



Department of the Environment and Heritage

Hazard Status of Zinc and Copper Ash, Dross and Residues under the Hazardous Waste Act

**Guidance Paper
April 2001**



Zinc Ash



Zinc Dross

Environment Australia has prepared a number of information papers and guidance papers to provide a resource to people and organisations concerned with the export or import of hazardous waste under the Australian Act.

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INTRODUCTION

1. Environment Australia is responsible for the implementation and administration of the *Hazardous Waste (Regulation of Exports and Imports) Act 1989* ('Act'). The Act implements Australia's obligations under the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal ('Basel Convention').

2. This paper has been prepared by Environment Australia on the basis of advice from the Hazardous Waste Technical Group, which has been established under the Act to provide advice to Environment Australia on the operation of the Hazardous Waste Act and related issues arising from Australia's implementation of the Basel Convention. The paper is current as at April 2001. It contains revised concentration cut-off levels for arsenic, lead, mercury and selenium, based on new values adopted by Worksafe Australia in 1999.

4. If you require further information on the operation of the Act, or about this guidance paper, please phone 02 6274 1411, fax 02 6274 1164 or email hwa@ea.gov.au.

SUMMARY

Ash, dross, residues and wastes of copper, zinc and their alloys are considered to be hazardous wastes if they contain antimony, arsenic, beryllium, cadmium, lead, mercury, selenium, tellurium and thallium at concentrations higher than those set out in Table 1. These types of metal-bearing wastes are considered to be "in dispersible form".

Such wastes are not considered hazardous if the concentrations of these metals are lower than the values set out in Table 2 (unless the waste possesses another hazardous characteristic such as emission of flammable gases in contact with water).

If the concentrations of metals are lower than the values in Table 1 but greater than the values in Table 2, a leachate test must be carried out to determine whether the metals are likely to enter the environment through leaching. The wastes are presumed hazardous if the concentrations of metals in leachate exceed the values in Table 3.

Hazardous waste must not be diluted or mixed with other materials, or otherwise treated, merely to reduce the concentration of hazardous materials below the cut-off levels specified here.

Metal-bearing wastes in metallic, non-dispersible form include copper and zinc scrap, hard zinc spelter and certain zinc drosses, provided they conform to relevant specifications. They are considered to be non-hazardous because Annex I metals, if present, are not in an environmentally available form.

WHICH MATERIALS ARE CONTROLLED UNDER THE HAZARDOUS WASTE ACT?

5. Metal-bearing wastes in dispersible form including ash, dross, residues and wastes of copper, zinc and their alloys are considered to be hazardous wastes when they contain hazardous concentrations of lead, cadmium or other heavy metals listed in Annex I of the Basel Convention. Export and import of these materials is illegal unless a permit has been granted under the Act.

6. The Basel Convention defines hazardous wastes as all wastes that belong to any category contained in Annex I unless they do not possess any of the characteristics contained in Annex III. Annex I contains a list of 45 waste streams or constituents of wastes. Annex III contains a list of hazardous characteristics that corresponds, for the most part, to the hazard classification system included in the *United Nations Recommendations on the Transport of Dangerous Goods*.

7. The Basel Convention does not define concentration cut-offs for hazardous constituents of wastes, but Annex III refers countries to their national tests which could be used for this purpose. Environment Australia uses two national tests to determine whether wastes contain hazardous concentrations of Annex I metals, as described in this paper.

8. Wastes are considered hazardous if they contain Annex I metals at concentrations greater than the cut-off levels specified in either Table 1 or Table 3, and as non-hazardous if both these levels are not exceeded. Wastes may also be considered non-hazardous if they contain higher concentrations of Annex I metals but in a form that would not exhibit Annex III hazardous characteristics: this is also described as “non-dispersible form”. In addition to describing the concentration cut-off levels, this paper also provides guidance on what is meant by “non-dispersible form” and “dispersible form”.

9. This paper should be read in conjunction with the other information papers on the operation of the Act, including Information Paper No.3: *‘Australian Guide to Exporting and Importing Hazardous Waste: Applying for a Permit – Second Edition’*, Information Paper No.2: *‘Distinguishing Wastes from Non-Wastes under Australia’s Hazardous Waste Act - Third Edition’* and Information Paper No. 5: *‘Setting Concentration Cut-off Levels for Metal-bearing Wastes under Australia’s Hazardous Waste Act’*.

WHAT ARE HAZARDOUS CONCENTRATIONS?

10. Two questions are used to determine whether the concentrations of metals in a waste are sufficient to characterise it as hazardous. The first question focuses on the proposed disposal operation and asks whether the concentration of each metal exceeds the cut-off level set by Worksafe Australia for occupational exposure. The second question applies if the concentrations do not exceed these cut-off levels. It focuses on what might happen if the disposal does not proceed as planned: it asks whether the material could be disposed of without special controls in Australia. To answer the second question a Toxicity Characteristic Leaching Procedure (TCLP) test is performed on the material and hazardous concentrations of metals in the leachate are set by reference to the procedures used by State and Territory Governments.

11. For the first question, concentration cut-offs for occupational exposure to Annex I metals are based on values set by Worksafe Australia and are set out in Table 1. Wastes containing concentrations greater than these are considered to be hazardous under the Act.

TABLE 1: Concentration cut-off levels set by Worksafe Australia.

Substance name	Percent (w/w)	mg/kg
Antimony	0.25	2,500
Arsenic	0.3	3,000
Beryllium	0.1	1,000
Cadmium	0.1	1,000
Lead	0.5	5,000
Mercury	1.0	10,000
Selenium	1.0	10,000
Tellurium	<i>no current value</i>	<i>no current value</i>
Thallium	0.1	1,000

Note 1. Where Worksafe Australia has provided a different concentration cut-off level for a particular compound, that level should prevail.

Note 2. Concentration cut-off levels have been set by Worksafe Australia only for compounds of antimony, cadmium and lead. These levels have been applied, for present purposes, to concentrations of the elements themselves.

Note 3. Measurements may be expressed either on a dry weight or wet weight basis depending on the nature of the material.

12. For the second question, if a waste contains concentrations lower than those listed above, it is then necessary to ensure that it can pass a TCLP test, currently used by State and Territory agencies for wastes destined for landfill, but also applicable to any waste in an acid environment.

13. If the concentration of a constituent of a waste is very low, there is no need to carry out a leachate test because there is too little of the constituent to generate a positive TCLP result. These contaminant threshold concentrations are set out in Table 2. If the concentration is less than the threshold concentration in Table 2, the waste is not hazardous (as far as that particular metal is concerned).

TABLE 2: Contaminant thresholds for Basel metals based on leachate levels in Table 3.

Substance name	percent (w/w)	mg/kg
antimony	0.0006	6.0
arsenic	0.0014	14.0
beryllium	0.0014	14.0
cadmium	0.0004	4.0
lead	0.002	20.0
mercury	0.0002	2.0
selenium	0.002	20.0
tellurium	<i>no current value</i>	<i>No current value</i>
thallium	<i>Value to be agreed</i>	<i>Value to be agreed</i>

14. The TCLP test must be carried out to determine whether the metals are likely to enter the environment through leaching. The wastes are considered hazardous if the concentrations of metals in the leachate exceed the values in Table 3.

TABLE 3: Concentration cut-off levels for Basel metals in leachate.

Substance name	mg/L
Antimony	0.3
Arsenic	0.7
Beryllium	0.7
Cadmium	0.2
Lead	1.0
Mercury	0.1
Selenium	1.0
Tellurium	<i>no current value</i>
Thallium	<i>Value to be agreed</i>

DILUTION

15. Hazardous waste must not be diluted, or mixed with other materials, or otherwise treated, merely to reduce the concentration of hazardous constituents below the cut-off levels specified here. For example, if zinc ash is mixed with sand to reduce the concentration of lead below 0.5 % and the sand is removed before the zinc ash is recovered, the concentration of lead for the purposes of the Act is the concentration in the zinc ash alone, without the sand.

WHAT IS DISPERSIBLE FORM?

16. Guidance on what is meant by dispersible and non-dispersible form is provided in Annexes VIII and IX of the Basel Convention (also known as lists A and B respectively). Annex VIII is a list of hazardous wastes **always** controlled by the Basel Convention. Annex IX is a list of wastes **not generally** controlled by the Basel Convention.

17. Annex VIII lists the following wastes as being in **dispersible** form:

- A1070** Leaching residues from zinc processing, dusts and sludges such as jarosite, haematite.
- A1080** Waste zinc residues not included on Annex IX, containing lead and cadmium in concentrations sufficient to exhibit Annex III characteristics.

18. These wastes are considered hazardous, and subject to the Act, unless they can be shown to lack the hazardous characteristics listed in Annex III.

19. In Information Paper No. 4: *‘Guide To Controlled and Other Wastes Under Australia’s Hazardous Waste Act’*, entry A1080 is considered to be synonymous with OECD amber list entry AA020, which lists the following materials as being in dispersible form: “Zinc wastes in the form of ash, residue, slag, dross, skimming, scaling, dust, powder, sludge and cake.”

20. Annex IX lists the following wastes as being in **non-dispersible** form. Because these are non-dispersible, they are considered non-hazardous even if they contain concentrations of Annex I metals above the cut-off levels:

- B1010** Metal and metal-alloy wastes in metallic, non-dispersible form: copper scrap.
- B1010** Metal and metal-alloy wastes in metallic, non-dispersible form: zinc scrap.
- B1100** Metal-bearing wastes arising from melting, smelting and refining of metals:
Hard zinc spelter;
Galvanising slab zinc top dross (>90 % Zn);
Galvanising slab zinc bottom dross (>92 % Zn);
Zinc die casting dross (>85 % Zn);
Hot dip galvanisers slab zinc dross (batch) (>92 % Zn);
Zinc skimmings.

21. In Information Paper No. 4, entry B1100 is considered to be synonymous with the OECD green list entries GB010 to GB025, which use identical words to describe these non-dispersible wastes.

22. Annex IX also includes the following wastes even though they are in **dispersible** form. All three entries contain the proviso that the waste must not contain hazardous concentrations of Annex I metals:

- B1070** Wastes of copper and copper alloys in dispersible form, unless they contain Annex I constituents to an extent that they exhibit Annex III characteristics.
- B1080** Zinc ash and residues including zinc alloys residues in dispersible form, unless containing Annex I constituents to an extent that they exhibit Annex III characteristics or exhibiting hazard characteristic H4.3.

B1100 Slags from copper processing for further processing or refining not containing arsenic, lead or cadmium to an extent that they exhibit Annex III hazard characteristics.

23. Wastes in these Annex IX entries that exhibit Annex III hazardous characteristics will be assigned to an appropriate entry on Annex VIII. For example, zinc ash and residues will be assigned to A1080, while wastes of copper and slags from copper processing will, if lead is the principal contaminant, be assigned to A1020: Wastes having as constituents or contaminants, excluding metal wastes in massive form, lead; lead compounds.

24. Most of these entries are reasonably clear but for the zinc wastes in Annex IX that are described as drosses, spelter or skimmings a more complete definition is required. This is done by reference to appropriate industry specifications, as described below.

- **Hard zinc spelter** is considered to be the same as galvanising slab zinc bottom dross (>92 % Zn) and should conform to the relevant specification as set out below.
- **Galvanising slab zinc top dross (>90% Zn)** should conform to the specification for continuous line galvanising slab zinc top dross, known as “Seal” by the Institute of Scrap Recycling Industries of the United States (ISRI), as modified below: Shall consist of unsweated zinc dross removed from the top of a continuous line galvanising bath, in slab form with a minimum zinc content of 90 %. Shall be free of skimmings. Broken pieces under 5 cm in diameter shall not exceed 10 % of the weight of each shipment.
- **Galvanising slab zinc bottom dross (>92% Zn)** should conform to the specification for continuous line galvanising slab zinc bottom dross, known as “Seam” by the Institute of Scrap Recycling Industries of the United States (ISRI), as modified below: Shall consist of unsweated zinc dross removed from the bottom of a continuous line galvanising bath, in slab form with a minimum zinc content of 92 %. Shall be free of skimmings. Broken pieces under 5 cm in diameter shall not exceed 10 % of the weight of each shipment.
- **Zinc die casting dross (>85% Zn)** should conform to the specification for prime zinc die-cast dross, known as “Shelf” by the Institute of Scrap Recycling Industries of the United States (ISRI), as modified below: Shall consist of metal skimmed from the top of pot of molten zinc die-cast metal. Must be unsweated, unfluxed, shiny, smooth, metallic and free from corrosion or oxidation. Should be poured in moulds or in small mounds. Zinc shall be a minimum of 85 %. Broken pieces under 5 cm in diameter shall not exceed 10 % of the weight of each shipment.

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Hot dip galvanisers slab zinc dross (batch) (>92 % Zn) should conform to the specification for hot dip galvanisers slab zinc dross (batch process), known as “Scrub” by the Institute of Scrap Recycling Industries of the United States (ISRI), as modified below: Shall consist only of galvanisers unsweated zinc dross in slab form from hot dip galvanising (batch process) with a minimum zinc content of 92 % and shall be free of skimmings and tramp iron. Broken pieces under 5 cm in diameter shall not exceed 10 % of the weight of each shipment. Material from continuous galvanising operation is not acceptable.

- **Zinc skimmings** is considered to be a synonym of zinc die casting dross (>85 % Zn) and material shipped as zinc skimmings must conform to the zinc die casting dross specification as set out above.

STATUS OF ZINC ASH FROM GALVANISERS HOT DIP PROCESSES

25. Entry A1080 in Annex VIII includes, in particular, zinc ash from galvanisers hot dip processes. Zinc ash is a mixture of zinc oxide and varying quantities of entrained free metallic zinc which is produced when floating debris is skimmed from the surface of a galvanising kettle. The skimming, generally with a rake, is done when steel is immersed into or withdrawn from the kettle and it prevents floating debris (oxidics) from sticking to the object or material being galvanised. Most of the ash is formed by the disturbance of the bath surface during working as a result of which clean zinc oxidises and particles of metallic zinc are entrained in the folds of the oxide. The ash is generally ladled off into 44-gallon drums.

26. A considerable amount of metallic zinc may be entrained during the removal of the ash from the bath surface if this is not done carefully, and as a result the material may contain variable proportions of zinc in metallic form, from as low as 40 to as high as 90 percent. The balance of the zinc, from 60 to 10 percent, is as zinc oxide and zinc ash is considered to be in dispersible form because of this high zinc oxide content. Zinc ash is generally processed by crushing and screening to separate lumps of metal (which may be fed into a furnace) from the fine powder which is removed and sold either for use in processes such as dry-cell battery manufacture or production of agricultural grade zinc oxide. Zinc ash from galvanisers hot dip processes is controlled under the Act unless the lead and cadmium contents are below the concentration cut-off levels set in this paper.

27. Since the introduction of the OECD green and amber lists and the Basel Convention’s lists A and B, some producers have taken to describing as “skimmings” the material formerly known as “ash”. Skimmings are on the green list and list B but ash is on the amber list and list A. As indicated earlier, zinc ash, particularly from galvanisers hot dip processes, is assigned to entry A1080 and falls within the definition of hazardous wastes in Article 1.1.(a) of the Basel Convention unless the lead and cadmium contents are below the concentration cut-off levels set in this paper and the ash lacks hazard characteristic H4.3. It is controlled under the Act.