BIOSOLIDS PRODUCTION AND USE SURVEY SUMMARY 2010 TO 2019

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AUSTRALIAN WATER ASSOCIATION

Australian & New Zealand Biosolids Partnership

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1 INTRODUCTION

In 2010, the Australian & New Zealand Biosolids partnership (ANZBP) commissioned a national survey to identify the main features of biosolids management across Australia and New Zealand. The survey was repeated in 2013, 2015, 2017 and again in 2019. This report summarises the results from these five surveys and provides some commentary on changes.

The surveys catalogued the following primary parameters:

- Biosolids production
- Biosolids end use
- Biosolids stabilisation grade
- Biosolids contamination grade (not surveyed in 2010)
- Biosolids primary stabilisation process
- Biosolids dewatering process.

The results of this survey are presented on a national and state basis. Some discussion is also provided on significant changes since 2010.

2 METHOD

The approach used to determine the biosolids production in both Australia and New Zealand was to survey as a minimum all plants servicing over 25,000 people or 5 ML/day. The ANZBP identified that this criterion would capture around about 80% of Australia's population and approximately 70% of New Zealand's population. In the course of the survey many water utilities provided information on plants smaller than this threshold and where they did, the data was included.

In 2019 over 320 sites were surveyed in Australia representing a total equivalent person (EP) count of about 24.8 million. In New Zealand 32 site sites were surveyed, covering an EP of over 4 million. Note that EP or plant inflow can include commercial inflow so does not cover every site in Australia however the data collected represents a very high proportion of biosolids produced in Australia.

Data is presented on the basis of dry tonnes of biosolids production. This allows for consistency of data over sites which have significantly different dewatered solids concentrations.

There have been some changes in approach between surveys. These changes are described in the specific parameter description in section 3 and include changes to:

- End use – ocean discharge of biosolids
- Stabilisation processes – method of reporting for biosolids treatment in lagoons
- Contaminant grading – changes to categorisation.

3 CLASSIFICATIONS

To enable relatively simple analysis and presentation of the data, each area of information, such as end use, has been classified into broad groupings. These groupings are discussed below.

3.1 PRODUCTION

Production is presented in terms of tonnes of dry biosolids.

3.2 END USE

The following classifications were used for end use:

- Agriculture: for biosolids applied to land for its fertiliser value without value added processing;
- Landscaping (compost): for biosolids processed through a composting facility and used for landscaping or other horticultural use;
- Forestry: for biosolids applied to plantation forests to aid tree growth;
- Landfill: for biosolids disposed to landfill;
- Ocean discharge: for biosolids discharged to the ocean (excluding the New Zealand approach– see below*);
- Stockpile: for biosolids stored, pending future planning, processing or use;
- Land rehabilitation: for biosolids applied to land, such as mine sites for rehabilitation of the land;
- Other: any other uses;
- Unspecified: for sites for which no data was provided by the utility or for which the end use could not be identified.

The following uses can be classified as being 'beneficial' uses: agriculture, landscaping, forestry and land rehabilitation.

*In New Zealand some sites have a treatment technique whereby treated wastewater is discharged to the sea without removal of solids. The solids concentration is very low and for the purposes of this report is not counted as a biosolid product except in the 2010 report. Subsequent New Zealand reports have reported both the breakdown by mass of biosolids and by number of plants. These ocean discharge plants are reported by number, but not by mass.

3.3 STABILISATION GRADE

Due to the different standards and naming conventions used for Stabilisation Grades across Australia and New Zealand, a standardised grading schema was applied (see Table 3-1). Stabilisation grade was classified on the basis of an A, B or Unstabilised grading. Some biosolids were not graded by the utility and are marked as NG (not graded) in the survey results.

Table 3-1 Stabilisation grading

Classification	NSW	Vic	SA	Qld	Tas	WA	NZ
A	A	T1, T2	A	A	A	P1, P2	A
B	B	T3	B	B	B	P3	B
Unstabilised	C	Unstabilised	Unstabilised	C	C	P4	Unstabilised

3.4 CONTAMINATION GRADE

Due to the different standards and naming conventions used for Contaminant Grades across Australia, a standardised grading schema was applied (see

Table 3-2). Contamination grade is classified on the basis of an A, B, C and Restricted/Unsuitable for Use. Some biosolids were not graded by the utility and are marked as NG (not graded) in the survey results.

In 2010, information on the biosolids contaminant grade was not collected. This was surveyed from 2013.

Up until the 2019 survey a contaminant grade category of Unsuitable for Use was used for Contaminant Grade E biosolids from New South Wales and Queensland. For the 2019 survey and for this summary survey, any data collected with this grading was rolled in with the Restricted/Unsuitable for Use category. Biosolids with an E contaminant grade were less than 1% of biosolids produced across all surveys.

Table 3-2 Contaminant grading

Classification	NSW	Vic	SA	Qld	Tas	WA	NZ
A	A	C1	A	A	A	C1	A
B	B	C2	B	B	B		
C	C		C	C	C	C2	B
Restricted or Unsuitable for Use	D, E	C3	Unsuitable for use	D, E	Unsuitable for use	C3	Unsuitable for use

3.5 STABILISATION PROCESS

Classification of the stabilisation process was made on the basis of the primary stabilisation process following the sewage treatment process. The following stabilisation process categories were used:

- δ Anaerobic digestion
- δ Aerobic digestion
- δ Agitated air drying
- δ Thermal drying
- δ Autothermal thermophilic aerobic digestion (ATAD)
- δ Thermal hydrolysis (e.g. CAMBI)
- δ Composting (used only for biosolids with no prior stabilisation)
- δ Incineration
- δ Lagoon (used for biosolids stored in liquid form)
- δ Lime stabilisation
- δ Long term storage (used for biosolids stored in dewatered form)
- δ Thermophilic anaerobic digestion
- δ None
- δ Other
- δ Unspecified

The method for collecting biosolids production figures for lagoon-based systems changed in 2016/17. Previously, producers were asked to estimate the average biosolids output from a lagoon. From 2016/17 producers were asked to provide data on the quantity of biosolids which were removed from a lagoon. If no biosolids were removed, then the quantity was zero. This better suited the sites where biosolids are not harvested from lagoons regularly.

3.6 DEWATERING PROCESS

Classification of the dewatering process was made on the basis of the following categories:

- Belt filter press
- Conventional centrifuge
- High solids centrifuge
- Drying bed or drying lagoons
- None
- Other
- Unspecified

4 RESULTS

4.1 PRODUCTION

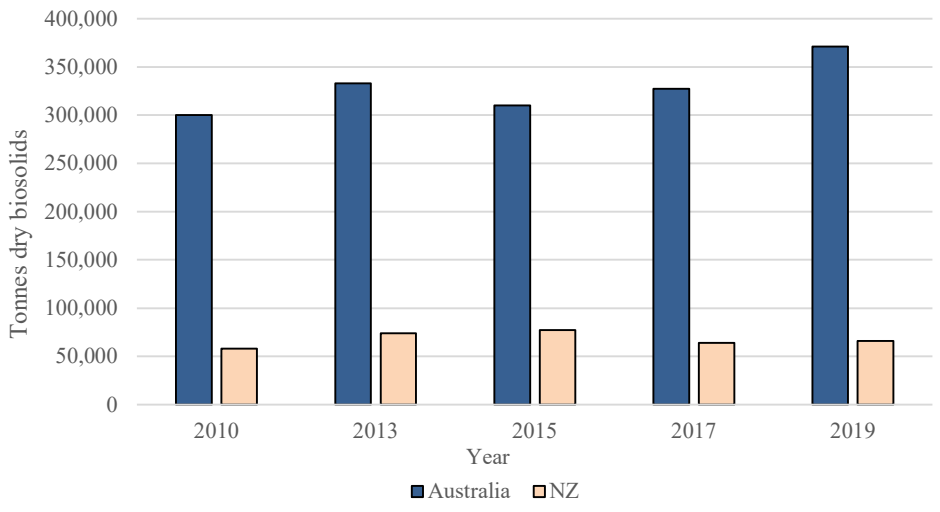
Total biosolids production survey results from Australia and New Zealand are shown in Table 4-1, and charts 4-1 and 4-2.

Table 4-1 also shows the reported average dry solids concentration. The reported dryness of the biosolids in Australia has fallen from 25% to 16% which is a considerable drop but one for which there is no obvious explanation.

Table 4-1 Reported annual biosolids production

	Australia		New Zealand	
Year	Tonnes dry solids	Reported % dry solids	Tonnes dry solids	Reported % dry solids
2010	300,000	25%	58,000	25%
2013	333,000	24%	74,000	28%
2015	310,000	21%	77,000	18%
2017	327,000	18%	64,000	33%
2019	371,000	16%	66,000	33%

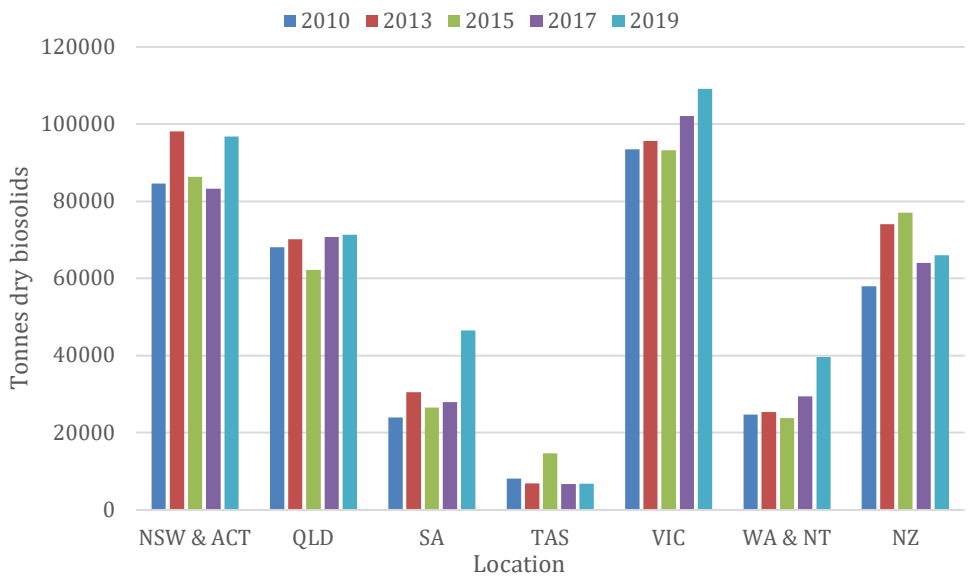
Chart 4-1 Annual biosolids production by year, Australia and New Zealand



Comment: In Australia, total annual dry biosolids production reported has increased by about 25% over the survey period. This can be partly attributed to population growth, 17% across Australia over this time, and partly to better data collection.

In New Zealand, total annual dry biosolids production reported has been variable. Improvements in data collection from 2010 to 2013 saw a significant increase. The drop in biosolids production from 2015 to 2017 was attributed to a significant decrease in production from several sites in Wellington. From 2013 to 2019 there was an overall drop in reported biosolids production of about 10%.

Chart 4-2 Annual biosolids production by year, Australian States and New Zealand

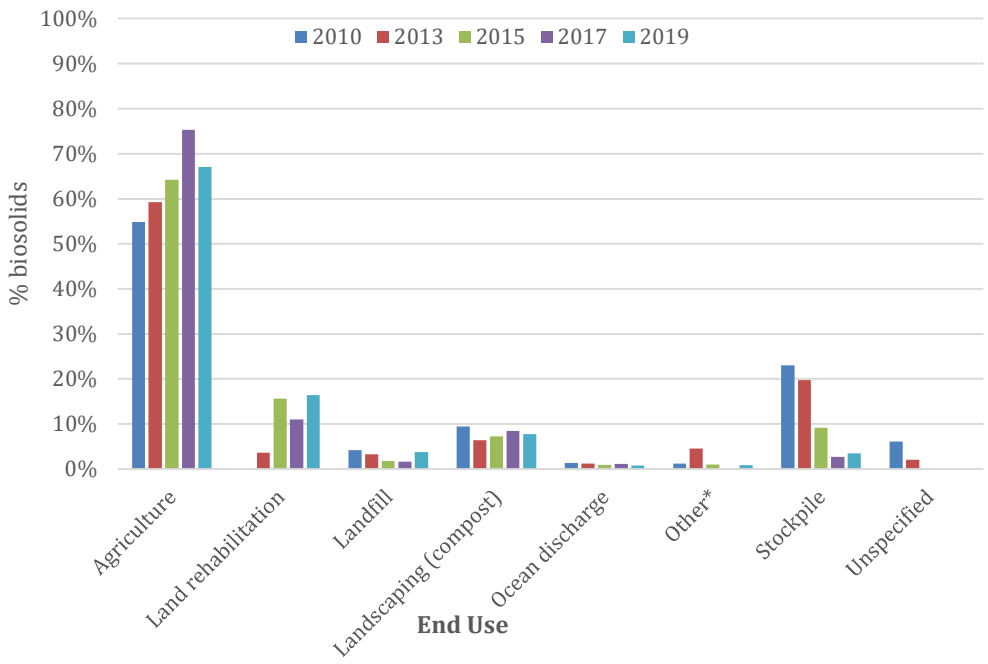


Comment: Biosolids production has remained proportionally similar over time. The SA, WA & NT production increased markedly in 2019 due to some large lagoons being desludged in this period.

4.2 END USE

Biosolids end use nationally for Australia and New Zealand and for each Australian state are presented in Charts 4-3 to 4-10 following.

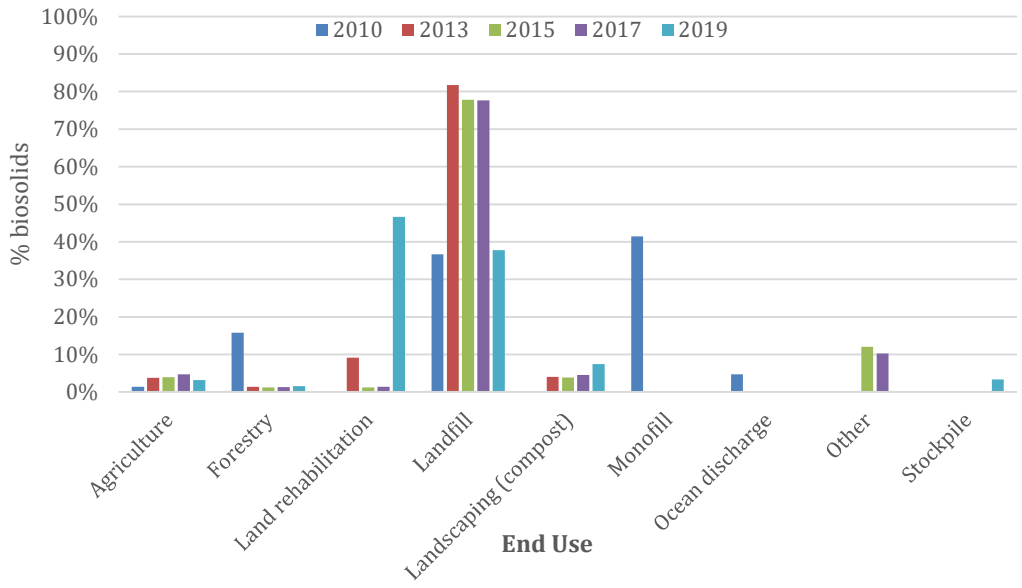
Chart 4-3 Proportional end use of biosolids over time, Australia



Comment: In Australia, about 90% of biosolids were beneficially used in 2019, up from about 65% in 2010. This change has largely come about from an increase in agricultural use and land rehabilitation. The reduction in stockpiling of biosolids is marked. In 2010 and 2013, 20% of biosolids was stockpiled and in 2019 only 5% was stockpiled across Australia.

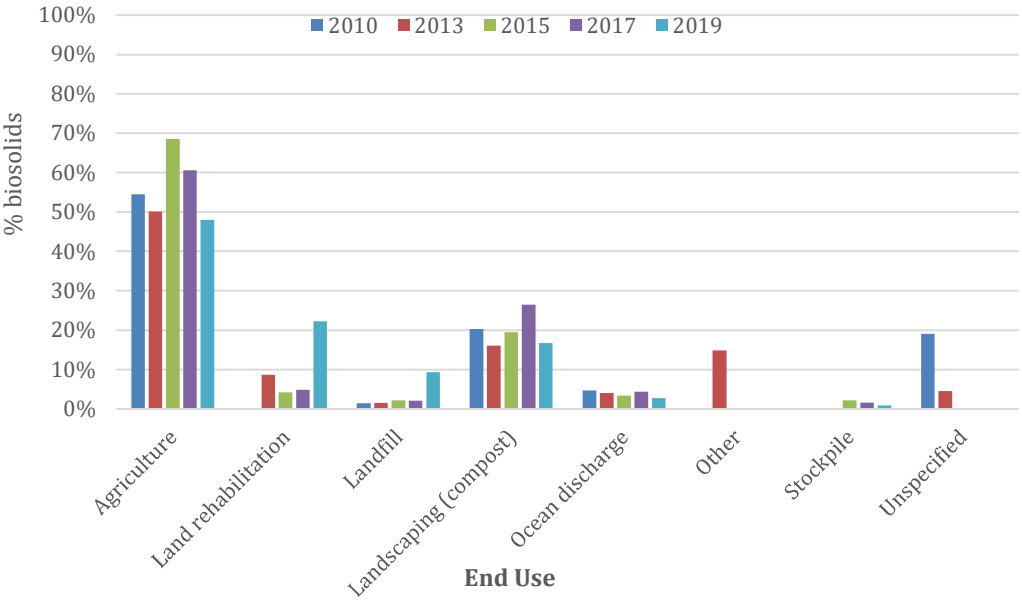
**Other* includes Forestry which was a recorded entry only in 2010. Subsequent entries into the category are mostly some forms of agricultural use such as composted biosolids used on agricultural land.

Chart 4-4 Proportional end use of biosolids over time, New Zealand



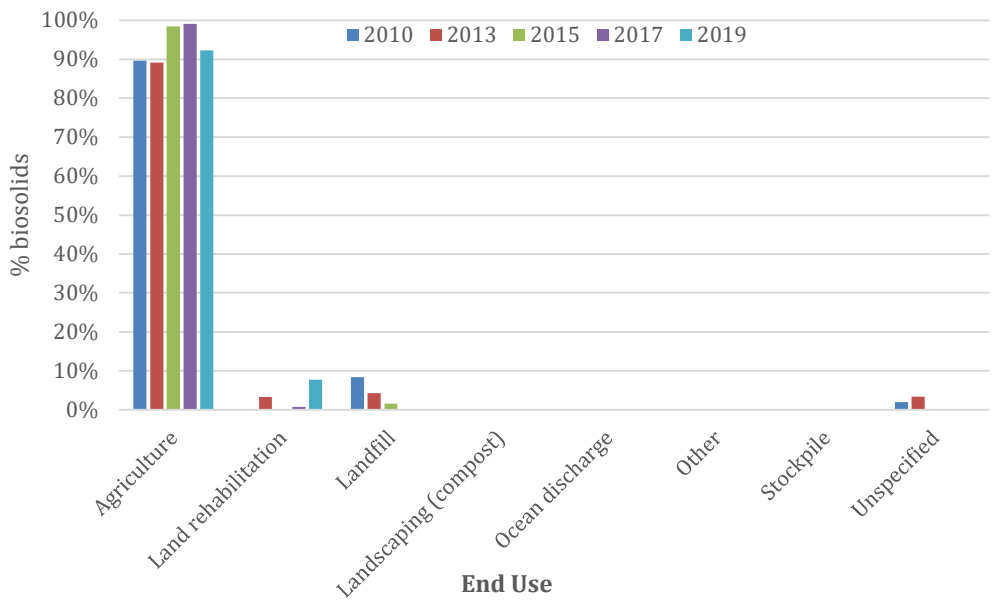
Comment: In New Zealand there was a significant change from landfill to beneficial use in the 2019 survey. This was mainly the result of reclassification of the use of biosolids for landfill capping as rehabilitation rather than disposal to landfill.

Chart 4-5 Proportional end use of biosolids over time, New South Wales



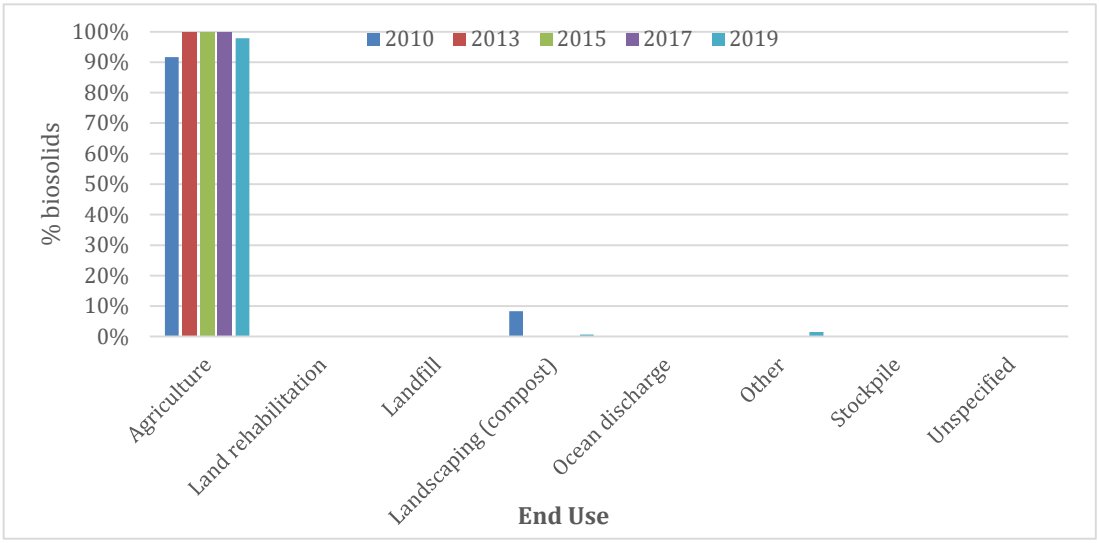
Comment: Beneficial use of biosolids increased from 75% of production in 2010 to about 90% of production in subsequent years.

Chart 4-6 Proportional end use of biosolids over time, Queensland



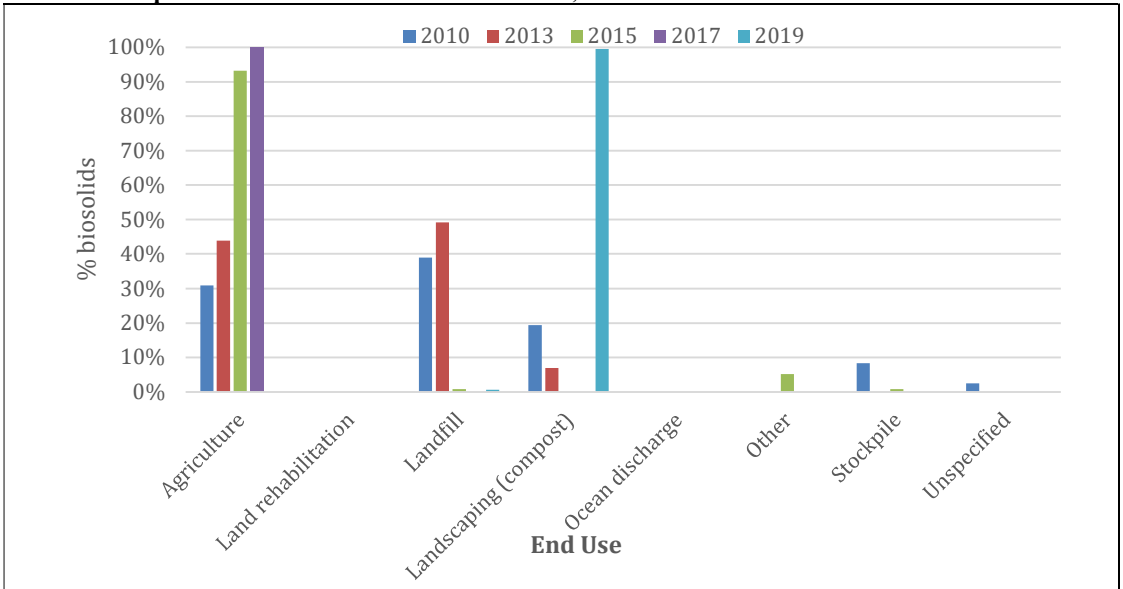
Comment: Beneficial use of biosolids increased from 90% of production in 2010 to 100% of production in subsequent years.

Chart 4-7 Proportional end use of biosolids over time, South Australia



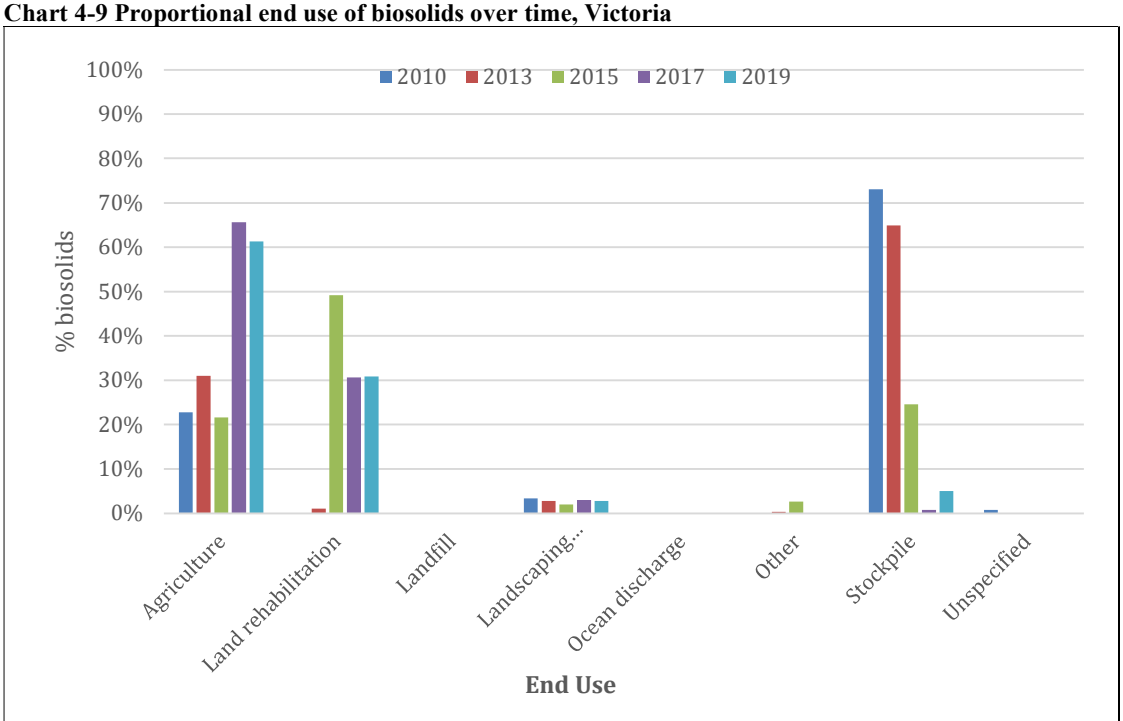
Comment: Beneficial use of biosolids has consistently been 100% over the survey period

Chart 4-8 Proportional end use of biosolids over time, Tasmania



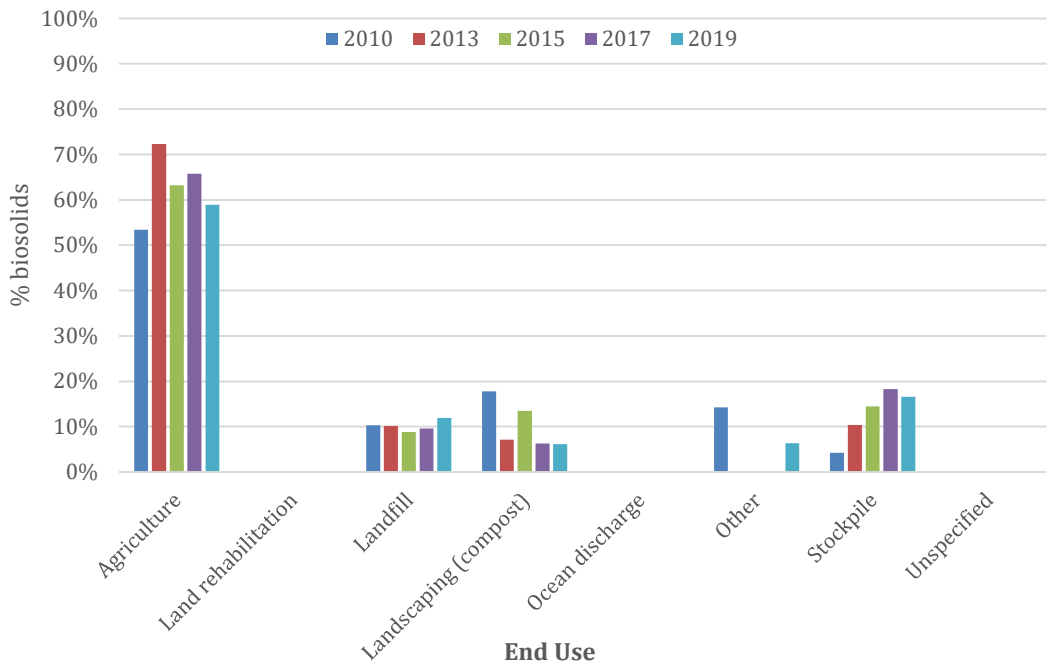
Comment: Beneficial use of biosolids increased from 30% in 2010 and grew steadily to 100% in the 2017 and 2019 surveys. From 2017 to 2019 there was a complete shift from direct agricultural use to composting for a range of landscaping and agricultural purposes.

Chart 4-9 Proportional end use of biosolids over time, Victoria



Comment: Beneficial use of biosolids increased from 26% of production in 2010 to 95 – 99% in 2017 and 2019. This has largely been achieved through finding a beneficial use for the previously stockpiled biosolids. Victoria has been the main driving force behind the reduction in stockpiling as an end use in Australia.

Chart 4-10 Proportional end use of biosolids over time, Western Australia and Northern Territory

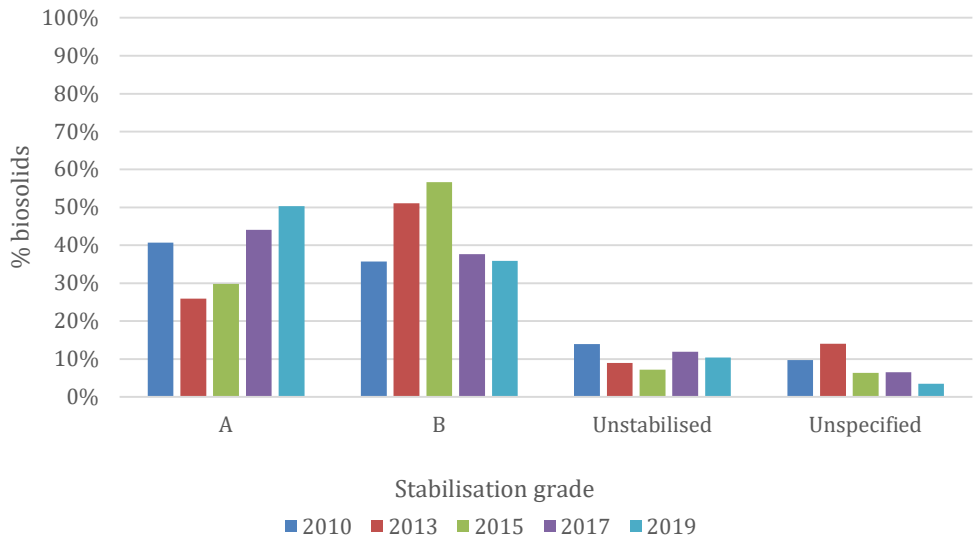


Comment: Beneficial use of biosolids has decreased from 85% of production in 2010 to about 70% of production in 2019. This has been a steady decline with time, mainly due to the increase in stockpiling as a method of end use.

4.3 STABILISATION GRADE

Biosolids stabilisation grade nationally for Australia and New Zealand and for each state is presented in Charts 4-11 to 4-18 following.

Chart 4-11 Proportional stabilisation grade of biosolids over time, Australia

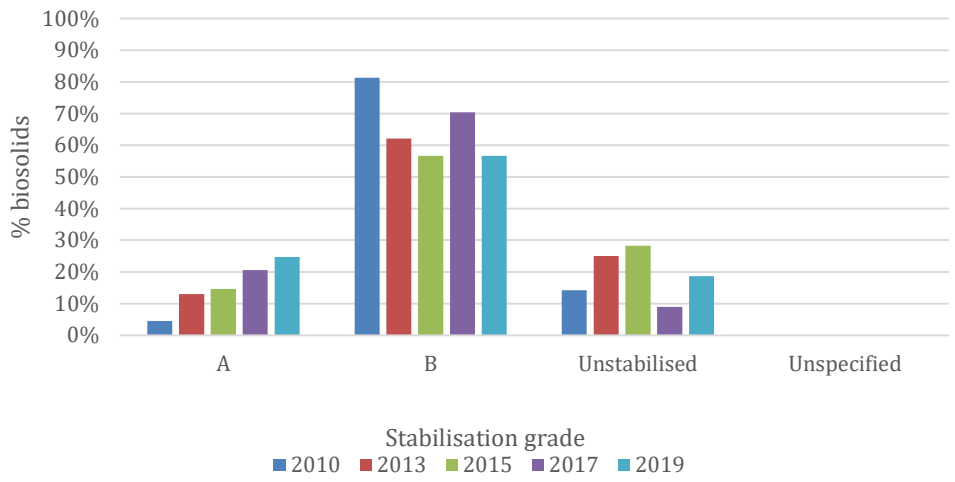


Comment: Over time, biosolids in Australia stabilised to grade A has increased to 50% of biosolids production. Producers who were unable to specify what grade their biosolids have decreased.

Overall, the proportion of biosolids which were not or could not be specified has dropped from a peak of 14% to a low of 3% in the 2019 survey.

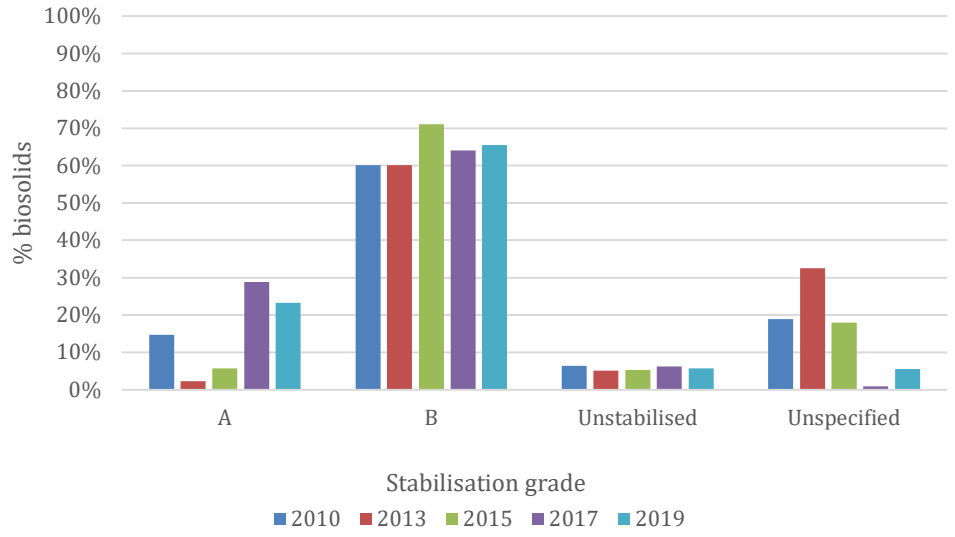
Unstabilised biosolids have remained proportionally fairly constant (7-14%) over the survey period.

Chart 4-12 Proportional stabilisation grade of biosolids over time, New Zealand



Comment: In New Zealand, the proportion of biosolids stabilised to grade A has increased over time. The unstabilised proportion is higher than Australia's due to the higher proportion of biosolids which go to landfill and don't need treatment.

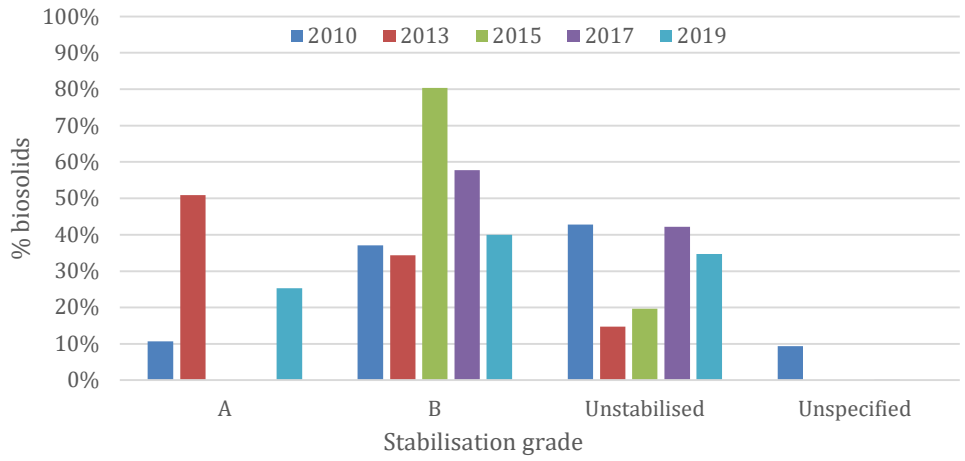
Chart 4-13 Proportional stabilisation grade of biosolids over time, New South Wales & ACT



Comment: The increase in stabilisation grade A biosolids in NSW/ACT between 2015 and 2017 is mostly the result of one site gaining clarity on the stabilisation grade of their product and being able to classify their biosolids as stabilisation grade A.

About 3% of biosolids which is reported as unstabilised are still beneficially used through the provision in the state biosolids guidelines of allowance of use of a barrier method (immediate incorporation into soil after land application) to achieve stabilisation grade B. The biosolids from these sites were all from wastewater treatment plants producing WAS, not primary solids, from extended aeration or BNR plants.

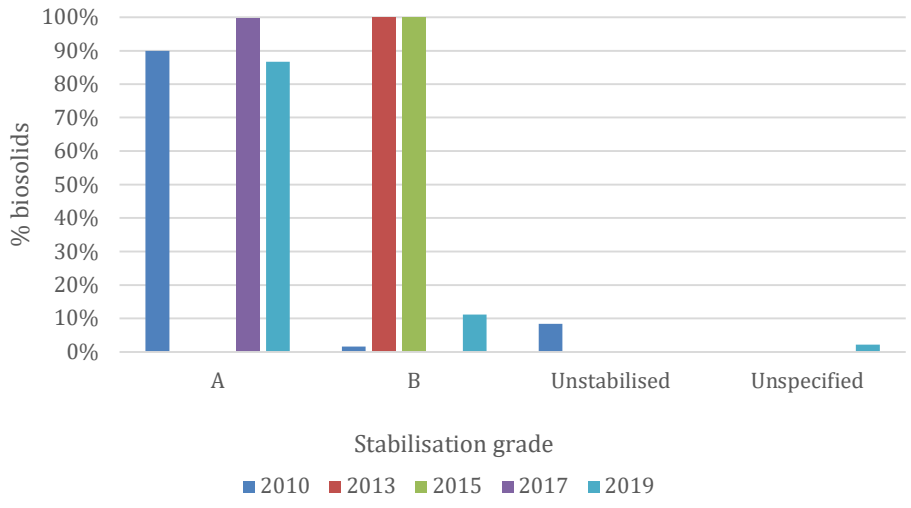
Chart 4-14 Proportional stabilisation grade of biosolids over time, Queensland



Comment: In Queensland in 2019, 30% of biosolids were reported as unstabilised in 2019, yet Queensland reports nearly 100% beneficial use. The producers at these sites achieved this through provision in the state biosolids guidelines of allowance of use of a barrier method (immediate incorporation into soil after land application) to achieve stabilisation grade B. The biosolids from these sites were all from wastewater treatment plants producing WAS, not primary solids, from extended aeration or BNR plants.

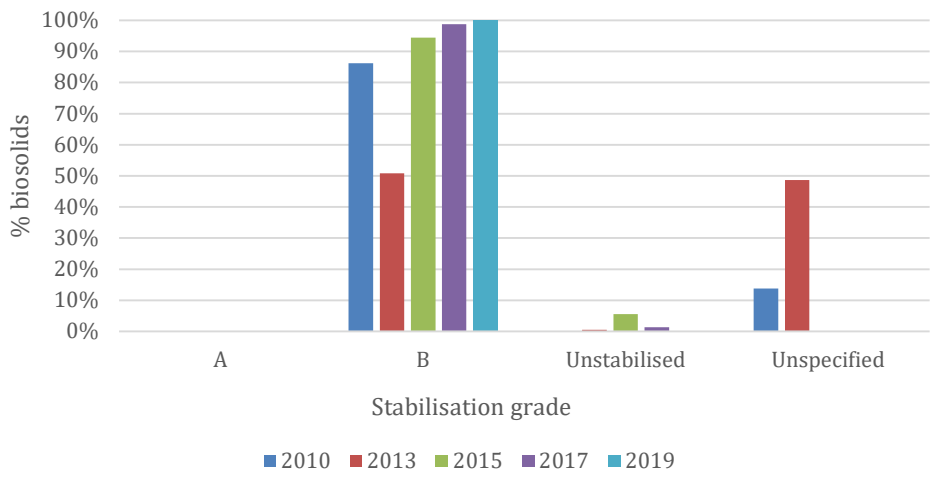
This practice also explains the high degree of variability of biosolids which are reported as unstabilised in Queensland over the survey period. Sometimes producers report the stabilisation grade of biosolids used in this way as grade B and sometimes grade C (unstabilised).

Chart 4-15 Proportional stabilisation grade of biosolids over time, South Australia



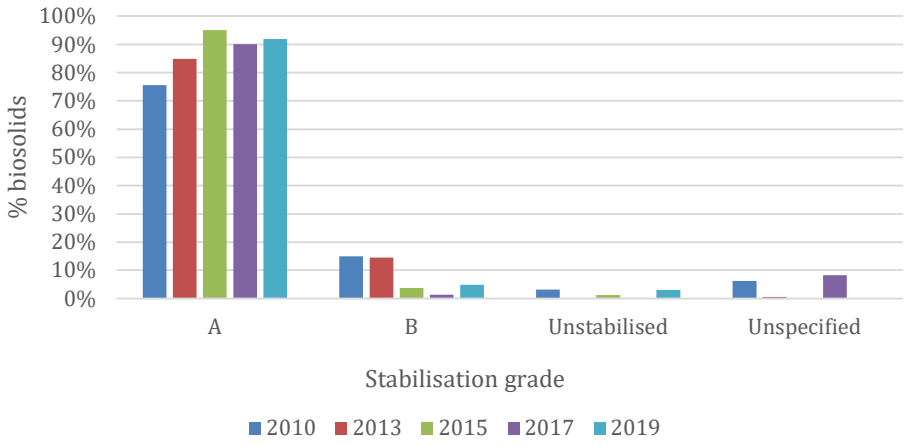
Comment: The change in stabilisation grade from B to A from the 2015 to the 2017 survey was the result of a change in approach to extend the storage time of biosolids post digestion to achieve an improved quality of biosolids.

Chart 4-16 Proportional stabilisation grade of biosolids over time, Tasmania



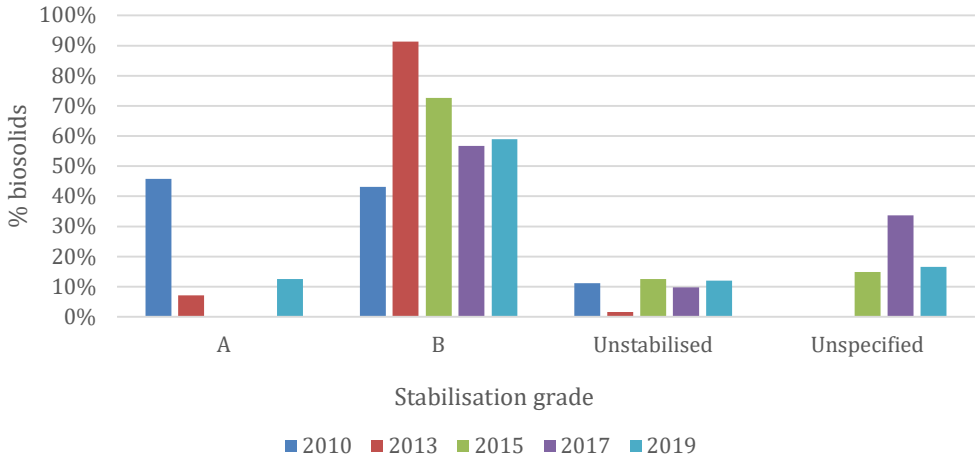
Comment: Since the 2015,reported stabilisation results have been very consistent.

Chart 4-17 Proportional stabilisation grade of biosolids over time, Victoria



Comment: Victoria's production has been fairly stable at around 90% stabilisation grade A for the last three surveys. This is partly due to the long storage times many producers in the state use although the existence of several thermal drying and composting facilities also contributes.

Chart 4-18 Proportional stabilisation grade of biosolids over time, Western Australia and Northern Territory

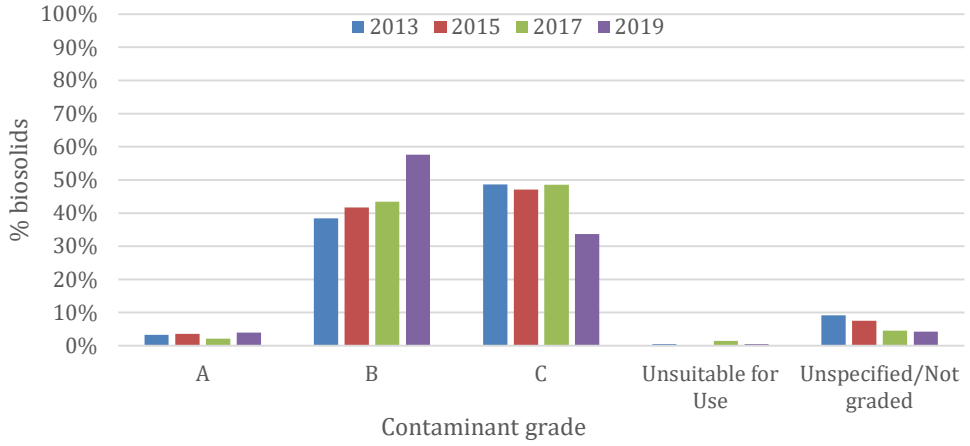


Comment: In 2010 the bulk of the grade A stabilisation biosolids were treated via a lime stabilisation process and composting processes. In 2013 this lime stabilisation achieved only stabilisation grade B.

4.4 CONTAMINANT GRADE

Biosolids stabilisation grade nationally and for each state is presented in Charts 4-19 to 4-26 following. Contaminant grade was not recorded in the first survey in 2010.

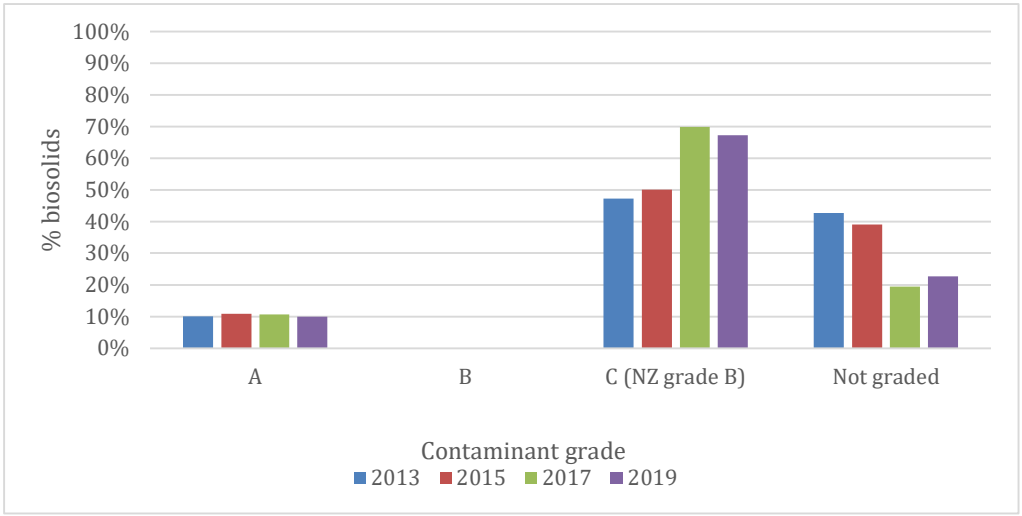
Chart 4-19 Proportional contaminant grade of biosolids over time, Australia



Comment: In Australia, 2019 was the first survey where there was a significant shift in the contaminant grade from previous surveys. The proportion of biosolids graded as contaminant grade C reduced from 49% to 36% with most of this shift being to contaminant grade B. This is almost entirely due to a shift by New South Wales producers.

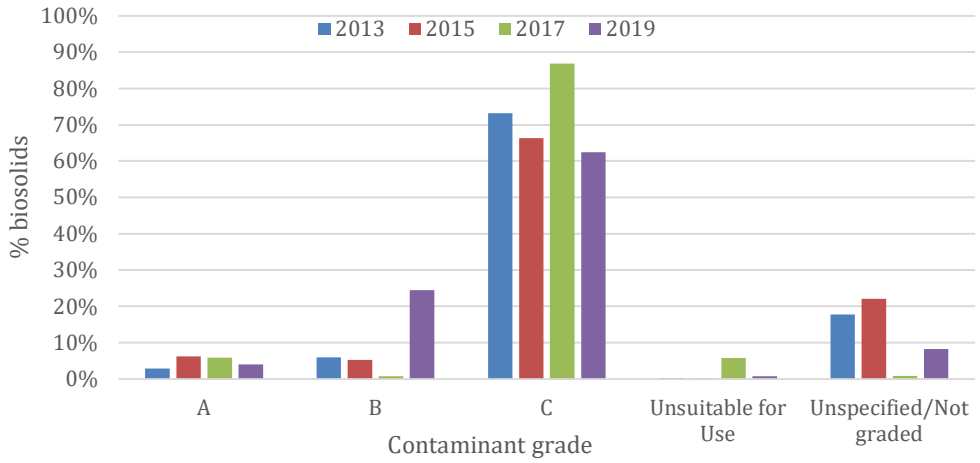
As with the stabilisation grade, the proportion of biosolids unspecified or not graded has decreased with time.

Chart 4-20 Proportional contaminant grade of biosolids over time, New Zealand



Comment: In New Zealand, contaminant grade has shown a marked shift from Not Graded to New Zealand grade B. New Zealand grade B biosolids were about 50% of biosolids produced in 2013 and 2015, rising to nearly 70% in 2017. This is mostly due to treatment plants in Wellington, where biosolids went to landfill in this period, reducing output.

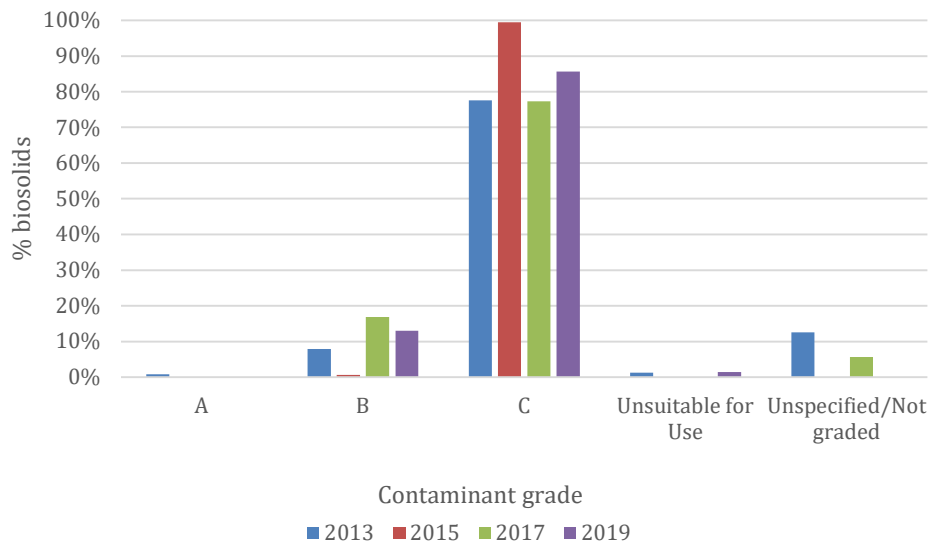
Chart 4-21 Proportional contaminant grade of biosolids over time, New South Wales and ACT



Comment: The increase in proportion of biosolids which achieved contaminant grade B in 2019 is due to one site in this region.

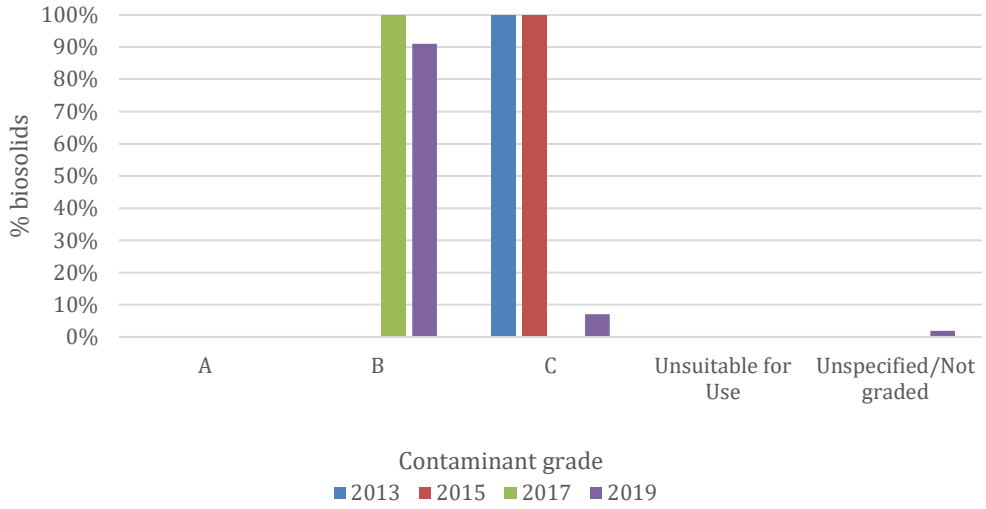
NSW and Queensland appear to have lower quality biosolids (mostly grade C vs grade B) than some other states. This is more likely the impacts of different guideline requirements rather than different concentrations of contaminants. Copper and zinc in particular often push biosolids in NSW and Queensland into contaminant grade C where in other states the limits for these contaminants are different. This is one of the impacts of different biosolids requirements across Australia and is only an anecdotal comment, no particular data on contaminants was collected for any of the surveys.

Chart 4-22 Proportional contaminant grade of biosolids over time, Queensland



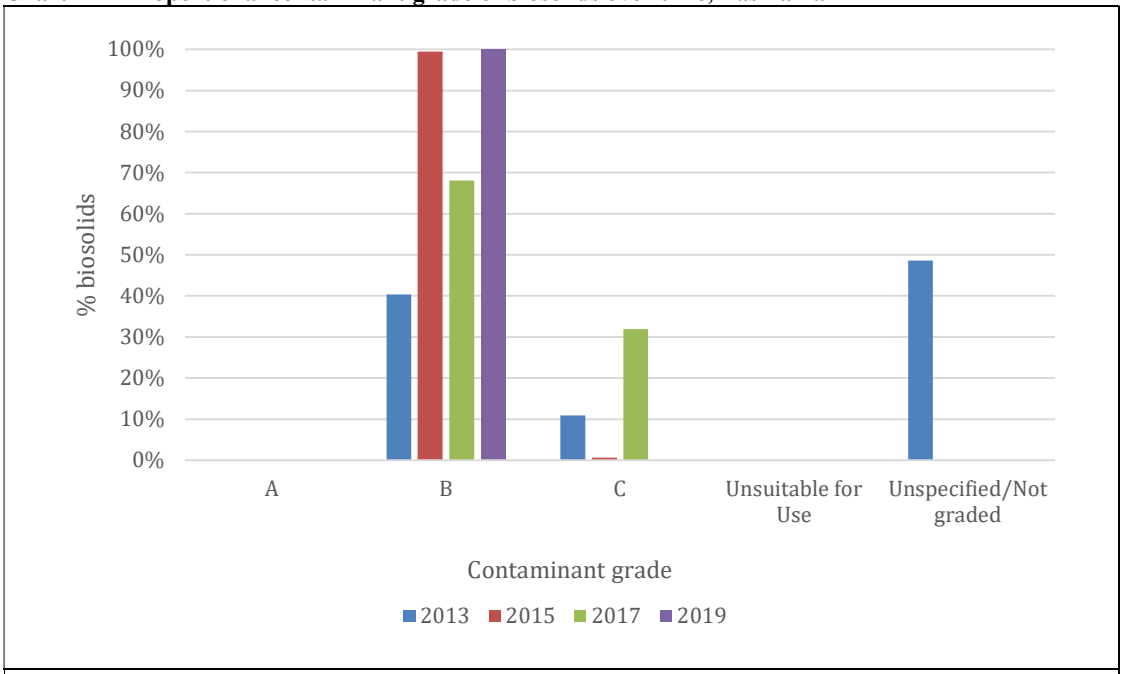
Comment: NSW and Queensland appear to have lower quality biosolids (mostly grade C vs grade B) than some other states. This is more likely the impacts of different guideline requirements rather than different concentrations of contaminants. Copper and zinc in particular often push biosolids in NSW and Queensland into contaminant grade C where in other states the limits for these contaminants are different. This is one of the impacts of different biosolids requirements across Australia and is only an anecdotal comment, no particular data on contaminants was collected for any of the surveys.

Chart 4-23 Proportional contaminant grade of biosolids over time, South Australia



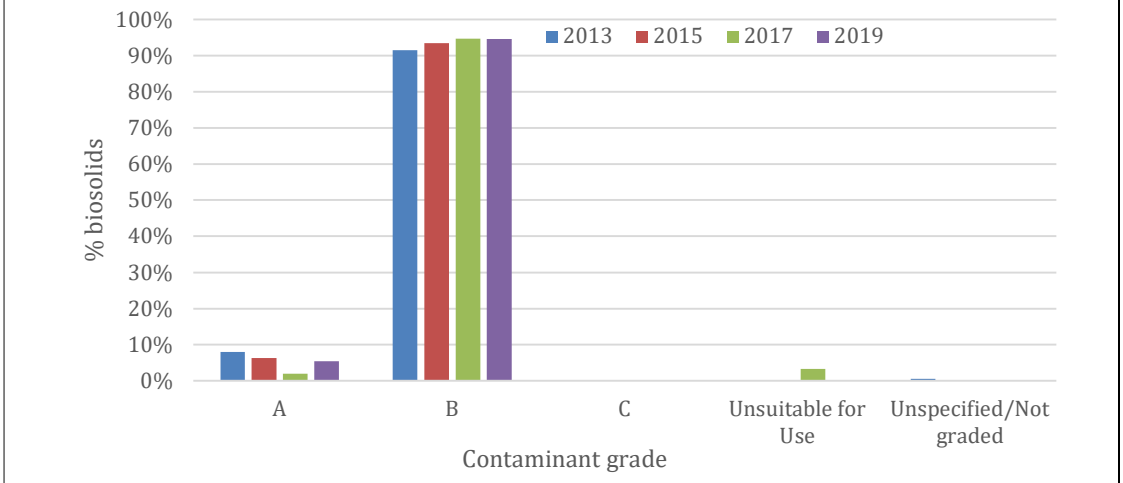
Comment: Biosolids contaminant grade has improved in the last two surveys, no reason was supplied for this change.

Chart 4-24 Proportional contaminant grade of biosolids over time, Tasmania



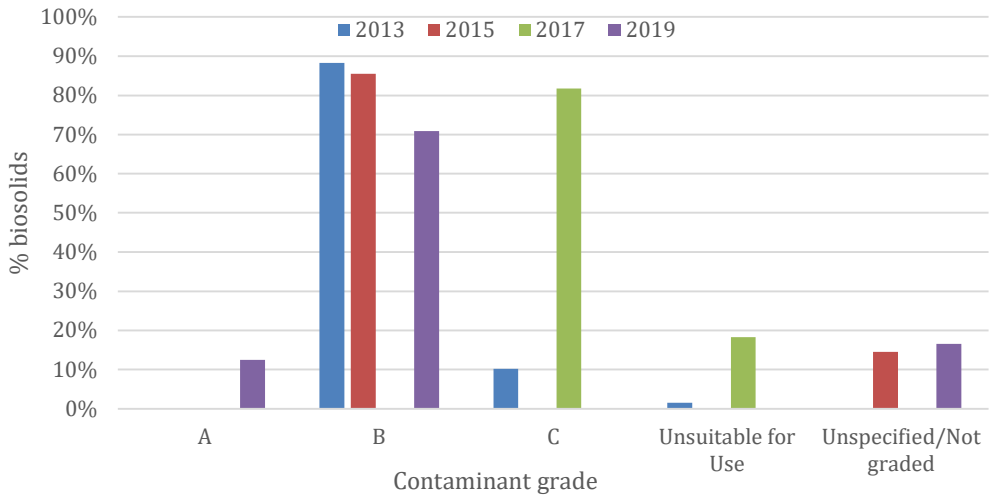
Comment: Provision of contaminant grade data has improved markedly since the 2013 survey as per other parameters for Tasmania.

Chart 4-25 Proportional contaminant grade of biosolids over time, Victoria



Comment: Contaminant grade has remained very consistent over time in Victoria.

Chart 4-26 Proportional contaminant grade of biosolids over time, Western Australia & Northern Territory



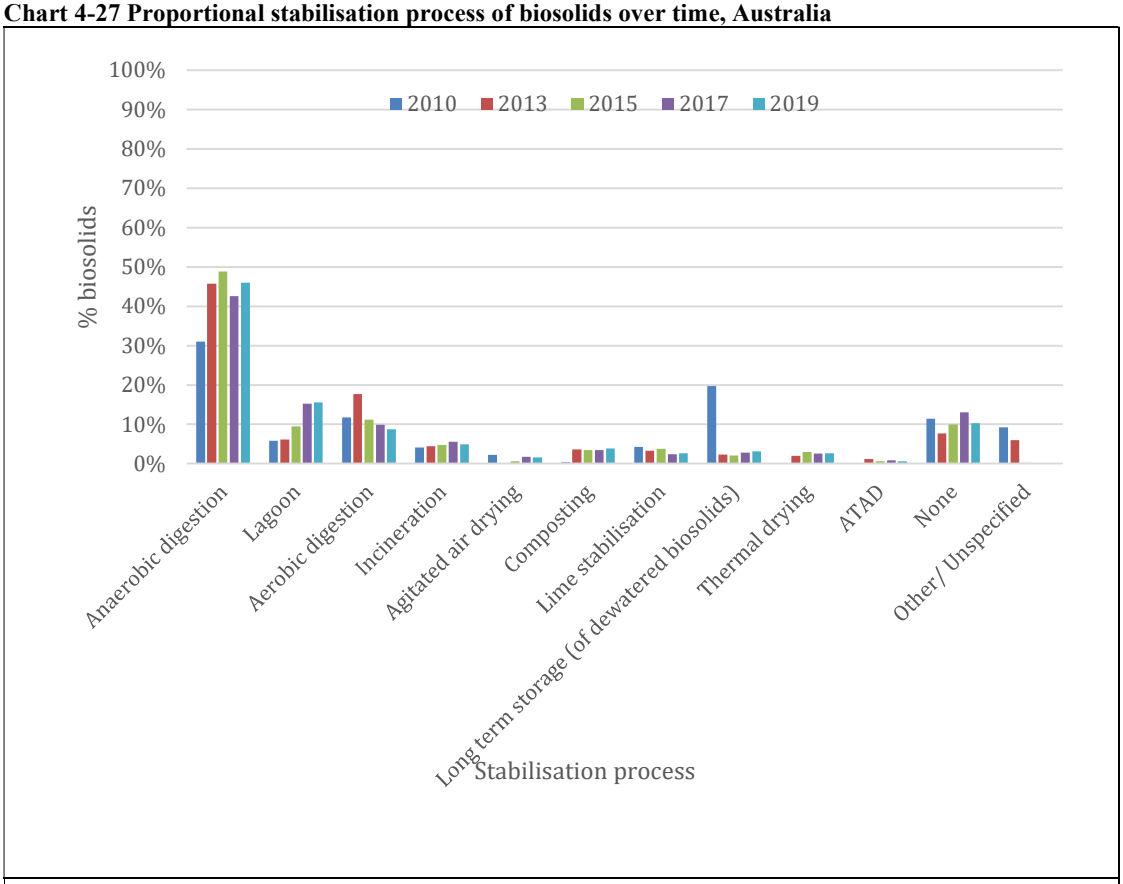
Comment: There is no obvious reason for the change in contaminant grade in 2017. This may be a reporting error.

4.5 STABILISATION PROCESS

Biosolids stabilisation process nationally and for each state is presented in Charts 4-27 to 4-34 following.

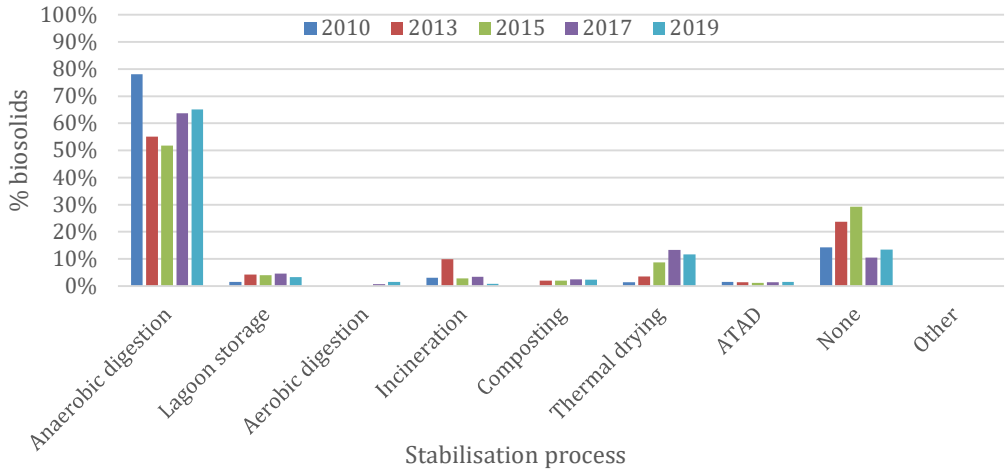
Western Australia and Tasmania have increased the use of composting as a stabilisation method in 2017 and 2019.

Chart 4-27 Proportional stabilisation process of biosolids over time, Australia



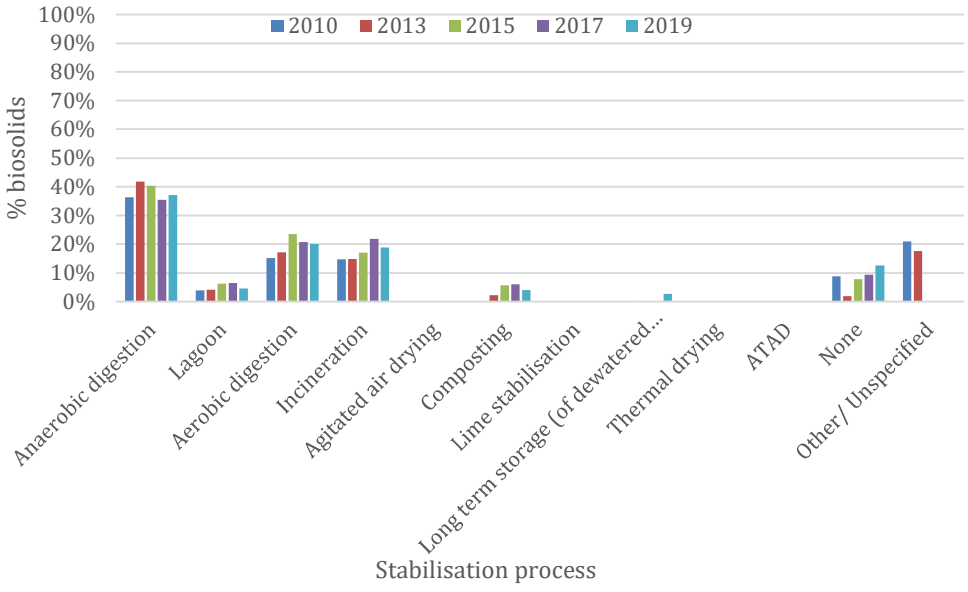
Comment: Biosolids stabilisation by anaerobic digestion has increased over time as has lagoon stabilisation. Aerobic digestion and ATAD stabilisation processes are showing a decline in use over time.

Chart 4-28 Proportional stabilisation process of biosolids over time, New Zealand



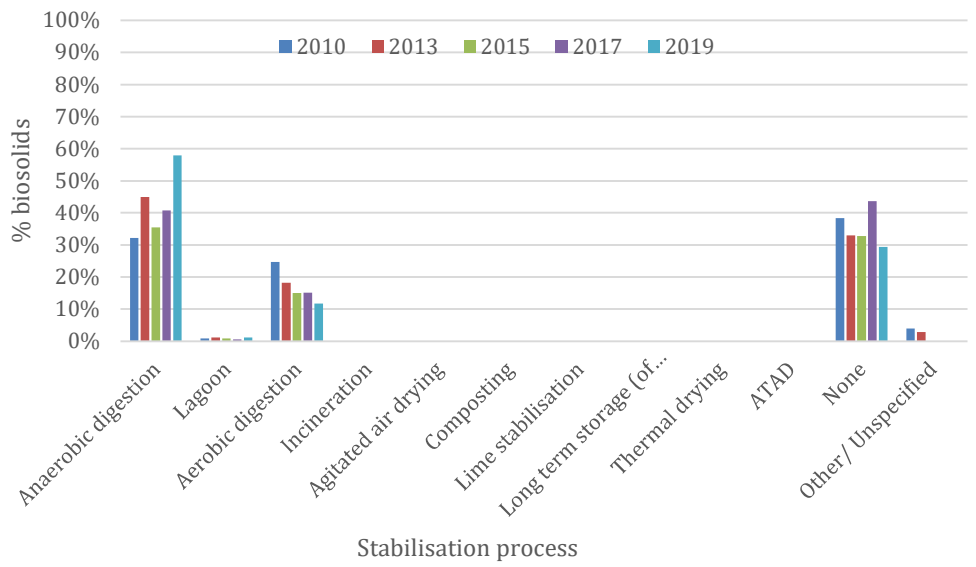
Comment: Biosolids undergoing no treatment has dropped from 30% to about 10% due to the introduction of additional anaerobic digestion and thermal drying capacity.

Chart 4-29 Proportional stabilisation process of biosolids over time, New South Wales & ACT



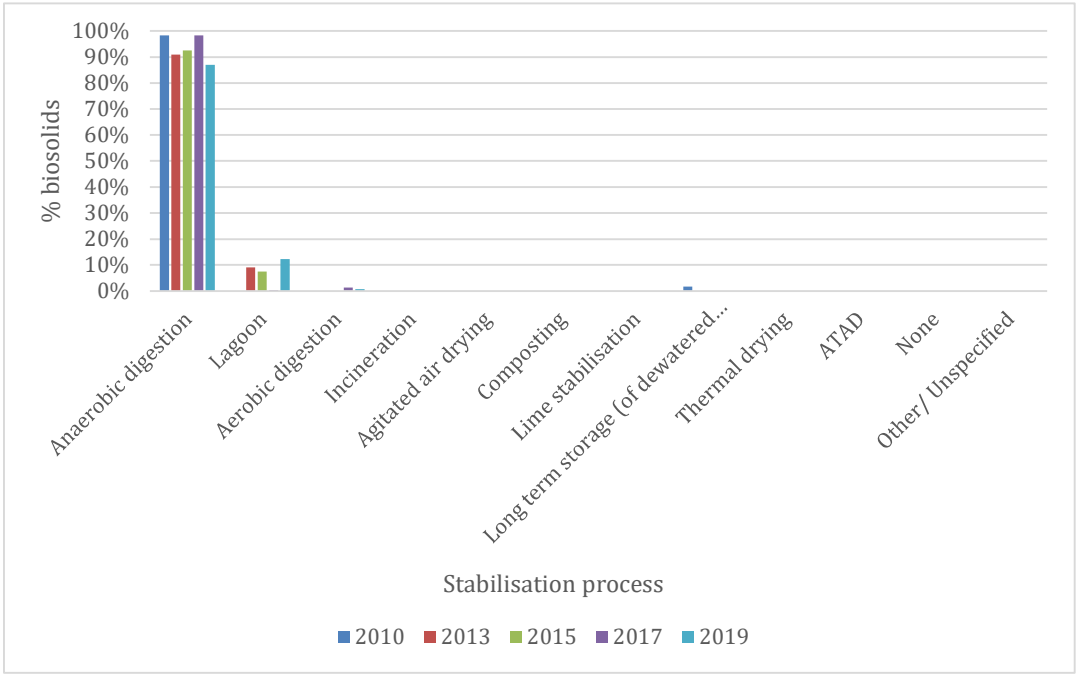
Comment: NSW and ACT stabilisation processes have remained quite stable over time.

Chart 4-30 Proportional stabilisation process of biosolids over time, Queensland



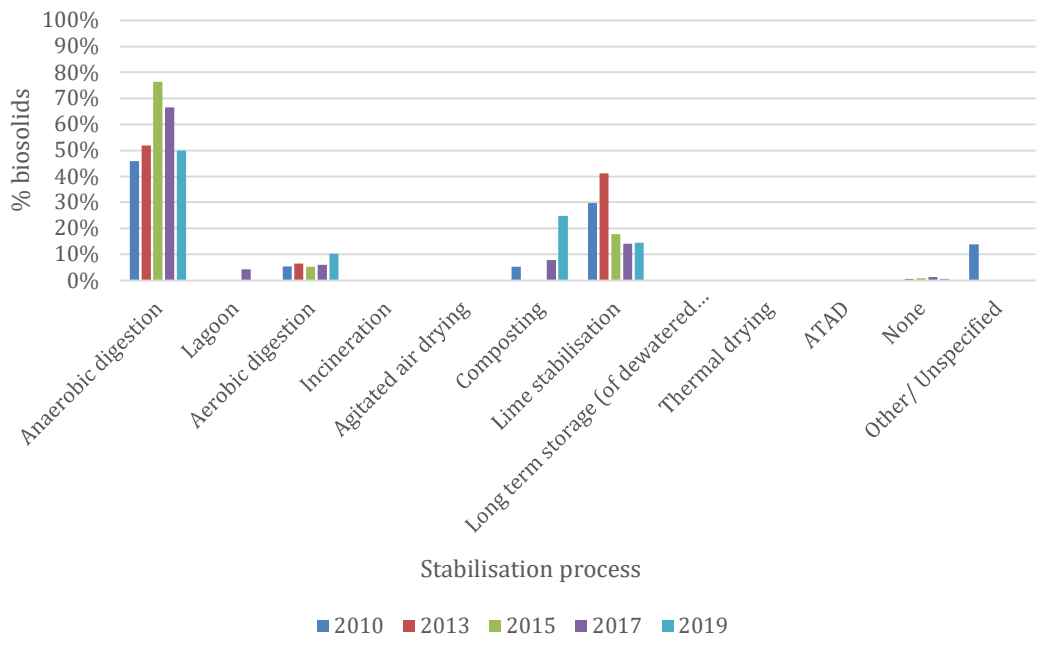
Comment: Thermal hydrolysis is a subset of anaerobic digestion. This technology accounts for about 5% of biosolids produced in 2019 in Australia or 25% of Queensland's biosolids in 2019 and 12% in 2017.

Chart 4-31 Proportional stabilisation process of biosolids over time, South Australia



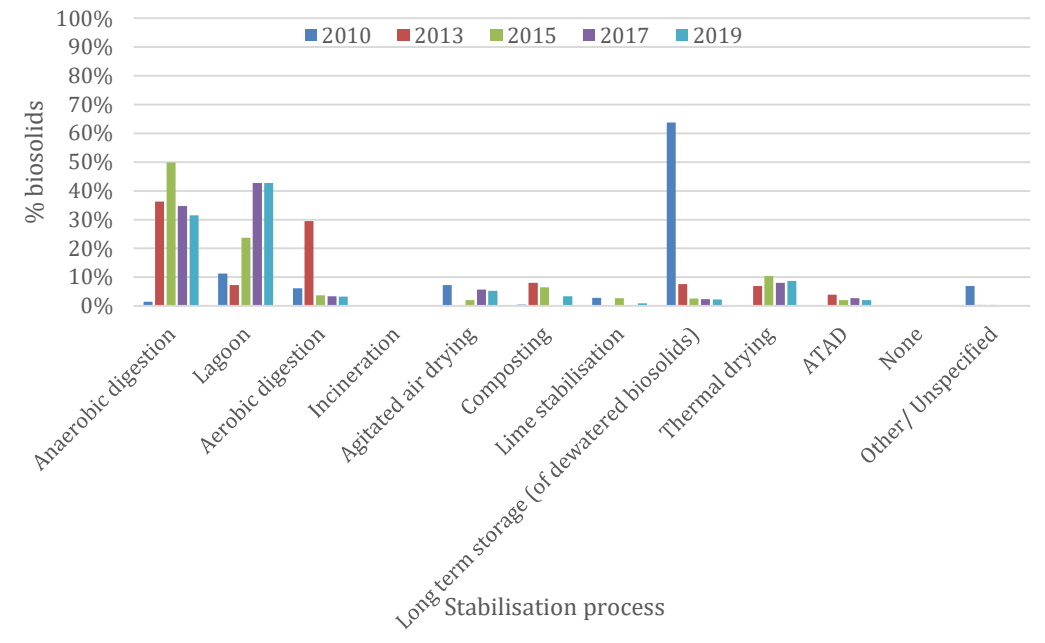
Comment: While most of SA's biosolids are stabilised using anaerobic digestion, a secondary stage of long term storage assists in achieving stabilisation grade A.

Chart 4-32 Proportional stabilisation process of biosolids over time, Tasmania



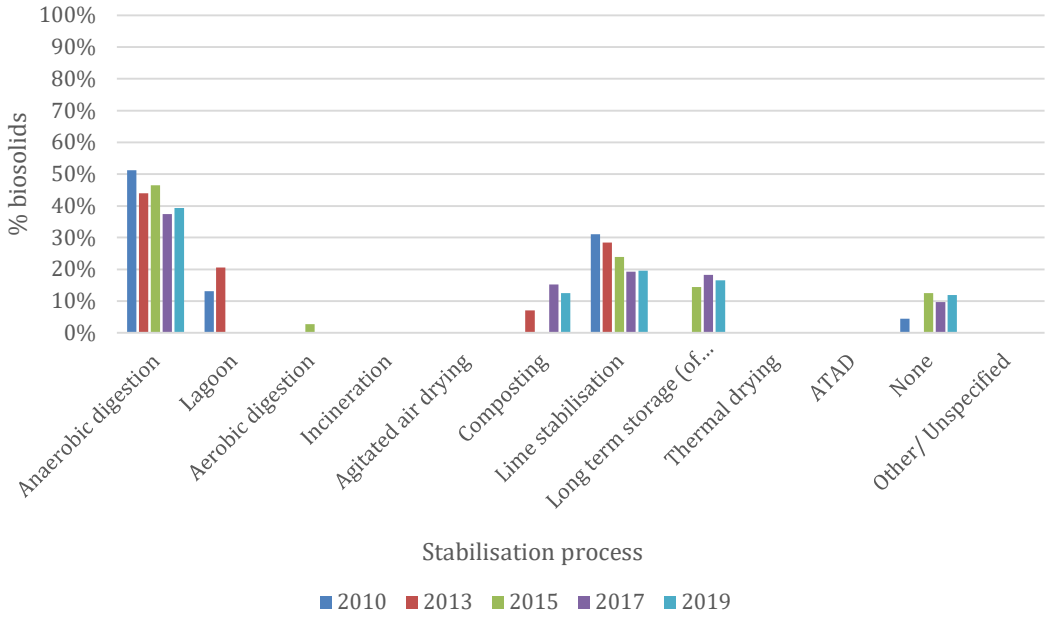
Comment: The proportion of biosolids being stabilised using composting processes has increased from nil in 2015 to over 20% in 2019.

Chart 4-33 Proportional stabilisation process of biosolids over time, Victoria



Comment: Anaerobic digestion and lagoon treatment dominate stabilisation processes in Victoria and are often supplemented with long term storage to achieve a stabilisation grade A.

Chart 4-34 Proportional stabilisation process of biosolids over time, Western Australia & Northern Territory

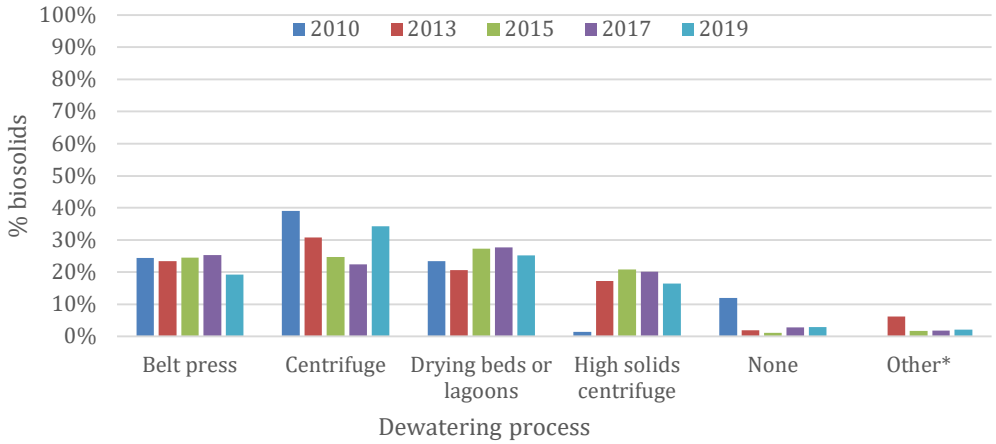


Comment: The only state where lime stabilisation is used to treat a significant proportion of biosolids, WA has seen a decrease in the use of this process since 2010.

4.6 DEWATERING PROCESS

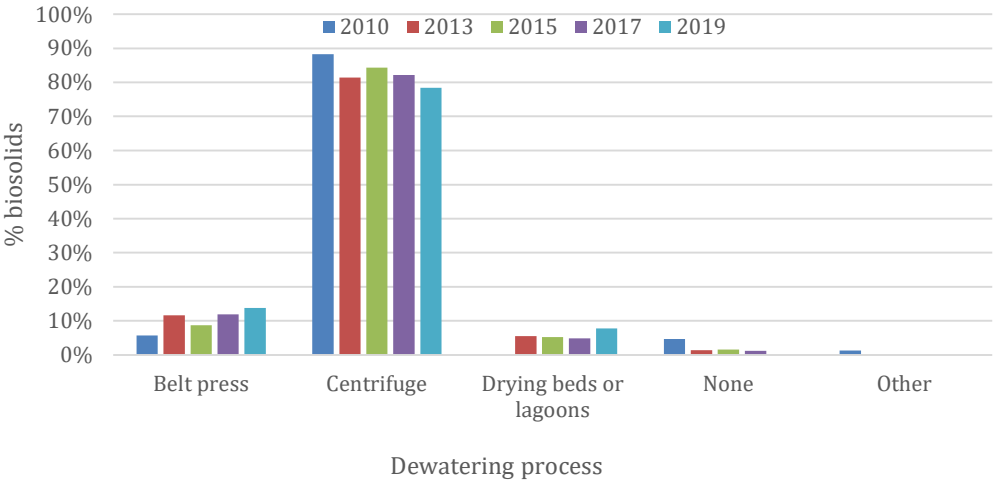
Biosolids dewatering process nationally and for each state is presented in Charts 4-35 to 4-42 following.

Chart 4-35 Proportional dewatering process of biosolids over time, Australia



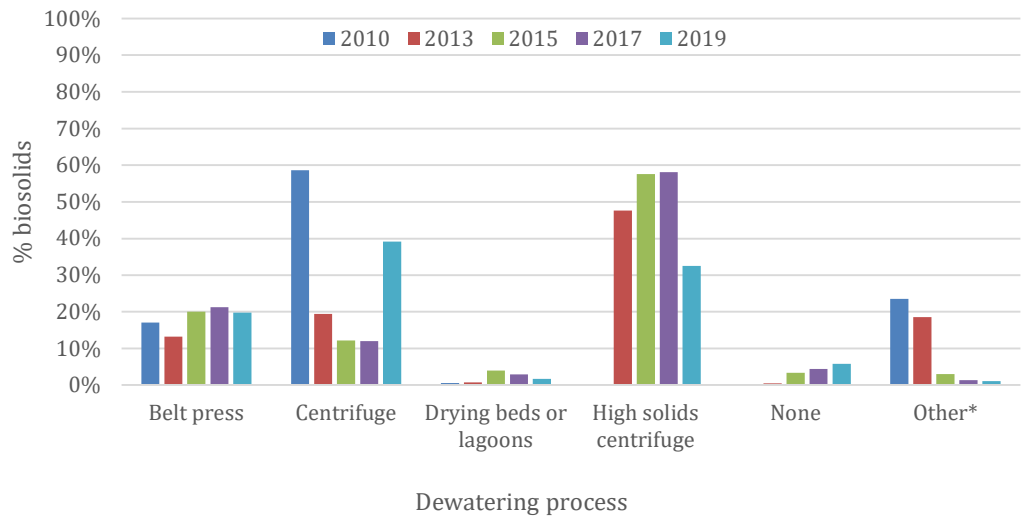
Comment: The choice of dewatering systems has remained very constant. The *Other* category includes unspecified processes which were 6% and 2% in 2010 and 2013 respectively. *Other* dewatering processes include solar dryers, a volute dehydrator and geobags. The *None* category is largely the ocean discharged biosolids, except for 2010.

Chart 4-36 Proportional dewatering process of biosolids over time, New Zealand



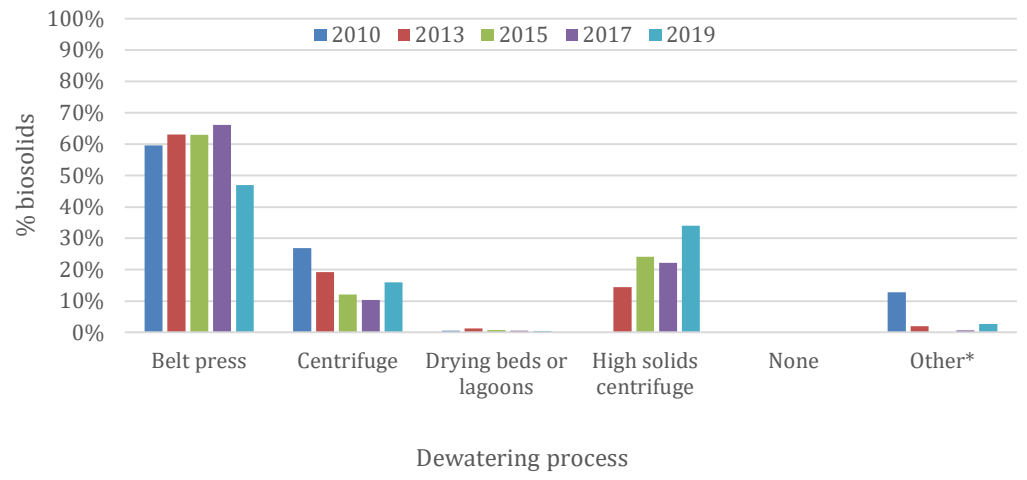
Comment: Centrifuges remain the most popular dewatering process in New Zealand.

Chart 4-37 Proportional dewatering process of biosolids over time, New South Wales & ACT



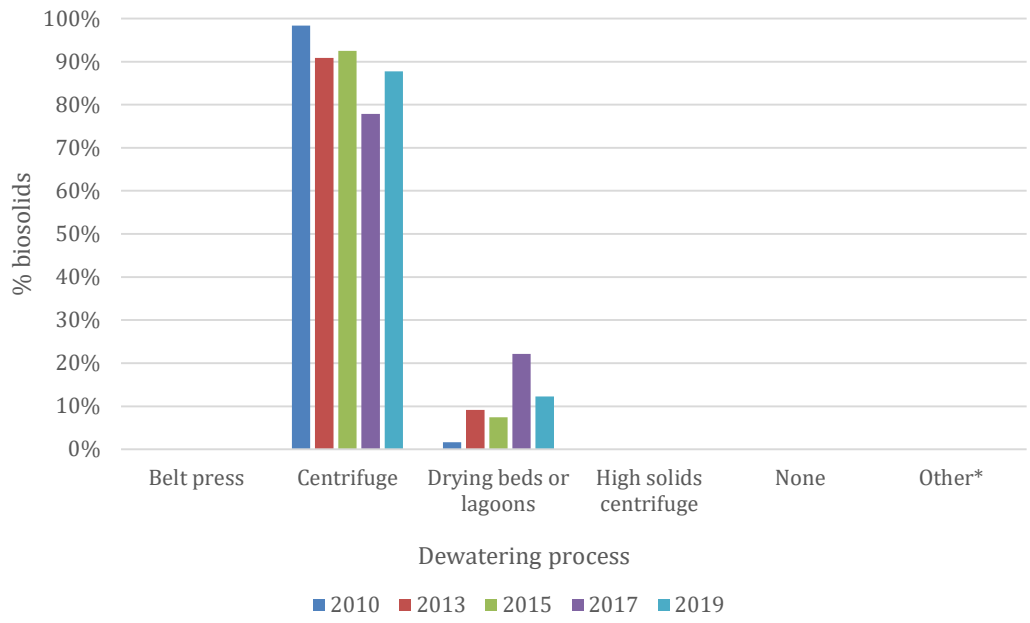
Comment: Variations in results between *Centrifuges* and *High Solids Centrifuges* have been found to be reporting errors.

Chart 4-38 Proportional dewatering process of biosolids over time, Queensland



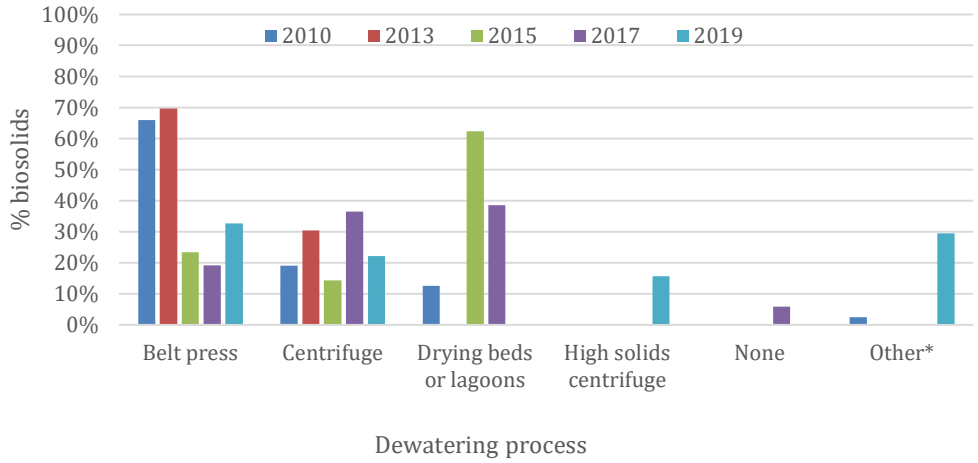
Comment: In 2019 the use of centrifuges was equal to the use of belt filter presses for dewatering biosolids.

Chart 4-39 Proportional dewatering process of biosolids over time, South Australia



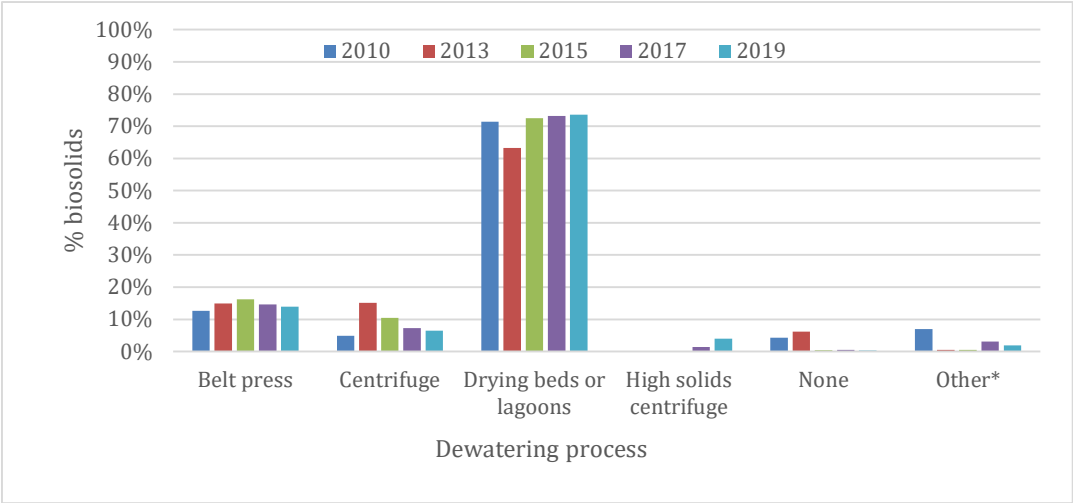
Comment: Dewatering biosolids in drying beds or lagoons has increased in use in SA in the last two surveys.

Chart 4-40 Proportional dewatering process of biosolids over time, Tasmania



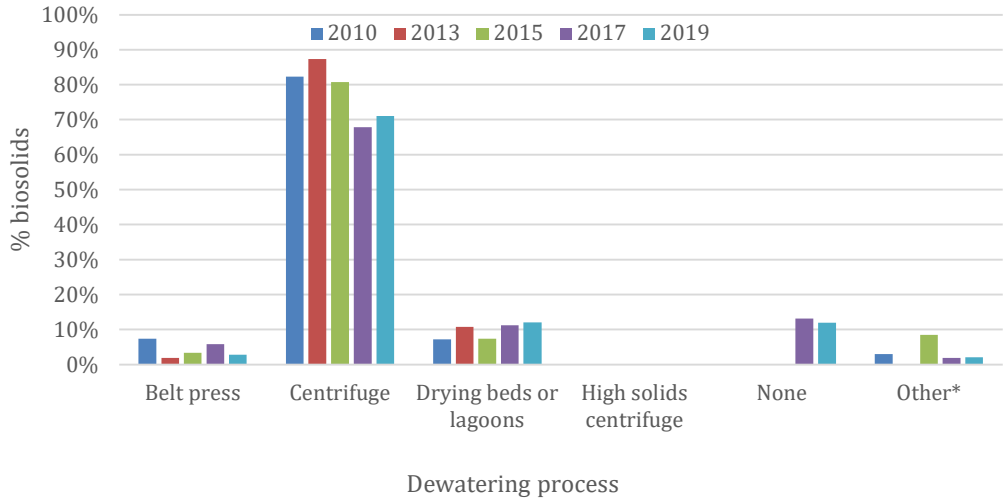
Comment: The increase in the category of *Other* in 2019 appears to be the result of the use of composting as a stabilisation methodology.

Chart 4-41 Proportional dewatering process of biosolids over time, Victoria



Comment: Victoria also has several solar dryers which are captured in the *Other* category.

Chart 4-42 Proportional dewatering process of biosolids over time, Western Australia & Northern Territory



Comment: The increase in the proportion of biosolids with no dewatering is probably more a reflection on the mass of biosolids removed from lagoons in 2017 and 2019 rather than changes at any other sites.