-09
U-nat	8.053E-02	Alpha	5.92E-14	1000	60	26	28300	1.00E-06	2.105E-10
U-232		Alpha	5.92E-14	1000	60	26	28300	1.00E-06	0.000E+00
U-233		Alpha	5.92E-14	1000	60	26	28300	1.00E-06	0.000E+00
U-234	1.065E-03	Alpha	5.92E-14	1000	60	26	28300	1.00E-06	2.784E-12
U-235		Alpha	5.92E-14	1000	60	26	28300	1.00E-06	0.000E+00
U-238	3.957E-03	Alpha	5.92E-14	1000	60	26	28300	1.00E-06	1.034E-11
Ac-228		Beta	3.62E-13	1000	60	26	28300	1.00E-06	0.000E+00
Ag-110m	3.221E-03	Beta	3.62E-13	1000	60	26	28300	1.00E-06	5.151E-11
Ba-133	9.252E-04	Beta	3.62E-13	1000	60	26	28300	1.00E-06	1.479E-11
Ba-140	8.326E-03	Beta	3.62E-13	1000	60	26	28300	1.00E-06	1.331E-10
C-14	1.647E-01	Beta	3.62E-13	1000	60	26	28300	1.00E-06	2.634E-09
Cd-109		Beta	3.62E-13	1000	60	26	28300	1.00E-06	0.000E+00
Ca-45		Beta	3.62E-13	1000	60	26	28300	1.00E-06	0.000E+00
Ce-141	7.047E-04	Beta	3.62E-13	1000	60	26	28300	1.00E-06	1.127E-11
Co-57	5.353E-04	Beta	3.62E-13	1000	60	26	28300	1.00E-06	8.560E-12
Co-58	8.218E-02	Beta	3.62E-13	1000	60	26	28300	1.00E-06	1.314E-09
Co-60	2.424E-01	Beta	3.62E-13	1000	60	26	28300	1.00E-06	3.876E-09
Cr-51	1.631E-02	Beta	3.62E-13	1000	60	26	28300	1.00E-06	2.608E-10
Cs-134	1.387E-02	Beta	3.62E-13	1000	60	26	28300	1.00E-06	2.218E-10
Cs-137	9.156E-02	Beta	3.62E-13	1000	60	26	28300	1.00E-06	1.464E-09
Eu-152	1.089E-02	Beta	3.62E-13	1000	60	26	28300	1.00E-06	1.742E-10
Eu-154		Beta	3.62E-13	1000	60	26	28300	1.00E-06	0.000E+00
Fe-55	8.250E-02	Beta	3.62E-13	1000	60	26	28300	1.00E-06	1.319E-09
Fe-59	1.031E-03	Beta	3.62E-13	1000	60	26	28300	1.00E-06	1.649E-11
Ge-68	7.850E-04	Beta	3.62E-13	1000	60	26	28300	1.00E-06	1.255E-11
Hf-181		Beta	3.62E-13	1000	60	26	28300	1.00E-06	0.000E+00
K-40	8.870E-02	Beta	3.62E-13	1000	60	26	28300	1.00E-06	1.418E-09
La-140	8.612E-04	Beta	3.62E-13	1000	60	26	28300	1.00E-06	1.377E-11
Mn-54	2.771E-02	Beta	3.62E-13	1000	60	26	28300	1.00E-06	4.431E-10
Na-22	5.819E-05	Beta	3.62E-13	1000	60	26	28300	1.00E-06	9.305E-13
Nb-93m	4.055E-02	Beta	3.62E-13	1000	60	26	28300	1.00E-06	6.483E-10
Nb-94	2.584E-03	Beta	3.62E-13	1000	60	26	28300	1.00E-06	4.131E-11
Nb-95	1.833E-04	Beta	3.62E-13	1000	60	26	28300	1.00E-06	2.931E-12
Ni-59	3.957E-04	Beta	3.62E-13	1000	60	26	28300	1.00E-06	6.327E-12
Ni-63	3.983E-02	Beta	3.62E-13	1000	60	26	28300	1.00E-06	6.369E-10
Ni-65		Beta	3.62E-13	1000	60	26	28300	1.00E-06	0.000E+00
P-32	5.411E-03	Beta	3.62E-13	1000	60	26	28300	1.00E-06	8.653E-11
P-33	2.909E-04	Beta	3.62E-13	1000	60	26	28300	1.00E-06	4.652E-12
Pa-234		Beta	3.62E-13	1000	60	26	28300	1.00E-06	0.000E+00
Pm-145		Beta	3.62E-13	1000	60	26	28300	1.00E-06	0.000E+00

Isotope	Isotope fraction	Decay Type	Annual Avg. Concentration (µCi/ml)	Ft3/min	Min. per Insp	Number per Year	cc/Ft3	Ci/µCi	Ci/Yr
Pm-147		Beta	3.62E-13	1000	60	26	28300	1.00E-06	0.000E+00
Pb-212		Beta	3.62E-13	1000	60	26	28300	1.00E-06	0.000E+00
Pr-144		Beta	3.62E-13	1000	60	26	28300	1.00E-06	0.000E+00
Ru-106		Beta	3.62E-13	1000	60	26	28300	1.00E-06	0.000E+00
S-35	5.086E-04	Beta	3.62E-13	1000	60	26	28300	1.00E-06	8.132E-12
Sc-46		Beta	3.62E-13	1000	60	26	28300	1.00E-06	0.000E+00
Sb-124	4.149E-04	Beta	3.62E-13	1000	60	26	28300	1.00E-06	6.634E-12
Sb-125	4.685E-03	Beta	3.62E-13	1000	60	26	28300	1.00E-06	7.492E-11
Sn-113	7.797E-03	Beta	3.62E-13	1000	60	26	28300	1.00E-06	1.247E-10
Sr-89	6.034E-04	Beta	3.62E-13	1000	60	26	28300	1.00E-06	9.649E-12
Sr-90	9.816E-04	Beta	3.62E-13	1000	60	26	28300	1.00E-06	1.570E-11
Tc-99		Beta	3.62E-13	1000	60	26	28300	1.00E-06	0.000E+00
Tl-208	1.214E-03	Beta	3.62E-13	1000	60	26	28300	1.00E-06	1.942E-11
Tl-204		Beta	3.62E-13	1000	60	26	28300	1.00E-06	0.000E+00
Y-90		Beta	3.62E-13	1000	60	26	28300	1.00E-06	0.000E+00
Zn-65		Beta	3.62E-13	1000	60	26	28300	1.00E-06	0.000E+00
Zr-95	5.713E-02	Beta	3.62E-13	1000	60	26	28300	1.00E-06	9.135E-10
H-3/T	1.885E-04	H-3		1000	60	26	28300	1.00E-06	2.480E-04
I-125		Iodine	0.00E+00	1000	60	26	28300	1.00E-06	0.000E+00
I-129	1.348E-01	Iodine	0.00E+00	1000	60	26	28300	1.00E-06	0.000E+00
I-131		Iodine	0.00E+00	1000	60	26	28300	1.00E-06	0.000E+00
Kr-85	8.652E-01	Kr-85		1000	60	26	28300	1.00E-06	1.050E-05

Additional input into CAP88:

Temperature: 14.2 °C

Precipitation: 16.5 cm/y

Humidity: 8 g/cum

Mixing Height: 1 km

MIE location: 100 meters, SSE

Stack Height: 4 m

Stack diameter: 1 m

Plume rise: None

Agriculture data: Default rural food source, Washington State defaults for beef and milk use.

Wind file: 2015 Hanford meteorological station

Decay chain length:

Results

US Ecology evaluated the data using CAP88 (Capp88PC Version 3.0 Users Guide, Rosnick, R, EPA Office of Radiation and Indoor Air, Washington DC. February 9, 2013.)

Effective dose equivalent = 6E-6 mrem/yr. (all isotopes)

These very low doses demonstrate compliance with the "Clean Air Act Limits for Radionuclide Emissions", and Radioactive Air Emissions License - 009 (AIR 10-502).

ATTACHMENT

A-1 RAES Data sheet

A-2 COMPLY Report

ATTACHMENT A-1

Washington State Department of Health

Office of Radiation Protection

RADIOACTIVE AIR EMISSIONS (RAE) DATA SHEET

NOTE: This Data Sheet is used by Washington State Department of Health (DOH), Radioactive Air Emissions Section (RAE) licensees to provide air emissions-specific technical data. The licensee may use this form to support reporting radioactive air emissions compliance information using the Environmental Report Format.

REFERENCES: Washington State Department of Health Air Emissions License RAES-009, Washington State Department of Health Radioactive Material License WN-I019-2. WAC 246-247-080, WAC 173-480-040.

DATA SECTION:

1. Name of DOH approved modeling program used to generate RAE compliance data:
   CAP88

2. Wind rose/joint frequency table (may also be included as an attachment). See A-3.

3. Annual average ambient temperature: 14.2 F

4. Annual average emission unit gas temperature (if available): N/A

5. Annual total rainfall: 16.5 cm/yr

6. Annual average emission unit flow rate and total volume of air released during the calendar year: 1000 cfm, 3.2 E 6 cubic feet.

STATEMENT OF RAE COMPLIANCE:

This facility is licensed to emit 1(one) mrem/year (RAEL 009, License Condition 1).

For Calendar Year 2015, this facility emitted 6E-6 mrem/year. This is in compliance with the above-referenced license condition and is supported by the above data and attached documentation. Licensees who are required by RAEL license to submit additional information should attach that information to this report.

SIGNED: DATE: Feb 29, 2016

Radiation Protection Manager/RSO

ATTACHMENT A-2
CAP88 REPORT

C A P 8 8 - P C

Version 4.0

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Mon May 02 10:45:53 2016

Facility: US Ecology
Address: Mailing: 1777 Terminal Drive
City: Richland
State: WA Zip: 99354

Source Category:
Source Type: Stack
Emission Year: 2015
DOSE Age Group: Adult

Comments: Facility: 1/4 mi West of 200 East, Hanford Reserva

Committed Effective Dose Equivalent (mrem)
6.37E-06

At This Location: 50 Meters Southeast
Dataset Name: Cap88(2015).
Dataset Date: Apr 28, 2016 04:45 PM
Wind File: S:\Radiation Protection\Environmental\Environmental Rep

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 50 Meters Southeast
Lifetime Fatal Cancer Risk: 4.04E-12

ORGAN DOSE EQUIVALENT SUMMARY
(RN-222 Working Level Calculations Excluded)

Organ	Dose Equivalent (mrem)
Adrenal	4.96E-06
UB_Wall	5.14E-06
Bone_Sur	1.58E-05
Brain	4.97E-06
Breasts	5.09E-06
St_Wall	5.94E-06
SI_Wall	5.08E-06
ULI_Wall	5.48E-06
LLI_Wall	6.41E-06
Kidneys	5.64E-06
Liver	5.46E-06
Muscle	5.20E-06
Ovaries	5.01E-06
Pancreas	4.97E-06
R_Marrow	5.83E-06
Skin	1.88E-05
Spleen	5.07E-06
Testes	5.21E-06
Thymus	4.98E-06
Thyroid	5.08E-06
GB_Wall	4.97E-06
Ht_Wall	5.02E-06
Uterus	5.03E-06
ET_Reg	6.28E-06
Lung_66	1.08E-05
Effectiv	6.37E-06

RADIONUCLIDE EMISSIONS DURING THE YEAR 2015

Nuclide	Type	Size	Source #1 Ci/y	TOTAL Ci/y
Pu-239	M	1.000	2.4E-12	2.4E-12
Pu-241	M	1.000	1.9E-11	1.9E-11
Ra-226	M	1.000	4.3E-10	4.3E-10

Th-232	S	1.000	1.7E-11	1.7E-11
U-234	M	1.000	3.6E-10	3.6E-10
U-238	M	1.000	1.7E-09	1.7E-09
Ag-110m	M	1.000	2.1E-12	2.1E-12
Ba-133	M	1.000	3.2E-11	3.2E-11
Ba-140	M	1.000	3.9E-11	3.9E-11
C-14	M	1.000	3.1E-09	3.1E-09
Ce-141	M	1.000	9.0E-12	9.0E-12
Co-57	M	1.000	1.8E-11	1.8E-11
Co-58	M	1.000	2.4E-10	2.4E-10
Co-60	M	1.000	3.1E-09	3.1E-09
Cr-51	M	1.000	1.6E-10	1.6E-10
Cs-134	F	1.000	3.8E-10	3.8E-10
Cs-137	F	1.000	1.3E-09	1.3E-09
Ba-137m	B	0.000	1.4E-09	1.4E-09
Eu-152	M	1.000	3.7E-10	3.7E-10
Fe-55	M	1.000	6.0E-10	6.0E-10
Fe-59	M	1.000	6.7E-12	6.7E-12
Ge-68	M	1.000	2.7E-11	2.7E-11
K-40	M	1.000	2.5E-09	2.5E-09
La-140	M	1.000	3.0E-11	3.0E-11
Mn-54	M	1.000	2.3E-10	2.3E-10
Nb-93m	M	1.000	1.4E-09	1.4E-09
Nb-94	M	1.000	8.9E-11	8.9E-11
Nb-95	M	1.000	6.3E-12	6.3E-12
S-35	M	1.000	1.8E-11	1.8E-11
Sb-125	M	1.000	1.5E-10	1.5E-10
Sr-89	M	1.000	1.3E-11	1.3E-11
Sr-90	M	1.000	2.7E-11	2.7E-11
Y-90	M	1.000	2.7E-11	2.7E-11
Tc-99	M	1.000	3.4E-11	3.4E-11
Zn-65	M	1.000	8.2E-10	8.2E-10
H-3	V	0.000	2.5E-04	2.5E-04
Kr-85	B	0.000	1.0E-05	1.0E-05
P-33	M	1.000	1.0E-11	1.0E-11
Po-210	B	0.000	1.3E-11	1.3E-11
U-235	M	1.000	2.5E-11	2.5E-11
Ni-63	M	1.000	5.2E-10	5.2E-10
Sn-113	M	1.000	2.7E-10	2.7E-10
In-113m	M	1.000	2.7E-10	2.7E-10

SITE INFORMATION

Temperature:	14.200	degrees C
Precipitation:	16.500	cm/y
Humidity:	8.000	g/cu m
Mixing Height:	1000.0	m

SOURCE INFORMATION

Source Number: 1

Stack Height (m): 4.00
Diameter (m): 1.00

Plume Rise Pasquill Cat:	A	B	C	D	E	F	G
Fixed (m):	None	None	None	None	None	None	None

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.7000	0.4000	0.4400
Fraction From Assessment Area:	0.3000	0.6000	0.5600
Fraction Imported:	0.0000	0.0000	0.0000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES (M) USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

50 100 1000 5600 7200 12050 24150
40250 56350 72450