

Appendix A – Project Specifications

- A.1 Project Specification (A)
- A.2 Project Specification (B)

A.1 Project Specification (A)

University of Southern Queensland
Faculty of Engineering and Surveying

**ENG 4111/2 Research Project
PROJECT SPECIFICATION**

FOR: **Kevin Chin Ning, TAN**
TOPIC: LIFE CYCLE ACCESSMENT OF A MOBILE PHONE
SUPERVISOR: Mr. David Parsons
Ms. Lynn Brodie

PROJECT AIM: This project seeks to investigate all forms of environmental impact of a mobile phone from production to the disposal.

PROGRAMME: Issue A, 21th March 2005

1. Research on the theoretical background of the methodology of 'life cycle assessment' and relevant international practices.
2. Measure energy use of a typical mobile phone. This can be achieved by producing a log of mobile phone usage and frequency of charging of battery. This is to be conducted by myself and also other mobile phone users *if possible* via a survey.
3. Open up mobile phone to retrieve individual parts to be accessed.
4. Construct a life cycle of a mobile phone. This can be done by producing a model and an inventory of all physical components. Each part is then compared according to how it affects the environment.
5. Analyse environmental impact of mobile phone using SimaPro software.
6. Investigate the role of a battery of various technologies on the environment.
7. Research on Australian / global statistics on the number of mobile phones produced/ disposed. This information is to be compared with respect to corresponding environmental impacts of other industries.
8. Make suggestions about how future mobile phones might be made to minimize their environmental impact

If time permits,

9. Expand analysis to include an estimate of environmental impact of mobile phone systems, including base stations, etc.
10. Constructively critique current recycling practices for mobile phones.

AGREED: _____(student)
_____ (supervisor)

Dated: ___/___/___

A.2 Project Specification (B)

University of Southern Queensland
Faculty of Engineering and Surveying

ENG 4111/2 Research Project
PROJECT SPECIFICATION

FOR: **Kevin Chin Ning, TAN**
TOPIC: LIFE CYCLE ASSESSMENT OF A MOBILE PHONE
SUPERVISOR: Mr. David Parsons

PROJECT AIM: This project seeks to investigate all forms of environmental impact of a mobile phone from production to the disposal.

PROGRAMME: Issue B, 17th July 2005

11. Research on the theoretical background of the methodology of 'life cycle assessment' and relevant international practices.
12. Measure energy use of a typical mobile phone. This can be achieved by producing a log of mobile phone usage and frequency of charging of battery. This is to be conducted by myself and also other mobile phone users *if possible* via a survey.
13. Open up mobile phone to retrieve individual parts to be accessed.
14. Construct a life cycle of a mobile phone. This can be done by producing a model and an inventory of all physical components. Each part is then compared according to how it affects the environment.
15. Analyse environmental impact of mobile phone using SimaPro software.
16. Constructively critique SimaPro and point out any limitations encountered when used to investigate an electronic device.
17. Investigate the role of a battery of various technologies on the environment.
18. Make suggestions about how future mobile phones might be made to minimize their environmental impact
19. Constructively critique current recycling practices for mobile phones.

AGREED: _____(student)
_____ (supervisor)

Dated: ___/___/_____

Appendix B – Inventory List

- B.1 Survey
- B.1a Survey Sample (a)
- B.1b Survey Sample (b)
- B.2 SimaPro Results

B.1 Survey
Mobile Phone Usage Survey

Dear friends, the following survey is done in order to gather information that will contribute to my final year project. Your participation is greatly appreciated. Thanks.

Phone/ phone use information

1. What is the make of your mobile phone?

2. What is the age of your phone?

3. What is the average usage of your phone on a daily basis?

_____ calls _____ smses

3a. How long does each call last for? _____

4. How often do you charge (the battery of) your phone? _____

5. Do you wait for the 'low batt' signal before charging the phone? ()yes ,()no

6. How long do you leave your phone charged? _____

7. Do you switch off your phone when you go to sleep? ()yes, ()no

Personal information

7. What is your age? _____ Sex: ()male ,()female

8. What is your occupation? _____

9. Which country are you currently staying in? _____

10. What are the rates for phone calls and sms charged by your service provider?

_____ /min calls _____ / sms

 (Signature)

 (date)

B.1a Survey Sample (a)
Mobile Phone Usage Survey

Dear friends, the following survey is done in order to gather information that will contribute to my final year project. Your participation is greatly appreciated. Thanks.

Phone/ phone use information

1. What is the make of your mobile phone?
 _____ nokia7610 _____
2. What is the age of your phone? _____ a
 week _____
3. What is the average usage of your phone on a daily basis?
 _____ 10 _____ calls _____ 10 _____ smses
- 3a. How long does each call last for? _____ 20mins _____
4. How often do you charge your phone? _____ once for 2 days _____
5. Do you wait for the 'low batt' signal before charging the phone? ()yes , (*)no
6. How long do you leave your phone charged? _____ the whole
 night _____
7. Do you switch off your phone when you go to sleep? ()yes, (x)no

Personal information

7. What is your age? _____ 22 _____ Sex: ()male , (*)female
8. What is your occupation? _____ undergraduate _____
9. Which country are you currently staying in? _____ Melbourne,
 Australia _____
10. What are the rates for phone calls and sms charged by your service provider?
 _____ \$1 _____ /min calls _____ \$0.25 _____ / sms

 (Signature)

 14th April 2005 _____
 (date)

B.1b Survey Sample (b)
Mobile Phone Usage Survey

Dear friends, the following survey is done in order to gather information that will contribute to my final year project. Your participation is greatly appreciated. Thanks.

Phone/ phone use information

1. What is the make of your mobile phone? Samsung E600C
2. What is the age of your phone? 1 yr+
3. What is the average usage of your phone on a daily basis?
 _____ 8 _____ calls _____ 40 _____ smses
- 3a. How long does each call last for? _____ approx 5mins _____
4. How often do you charge your phone? _____ once in 2 days _____
5. Do you wait for the 'low batt' signal before charging the phone? ()yes , (*)no
6. How long do you leave your phone charged? _____ 2 hrs _____
7. Do you switch off your phone when you go to sleep? ()yes, (*)no

Personal information

7. What is your age? 18 Sex: ()male , (*)female
8. What is your occupation? _____ Student _____
9. Which country are you currently staying in?
 _____ Singapore _____
10. What are the rates for phone calls and sms charged by your sevice provider?
 _____ 0.25 _____ /min calls _____ 0.15 _____ / sms

 (Signature)

_____ 19/4/05 _____
 (date)

B.2 SimaPro Results

SimaPro 6.0

Product
stages

Date: 17/10/2005 Time: 12:54:00 PM

Assembly:

Name

Battery Pack

Materials/Assemblies	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
AA cell battery (Li-ion)	0.03983	Kg	Undefined				Battery pack (Not AA battery)
ABS, Acryloniril butastylene AU	10.31	g	Undefined				Plastic Casing
Tin plate 50% scrap B250	0.37	g	Undefined				Metal (Unknown)
Printed board I	0.41	g	Undefined				Printed Board

Processes	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
Injection moulding I	10.31	g	Undefined				
Reprocessing tinplate	0.37	g	Undefined				

Reuse:

Name

Complete Mobile Phone

Assembly	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
Complete Mobile Phone Package 2	1	p					

Processes	Amount	Unit	Distribution	SD ² or 2*SD	Min	Max	Comment
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Disassembly:

Name
Complete Mobile Phone

Assembly	Amount	Unit	Distribution	SD ² or 2*SD	Min	Max	Comment
Complete Mobile Phone Package 2		1 p					

Processes	Amount	Unit	Distribution	SD ² or 2*SD	Min	Max	Comment
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Disposal scenarios	Percentage						Comment
Disposal of Complete Mobile Phone Package	100 %						

Waste scenarios	Percentage						Comment
Recycling AU	1 %						
Landfill AU	99 %						

Assembly:

Name
Complete Mobile Phone Package

Materials/Assemblies	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
Processes	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
Container ship I	667.715	kgkm	Undefined				Transportation of batteries from Japan to S.Korea for assembly (1500km * 0.44381kg)
Container ship I	4881.91	kgkm	Undefined				Transportation of mobile phones from S.Korea to Australia (11000km * 0.44381kg)
Delivery van <3.5t ETH S	221.905	kgkm	Undefined				Distribution within Australia (500km * 0.44381kg)

Assembly:

Name
Complete Mobile Phone
Package 2

Materials/Assemblies	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
Battery Pack	1	p	Undefined				
Mobile Phone	1	p	Undefined				
Mobile Phone Charger Adapter	1	p	Undefined				
Mobile Phone Desktop Charger	1	p	Undefined				
Mobile Phone Packaging	1	p	Undefined				
Processes	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
Container ship I	667.715	kgkm	Undefined				Transportation of batteries from Japan to S.Korea for assembly (1500km * 0.44381kg)
Container ship I	4881.91	kgkm	Undefined				Transportation of mobile phones from

Delivery van <3.5t ETH S	221.905	kgkm	Undefined				S.Korea to Australia (11000km * 0.44381kg) Distribution within Australia (500km * 0.44381kg)
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Assembly:

Name
Desktop Charger Housing

Materials/Assemblies	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
ABS, Acryloniril butastyrene AU	41.5	g	Undefined				Casing ABS-PC
Steel ETH S	2.1	g	Undefined				Screws
Copper AU	0.33	g	Undefined				Copper
NBR I	0.18	g	Undefined				Glue (very unsure)
PVC, Polyvinyl chloride, AU	0.25	g	Undefined				Wire (insulation)
GX12Cr14 (CA15) I	0.85	g	Undefined				From connector (Stainless Steel)
ABS, Acryloniril butastyrene AU	0.85	g	Undefined				From connector(Plastic ABS-PC)
Copper AU	0.25	g	Undefined				Copper from Wlre

Processes	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
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Disposal scenario:

Name
Disposal of Complete Mobile Phone
Package

Assembly	Amount	Unit	Distribution	SD ² or 2*SD	Min	Max	Comment
Complete Mobile Phone Package 2		1 p					

Processes	Amount	Unit	Distribution	SD ² or 2*SD	Min	Max	Comment
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Waste scenarios	Percentage						Comment
Landfill AU	99 %						
Recycling AU	1 %						

Disassemblies	Percentage						Comment
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Reuses	Percentage						Comment
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Life cycle:

Name
Life Cycle of a Mobile Phone

Assembly	Amount	Unit	Distribution	SD ² or 2*SD	Min	Max	Comment
Complete Mobile Phone Package 2		1 p	Undefined				

Processes	Amount	Unit	Distribution	SD ² or 2*SD	Min	Max	Comment
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Electricity, high voltage, Queensland average 2001-02	1.418	kWh	Undefined				Charging of a phone
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Queensland average electricity mix, high voltage	2	kWh	Undefined				Energy used in retail
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Waste/Disposal scenario
 Disposal of Complete Mobile Phone Package

Comment

Additional life cycles	Number	Distribution	SD^2 or 2*SD	Min	Max	Comment
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Assembly:

Name
 Mobile Phone

Materials/Assemblies	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
Mobile Phone (Electronics)	1	p	Undefined				
Mobile Phone Housing	1	p	Undefined				

Processes	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
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Assembly:

Name
 Mobile Phone (Electronics)

Materials/Assemblies	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
Printed board I	11.22	g	Undefined				Printed Circuit Boards
ABS, Acryloniril butastyrene AU	1.54	g	Undefined				Total Plastics
IC's (weigth) I	6.66	g	Undefined				Total ICs

Tin I	3.03	g	Undefined				Tin (Unsure Metal)
Steel I	0.56	g	Undefined				Steel (Unsure Metal)
Copper AU	0.41	g	Undefined				Copper (Unsure Metal)
Processes	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
Residual oil in power plant UCPT E S	0.5	kJ	Undefined				Production of components. (Petroleum 60% of electricity in S.Korea)
Injection moulding PET	1.54	g	Undefined				

Assembly:

Name
Mobile Phone Charger

Materials/Assemblies	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
IC's (weigh) I	0.74	g	Undefined				
Printed board I	17.79	g	Undefined				
Tin plate 100%scrap B250(98)	0.14	g	Undefined				Unsure of exact material of metal (YET)
IC's (weigh) I	1.09	g	Undefined				Resistor
IC's (weigh) I	0.77	g	Undefined				Diodes
IC's (weigh) I	2.04	g	Undefined				Transistors
IC's (weigh) I	1.42	g	Undefined				Capacitors
Copper AU	3.87	g	Undefined				Copper wires from Inductor
PZT Piezo-electric ceramic	5	g	Undefined				Insulator for Inductor
Glass fibre AU	2.55	g	Undefined				LCD (UNsure)
Processes	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment

Assembly:

Name
Mobile Phone Charger
Adapter

Materials/Assemblies	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
ABS, Acryloniril butastylene AU	40.73	g	Undefined				Casing of Charger (ABS-PC)
Printed board I	2	g	Undefined				Printed Board of Charger
Copper AU	15.28	g	Undefined				Wlre (Copper)
PVC, Polyvinyl chloride, AU	15.28	g	Undefined				Wire (Insulation)
IC's (weigth) I	1	g	Undefined				Diodes
IC's (weigth) I	2.19	g	Undefined				Capacitors
Crude iron I	140	g	Undefined				Iron Core of Transformer
Copper AU	27.68	g	Undefined				Copper wires from Transformer

Processes	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
Injection moulding I	40.73	g	Undefined				

Assembly:

Name
Mobile Phone Desktop
Charger

Materials/Assemblies	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
Desktop Charger Housing	1	p	Undefined				

Mobile Phone Charger

1 p Undefined

Processes	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
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Assembly:

Name

Mobile Phone Housing

Materials/Assemblies	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
ABS, Acryloniril butastyrene AU	27.53	g	Undefined				Total Plastic (Assumed to be ABS-PC)
EPDM rubber ETH S	0.62	g	Undefined				Rubber material
Electro steel ETH S	1.43	g	Undefined				Screws (Assumed to be Steel)
Cobalt I	0.08	g	Undefined				Substitute for Gold (Assumed)(might be brass)
Copper AU	1.28	g	Undefined				Copper (unknown yet)

Processes	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
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Forging aluminium I	1.43	g	Undefined				FOrging screws
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Assembly:

Name

Mobile Phone Packaging

Materials/Assemblies	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
Packaging carton ETH S	100	g	Undefined				Box

Paper ETH S	100	g	Undefined				Misc. books (paper)
Packaging carton ETH S	100	g	Undefined				Packaging material
PP, Polypropylene, AU	10	g	Undefined				Plastic wrappers

Processes	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
Production cardboard box I	100	g	Undefined				
Cutting rolls CF	100	g	Undefined				
Laminating solvent free	100	g	Undefined				

Quantities

Name	Dimension
Mass	Yes
Amount	Yes
Energy	Yes
Transport	Yes

Units

Name	Quantity	Factor	Unit	Standard	Default	Metric
kg	Mass	1	kg	*	*	*
p	Amount	1	p	*	*	*
g	Mass	0.001	kg			*
kWh	Energy	3.6	MJ			
MJ	Energy	1	MJ	*	*	*
tkm	Transport	1	tkm	*	*	*
ton	Mass	1000	kg			*
µg	Mass	1E-09	kg			*
mg	Mass	1E-06	kg			*
GJ	Energy	1000	MJ			*
J	Energy	1E-06	MJ			*

kJ	Energy	0.001	MJ	*
Mtn	Mass	1E+09	kg	*
PJ	Energy	1E+09	MJ	*
TJ	Energy	1E+06	MJ	*
kgkm	Transport	0.001	tkm	*
ktkm	Transport	1000	tkm	*
kton	Mass	1E+06	kg	*
ng	Mass	1E-12	kg	*
pg	Mass	1E-15	kg	*
MWh	Energy	3600	MJ	
lb	Mass	0.454	kg	
Btu	Energy	0.001	MJ	
tmi*	Transport	1.46	tkm	
oz	Mass	0.028	kg	
tn.sh	Mass	907.2	kg	
tn.lg	Mass	1016	kg	
kmk	Transport	0.001	tkm	
GWh	Energy	4E+06	MJ	*
np	Amount	1E-09	p	
Kton	Mass	1E+06	kg	*
Ttk	Transport	1E+12	tkm	
mp	Amount	0.001	p	
μp	Amount	1E-06	p	
HH	Amount	1	p	*
kWp	Energy	3.6	MJ	
TWh	Energy	4E+09	MJ	*
Kg	Amount	1	p	
HP.Hr	Energy	2.685	MJ	

Appendix C – Network Analysis

- Figure C.1 Characterization – Carcinogens
- Figure C.2 Characterization – Ecotoxicity
- Figure C.3 Characterization – Acidification/ Eutrophication
- Figure C.4 Characterization – Ozone Layer
- Figure C.5 Characterization – Climate Change
- Figure C.6 Characterization – Fossil Fuels
- Figure C.7 Characterization – Land Use
- Figure C.8 Characterization – Minerals
- Figure C.9 Damage Assessment – Ecosystem Quality
- Figure C.10 Damage Assessment – Human Health
- Figure C.11 Damage Assessment – Resources

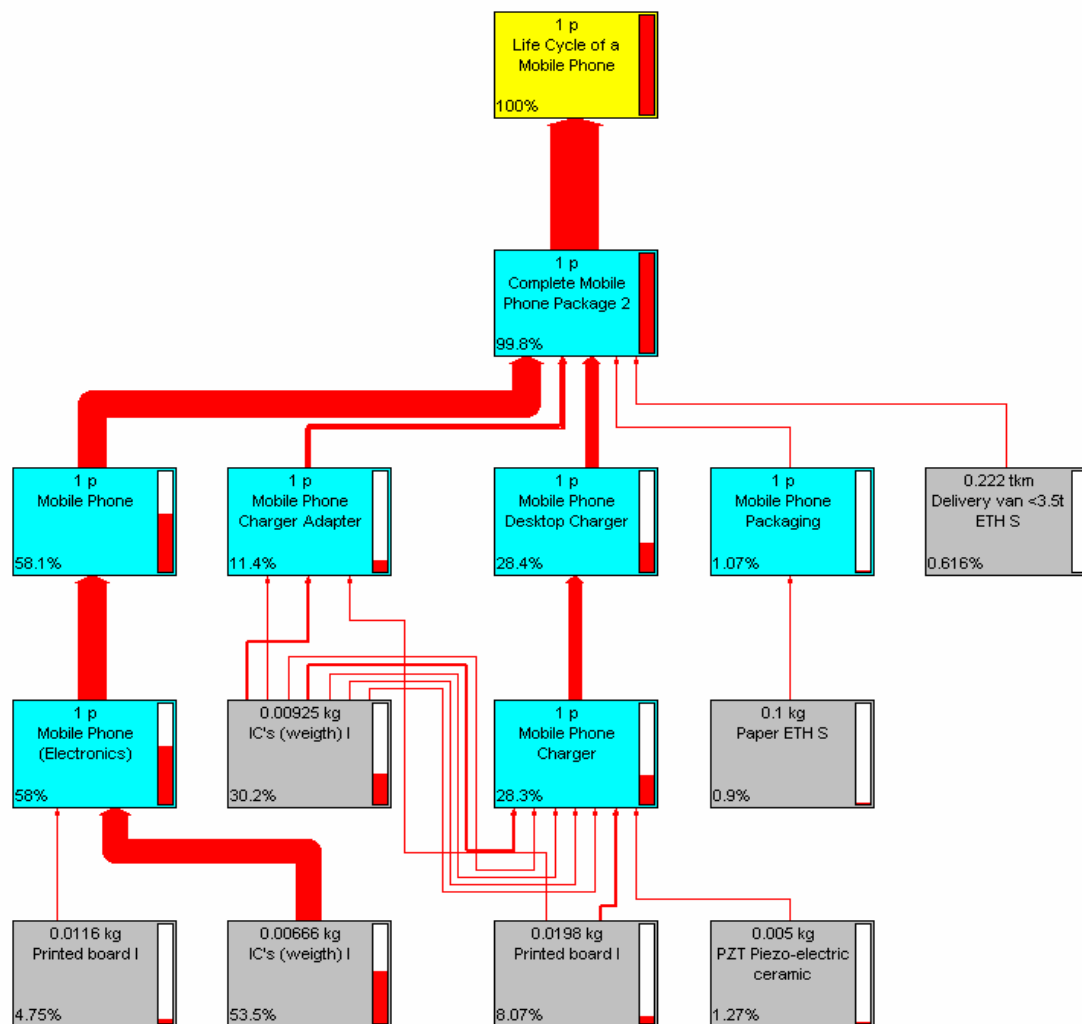


Figure C.1 Characterization – Carcinogens

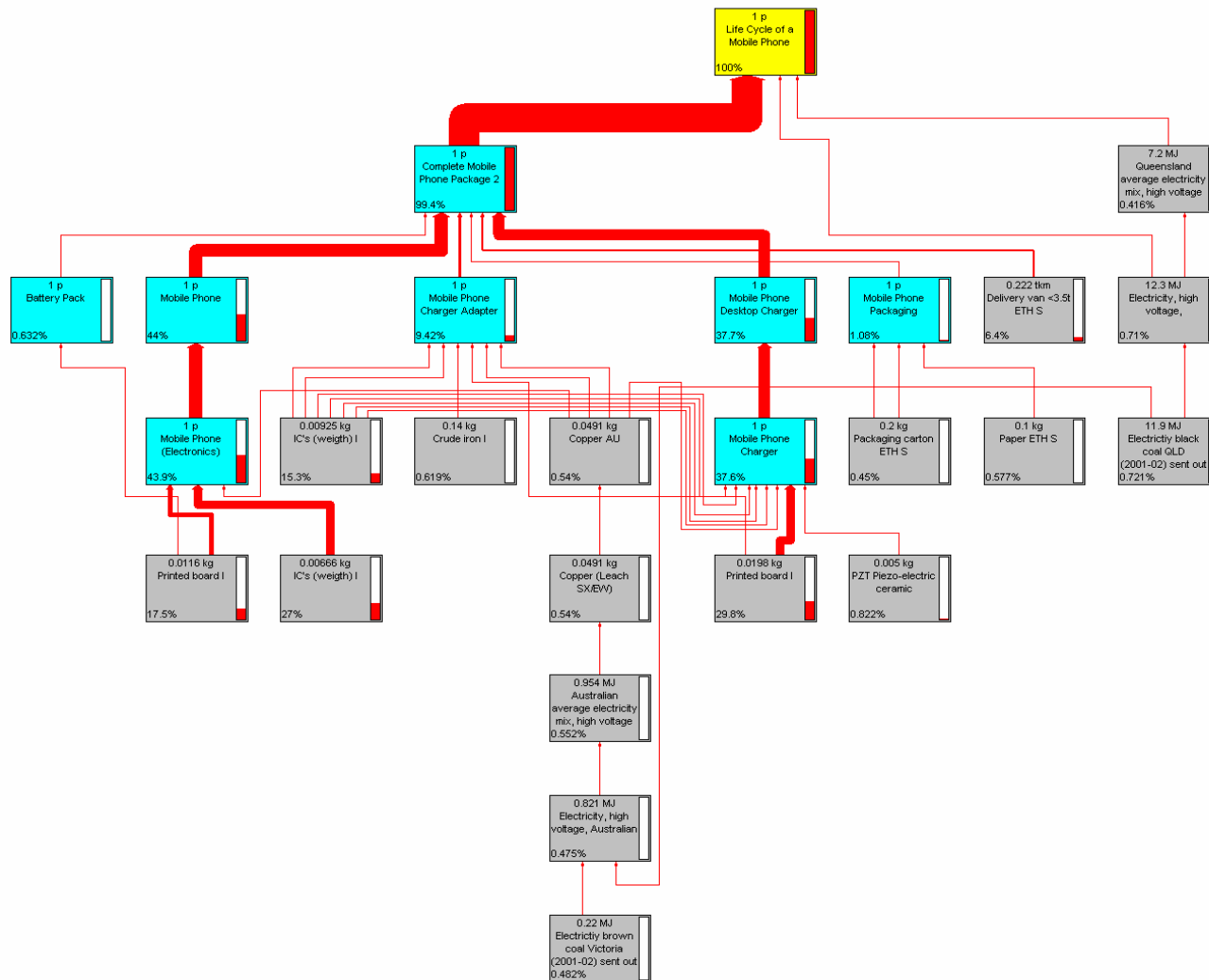


Figure C.2 Characterization – Ecotoxicity

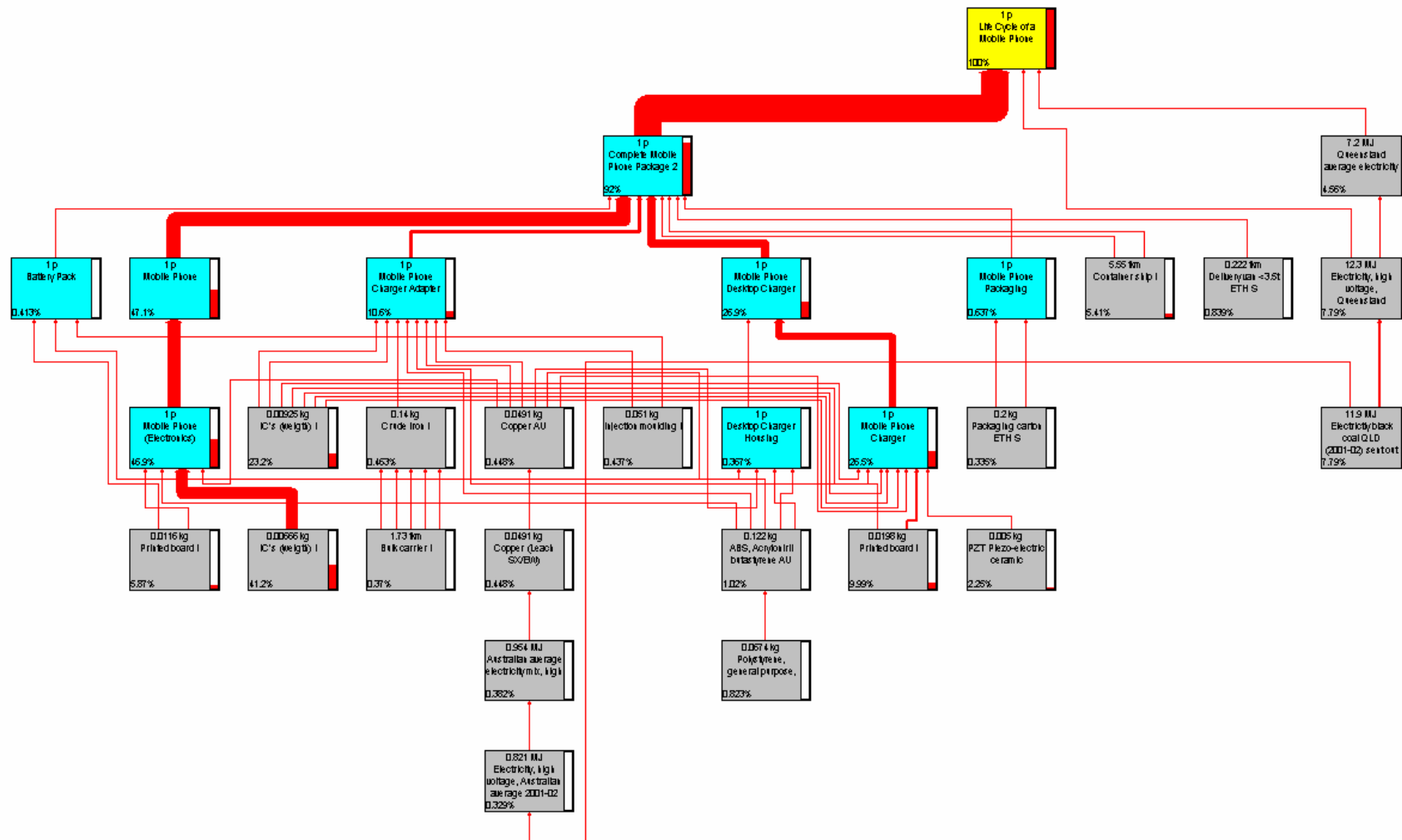


Figure C.3 Characterization – Acidification/ Eutrophication

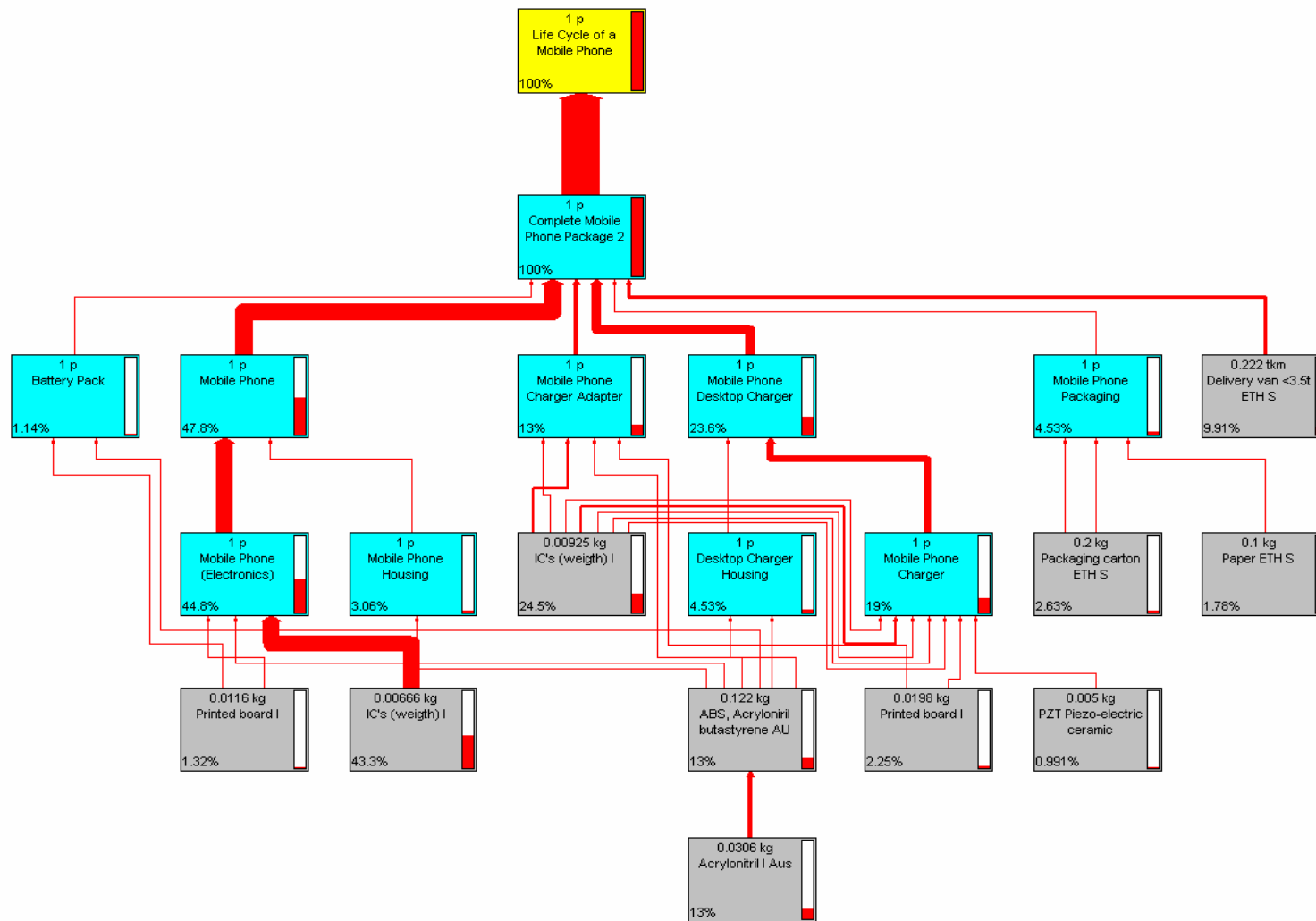


Figure C.4 Characterization – Ozone Layer

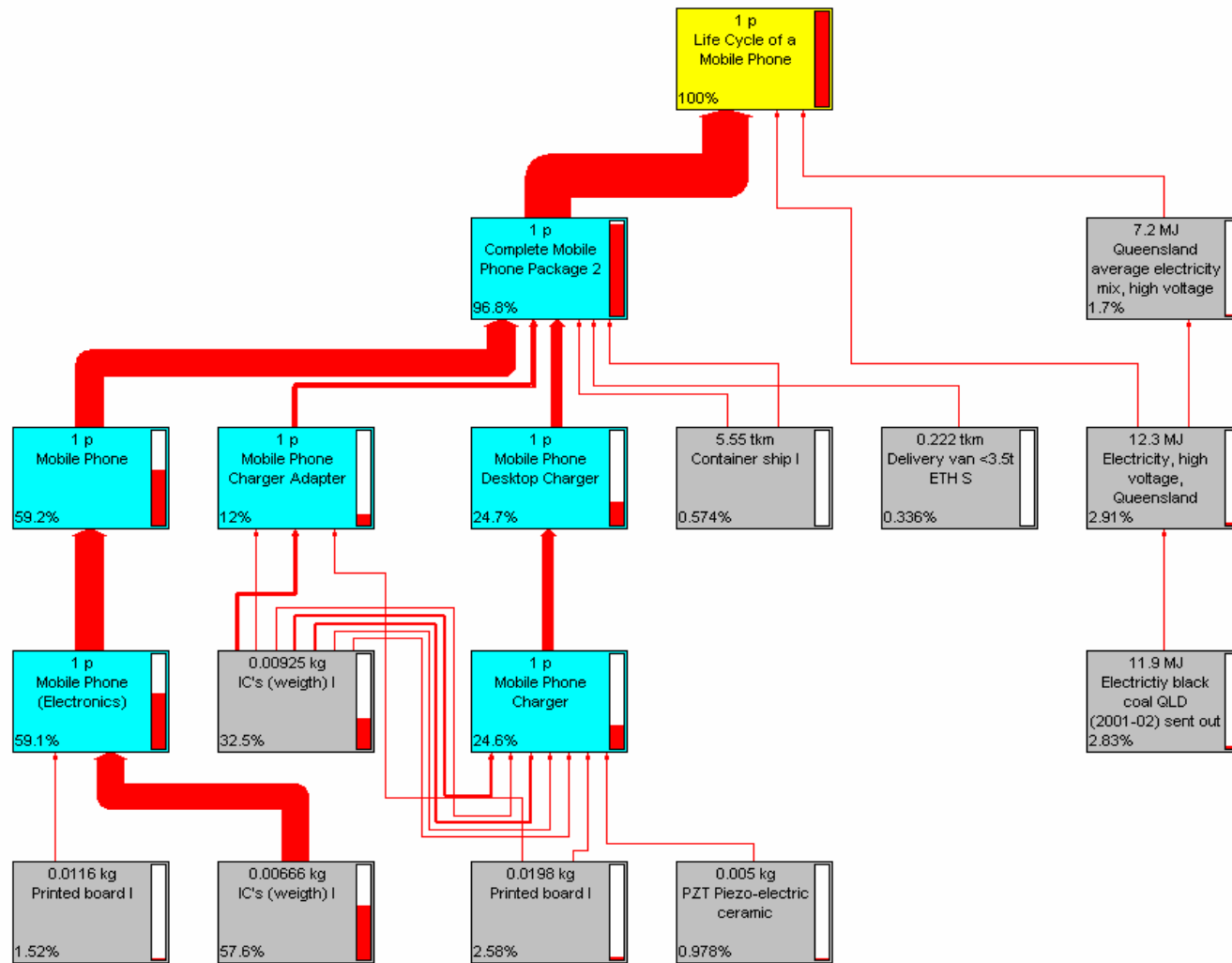


Figure C.5 Characterization – Climate Change

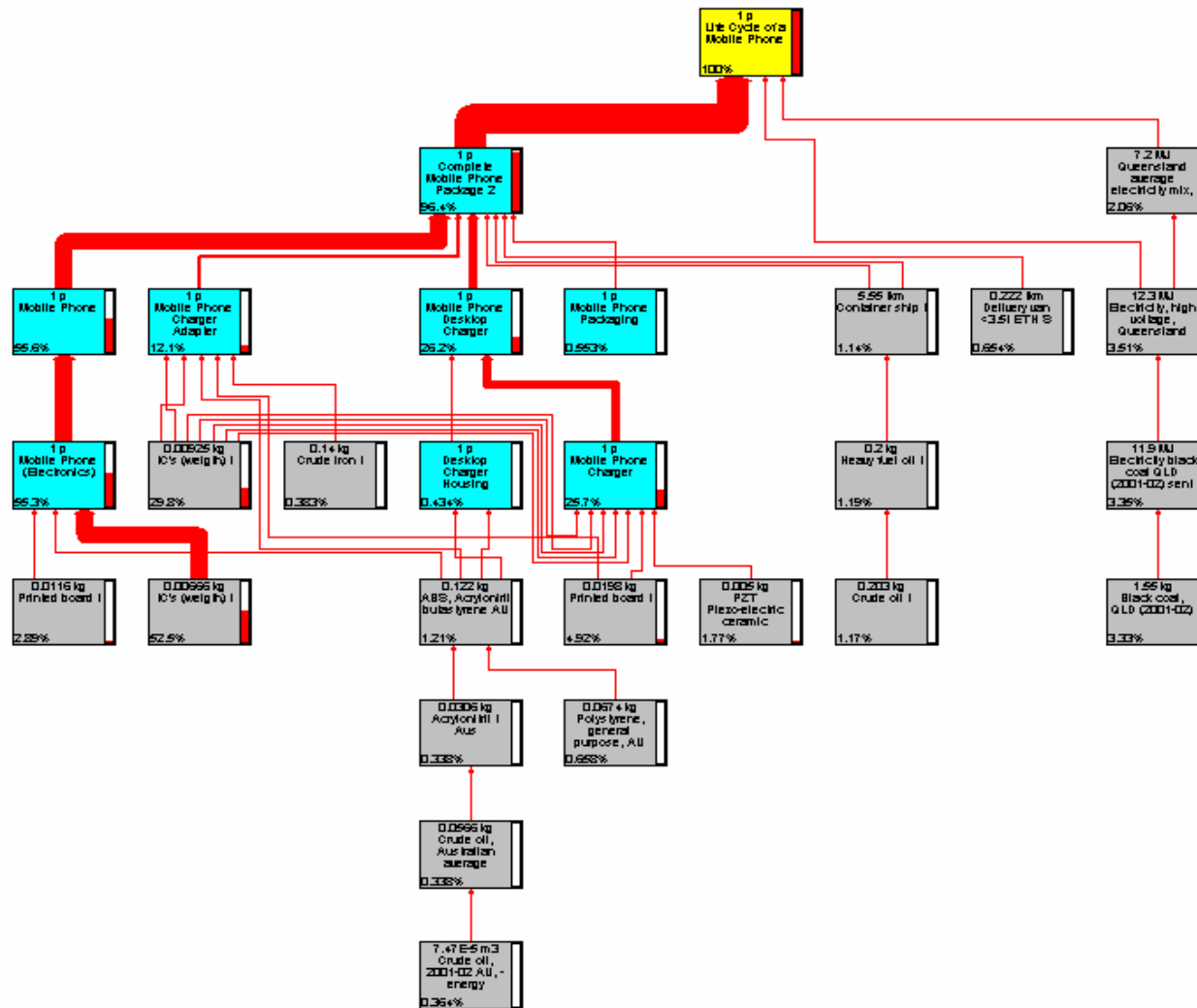


Figure C.6 Characterization – Fossil Fuels

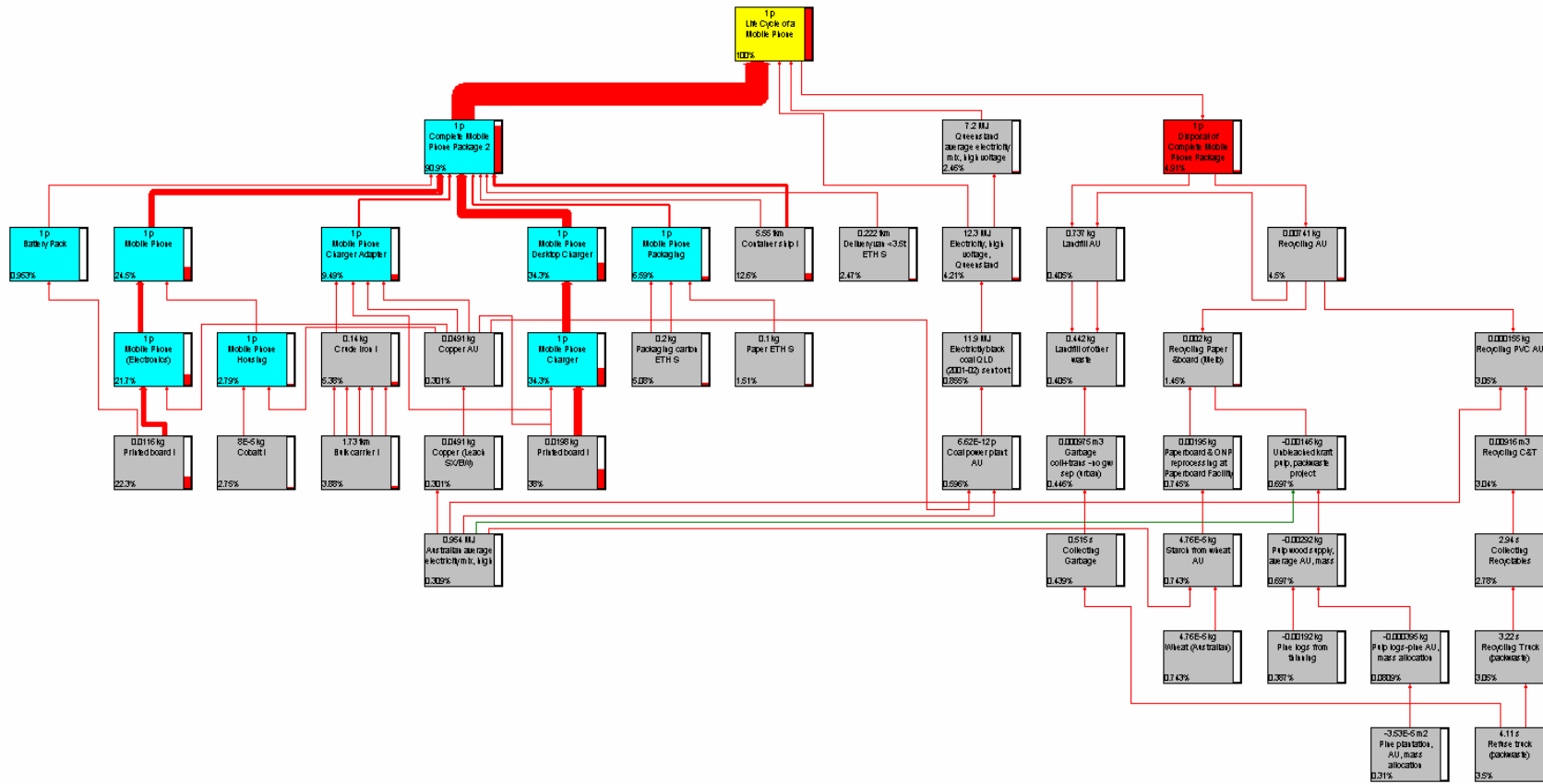


Figure C.7 Characterization – Land Use

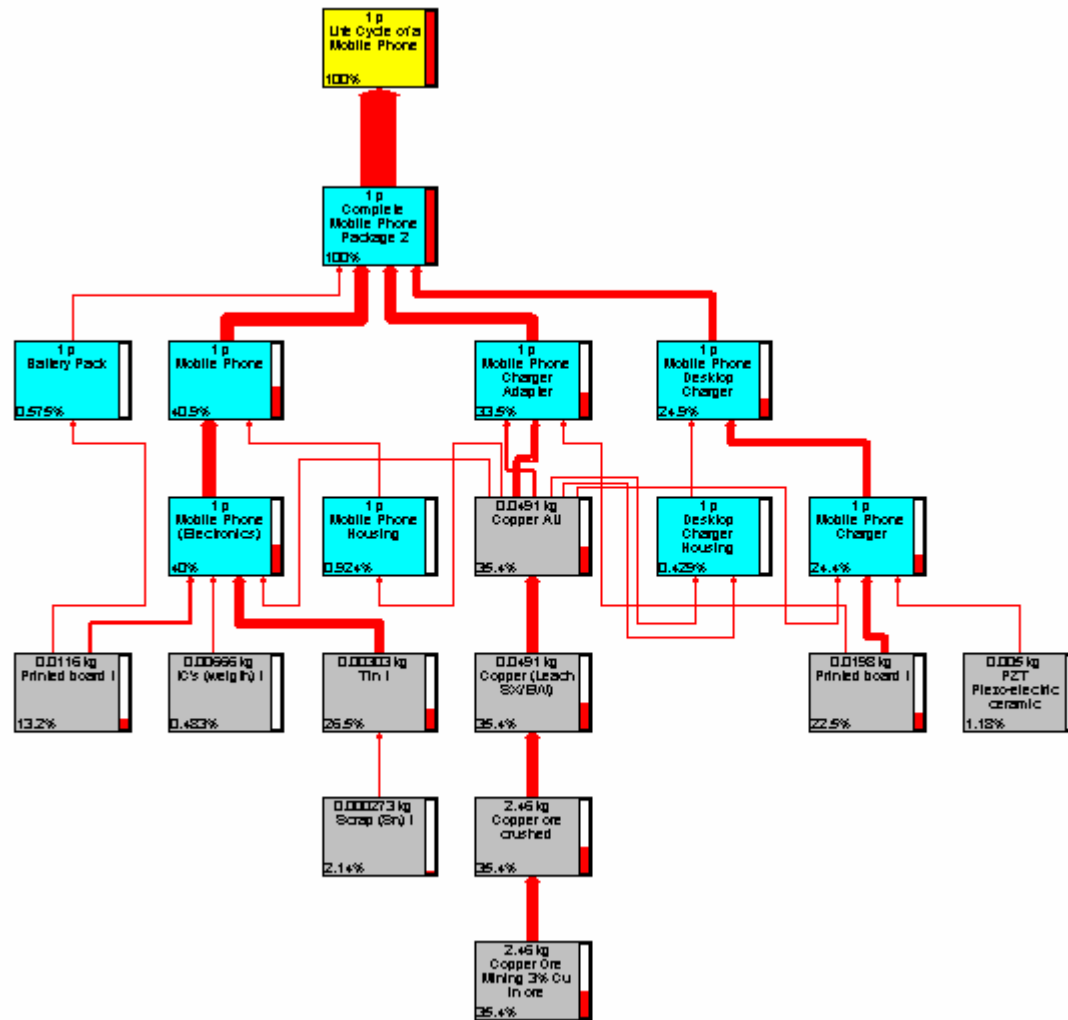


Figure C.8 Characterization – Minerals

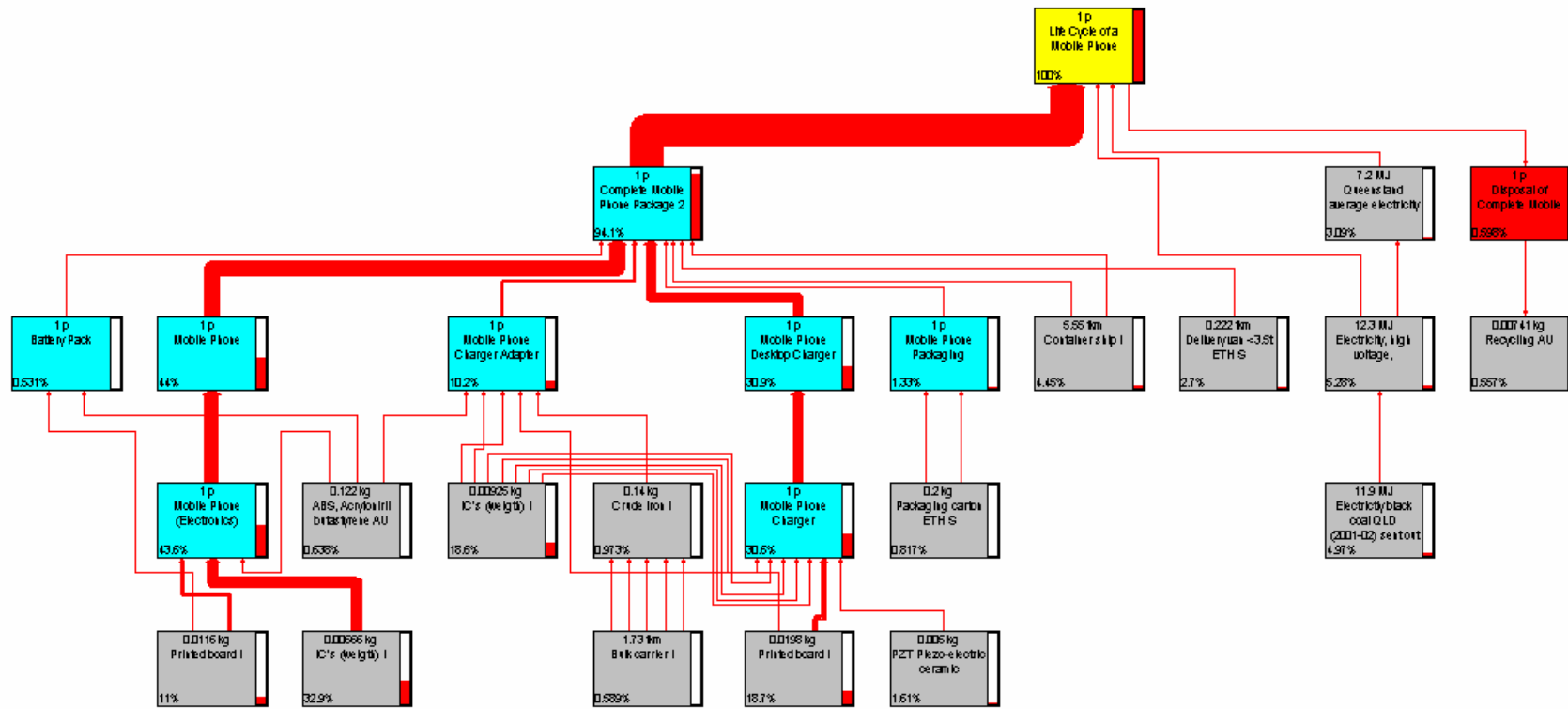


Figure C.9 Damage Assessment – Ecosystem Quality

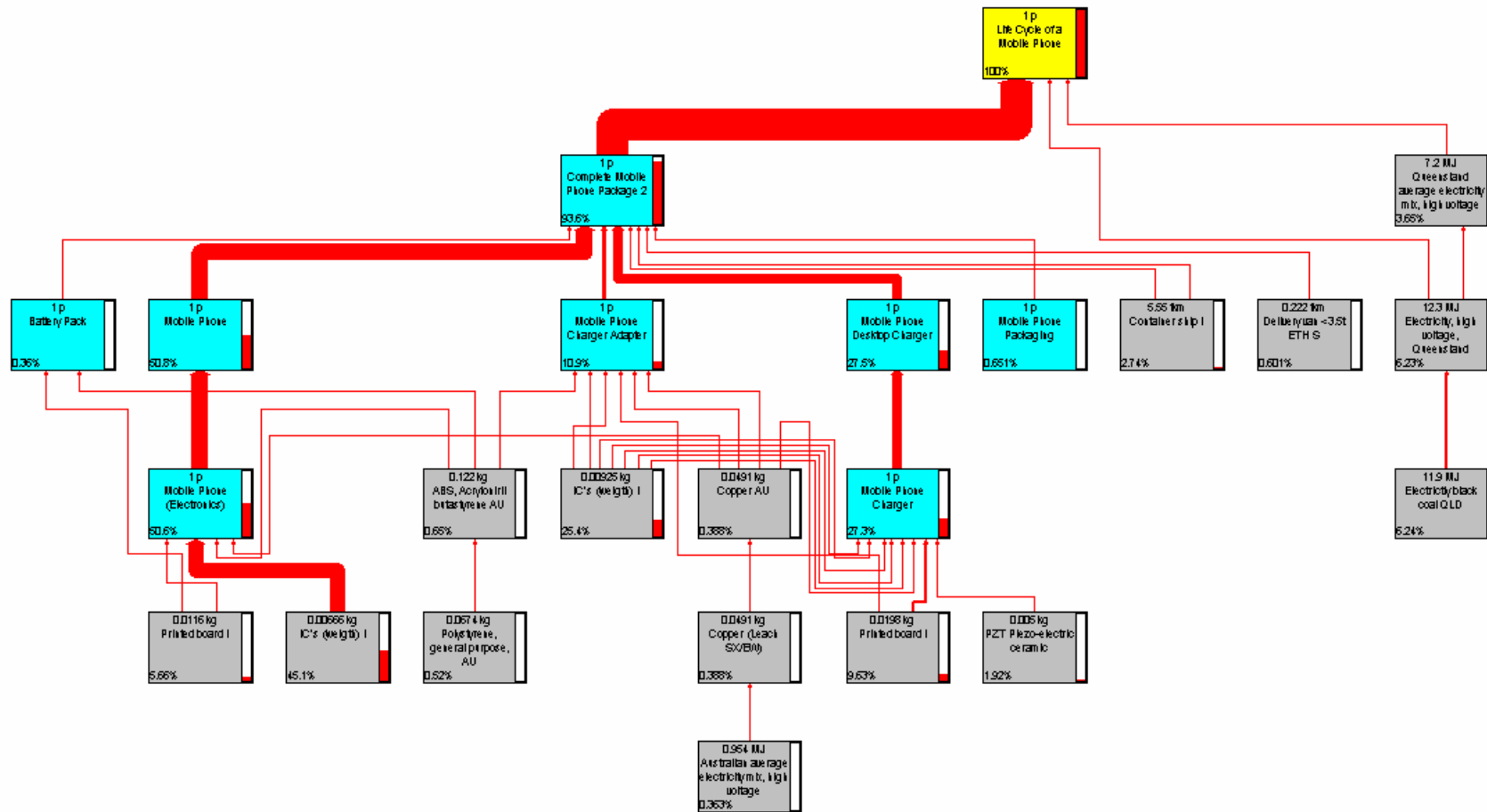


Figure C.10 Damage Assessment – Human Health

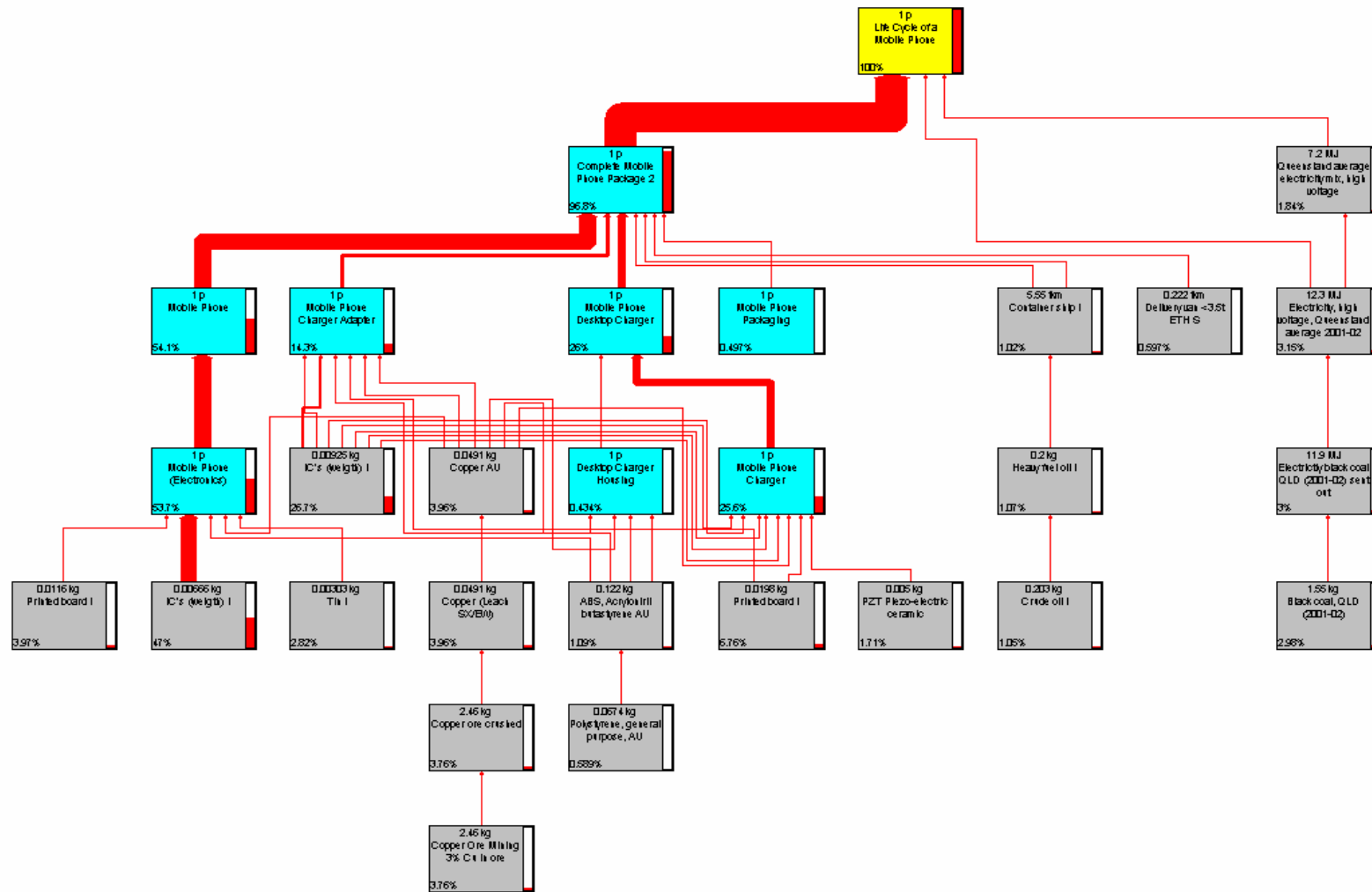
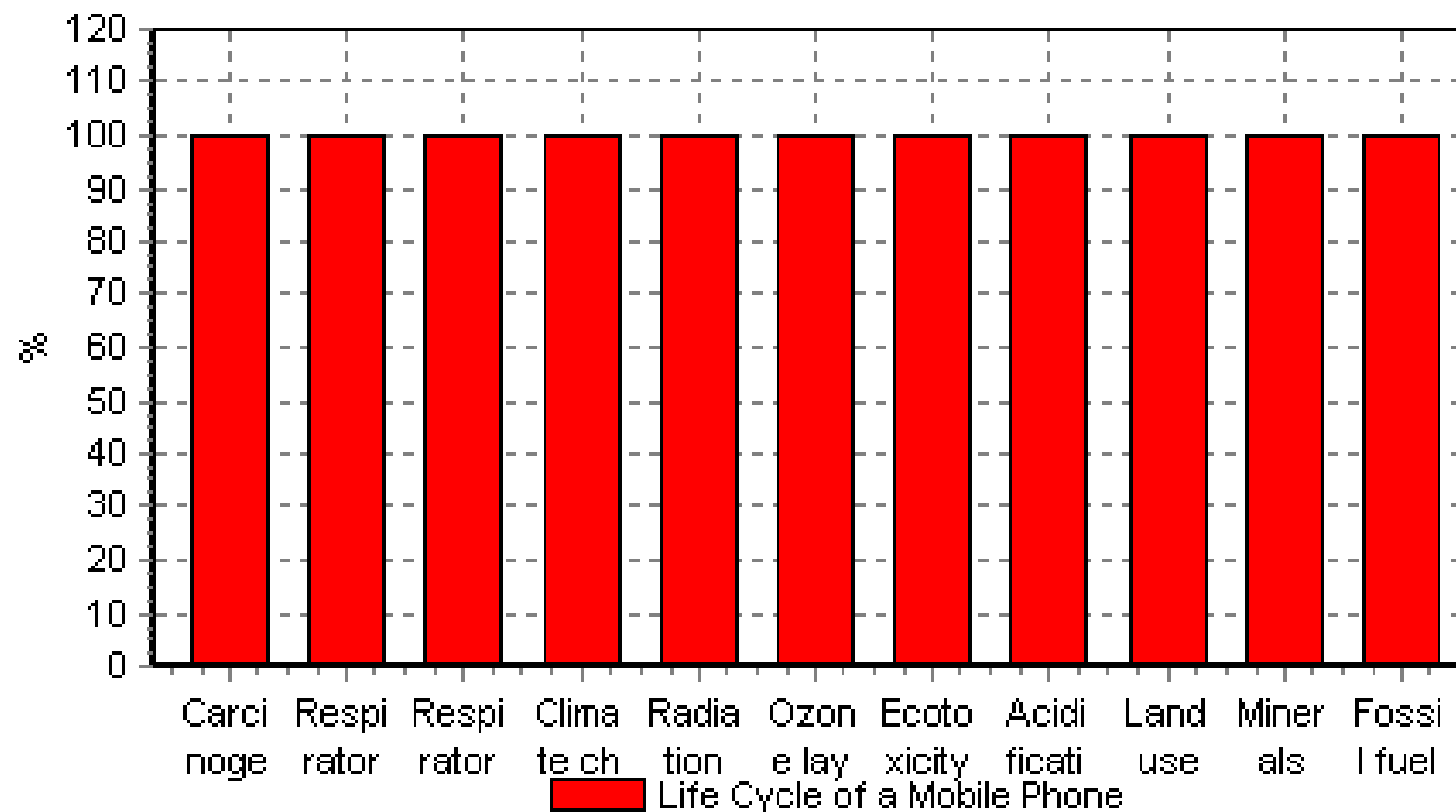


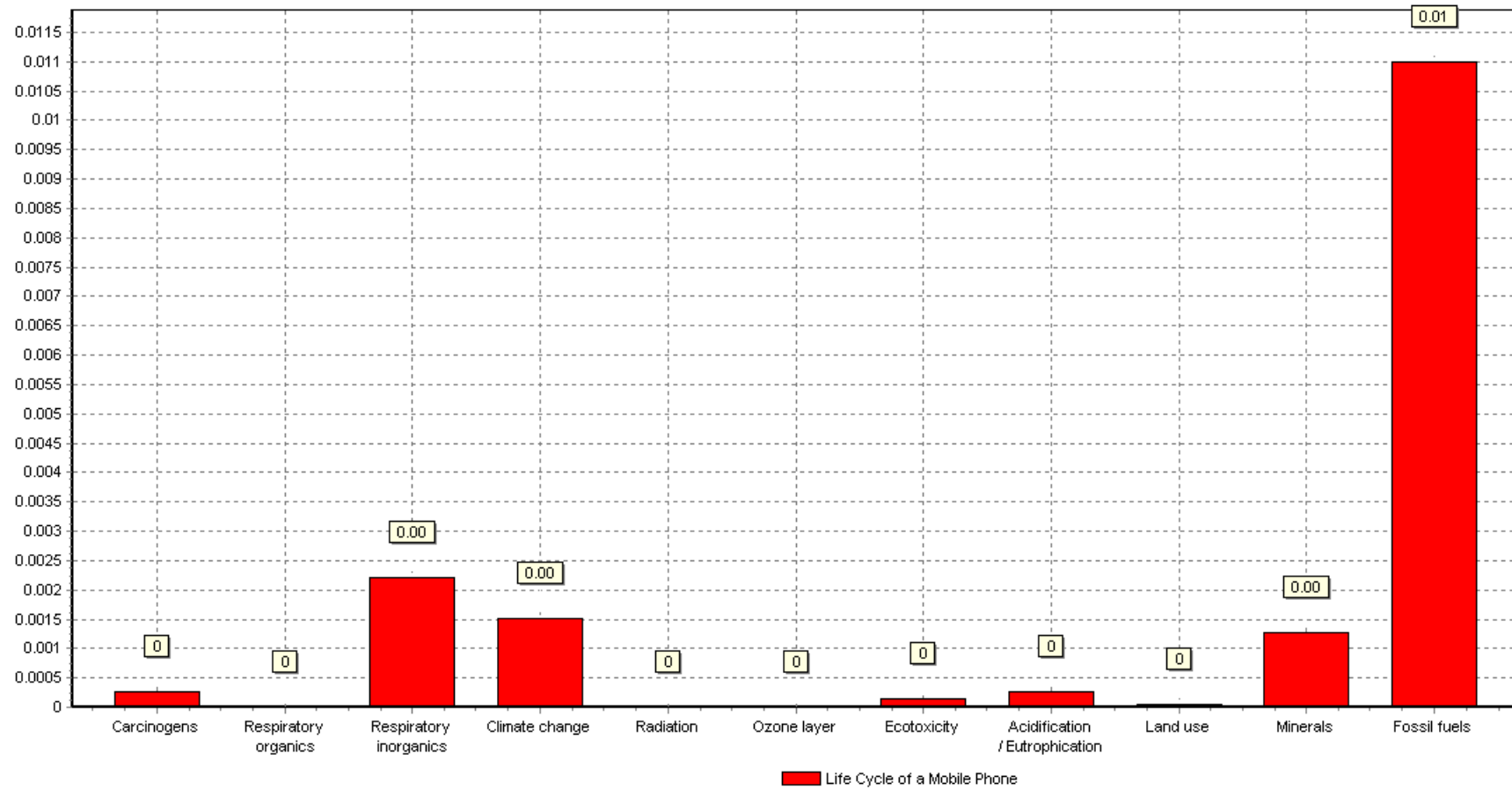
Figure C.11 Damage Assessment – Resource

Appendix D – Impact Assessment

- D.1 Impact Assessment - Damage Assessment
- D.2 Impact Assessment - Normalization
- D.3 Impact Assessment - Weighting

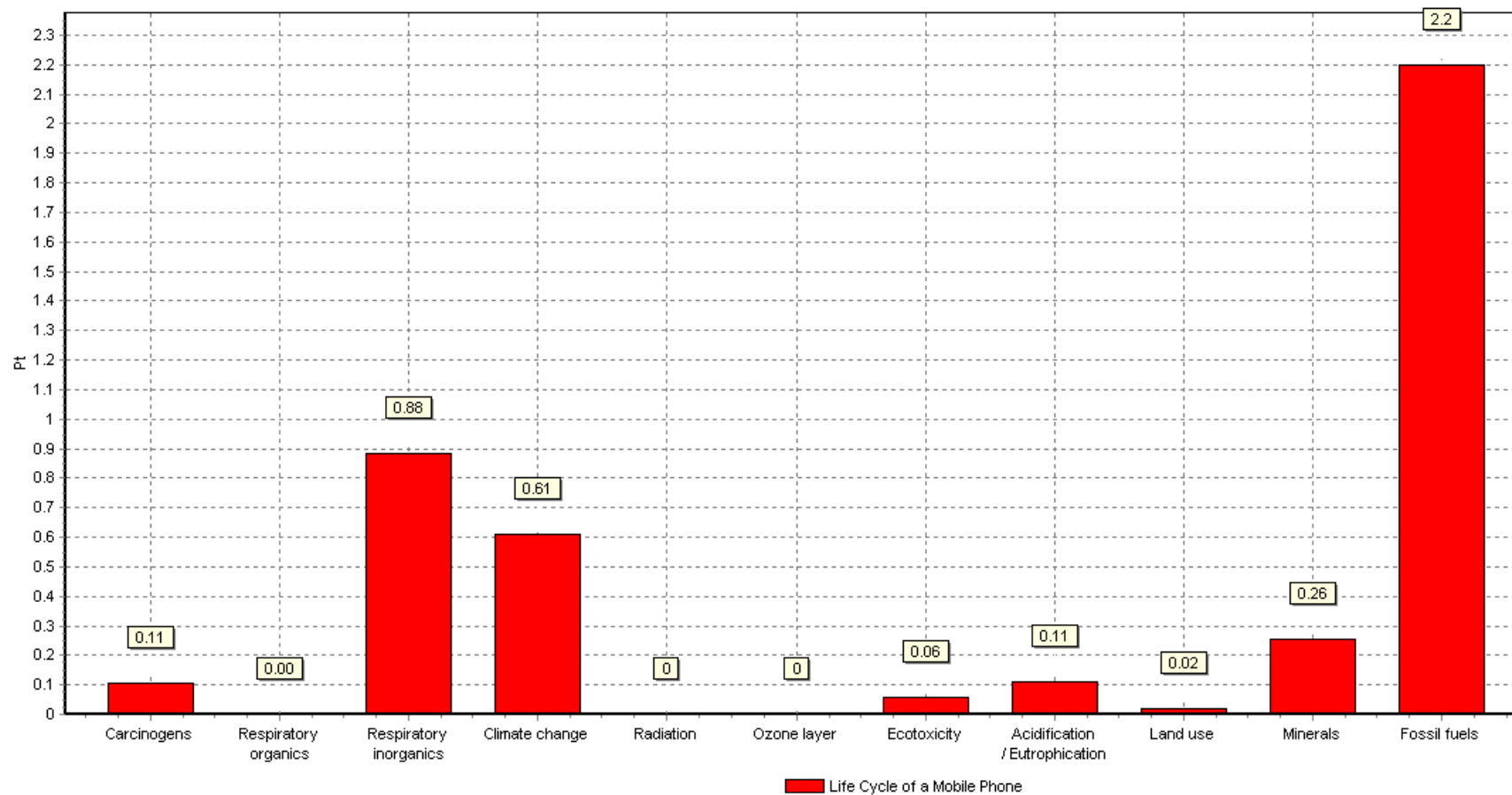


Analyzing 1 p life cycle 'Life Cycle of a Mobile Phone'; Method: Eco-indicator 99 (E) V2.1 A



Analyzing 1 p life cycle 'Life Cycle of a Mobile Phone'; Method: Eco-indicator 99 (E) V2.1 Australian substances / Europe EI 99 E/A / normalization

D.2 Impact Assessment - Normalization

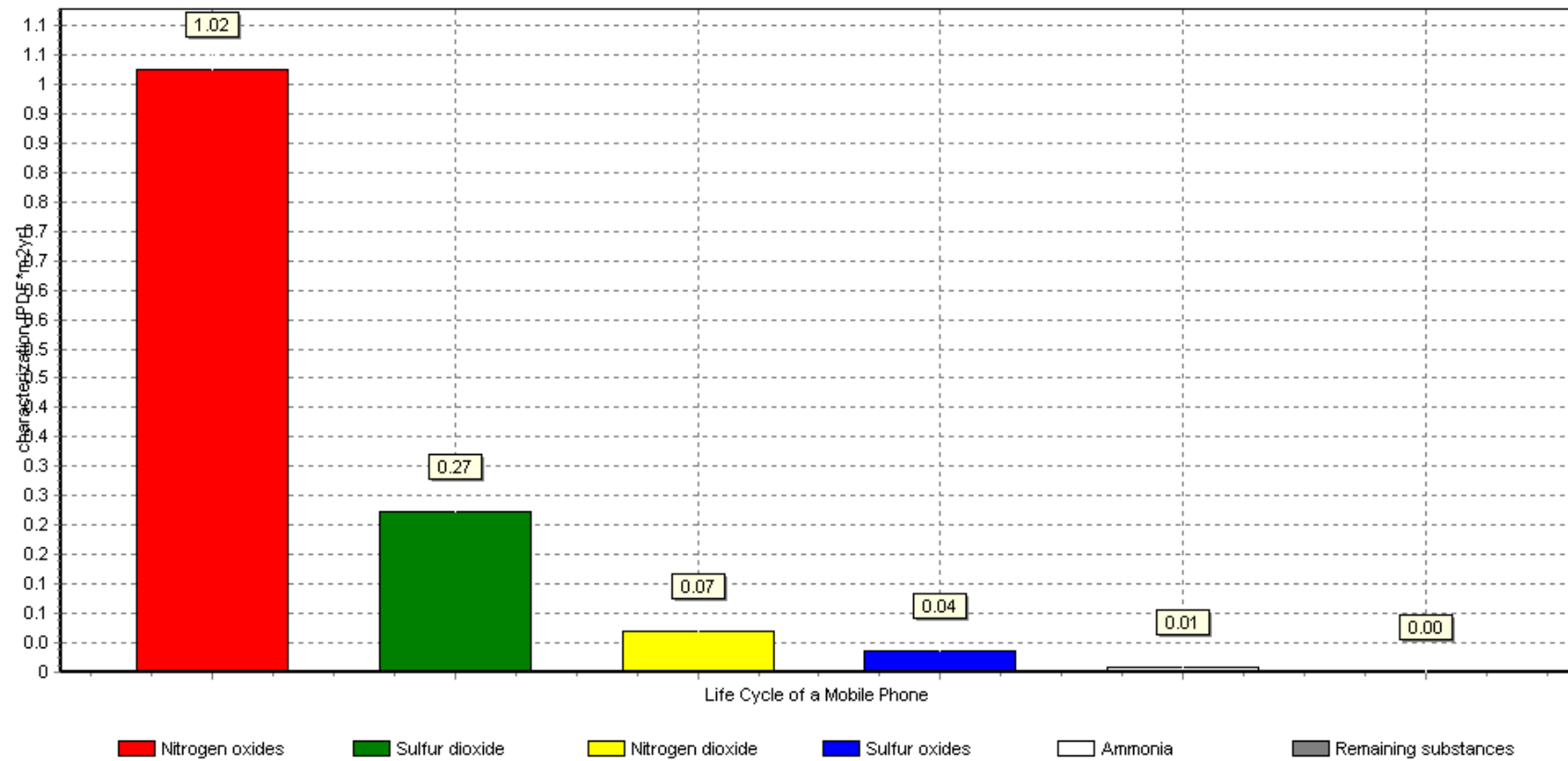


Analyzing 1 p life cycle 'Life Cycle of a Mobile Phone'; Method: Eco-indicator 99 (E) V2.1 Australian substances / Europe EI 99 E/A / weighting

D.3 Impact Assessment - Weighting

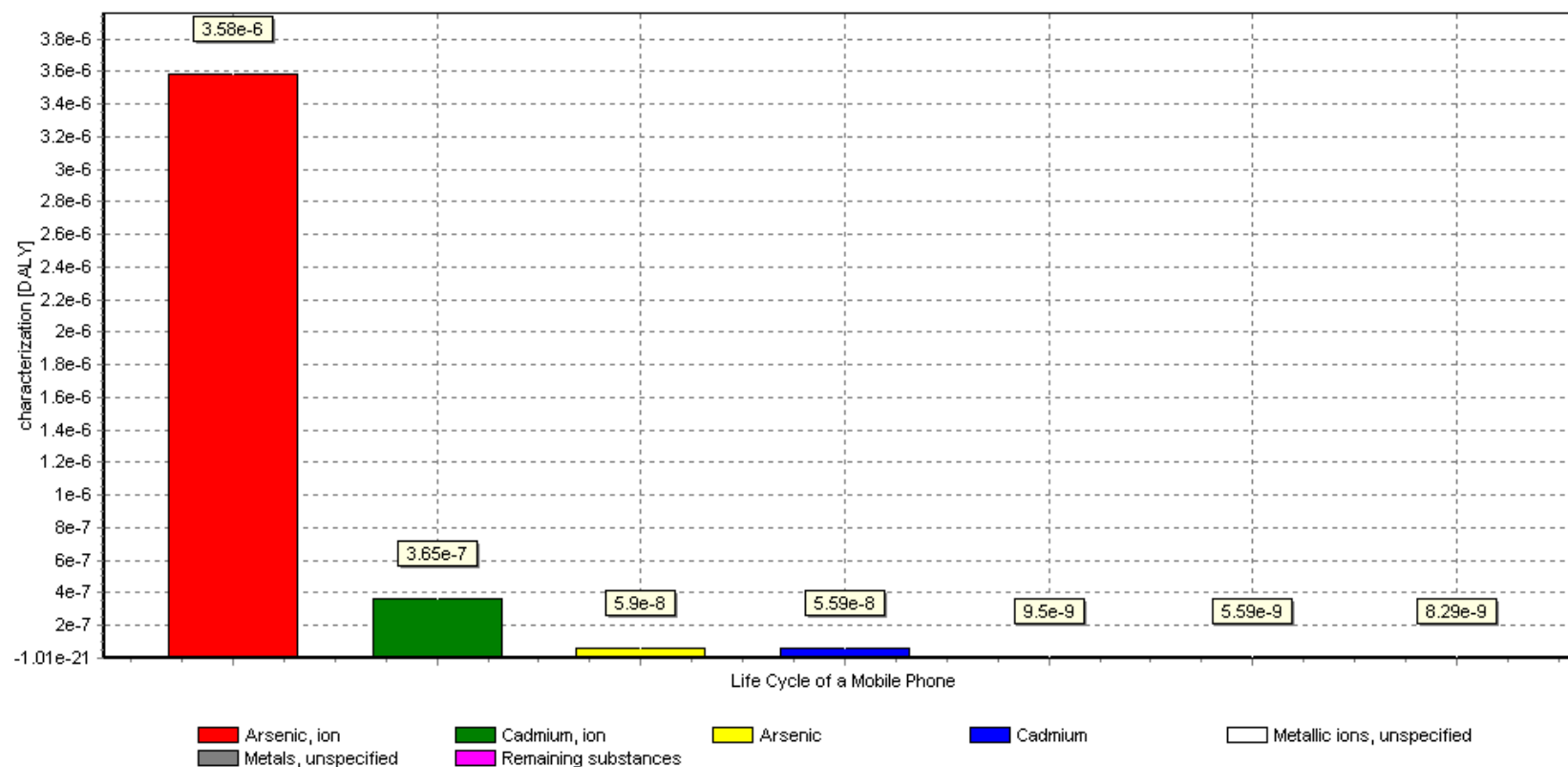
Appendix E - Inventory

- Figure E.1 Characterization – Acidification / Eutrophication
- Figure E.2 Characterization – Carcinogens
- Figure E.3 Characterization – Climate Change
- Figure E.4 Characterization – Ecotoxicity
- Figure E.5 Characterization – Fossil Fuels
- Figure E.6 Characterization – Land Use
- Figure E.7 Characterization – Minerals
- Figure E.8 Characterization – Ozone Layer
- Figure E.9 Damage Assessment – Ecosystem Quality
- Figure E.10 Damage Assessment – Human Health
- Figure E.11 Damage Assessment – Resources
- Figure E.12 Normalization – Ecosystem Quality
- Figure E.13 Normalization – Human Health
- Figure E.14 Normalization - Resources
- Figure E.15 Weighting – Ecosystem Quality
- Figure E.16 Weighting – Human Health
- Figure E.17 Weighting – Resource



Analyzing 1 p life cycle 'Life Cycle of a Mobile Phone'; Method: Eco-indicator 99 (E) V2.1 Australian substances / Europe EI 99 E/A / characterization

Figure E.1 Characterization – Acidification / Eutrophication



Analyzing 1 p life cycle 'Life Cycle of a Mobile Phone'; Method: Eco-indicator 99 (E) V2.1 Australian substances / Europe EI 99 E/A / characterization

Figure E.2 Characterization – Carcinogens

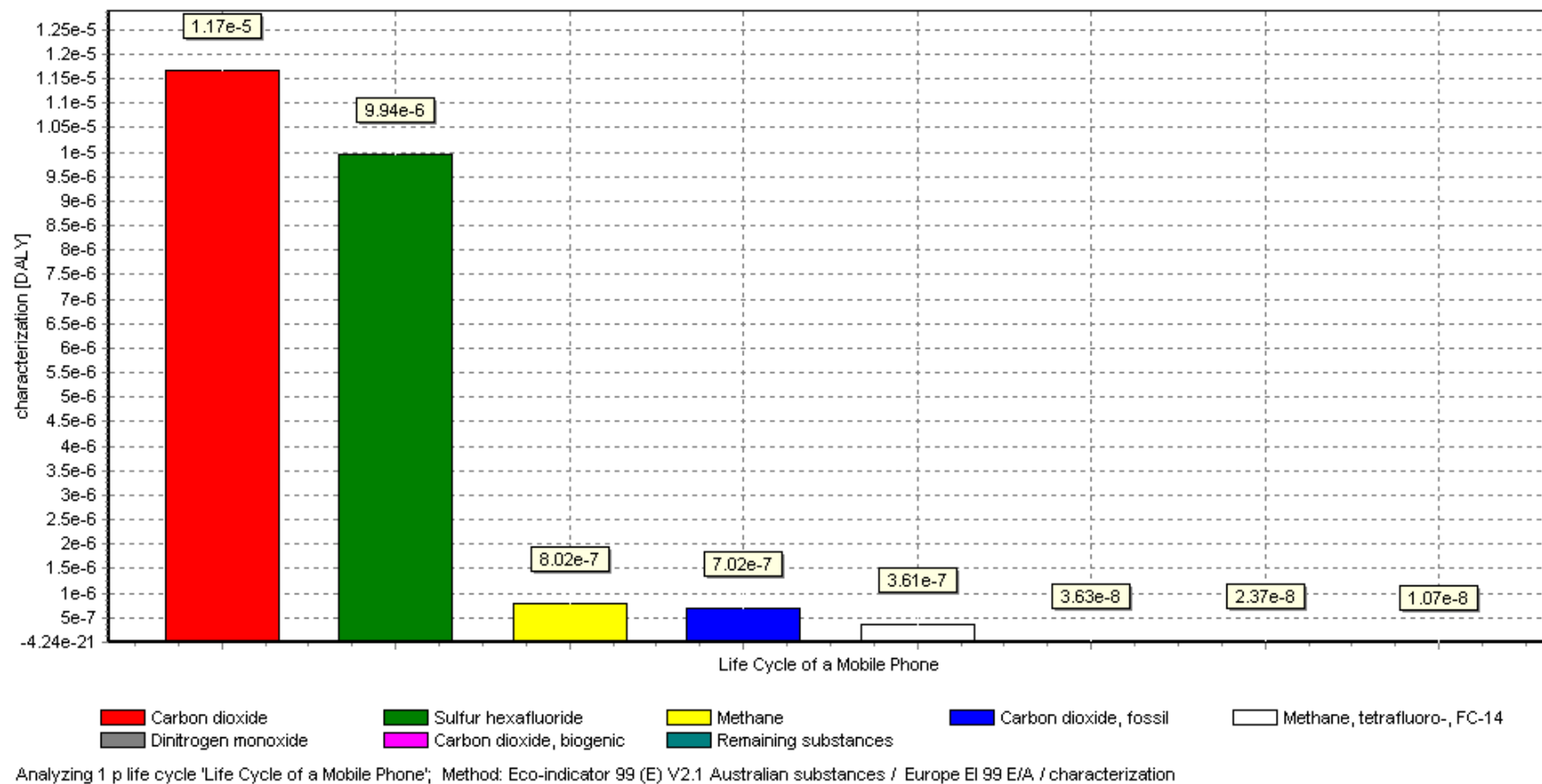
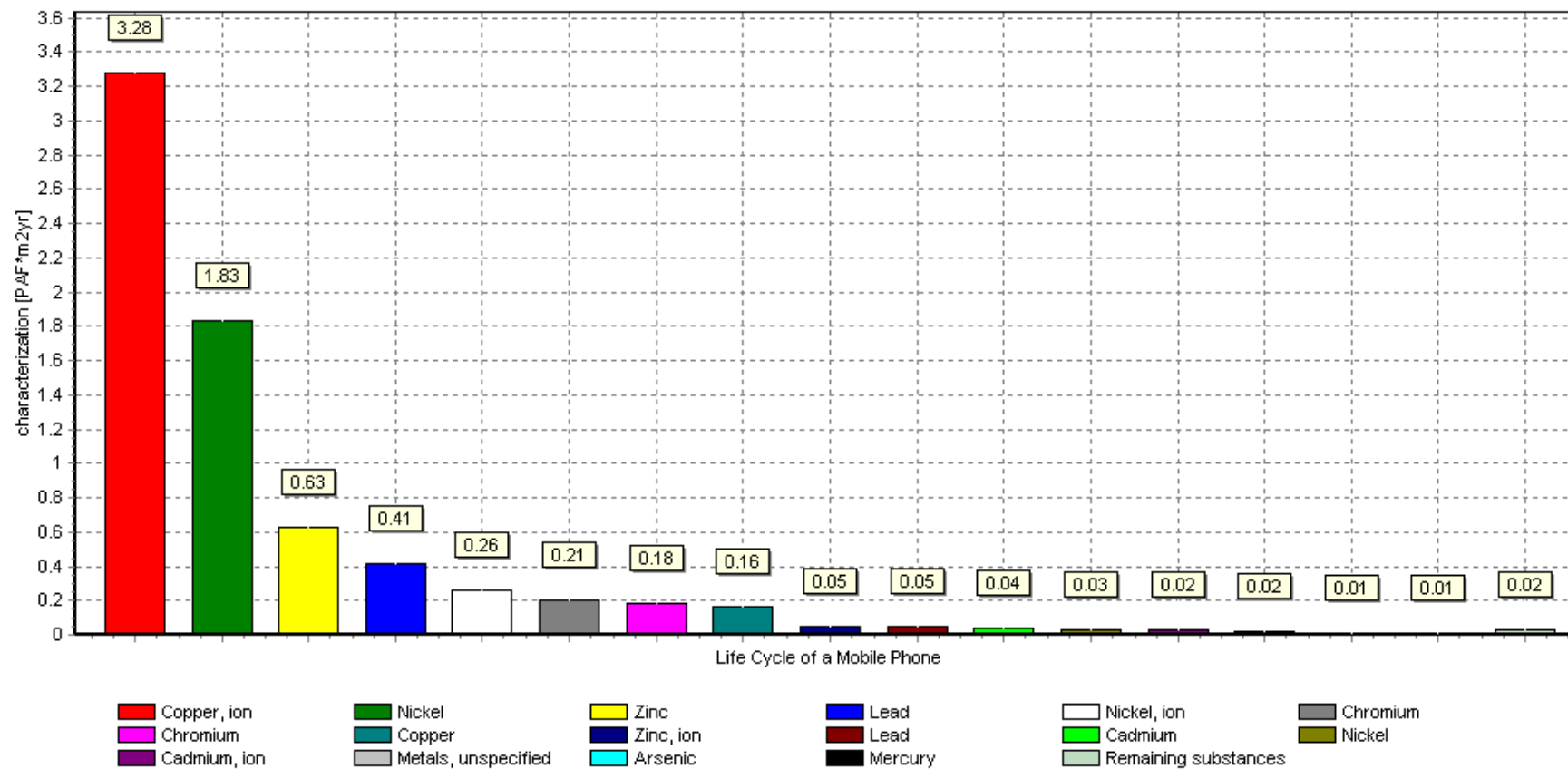
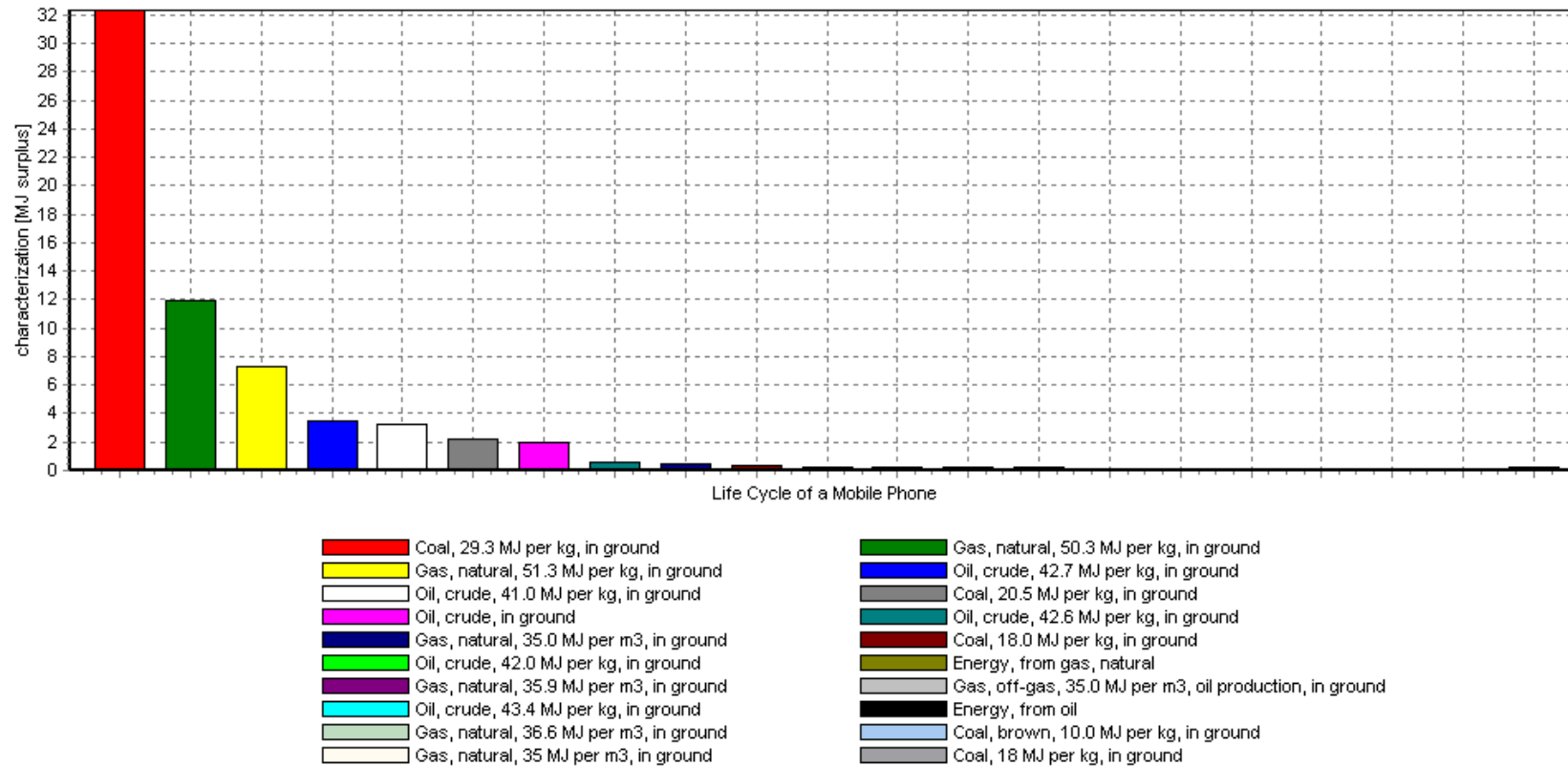


Figure E.3 Characterization – Climate Change



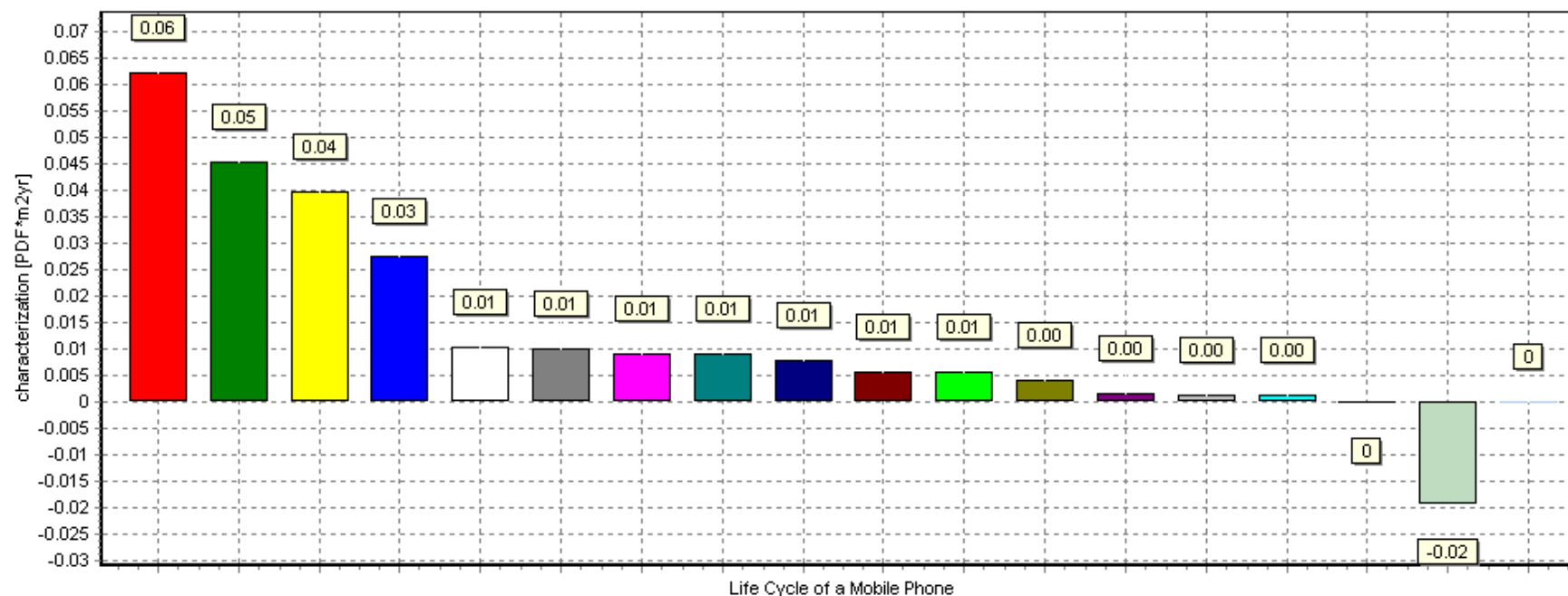
Analyzing 1 p life cycle 'Life Cycle of a Mobile Phone'; Method: Eco-indicator 99 (E) V2.1 Australian substances / Europe EI 99 E/A / characterization

Figure E.4 Characterization – Ecotoxicity



Analyzing 1 p life cycle 'Life Cycle of a Mobile Phone'; Method: Eco-indicator 99 (E) V2.1 Australian substances / Europe EI 99 E/A / characterization

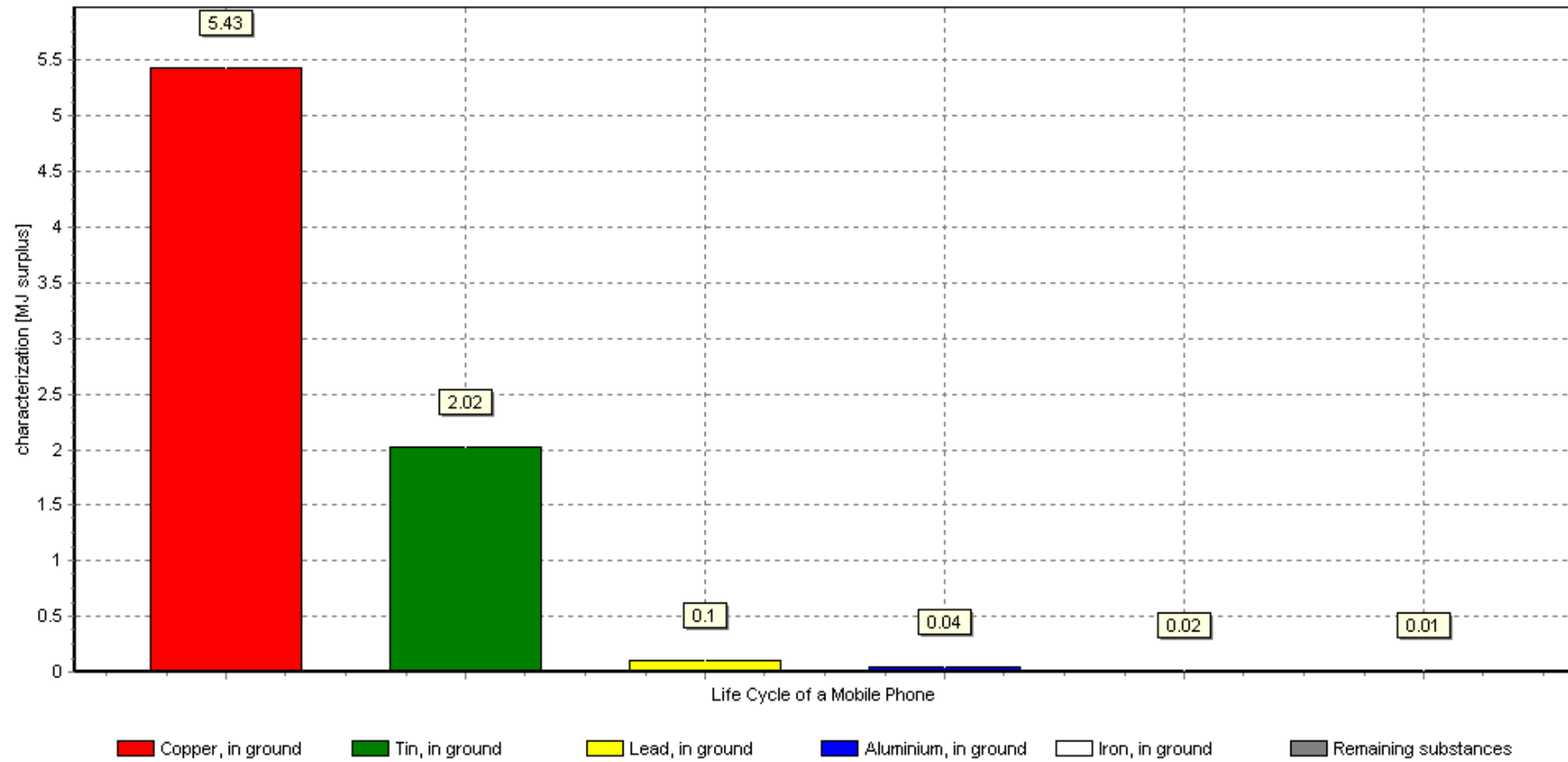
Figure E.5 Characterization – Fossil Fuels



- Transformation, to urban, continuously built
- Transformation, to industrial area
- Occupation, industrial area
- Occupation, arable
- Land use II-IV
- Transformation, to arable
- Occupation, traffic area
- Transformation, to water bodies, artificial
- Occupation, urban, green areas
- Land use II-III
- Occupation, urban, continuously built
- Land use III-IV
- Transformation, from forest, intensive, clear-cutting
- Occupation, industrial area, vegetation
- Transformation, to industrial area, vegetation
- Occupation, forest
- Transformation, from unknown
- Remaining substances

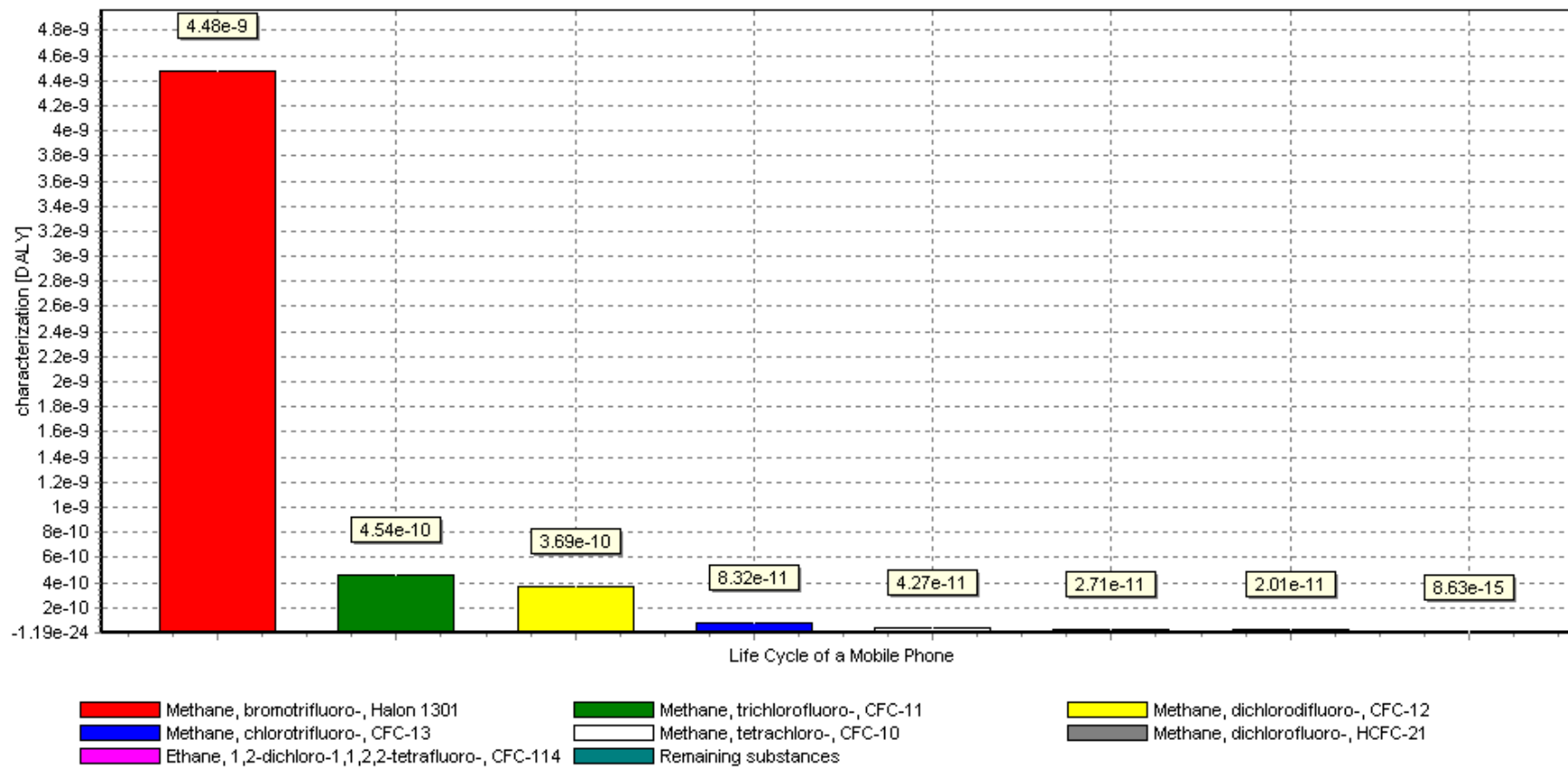
Analyzing 1 p life cycle 'Life Cycle of a Mobile Phone'; Method: Eco-indicator 99 (E) V2.1 Australian substances / Europe EI 99 E/A / characterization

Figure E.6 Characterization – Land Use



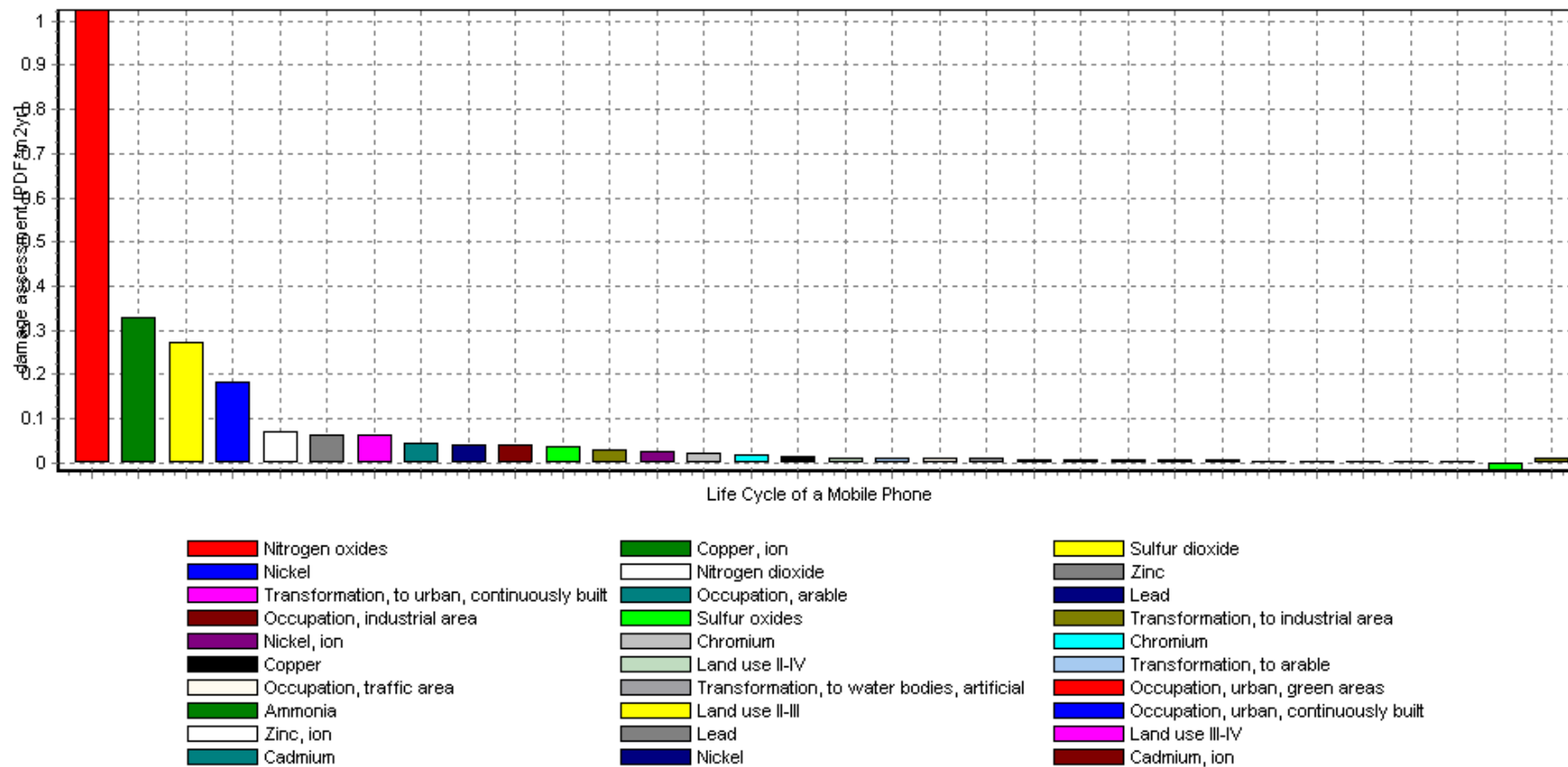
Analyzing 1 p life cycle 'Life Cycle of a Mobile Phone'; Method: Eco-indicator 99 (E) V2.1 Australian substances / Europe EI 99 E/A / characterization

Figure E.7 Characterization – Minerals



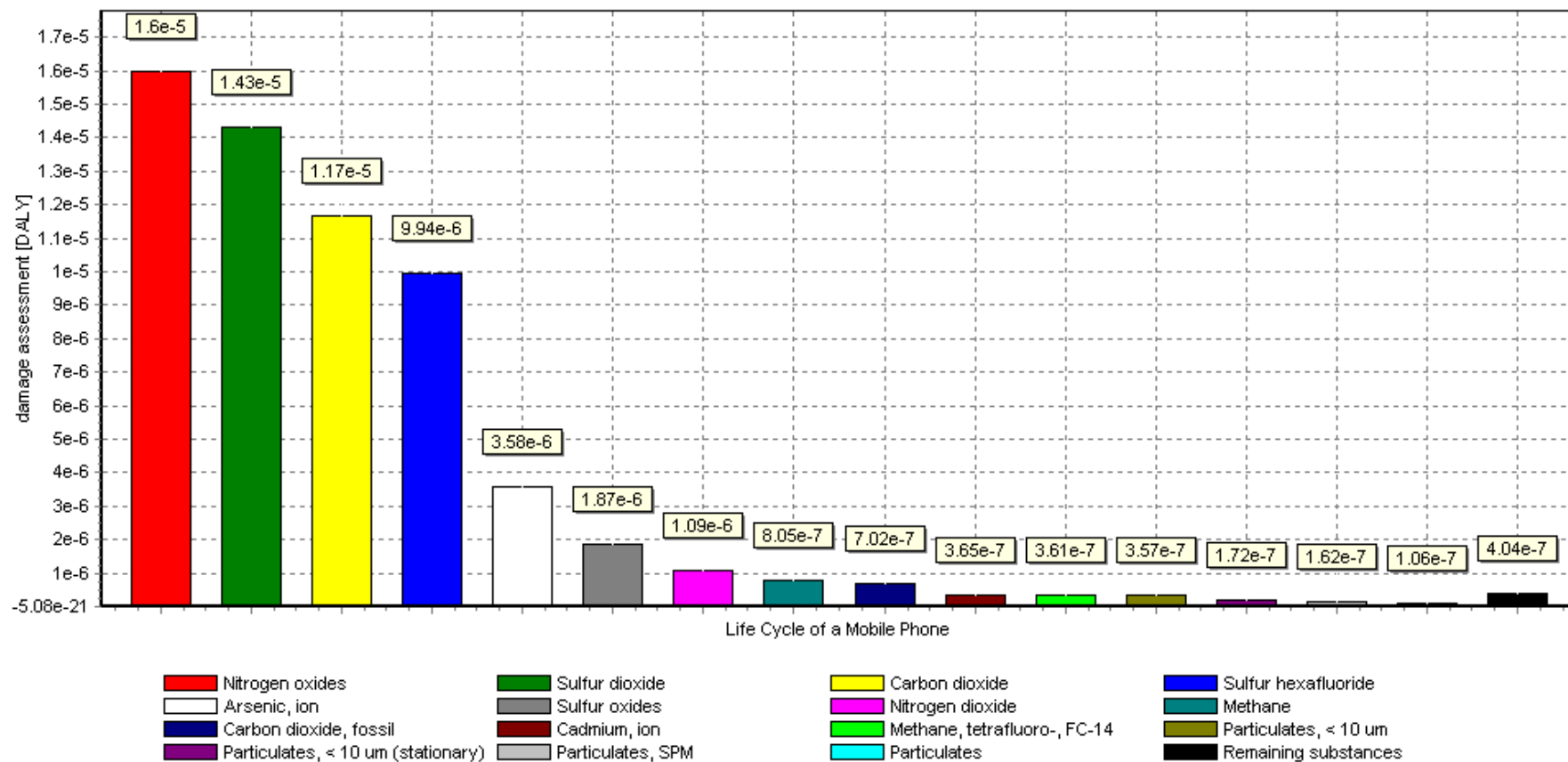
Analyzing 1 p life cycle 'Life Cycle of a Mobile Phone'; Method: Eco-indicator 99 (E) V2.1 Australian substances / Europe EI 99 E/A / characterization

Figure E.8 Characterization – Ozone Layer



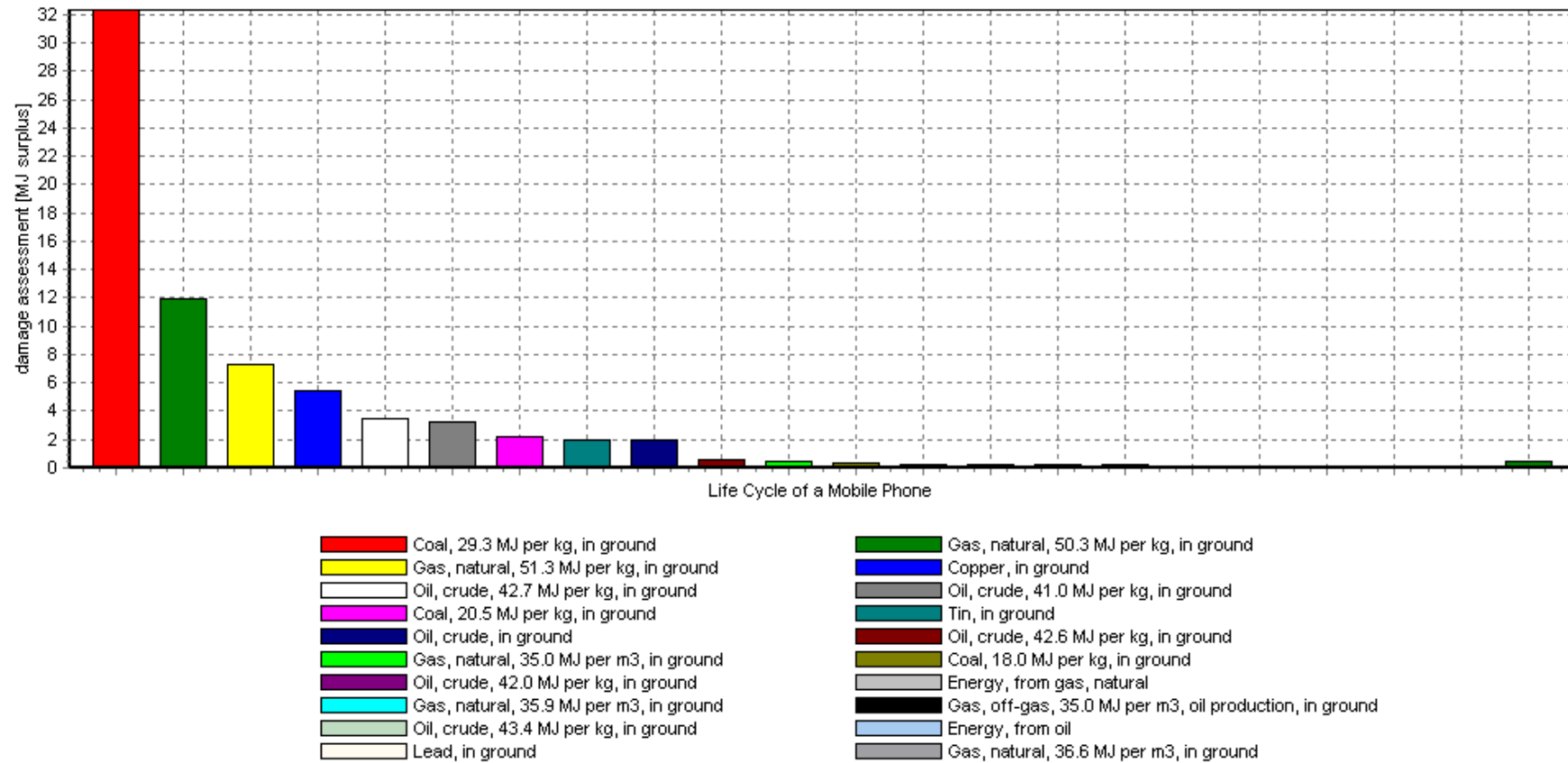
Analyzing 1 p life cycle 'Life Cycle of a Mobile Phone'; Method: Eco-indicator 99 (E) V2.1 Australian substances / Europe EI 99 E/A / damage assessment

Figure E.9 Damage Assessment – Ecosystem Quality



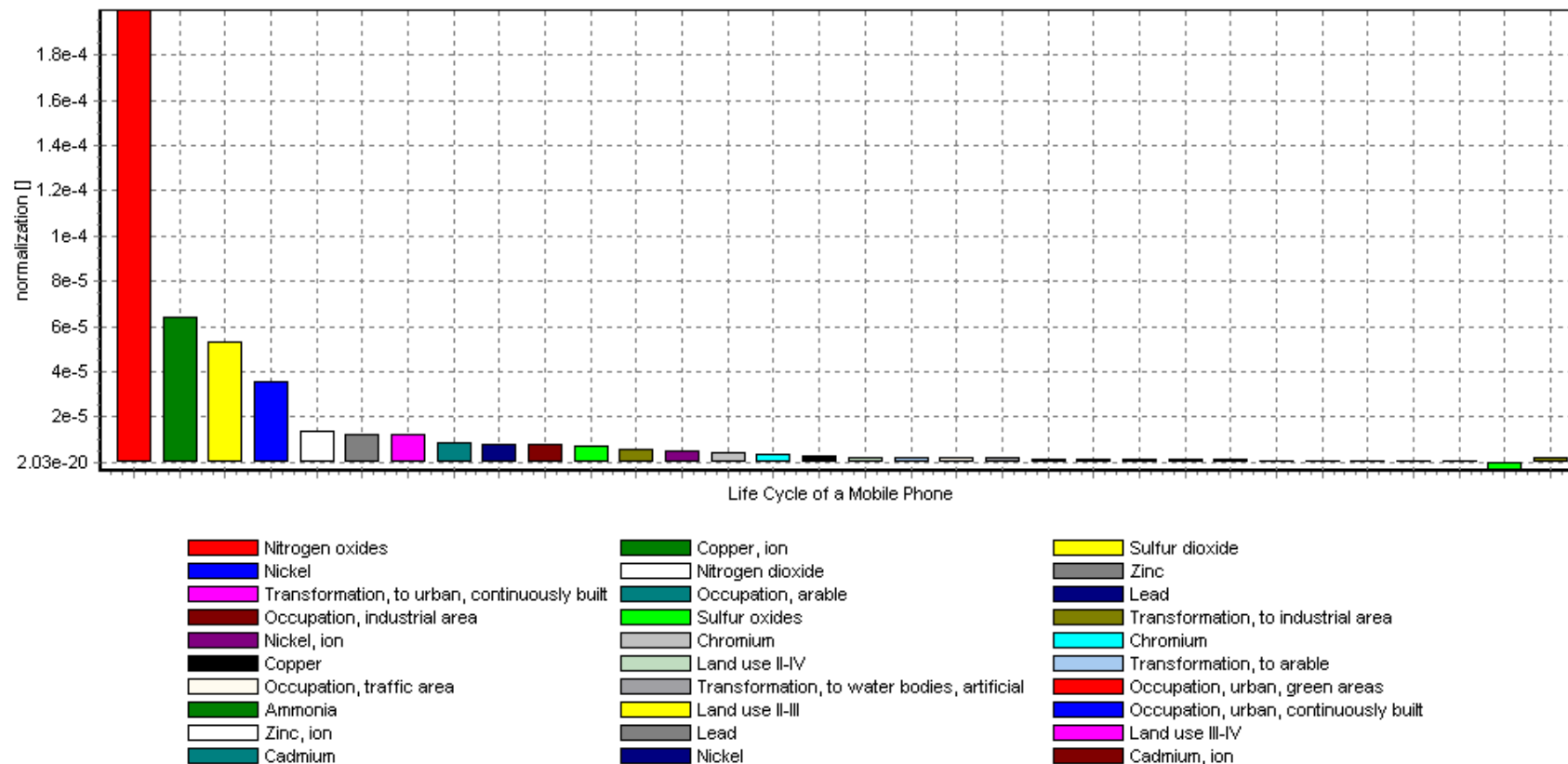
Analyzing 1 p life cycle 'Life Cycle of a Mobile Phone'; Method: Eco-indicator 99 (E) V2.1 Australian substances / Europe EI 99 E/A / damage assessment

Figure E.10 Damage Assessment – Human Health



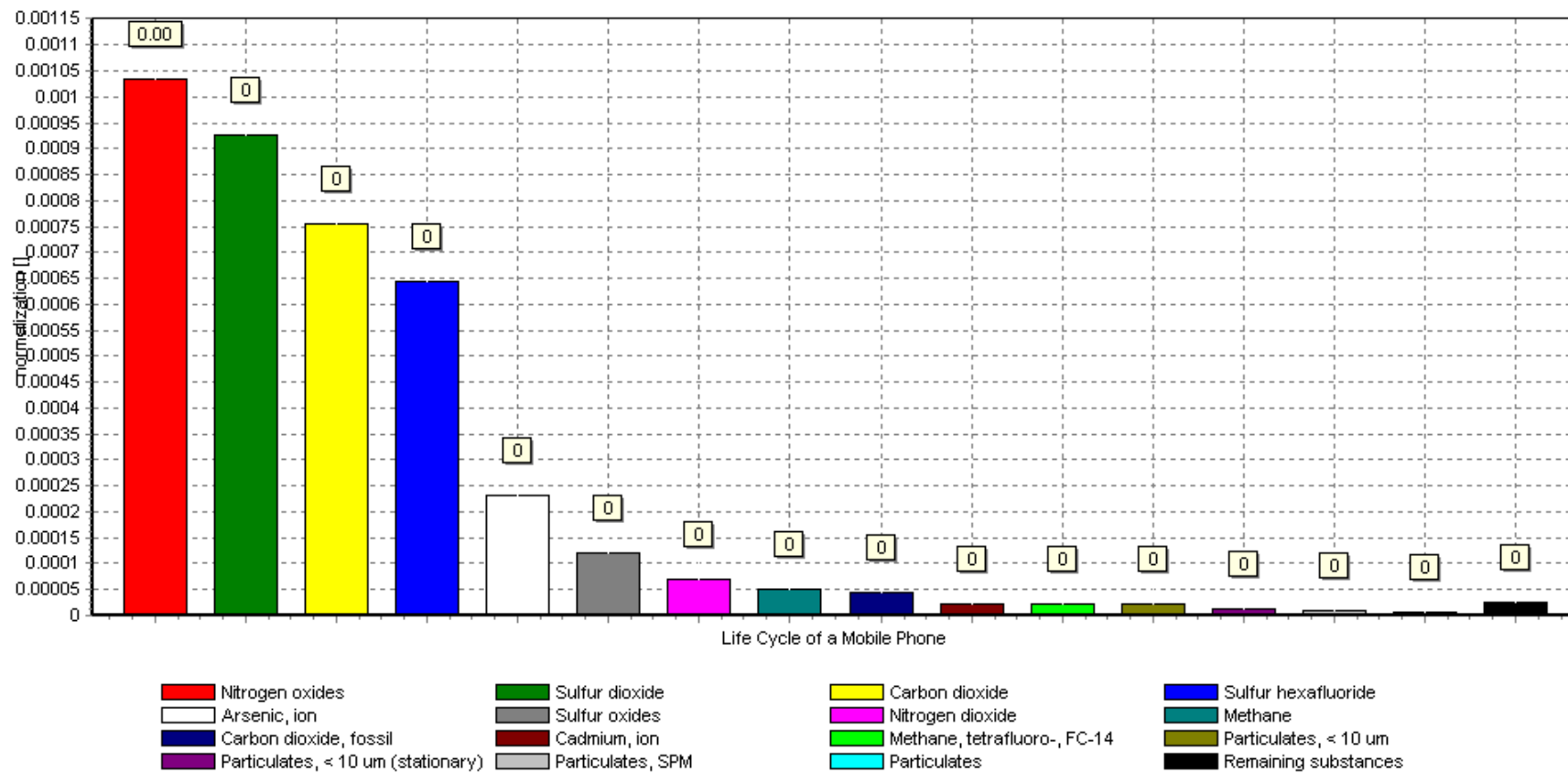
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Figure E.11 Damage Assessment – Resources



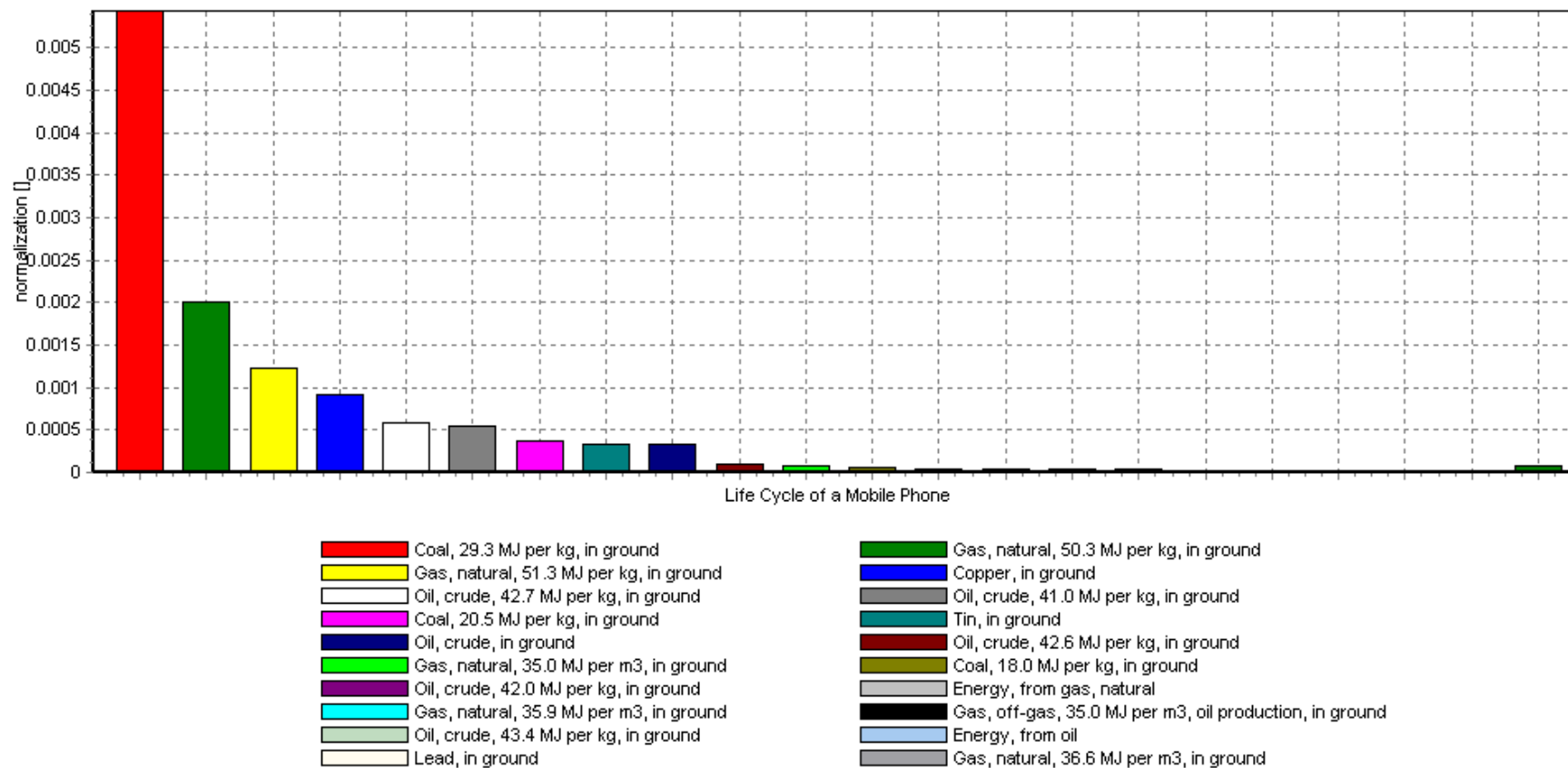
Analyzing 1 p life cycle 'Life Cycle of a Mobile Phone'; Method: Eco-indicator 99 (E) V2.1 Australian substances / Europe EI 99 E/A / normalization

Figure E.12 Normalization – Ecosystem Quality



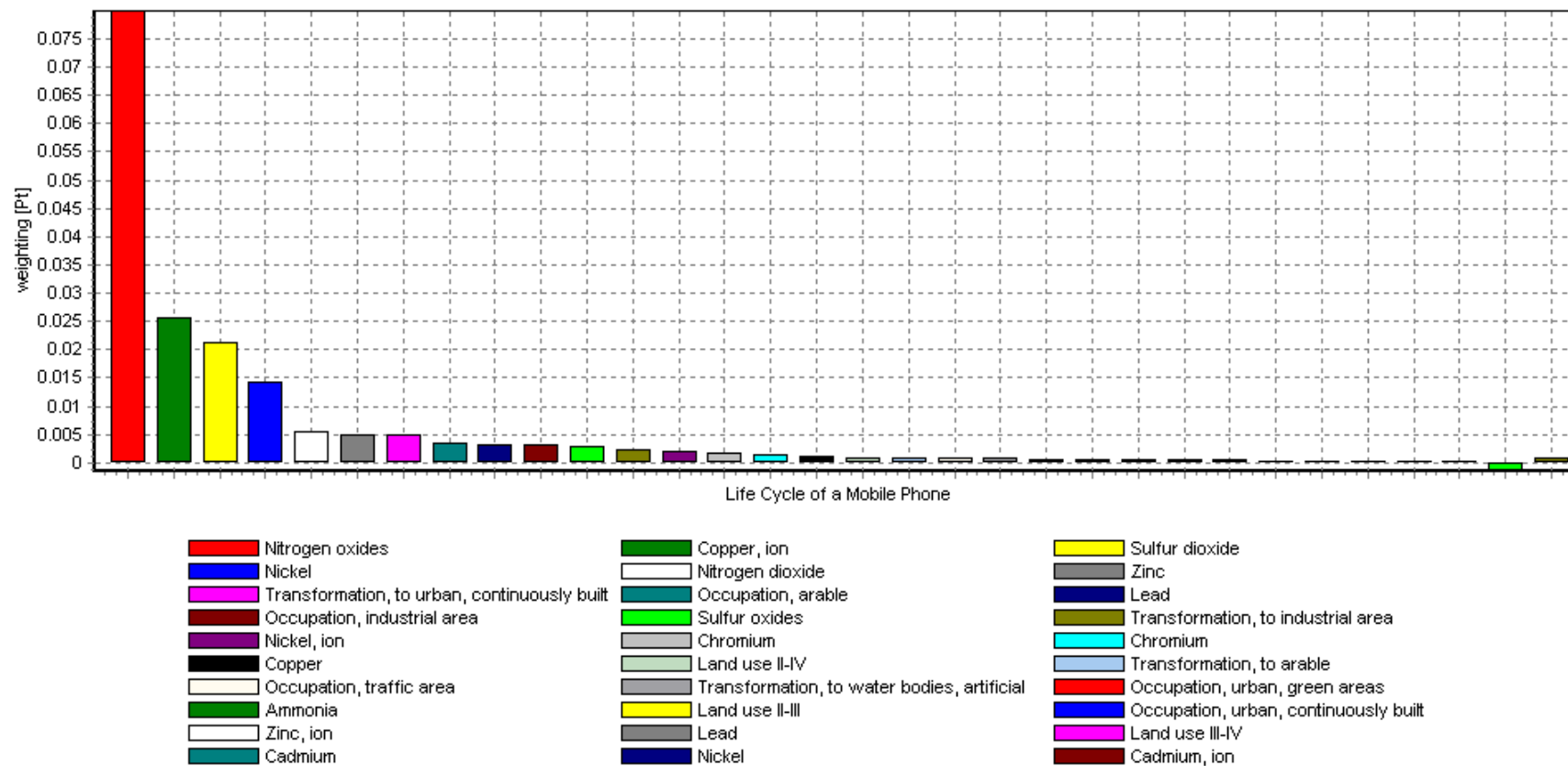
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Figure E.13 Normalization – Human Health



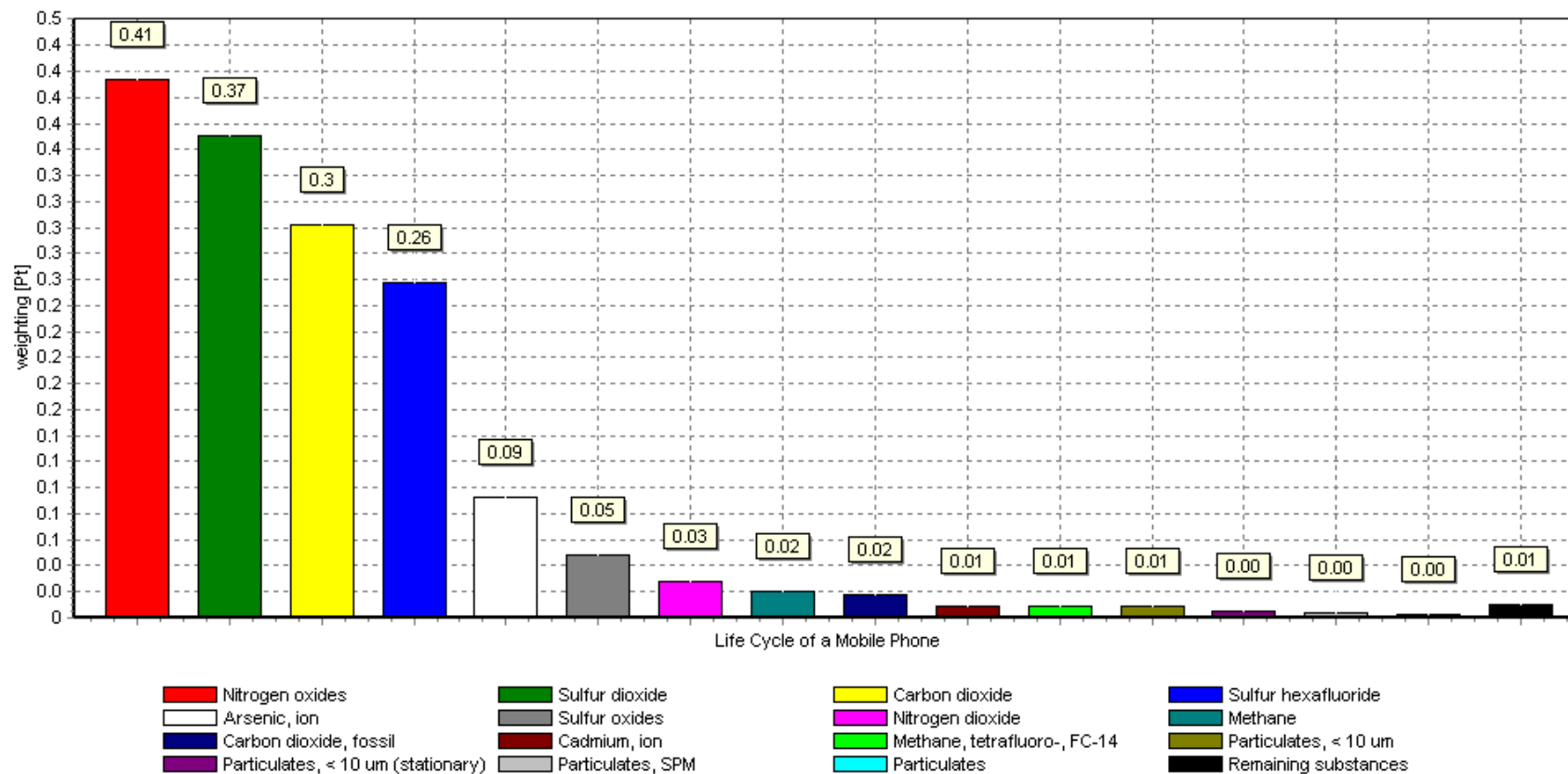
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Figure E.14 Normalization - Resources



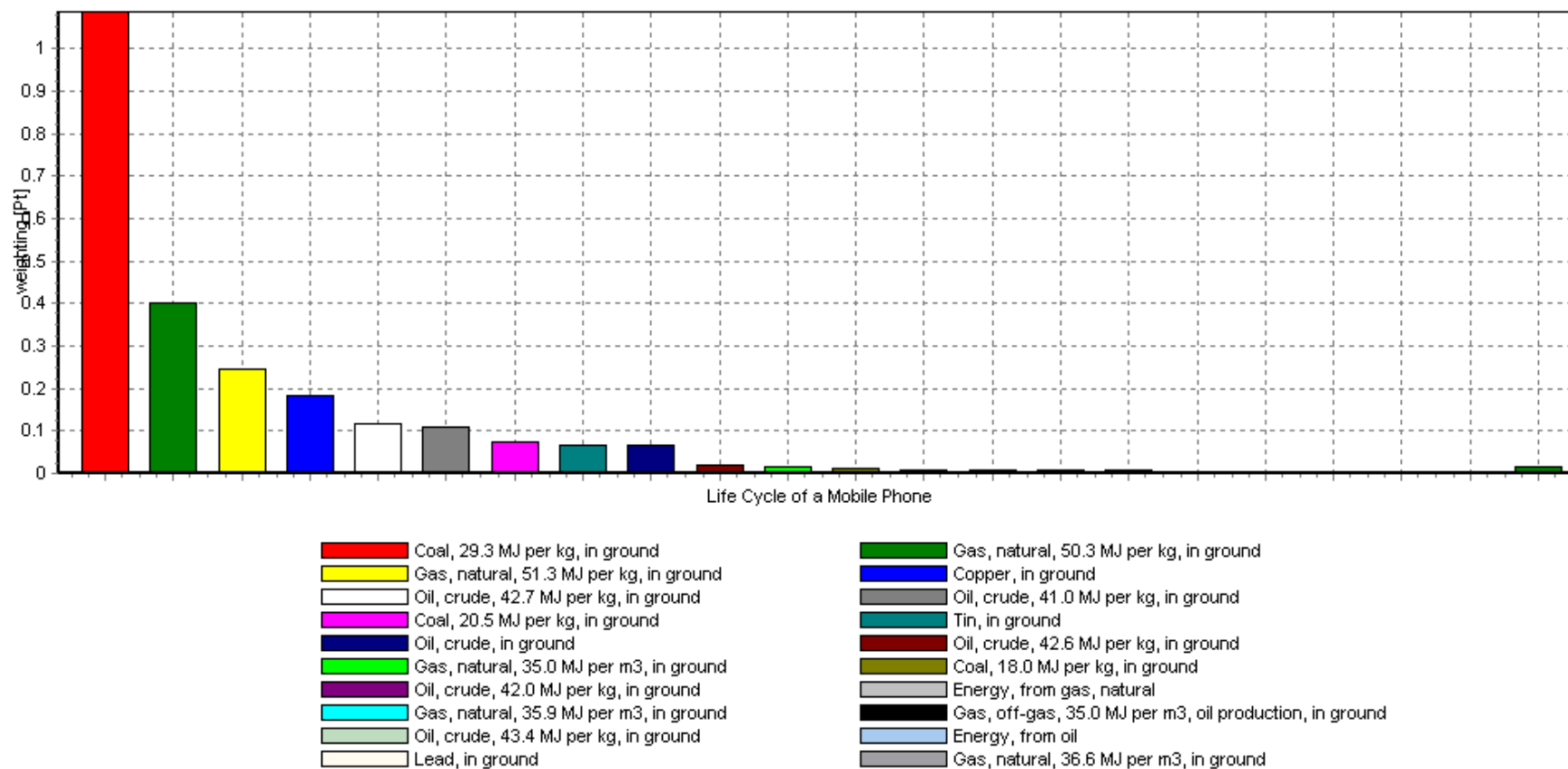
Analyzing 1 p life cycle 'Life Cycle of a Mobile Phone'; Method: Eco-indicator 99 (E) V2.1 Australian substances / Europe EI 99 E/A / weighting

Figure E.15 Weighting – Ecosystem Quality



Analyzing 1 p life cycle 'Life Cycle of a Mobile Phone'; Method: Eco-indicator 99 (E) V2.1 Australian substances / Europe EI 99 E/A / weighting

Figure E.16 Weighting – Human Health

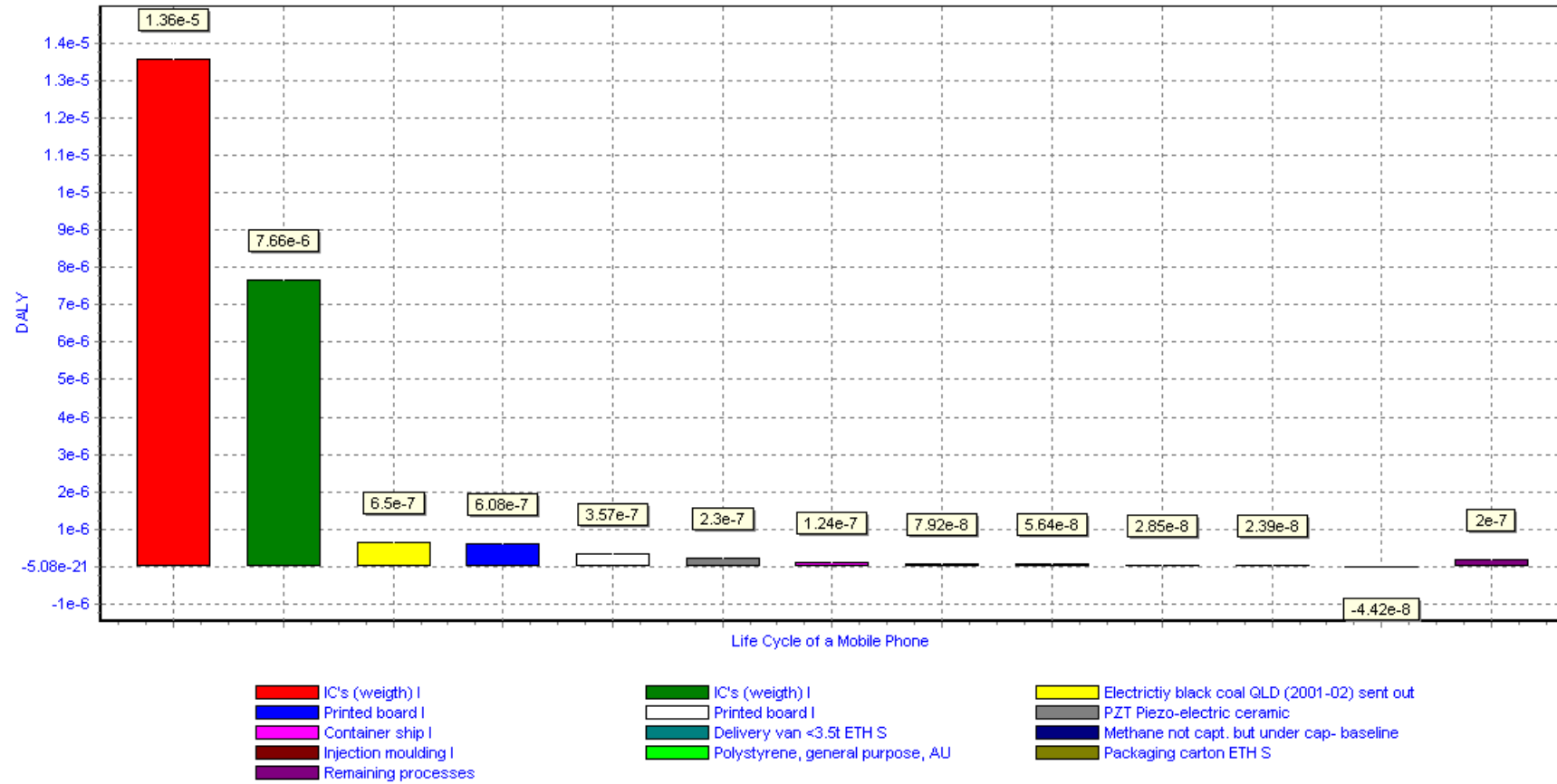


Analyzing 1 p life cycle 'Life Cycle of a Mobile Phone'; Method: Eco-indicator 99 (E) V2.1 Australian substances / Europe EI 99 E/A / weighting

Figure E.17 Weighting – Resource

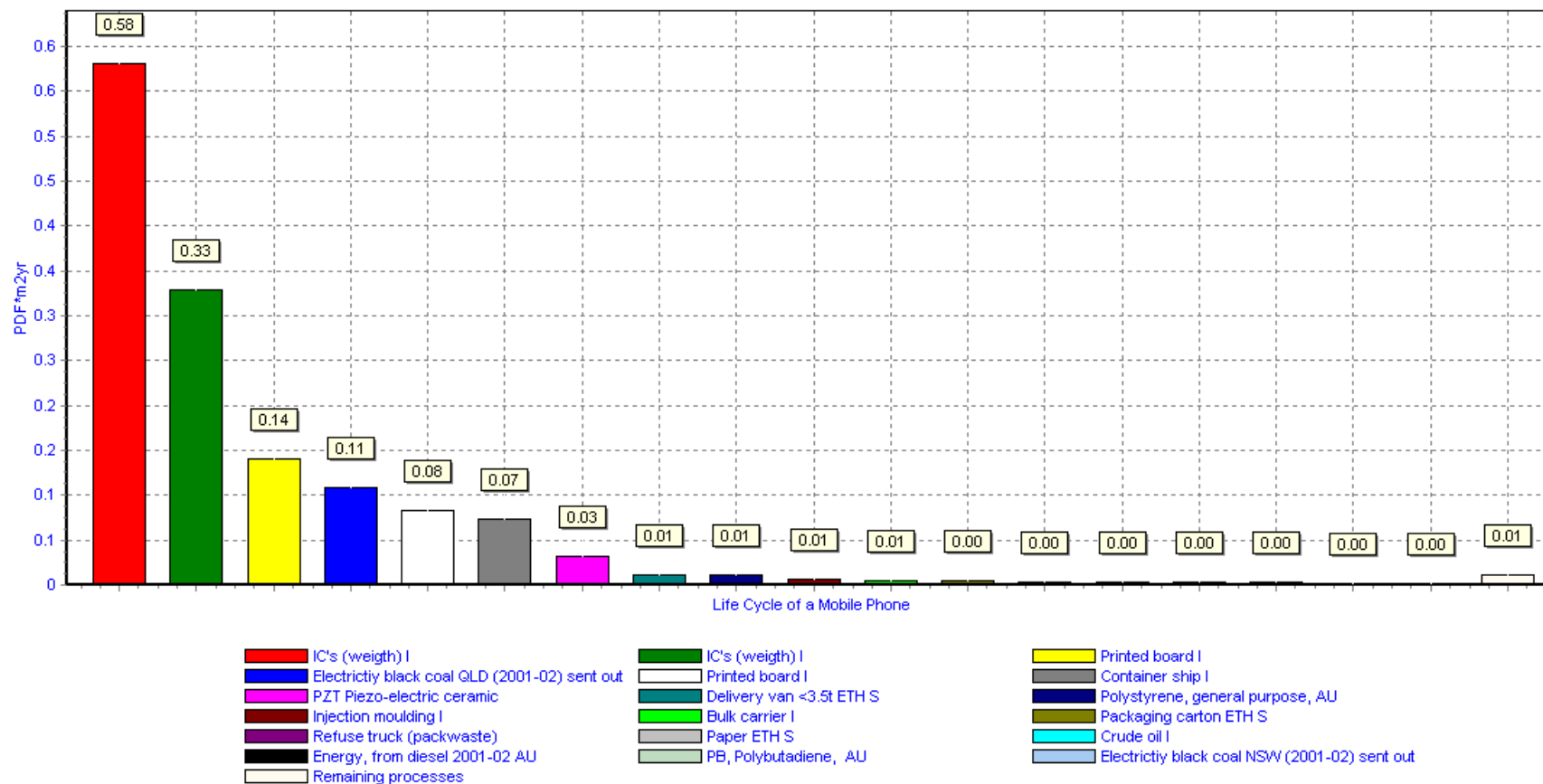
Appendix F – Process Contribution

- Figure F.1 Characterization – Climate Change
- Figure F.2 Characterization – Acidification/Eutrophication
- Figure F.3 Characterization – Carcinogens
- Figure F.4 Characterization – Fossil Fuels
- Figure F.5 Characterization – Land Use
- Figure F.6 Characterization - Minerals
- Figure F.7 Characterization – Ozone Layer
- Figure F.8 Characterization - Ecotoxicity
- Figure F.9 Damage Assessment – Ecosystem Quality
- Figure F.10 Damage Assessment – Human Health
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- Figure F.12 Normalization – Ecosystem Quality
- Figure F.13 Normalization – Human Health
- Figure F.14 Normalization - Resources
- Figure F.15 Weighting – Ecosystem Quality
- Figure F.16 Weighting – Human Health
- Figure F.17 Weighting - Resources



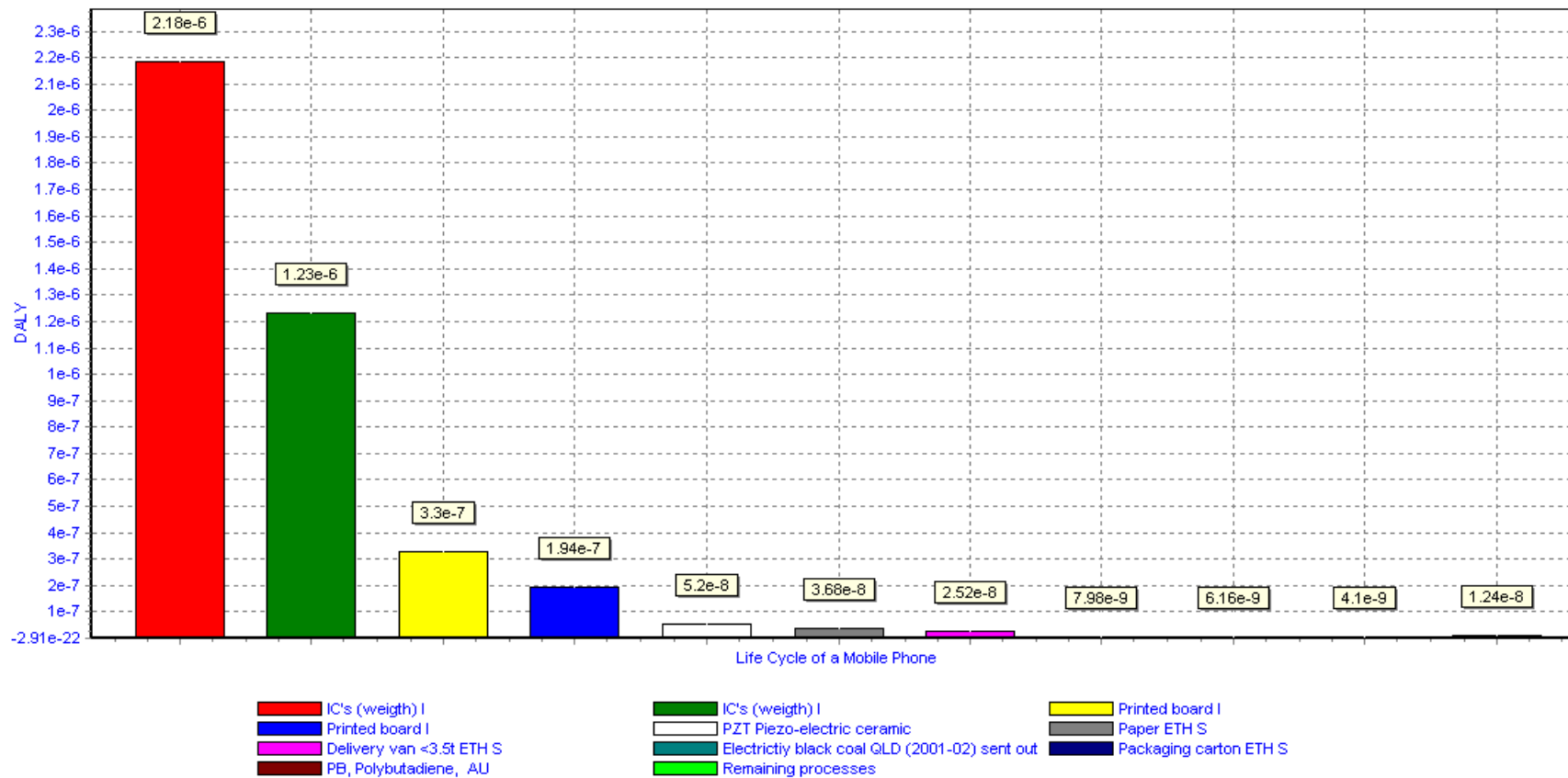
Analyzing 1 p life cycle 'Life Cycle of a Mobile Phone'; Method: Eco-indicator 99 (E) V2.1 Australian substances / Europe EI 99 E/A / characterization

Figure F.1 Characterization – Climate Change



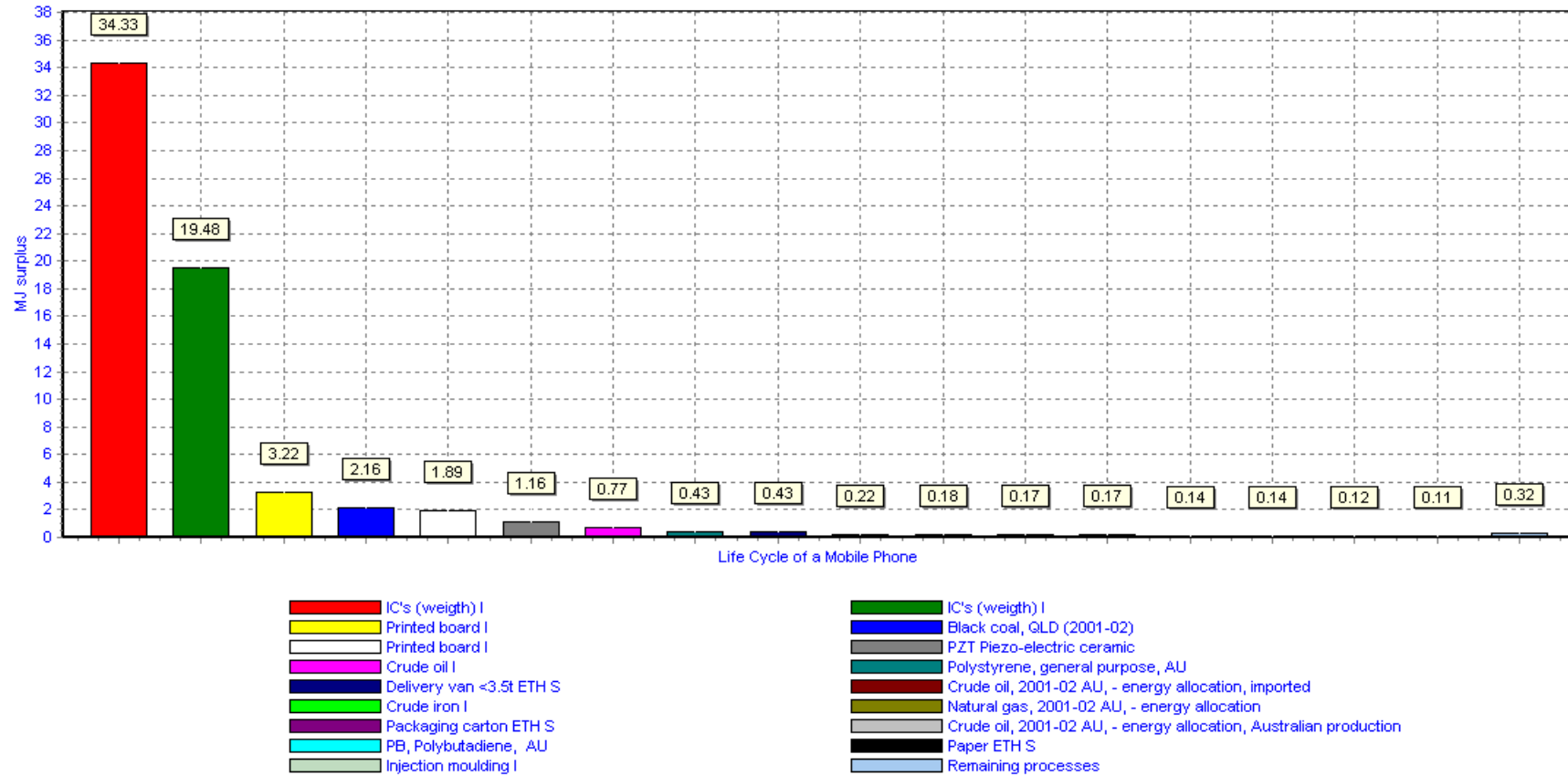
Analyzing 1 p life cycle 'Life Cycle of a Mobile Phone'; Method: Eco-indicator 99 (E) V2.1 Australian substances / Europe EI 99 E/A / characterization

Figure F.2 Characterization – Acidification/Eutrophication



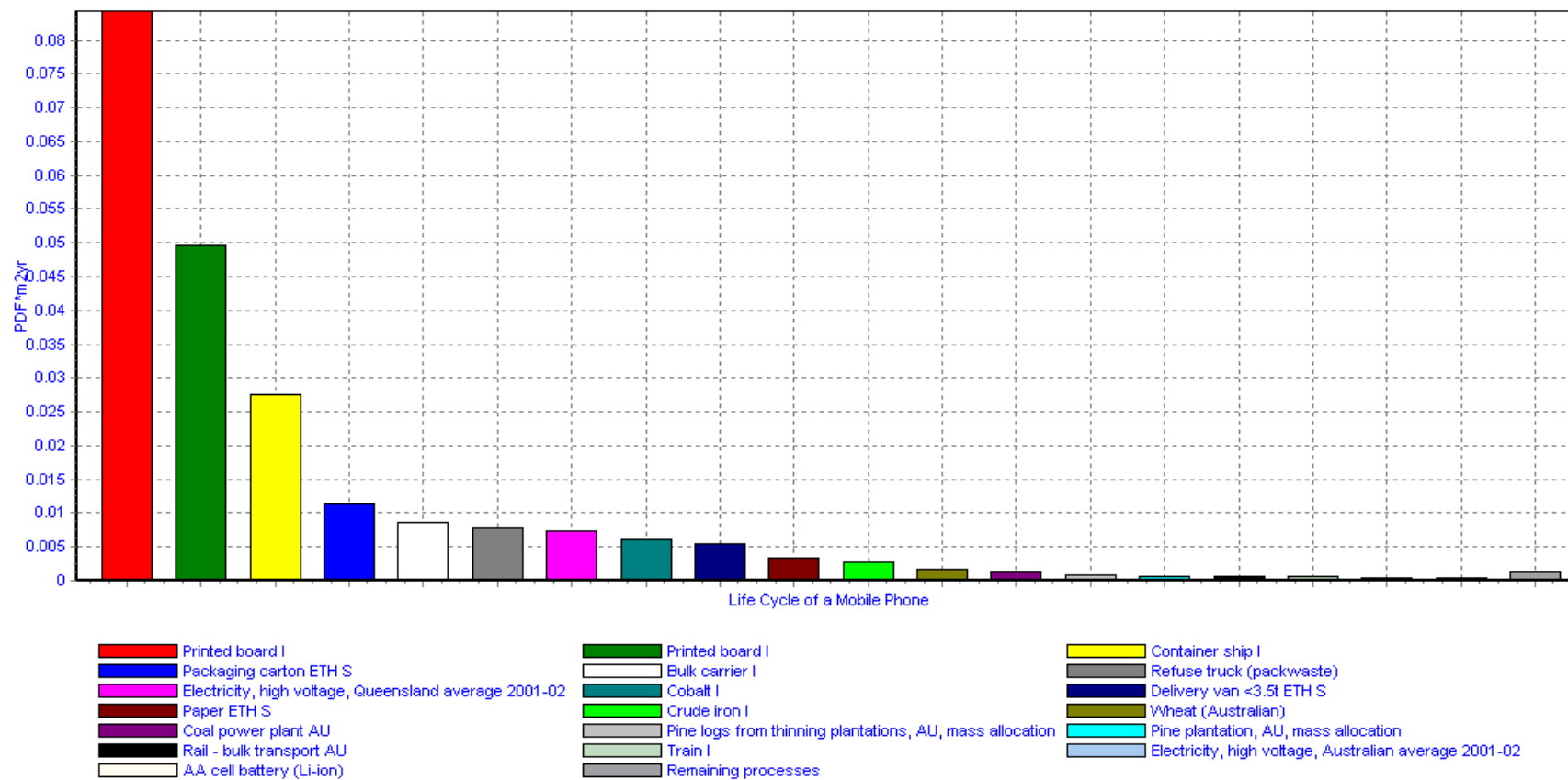
Analyzing 1 p life cycle 'Life Cycle of a Mobile Phone'; Method: Eco-indicator 99 (E) V2.1 Australian substances / Europe EI 99 E/A / characterization

Figure F.3 Characterization – Carcinogens



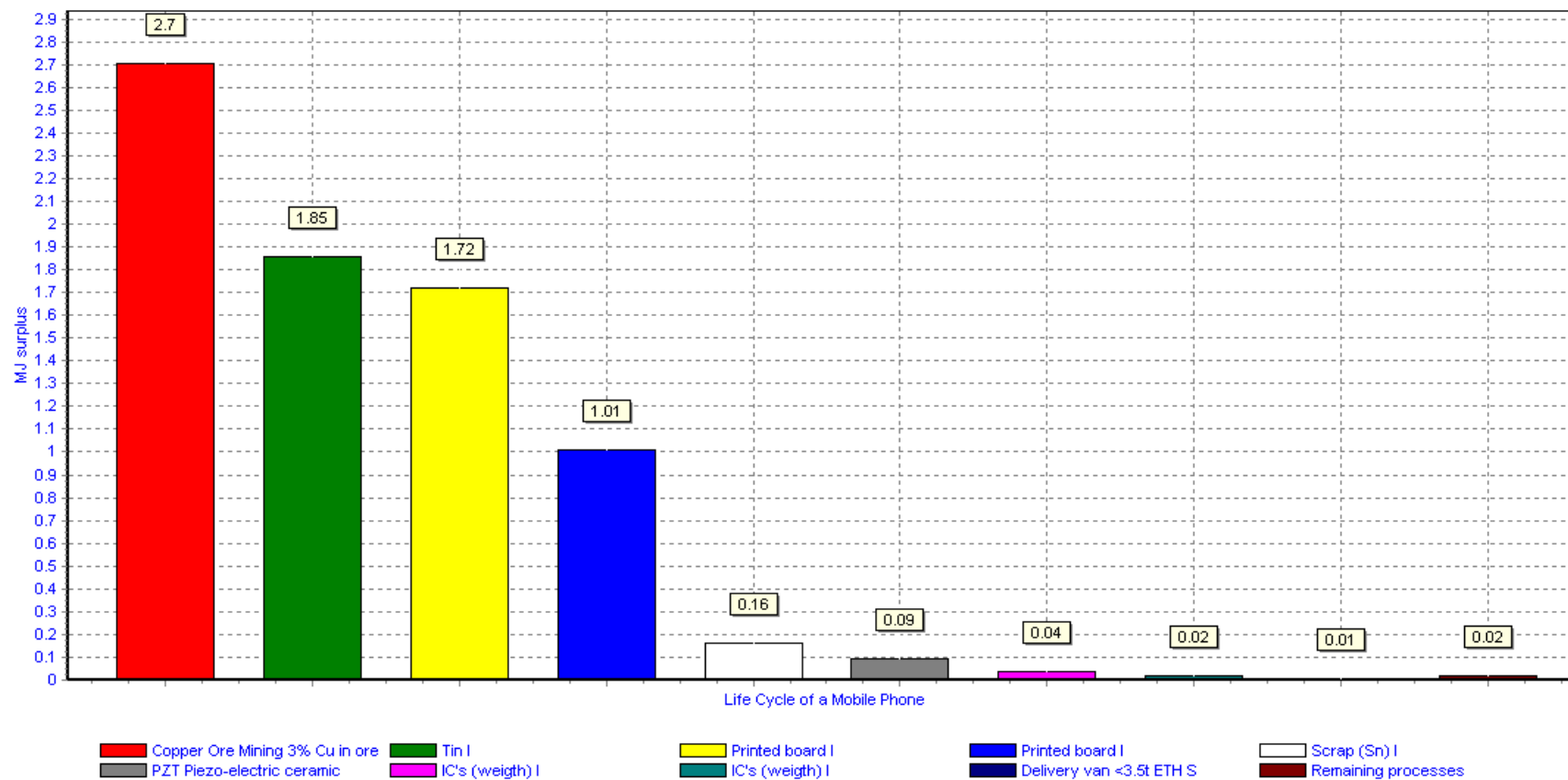
Analyzing 1 p life cycle 'Life Cycle of a Mobile Phone'; Method: Eco-indicator 99 (E) V2.1 Australian substances / Europe EI 99 E/A / characterization

Figure F.4 Characterization – Fossil Fuels



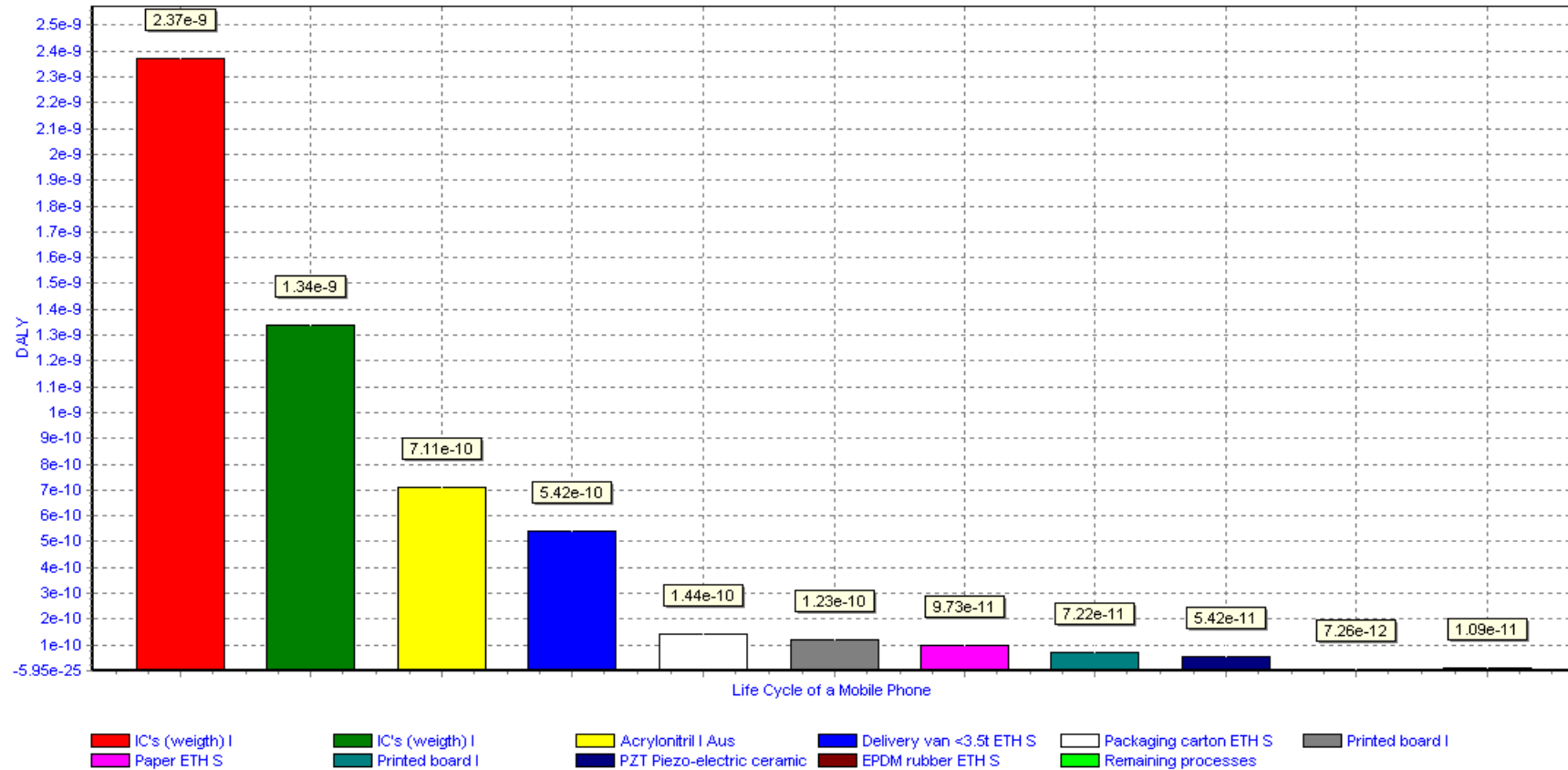
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Figure F.5 Characterization – Land Use



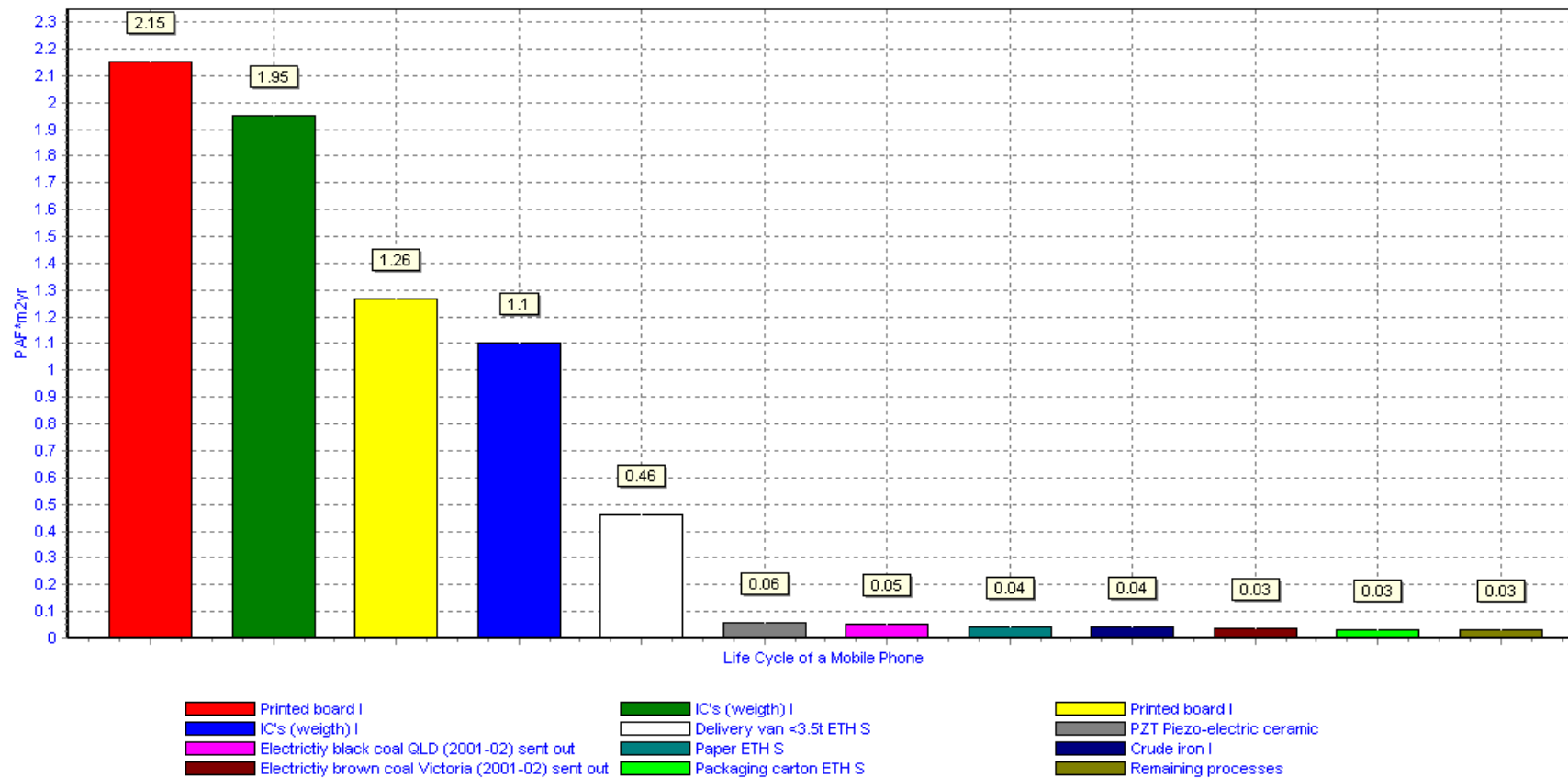
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Figure F.6 Characterization - Minerals



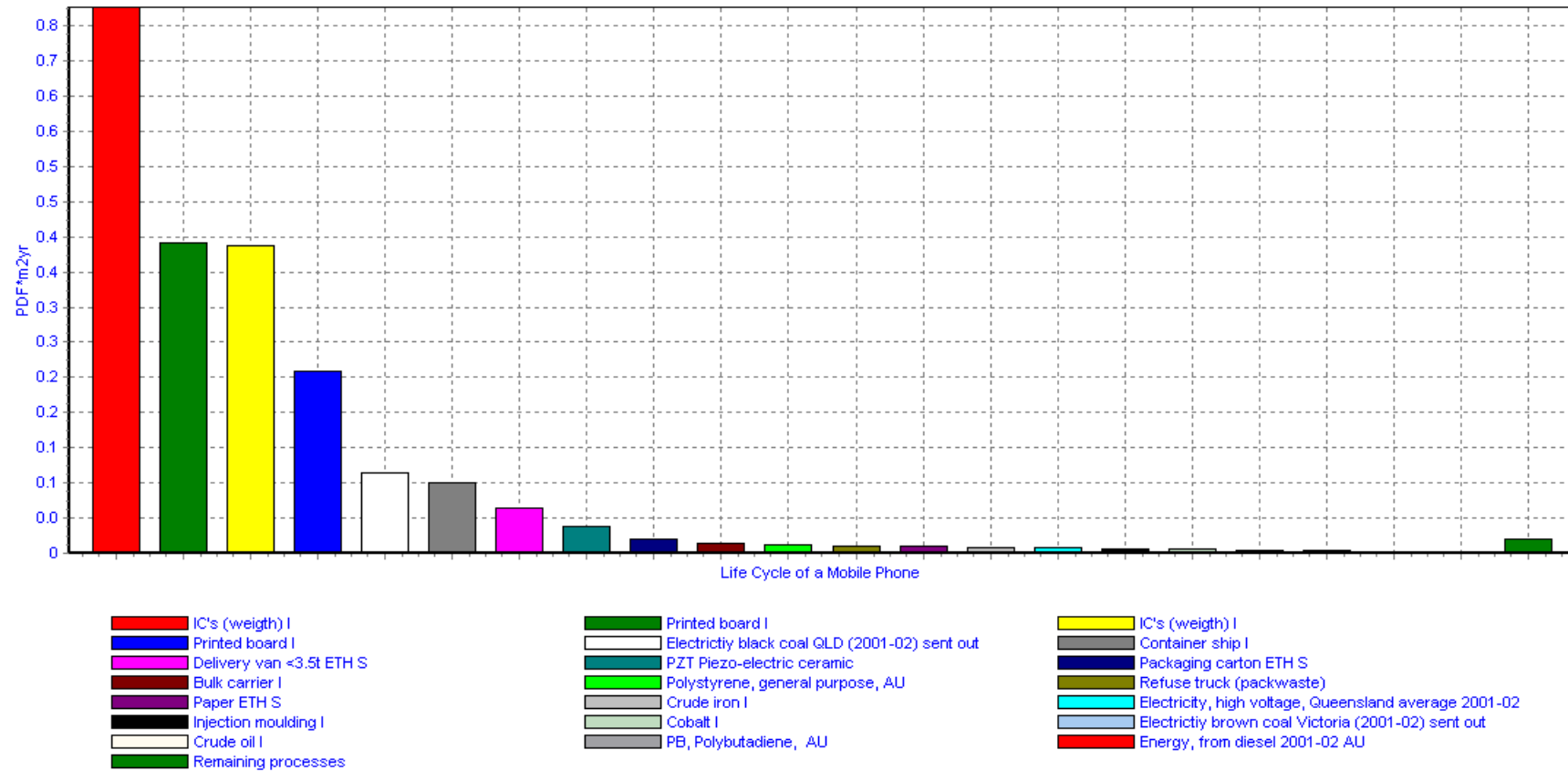
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Figure F.7 Characterization – Ozone Layer



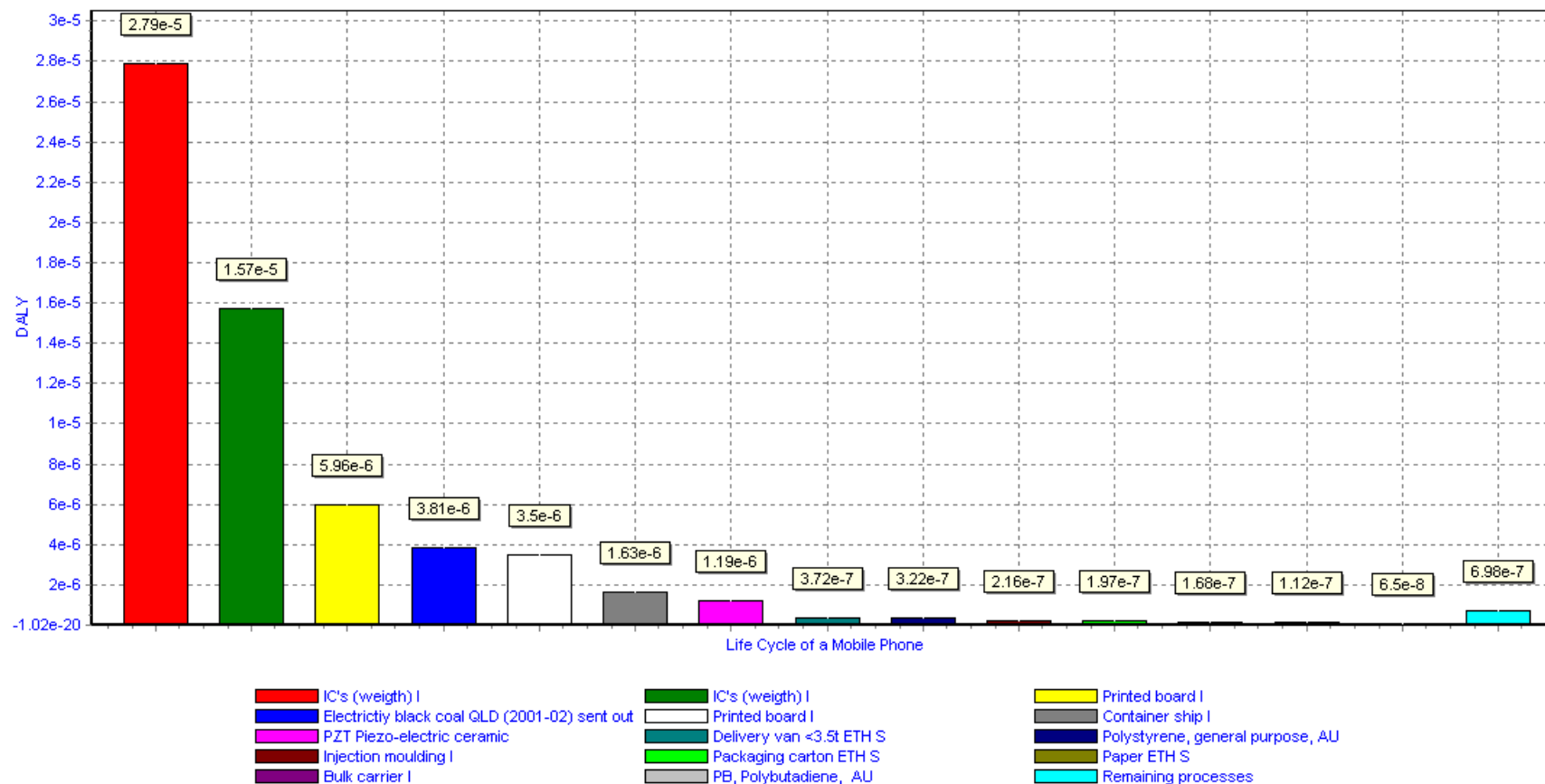
Analyzing 1 p life cycle 'Life Cycle of a Mobile Phone'; Method: Eco-indicator 99 (E) V2.1 Australian substances / Europe EI 99 E/A / characterization

Figure F.8 Characterization – Ecotoxicity



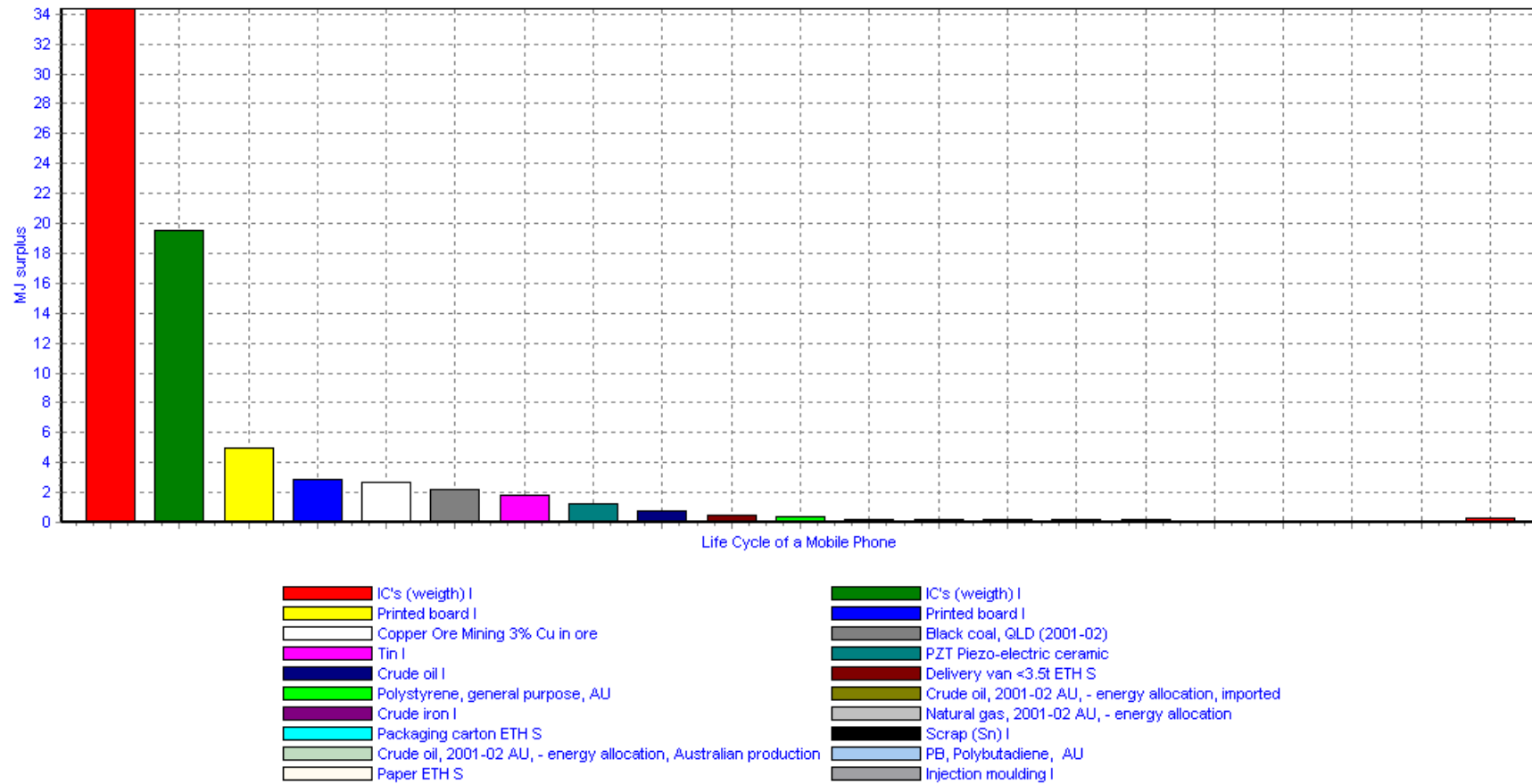
Analyzing 1 p life cycle 'Life Cycle of a Mobile Phone'; Method: Eco-indicator 99 (E) V2.1 Australian substances / Europe EI 99 E/A / damage assessment

Figure F.9 Damage Assessment – Ecosystem Quality



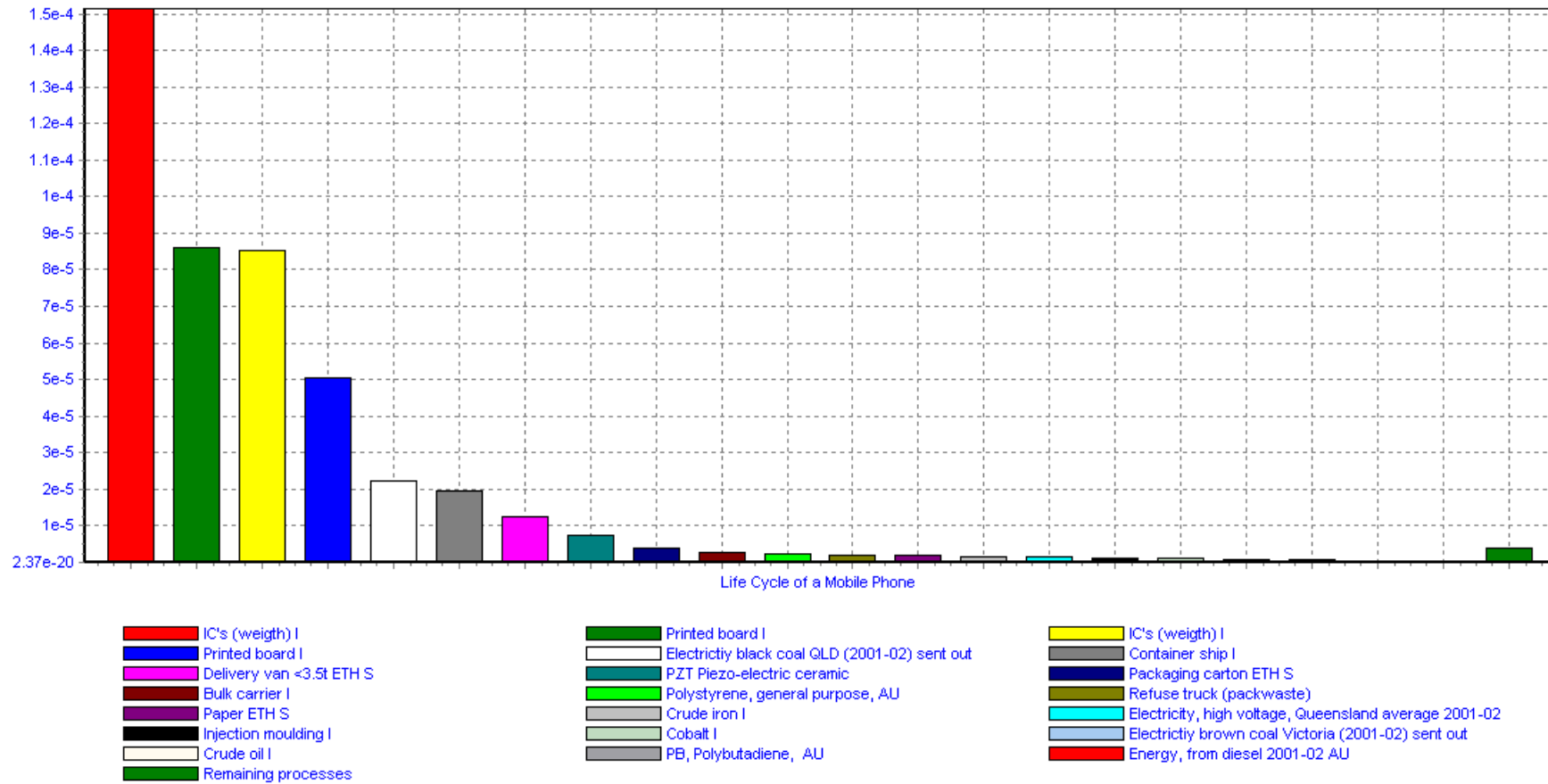
Analyzing 1 p life cycle 'Life Cycle of a Mobile Phone'; Method: Eco-indicator 99 (E) V2.1 Australian substances / Europe EI 99 E/A / damage assessment

Figure F.10 Damage Assessment – Human Health



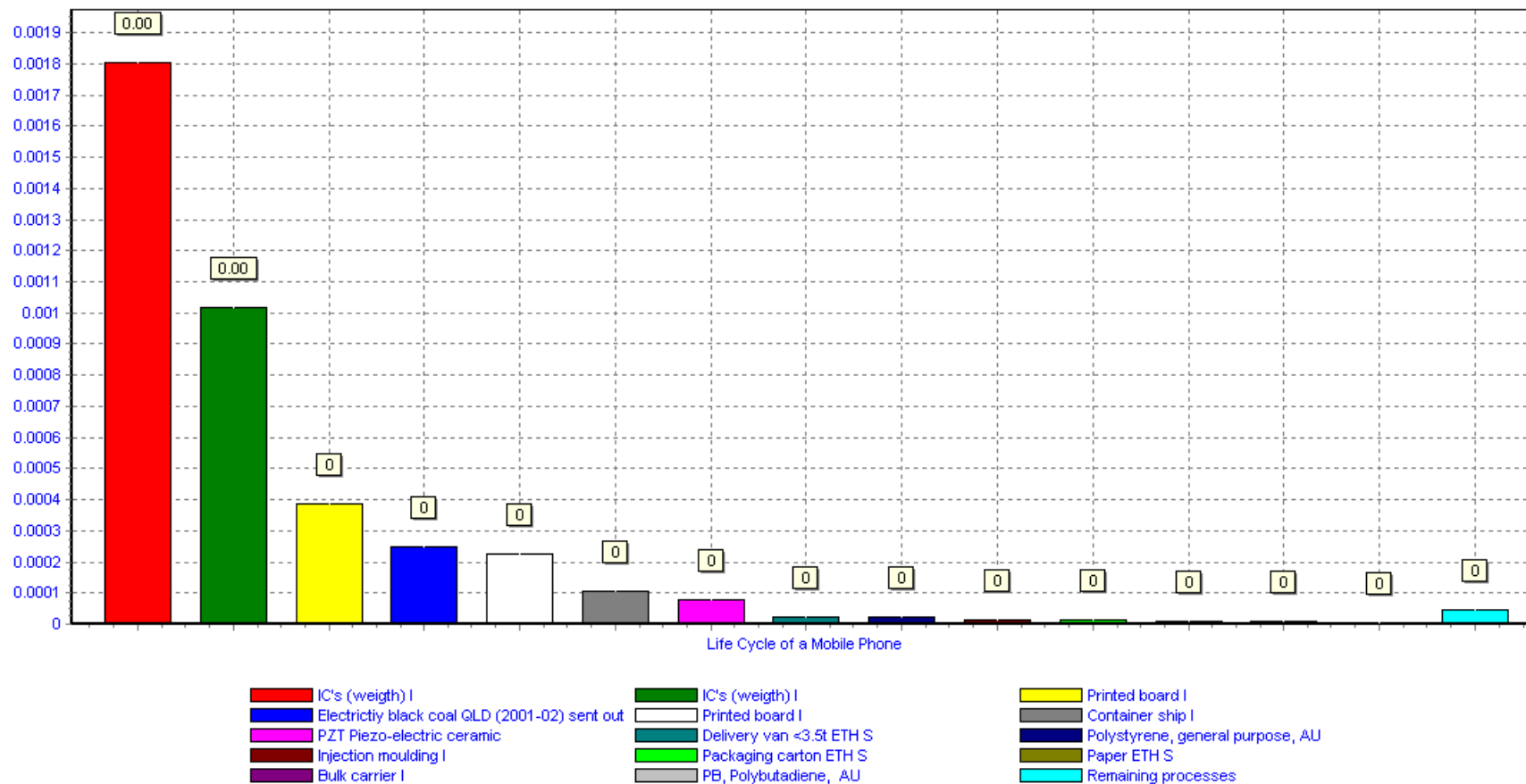
Analyzing 1 p life cycle 'Life Cycle of a Mobile Phone'; Method: Eco-indicator 99 (E) V2.1 Australian substances / Europe EI 99 E/A / damage assessment

Figure F.11 Damage Assessment – Resources



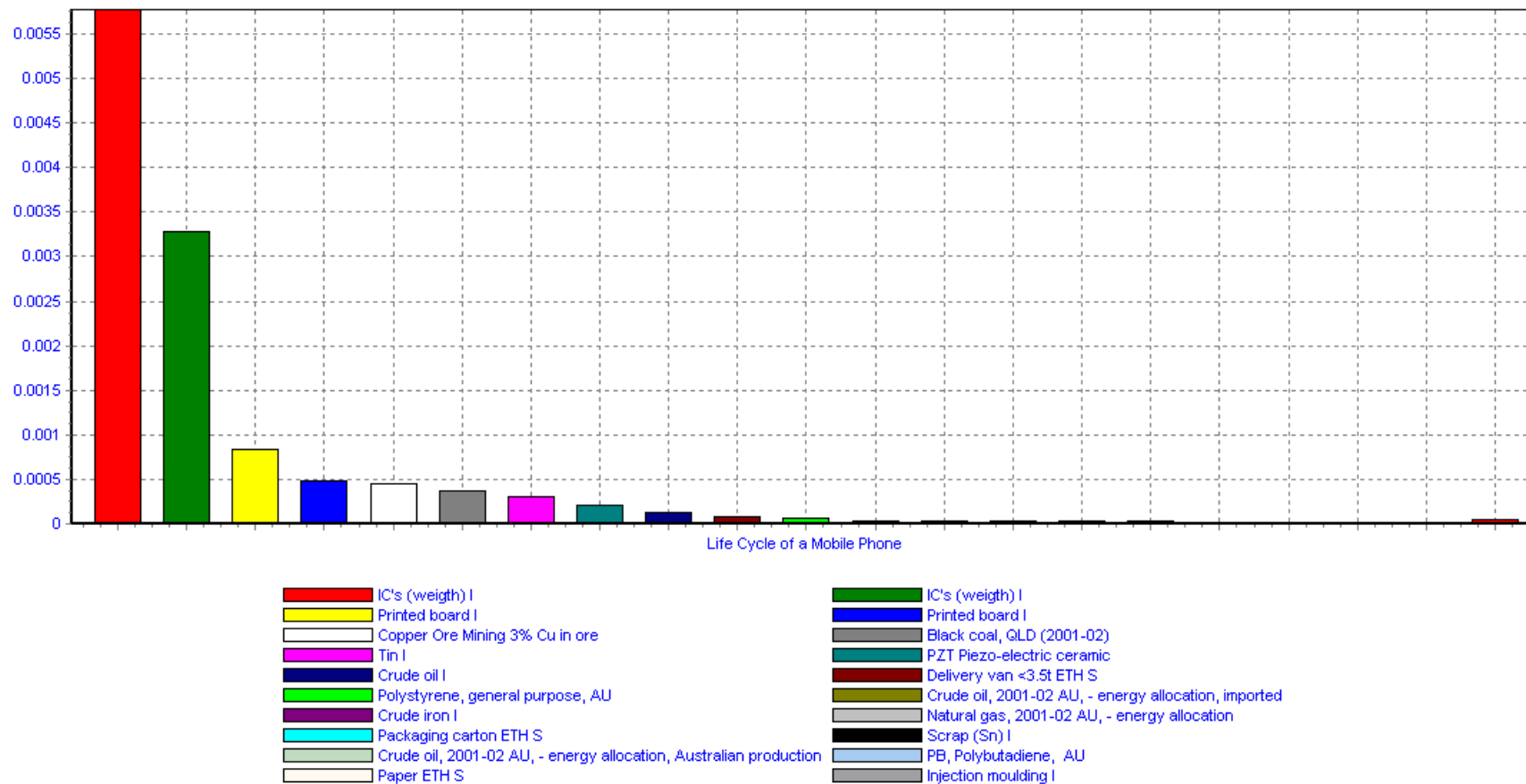
Analyzing 1 p life cycle 'Life Cycle of a Mobile Phone'; Method: Eco-indicator 99 (E) V2.1 Australian substances / Europe EI 99 E/A / normalization

Figure F.12 Normalization – Ecosystem Quality



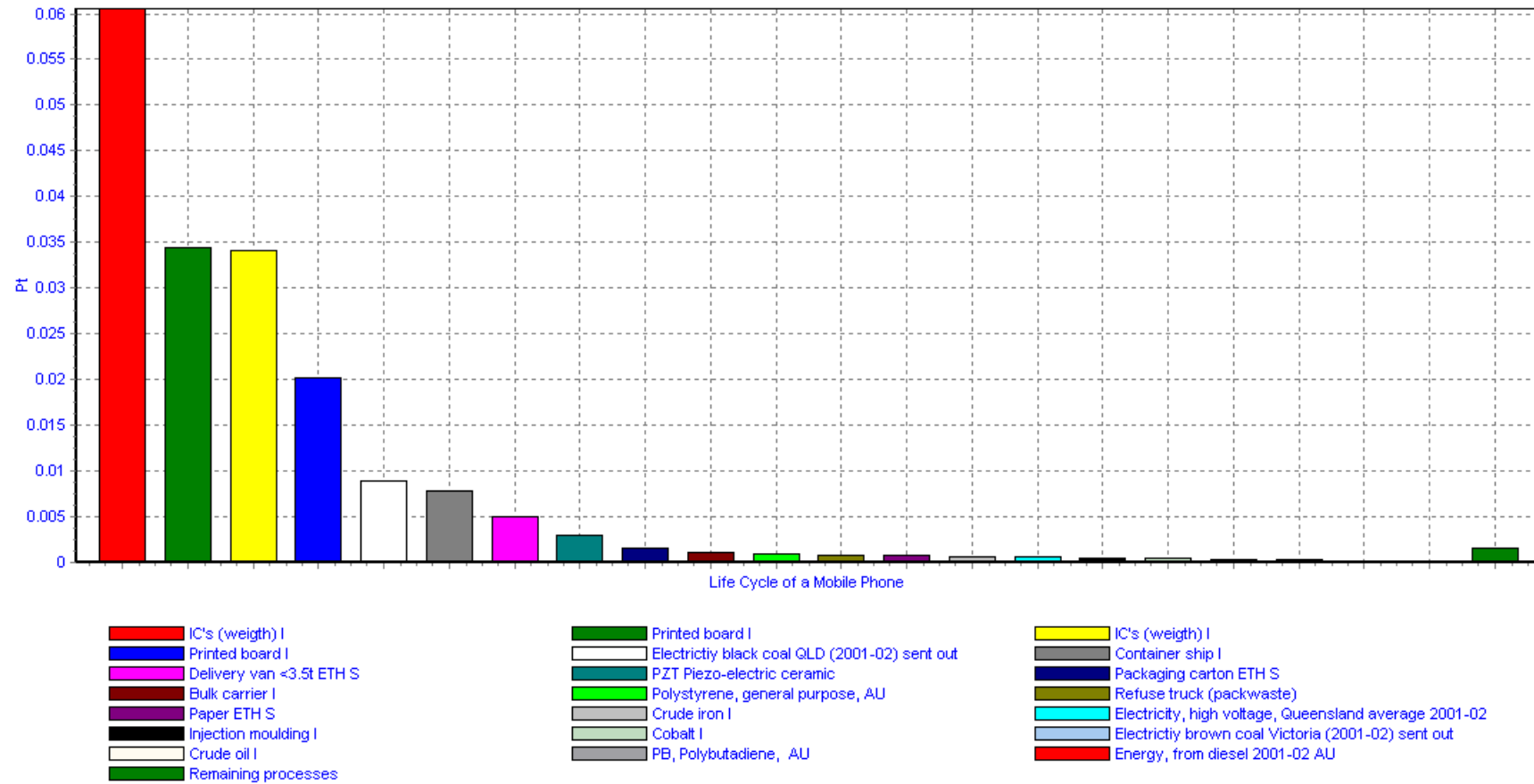
Analyzing 1 p life cycle 'Life Cycle of a Mobile Phone'; Method: Eco-indicator 99 (E) V2.1 Australian substances / Europe EI 99 E/A / normalization

Figure F.13 Normalization – Human Health



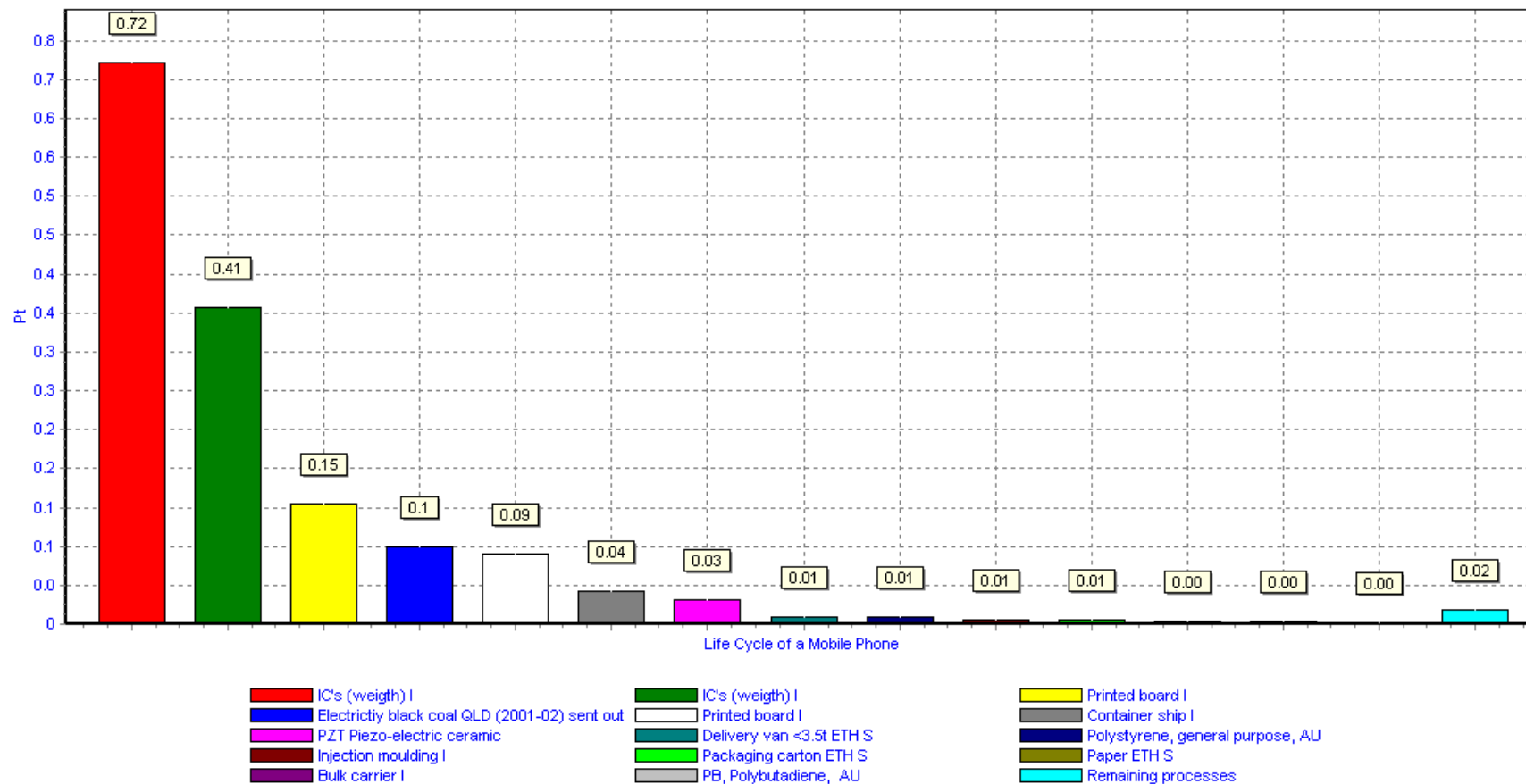
Analyzing 1 p life cycle 'Life Cycle of a Mobile Phone'; Method: Eco-indicator 99 (E) V2.1 Australian substances / Europe EI 99 E/A / normalization

Figure F.14 Normalization – Resources



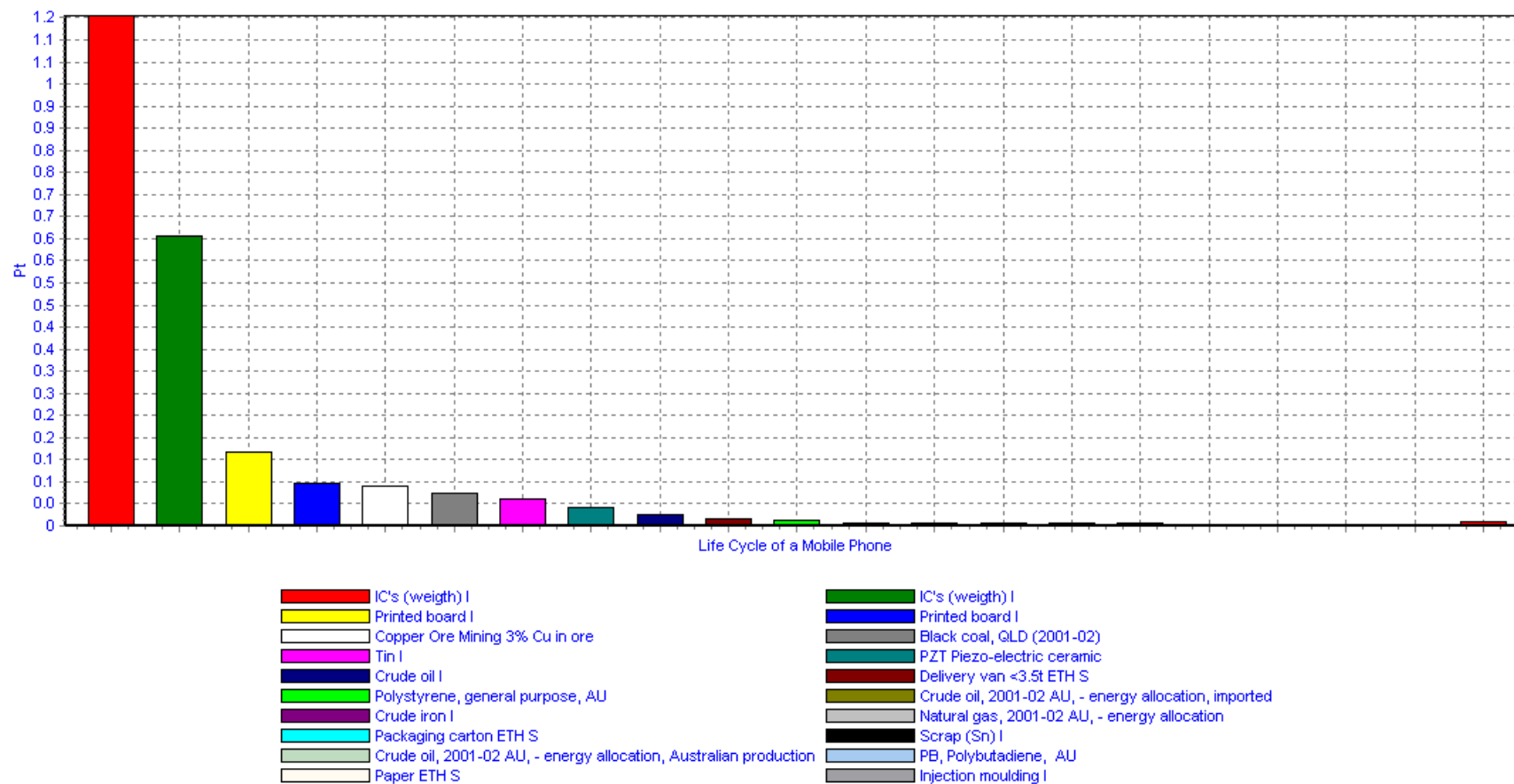
Analyzing 1 p life cycle 'Life Cycle of a Mobile Phone'; Method: Eco-indicator 99 (E) V2.1 Australian substances / Europe EI 99 E/A / weighting

Figure F.15 Weighting – Ecosystem Quality



Analyzing 1 p life cycle 'Life Cycle of a Mobile Phone'; Method: Eco-indicator 99 (E) V2.1 Australian substances / Europe EI 99 E/A / weighting

Figure F.16 Weighting – Human Health



Analyzing 1 p life cycle 'Life Cycle of a Mobile Phone'; Method: Eco-indicator 99 (E) V2.1 Australian substances / Europe EI 99 E/A / weighting

Figure F.17 Weighting - Resources