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CCA Treated Timber Extended Producer Responsibility Discussion Paper

Jackson Environment and Planning Pty Ltd
119 Willoughby Rd, Crows Nest NSW 2065
T: 02 9956 3866 | E: admin@jacksonenvironment.com.au
W: www.jacksonenvironment.com.au

Executive Summary

Timber products treated with CCA (copper chrome arsenate) are broadly spread throughout the community. The ongoing production, use and progressive demolition and removal of CCA treated timber structures will result in a steady amount of CCA treated timber requiring waste disposal for the foreseeable future.

In NSW, some reuse of CCA treated timber occurs. Examples include the reuse of posts for fencing, and the use of power poles as traffic bollards in car park applications. Despite this, most CCA treated timber at end of life is disposed to landfill. It is unlawful for CCA treated timber to be processed into mulch and applied to land (under the *Mulch Order* 2016), incinerated or used as a waste derived solid fuel combusted for energy.

In 2003, the Australian Pesticides and Veterinary Medicines Authority (APVMA) reviewed the use of arsenic timber treatment products, including CCA. In 2005, APVMA implemented restrictions that no longer permitted CCA as a treatment for timber used for playground equipment or other structures where children could come into close and frequent contact. They also required these products to be clearly identified for consumers as treated with copper chrome arsenate. Importers, who are not within the scope of APVMA's decision, voluntarily complied with these labelling requirements. Further restrictions were put in place from 1 July 2012, with APVMA declaring CCA a restricted chemical product to help reduce the potential for impacts on human health and the environment.

To assist in the development of policy around the management of CCA treated timber, this discussion paper estimates the amount of CCA treated timber consumed by NSW households and how much of this timber, once it is past its useable life, is entering the waste stream through the various disposal pathways. The study found on average 102,000 tonnes of CCA treated timber is consumed in NSW per year. The average NSW household consumes approximately 41 kg of CCA treated timber per year. In NSW, this timber has an average useful life of 30-40 years before it typically enters the waste stream.

Once the material reaches the end of its useful life, it is disposed of through a number of pathways. These include domestic kerbside waste collection (bin system), domestic bulky waste collection (clean-up), as contamination in composting facilities and construction and demolition waste recycling facilities, into landfills and through illegal dumping. Based on the data available, the average projected waste flow through these pathways at a state level is 82,000 tonnes per year, equivalent to 29.9 kg/household/year. Results suggest that self-haul to landfill and domestic bulky waste collections are the main pathways that households use for disposal of CCA treated timber.

This study has identified that there is large quantity of CCA treated timber in use throughout the community. Mismanagement of this CCA treated timber, through poor handling, inappropriate disposal, deliberate or unintentional burning and illegal dumping can lead to potential human health and environmental impacts. The study found that exposure to dust from sawing or sanding of recently treated timber can impact on human health, and the unlawful mulching of CCA treated timber and application to land can impact on the environment. However, the risk to human health and the environment from mulching and land application of CCA treated timber is considered low as this is regulated and is unlawful.

The impacts of arsenic exposure are well documented. Exposure to Arsenic can cause cancers and affect the respiratory, pulmonary, cardiovascular, gastrointestinal, haematological, hepatic, renal, neurological and immunological systems. The main exposure pathway is direct contact through use and handling of CCA treated timber. The study found that children are more susceptible as they are more likely to have frequent and intimate contact with CCA treated timber, particularly in relation to playground structures. Physiological differences also mean that children are more susceptible to the effects of exposure to arsenic.

CCA treated timber presents several waste management challenges. Identifying the best option for managing CCA treated timber waste is important for the safety of the environment and community. Unfortunately, there are limited examples of best practice. This report explores the options for Extended Producer Responsibility or Product Stewardship schemes as a means of managing this problem waste.

In NSW, the *Waste Avoidance and Resource Recovery Act* 2001 enables the NSW Government to implement 'extended producer responsibility schemes' (EPR). EPR is a policy tool that places the responsibility for the end-of-life environmental impacts (including physical or financial responsibility) of a product on the producer. Similarly, Product Stewardship schemes can be created under the Commonwealth's *Product Stewardship Act* 2011 which provides a mechanism for national level EPR schemes that can be either voluntary, co-regulatory or mandatory.

In response to the NSW Government listing treated timber as a waste of concern under the state's EPR framework, industry formed a National Timber Product Stewardship Group (NTPSG). This group undertook a significant amount of research and developed a national strategy for all post-consumer timber (including treated timber). For CCA treated timber, a key strategy proposed by the group involved better identification and removal of CCA timber from the recycling stream, to facilitate its disposal in well managed landfills.

Following APVMA's restrictions on production of some CCA treated products and voluntary industry restrictions on CCA imports, a shift to non-arsenic based wood preservatives has occurred. However, CCA treated timber is still permitted in many applications and is purchased in large quantities. This means that CCA treated timber will continue to be present in the waste stream for many years to come.

An appropriately designed EPR scheme at a state or national level could foster innovation through product life cycle design changes (for example easier identification of treated products) to reduce the costs of end-of-life disposal of CCA products. This could include making CCA treated products that can be more readily reused or recycled or reducing the potential for contamination of other materials. An EPR scheme can also promote changes to marketing practices so that consumers are more informed of their product choices and the potential to avoid waste through education. An EPR scheme would also enable better management of the material prior to disposal, and a more effective means of tracking CCA treated timber waste.

Given the lack of alternative management options for end of life treated timber in NSW, except landfill, and evidence demonstrating the potential for health and environmental impacts in the community, a staged phase out of CCA timber treatments and use of safer timber treatment alternatives may be considered as a longer-term goal. A phase out of CCA could be supported by an EPR scheme based on an advance disposal fee (ADF) paid at the point of sale of a CCA timber item. This funding could be used to support public education on the management of existing CCA treated timber structures, end of life management of CCA treated timber, and education to encourage use of sustainable alternatives to CCA treated timber. This approach has two principal benefits. Firstly, it would make alternative treated timber products more cost competitive. Secondly, it will enable government to manage the human health and environmental impacts of the current stock of CCA treated timber in service and at end of life.

This paper highlights opportunities for engaging in discussions with the building industry, consumers, manufacturers and importers of CCA treated timber, and suppliers of CCA preservatives to consider strategies for longer term adoption of more sustainable and non-CCA timber preservative options. While EPR schemes could play a role in facilitating this change, the overall financial, environmental and social costs and benefits need to be better understood to support policy development.

CONTENTS

1. Introduction

The timber and forest products industry in New South Wales plays a vital role in the Australian economy, and particularly in the construction sector. The state-owned Forestry Corporation is the main softwood plantation manager in NSW and produces enough timber for a quarter of new Australian homes (Forestry Corporation of NSW, 2017). The industry supports over 22,000 employees as well as local and regional communities and businesses, producing $2.4 billion in value and exports of $240 million (Timber NSW, 2017).

Before it reaches the point of consumption, much of the timber produced goes through a series of secondary processes in the supply chain to produce a wide range of wood products. One of these processes is timber treatment. Timber treatment involves the application of wood preservatives to protect timber from biological and/or climatic hazards and thereby significantly increasing the lifespan of timber that is not naturally resistant to insect attack or decay causing fungi.

Treated timber, in one form or another, has been around for over 2,000 years. Historical timber preservatives include animal, vegetable and mineral oils, as well as coal tar pitches and bitumen. One of the oldest and widely used engineered preservatives is creosote, a coal tar product, that has been used as a timber preservative on a commercial scale since the late 1830's (Australian Timber Importers Federation, 2004).

Since then a number of treatment types have been developed for different applications and exposure hazards, mainly biological such as borers, termites and decay causing fungi. Up until recently, Copper Chrome Arsenate (CCA) was the most common timber treatment process worldwide. The use of CCA was pioneered in 1933 and dominated the treated wood market from the late 1970s (Morrell, 2006). CCA was commonly used for treating timber used for telegraph poles, decking and fencing, posts as well as children's playground equipment. Australian Standard AS 1604.1 (2012) *Specification for Preservative Treatment, Part 1: Sawn and round timber* specifies that the composition of CCA formulations shall fall in the limits copper 23-25%, chromium (hexavalent) 38-45% and arsenic (pentavalent) 30-37%. The role of copper in CCA treated wood is to protect the wood from bacterial and fungal attack; arsenic plays the role of insecticide to protect wood against termite and borer attack, while chromium acts as a binder of arsenic and copper to the wood surface (Lebow, 1996).

After being used for over 70 years in numerous building products, health and environmental concerns about the potential exposure to arsenic found in CCA treated timber were raised. This exposure was of particular concern in 'frequent and intimate' contact products such as children's play equipment, decking and outdoor furniture.

All new preservative formulations used in Australia must be approved for use by the Australian Pesticides and Veterinary Medicines Authority (APVMA) under the *Agricultural and Veterinary Chemicals Code Act* 1994. In 2003, APVMA reviewed the use of CCA in the timber treatment process and in 2005 implemented restrictions that no longer permitted it to be used as a timber treatment for playground equipment or other 'frequent and intimate' products for use in structures such as:

- Garden furniture;
- Picnic tables;
- External seating;
- Domestic decking boards; and
- Handrails.

Other existing uses were still permitted under these changes.

Further restrictions were put in place from 1 July 2012, with APVMA declaring CCA a restricted chemical product. This means CCA chemical solutions used in the treatment process can only be supplied to, and used by, suitably trained persons authorised under a relevant state or territory law.

It is noted, however, that the regulatory powers of APVMA do not extend to the end use or disposal of CCA treated timber. End of life management and landfill disposal of CCA treated timber is managed in NSW under the *Protection of the Environment Operation Act* 1997.

Timber products containing CCA are broadly spread throughout the community due to ongoing construction, use and retention of existing structures. The progressive demolition and removal of treated timber products will result in an increase in the amount of CCA treated timber requiring proper waste disposal in the coming years. Current use of CCA treated timber in new structures is limited to those applications which are not restricted by APVMA.

Currently in NSW, end of life CCA treated timber is not permitted to be used in any land applied recycled product (such as a mulch or compost). Nor is it permitted to be burnt in the open or used in any solid fuel in power stations or other industrial combustion facility. CCA timber at end of life must be disposed of at a lawful *General Solid Waste* landfill in accordance with the *NSW Waste Classification Guidelines* (NSW EPA, 2014a). Disposal of CCA treated timber in landfill is approved by the EPA under the Immobilisation Approval (2001/11) under Part 10 of the *Protection of the Environment Operations (Waste) Regulation* 2014.

Landfill environments are particularly usefully in managing the potential health and environmental hazards associated with the CCA preservative because it is contained within a lined and reasonably impervious landfill environment, where the chemical preservatives are deemed to be immobilised and cannot move into groundwater and pollute waterways.

Disposal of timber in landfill consumes valuable landfill space. In addition, the presence of treated timber in waste also prevents opportunities for recovering untreated timber that can be used in other applications, such as a mulch in landscaping applications. Untreated and untreated timber also breaks down in landfills (albeit at different rates) and contributes to the greenhouse impacts of landfills. For every tonne of timber disposed to landfill, ~0.6 tonnes of CO_2-e is released into the environment (Department of Environment and Energy, 2016). Reducing timber disposal in landfill can reduce the greenhouse impacts of landfills.

This discussion paper has been prepared to assist the NSW EPA assess future policy options to manage and regulate the use and disposal of end of life CCA treated timber products. Specifically, this discussion paper aims to:

- Assess the current and projected volume of CCA treated timber waste generated by domestic households;
- Analyse the current collection options open to domestic generators;
- Explore the possibility of substantial risks to human health and the environment from the mismanagement of CCA treated timber waste; and
- Examine the purpose of establishing an EPR scheme for CCA treated timber.

1.1. NSW Treated Timber Initiative

The Treated Timber Initiative is an innovative consumer-focused education program of the NSW EPA to raise awareness and to engage the community to make sustainable choices in relation to purchasing, use and end of life management of CCA timber products. The education initiative is supported by the NSW Environmental Trust.

The community education initiative is supported through a suite of online information resources, and a YouTube video posted on-line as a simple and accessible information resource for NSW householders. An educational lesson is also available online, using the YouTube video to highlight in an engaging way how consumers can choose the right product for the job; working with treated timber; and disposing of treated timber. The learning objectives of the instructional video and supporting lesson module are to:

- Identify different treated timber types;
- Determine which treated timber product to use;
- Know how to work safely with treated timber;
- Understand how to safely dispose of treated timber; and
- Manage treated timber structures.

The community education resources for the Treated Timber Initiative are online at: http://www.epa.nsw.gov.au/chemicals/tt-treated-timber.htm.

1.2 Extended Producer Responsibility

As part of the Treated Timber Initiative, the NSW EPA are seeking to consult and engage with the timber manufacturing industry, the building industry, the community, councils, recyclers and operators of landfills on how NSW as a state can better manage the appropriate use, recovery and disposal of CCA treated timber at end of life, to minimise impacts on public health and the environment.

Under Clause 15 of the *Waste Avoidance and Resource Recovery Act* 2001, the NSW Government has the power to implement Extended Producer Responsibility schemes for waste materials of concern, requiring producers to take responsibility for a product (including physical or financial responsibility) at the post-consumer stage of a product's life-cycle. The NSW Government in 2010 published the *NSW Extended Producer Responsibility Priority Statement* 2010 stating:

> "*Extended producer responsibility (EPR) policies aim to minimise waste generation and toxicity and maximise recycling. EPR policies engage producers and others involved in the supply chain of a product to take responsibility for the environmental, health and safety footprint of those products. This includes the design and manufacture of a product, as well as how the product is managed at the end of its life (including resource recovery and proper disposal).*"

Since the introduction of these legislative reforms in 2001, Extended Producer Responsibility laws have been introduced at a Commonwealth level under the *Product Stewardship Act* 2011. The *Product Stewardship Act* 2011 provides a framework to manage the environmental, health and safety impacts of products, and in particular those impacts associated with the disposal of products. The framework includes voluntary, co-regulatory and mandatory product stewardship. Examples of Commonwealth led product stewardship schemes includes the National TV and Computer Recycling Scheme; end of life tyres; used oil; mercury containing lamps and consumer packaging. Under Section 108A of the *Product Stewardship Act* 2011, the Minister for the Environment lists wastes of concern that are considered for some form of accreditation or regulation under the Act.

This discussion paper reviews the policy context and legislative basis for Extended Producer Responsibility schemes as well as the current status of the voluntary product stewardship strategy for post-consumer timber initiative and its application to CCA treated timber. This discussion paper also reviews the status of other EPR schemes overseas and regulation of CCA treated timber during in-service life and at end of life.

2. Treated timber

Untreated softwood radiata pine is not regarded as a durable timber. Left exposed to termite attack or the elements, untreated radiata pine is readily attacked by termites or rots due to decay causing fungi. Untreated softwood timber is therefore not recommended as an outdoor or structural building product. Treating timber for the purpose of increasing its lifespan involves the application of wood preservatives to protect the timber from biological and/or environmental hazards. Timber that is treated has a significantly increased lifespan in applications where, untreated, it would not be suitable.

Some hardwoods are also treated with preservative. Only the outer sapwood absorbs the preservative. Inner heartwood, which in many hardwoods is naturally resistant to termites and decay, is highly resistant to penetration with preservatives.

2.1. Treatment types

A number of different types of timber treatment exist. Each treatment varies in terms of process and the chemicals used as the preservative. The treatment type is specific to what the treated product may be used for and where it may be used.

Figure 2.1. Garden retaining wall built with CCA treated timber.

The four main types of timber treatment include:

- Water-borne preservatives – examples include Copper Chrome Arsenate (CCA), Alkaline Copper Quaternary (ACQ), Boron and Copper azole;
- Light organic solvent-borne preservatives (LOSPs) – examples include combination of azoles (tebuconazole, propiconazole) and synthetic pyrethroids (e.g. permethrin);
- Oil-borne preservatives – (e.g. Creosote, pigment emulsified creosote (PEC)); and
- Envelope treatments – synthetic pyrethroids (e.g. bifenthrin, permethrin) and imidacloprid applied with a water or white spirit carrier.

Up until recently, Copper Chrome Arsenate (CCA) was the most common timber treatment worldwide (American Wood-Preservers' Association, 2005). CCA was pioneered in 1933 and dominated the treated wood market from the late 1970s due to its effectiveness in extending the life of non-durable timbers, as well as being relatively inexpensive to produce (CSIRO, 2011). More recent concerns over the potential health and environmental impacts from the arsenic found in CCA treated timber has led to certain restrictions on its use, specifically in playground equipment and other applications were children may come into 'frequent and intimate' contact.

Since the early 1990s, Alkaline Copper Quaternary (ACQ) has been used in the Australian preserved timber market and has become more commonly used in place of CCA treated timbers. ACQ is considered to be safer than CCA as it offers the same level of resistance but with lower health and environmental risks such as no leaching of arsenic and chromium (American Wood-Preservers' Association, 2005). Though the high levels of copper increases manufacturing costs, and can make it less cost competitive compared to CCA treated timber.

Waterborne, oil-based and LOSP preservatives are the three most common timber treatments in Australia. Timber treated with waterborne preservatives are typically used in residential, commercial and industrial building structures whereas timber treated with oil-borne preservatives are used primarily for heavy duty construction and in the marine environment. The main oil-borne preserved products (i.e. PEC) include vineyard sticks, utility poles and some marine piles. Timber products treated with the LOSP are typically used in housing construction such as framing and truss timbers as well as high value joinery. LOSP treated products are approved only for use in above ground applications.

2.2. Hazard levels

Treated timber in Australia is categorised into 6 hazard levels or "H" levels, 1 through to 6, which relate to the type of treatment used and the intended use of the treated timber product. The hazard levels are defined based on the hazard to which the product will be exposed and are defined in Australian Standard 1604 series which specifies the preservative treatment of timber and timber products including minimum preservative penetration and retention requirements.

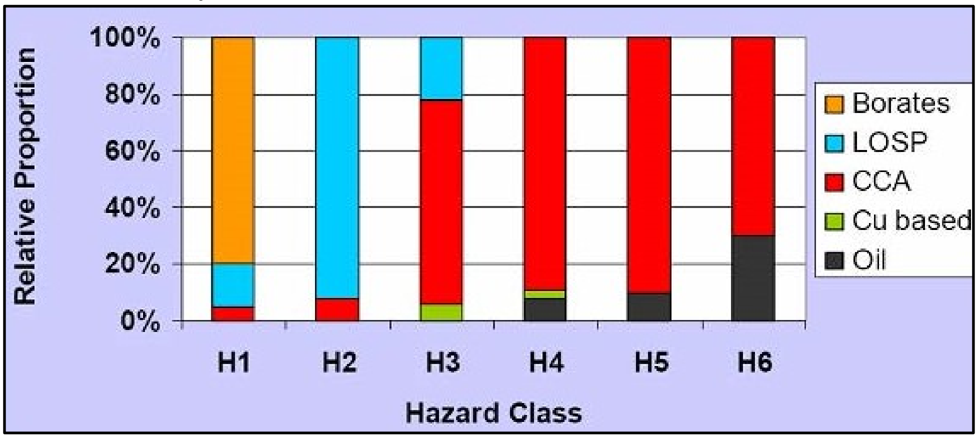
While the hazard levels are not directly related to a human health or environment hazard level, a lower H level means a lower level of treatment and therefore potentially a lower health and environmental hazard. Table 2.1 provides an overview of the hazard levels and chemical treatment types.

Table 2.1. Hazard levels and chemical treatment types[1].

Hazard Level	Exposure	Biological hazard	Typical uses	Preservative currently used for hazard level
H1	Inside, above ground	Lyctid borer	Borer susceptible hardwood used for dry interior framing, flooring, furniture and joinery	Boron
H2	Inside, above ground	Borers and termites	Framing, flooring, joinery, etc. used in interior dry situations	Boron (south of the Tropic of Capricorn only), synthetic pyrethroids, imidacloprid
H2F	Inside, above ground	Borers and termites	Framing used in interior dry situations (south of the Tropic of Capricorn only)	'Blue Pine' (synthetic pyrethroids, imidacloprid)
H2S	Inside, above ground	Borers and termites	LVL/Plywood (glue-line treatment) in dry situations (south of the Tropic of Capricorn only)	Synthetic pyrethroids, imidacloprid
H3	Outside, above ground	Moderate decay, borers and termites	Weatherboard, fascia, pergola posts (above ground), window joinery, framing and decking	ACQ, CA, CCA (not residential decking), LOSP
H3A	Outside, above ground (protected by paint)	Moderate decay, borers and termites	Fascia, bargeboards, exterior cladding, decking, window and door joinery and veranda posts	LOSP
H4	Outside, in-ground	Severe decay, borers and termites	Landscaping timbers, fence posts and pergola posts (in-ground)	ACQ, CA, CCA, creosote (farm fencing only)
H5	Outside, in-ground, contact with or in fresh water	Very severe decay, borers and termites	Retaining walls, piling, house stumps and building poles	ACQ, CA, CCA, creosote (power poles)
H6	Marine waters	Marine wood borers and decay	Boat hulls, marine piles and jetty cross bracing	CCA, creosote (in waters above Batemans Bay only in combination with CCA)

The relative proportion of preservative used in each treated timber hazard level is shown in Figure 2.2. The figure shows hazard levels H3 to H6 have a high proportion of CCA preservative. The majority of treated timber is treated to a H3 and H4 level as shown in Figure 2.3. Since 2007, the growth in H2F treated pine timber for house framing has been rapid. The preservative most favoured is envelope treatment with synthetic pyrethroid, bifenthrin.

Figure 2.2. Relative proportion of treated timber products by preservative type in hazard level (Source: Carruthers (2003) in A3P and TDANSW, 2007).



[1] Modified version of Australian Standards (AS 1604-2000). NSW EPA - treated timber hazard level and treatment types chart at http://www.epa.nsw.gov.au/resources/epa/treated-timber-chart.pdf).

Figure 2.3. Relative proportion of timber treated by hazard class (Source: Carruthers (2003) in A3P and TDANSW, 2007).

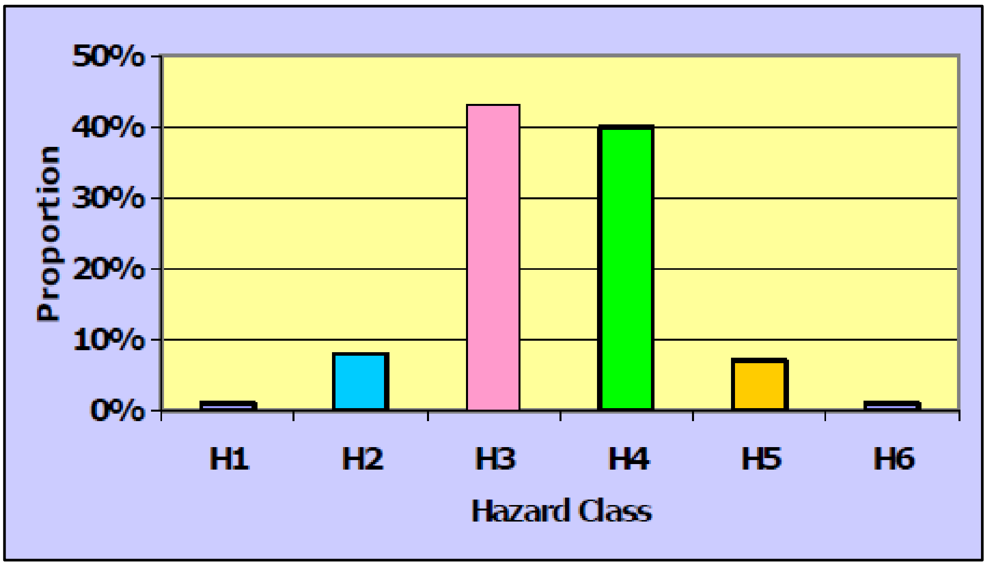


Table 2.2 provides a guide on the use of some of the more commonly treated timber products and associated hazard levels.

Table 2.2. Common treated timber products and hazard level[2].

Treated product	H1	H2	H2F	H3	H3A	H4	H5	H6
Baluster				✓				
Battens – inside	✓	✓	✓					
Battens – outside - structural				✓				
Battens – outside – non-structural				✓	✓			
Beams laminated – inside – low risk	✓	✓						
Beams laminated – inside – high risk				✓				
Beams laminated - outside				✓				
Boat hull								✓
Cladding				✓	✓			
Compost bin						✓		
Containers - plants						✓		
Cooling tower – fill and structure							✓	
Decking – bridge & wharf							✓	
Decking - jetty						✓		
Decking - patio				✓				
Droppers - fence				✓	✓			
Fascia boards				✓	✓			
Fence - palings				✓	✓			
Fence – rail				✓				
Flooring - interior	✓	✓						
Framing – interior – components, lintels, noggins, studs, subfloor, top and bottom plates	✓	✓	✓					

[2] Timber Preservers Association of Australia accessed at http://www.tpaa.com.au/timber-treatment/ on 5 April 2017.

Treated product	H1	H2	H2F	H3	H3A	H4	H5	H6
Furniture - inside	✓							
Furniture – outside (garden)				✓				
Garden wall more than 1m high						✓	✓	
Gate – outside (garden)				✓				
Glasshouse framing						✓		
Handrails, balustrade				✓				
Horticultural timbers						✓	✓	
Jetty components (submerged) – freshwater							✓	
Jetty components (submerged) – saltwater								✓
Joinery– Interior	✓	✓						
Joinery– exterior				✓	✓			
Landscaping timbers						✓		
Lattice				✓	✓			
Marina timbers								✓
Mushroom boxes						✓		
Oyster-farming timbers								✓
Pergola timbers – above ground				✓	✓			
Pergola timbers – in ground						✓		
Piles – building foundation and freshwater							✓	
Piles – marina								✓
Poles – building and utility							✓	
Posts – sawn						✓		
Posts – guardrail, horticulture and fencing						✓	✓	
Seed boxes						✓		
Shingles						✓	✓	
Slipways – marinas						✓		
Spa pools						✓		
Stumps – sawn – house							✓	
Trellis				✓	✓			
Verandah – floors				✓				
Verandah – supports in ground							✓	
Verandah – supports out of ground				✓		✓		
Weatherboards				✓	✓			
Wet process factories						✓		

Combining the information in the above figures and tables, it can be summarised that over 80% of treated timber is treated to a H3 or H4 hazard class. Table 2.1 identifies a number of common uses of treated timber products and hazard level. The table shows that the majority of treated timber is used in external applications such as fascia boards, veranda post, framing and decking, exterior cladding, decking, window and door joinery, landscaping timbers and fence posts. This information highlights that a high proportion of CCA treated timber has been used in building and landscaping products and many of which are accessible to the community.

3. Projected volumes of treated timber consumed in NSW

The focus of this section is to evaluate existing data to determine the current and projected volume of CCA treated timber produced and consumed by domestic households. Using this information, along with current and projected volumes of CCA treated timber waste (section 4), a relationship between production, consumption and disposal can be established. This is the first time that such a combined analysis has been done on CCA treated timber in NSW.

The following table provides a breakdown of the various uses of treated timber, the approximate production volume and hazard level. The information has been taken from the survey conducted by A3P and TDANSW in 2007, which found that at a national level, almost 1.5 million cubic metres of treated timber is produced annually.

Table 3.1. Estimated annual volume of treated timber by wood product in 2007 sold in Australia (modified from A3P and TDANSW, 2007).

PRODUCT	TOTAL VOLUME (M^3)	HAZARD LEVEL
ROUNDWOOD	**555,000**	
Vineyard post (CCA)	240,000	H4
Vineyard post (creosote)	30,000	H4
Landscape and fencing round (CCA)	200,000	H4
Landscape and fencing round (creosote)	15,000	H4
Pole and pile (CCA & creosote)	70,000	H5 & H6
SAWNWOOD	**470,000**	
Fencing and landscaping	235,000	H3
Fence post and general landscape	140,000	H4
Paling and picket	80,000	H3
Sleeper	15,000	H4
STRUCTURAL	**550,000**	
H1	30,000	H1
H2	70,000	H2
H2F (framing)	250,000	H2
H3	160,000	H3
H4	30,000	H4
H5	10,000	H5
OTHER	**59,000**	
Decking	50,000	H3
Handrails	3,000	H3
Cladding	6,000	H3
ENGINEERED WOOD PRODUCTS	**60,000**	
Particle board flooring	30,000	H2
Plywood	10,000	H2
LVL and I-beams	20,000	H2
Oriented strand board	NA	
TOTAL VOLUME	**1,454,000**	

The data in the table above represents the production volumes following the restrictions placed on CCA treated timber production in Australia by APVMA in 2005. Despite these restrictions, the total volume of treated timber produced and sold remained relatively stable. Following the restrictions, only the proportion of timber treated with CCA has declined. Approved replacement treatments, such as ACQ and LOSPs, that were introduced prior to these restrictions have been used as an alternative treatment to make up for any shortfall in supply for applications where the use of CCA treated timber was restricted by APVMA.

The biggest impact of the CCA restrictions would have been on Structural H3 softwood, decking and handrails. Other products would have been unaffected by the restrictions.

For the purpose of this discussion paper, we focus on the production and consumption of CCA treated timber for NSW domestic applications. To do this, we have made a number of assumptions to establish a rate of consumption of CCA treated timber by NSW households:

- NSW is Australia's largest state economy, with 33% of national household spending occurring in the state (Australian Bureau of Statistics, 2013);
- 75% of sawn timber produced is used in the residential construction sector (Timber NSW, 2013);
- 72% of the treated timber market is made up of by H3 to H6 treated timber, of which, 80% is treated with CCA (Carruthers (2003) in A3P and TDANSW, 2007); and
- The average density of treated timber is 500 kg/ cubic metre (EPA South Australia, 2008).

Using the above data, it is estimated that a total of 104,000 tonnes of CCA treated timber is consumed by NSW households per year. This is equivalent to 42kg of CCA treated timber per NSW household per year[3].

This estimate is consistent with more up to date data published by Dunn (2011). Dunn (2011) estimates that in 2010, between 1,894,775 to 2,632,753 cubic metres of new outdoor and infrastructure timbers were consumed by Australian Households. Of this, sawn treated plantation pine represents approximately 62%. Using the data from Dunn (2011) and same assumptions as above, the rate of consumption of CCA treated timber by NSW households in 2010 was estimated to be between 83,736 and 116,350 tonnes, or an average consumption of 100,000 tonnes. This is equivalent to 40kg of CCA treated timber per NSW household per year.

[3] According to the 2006 Census of Population and Housing there were 2.5 million occupied private dwellings in NSW (http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/1338.1Main+Features7Dec+2010). This population value has been used as the year of estimation is similar to that of the year of estimated annual volume of treated timber produced in Australia.

4. Projected volumes of treated timber waste disposed in NSW

4.1. Service life factors

The CCA timber treatment process was pioneered in 1933 and dominated the treated wood market from the late 1970s. CCA treated timber has been used relatively unrestricted for over 70 years with restrictions only coming into place after health and environment concerns were raised in the early 2000s. The problem this presents, in terms of managing CCA treated timber waste, is that the amount of CCA treated wood being disposed will continue in years to come. This is due to the service life of CCA treated timber which depends on a variety of factors, including:

- Natural durability of the heartwood;
- Adequacy of preservative treatment;
- Decay hazard and type of environment throughout the service life of the product;
- End use application;
- Inspection and maintenance;
- Weathering; and
- Fashion and cost of alternatives.

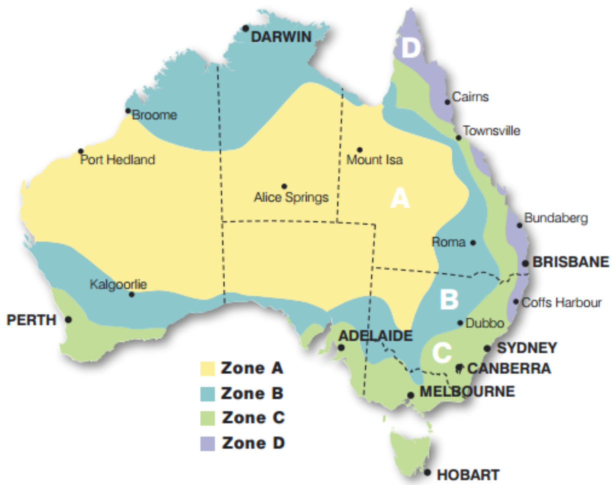
Peak use of CCA treated timber in residential construction occurred from the later 1970s through to the early 2000s. Research has shown that the typical service life of CCA treated timber before decay commences is approximately 35-40 years, though this will depend on application (Table 4.1) and climate (Figure 4.1). Given this, it is expected that CCA treated timber will continue to be found in the waste stream until at least 2040.

Table 4.1. Typical service life of preservative treated timber for onset of above ground decay (modified from Mackenzie *et al.*, 2015).

Type of preservative treated wood product		Hazard Level	Typical service life for onset decay (years)[1]			
			Zone A	Zone B	Zone C	Zone D
Fencing	Sapwood	H3	>70	>50	>40	>35
Decking	Sapwood	H3	>60	>50	>40	>35
Pergolas	Sapwood	H3	>50	>40	>30	>30

[1] Specific Figures are given in the Timber Service Life Design Guide (Mackenzie *et al.,* 2015).

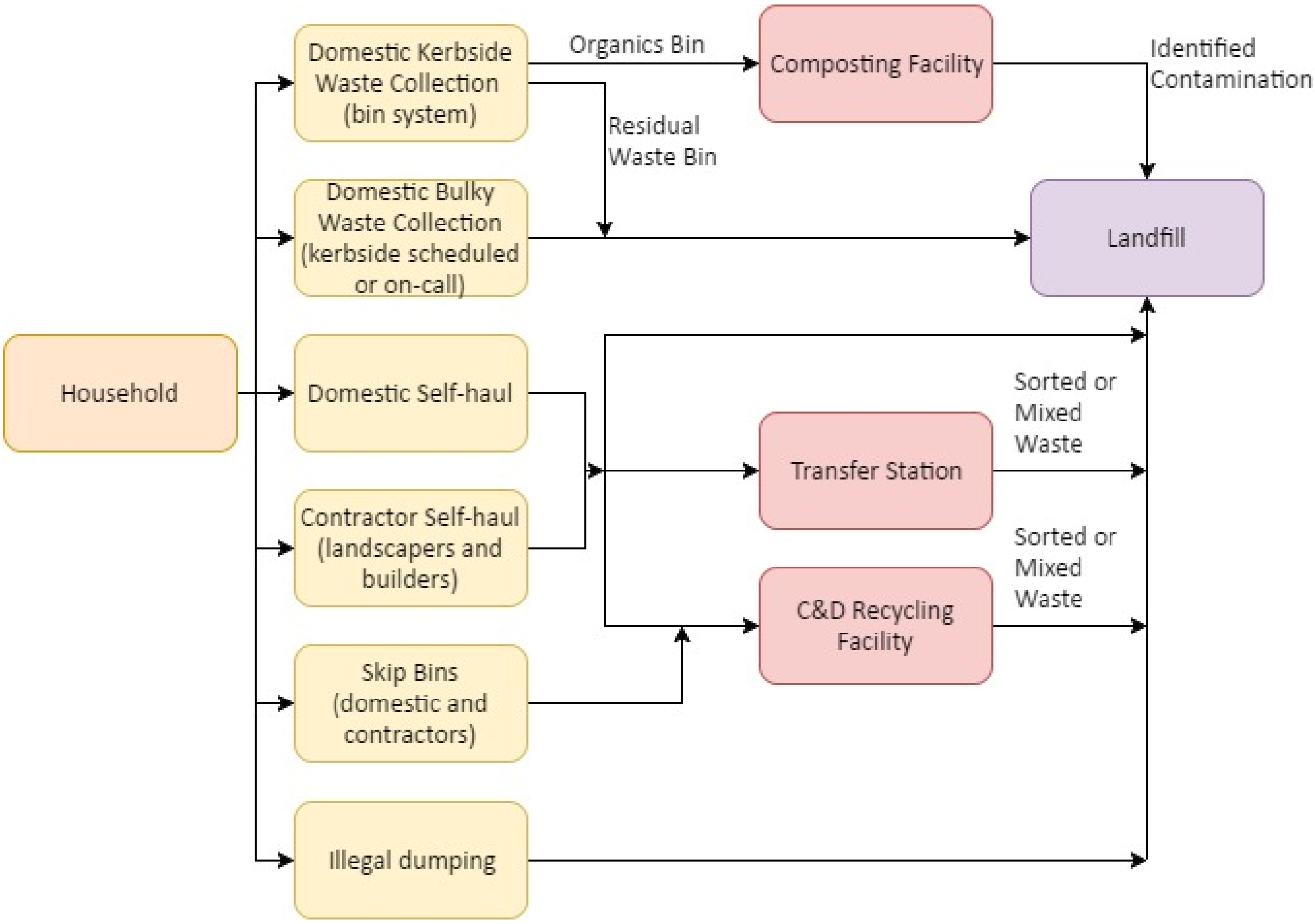
Figure 4.1. Above ground decay hazard zones for Australia (MacKenzie *et al.,* 2015).



4.2. Flows of CCA treated timber and disposal pathways in NSW

The following section attempts to estimate flows of CCA from domestic applications through the different disposal pathways in NSW. Specific data has been sought for the domestic kerbside waste collection system (kerbside bins), domestic bulky waste or clean-up collection services, construction and demolition waste recycling facilities, composting facilities and landfill disposal. The following diagram provides a summary of the potential disposal pathways in NSW.

Figure 4.2. Potential disposal pathways for CCA treated timber in NSW.



Treated wood products are normally generated from the following activities (Hann *et al*, 2010):

- Construction and demolition activities (housing renovation and replacement);
- Industrial buildings;
- Office strip outs; and
- Agricultural and landscape remediation.

Table 4.2 provides a summary of wood waste products and the probable preservative chemical present (Adapted from Hann *et al*, 2010).

Table 4.2. Summary of wood waste products and probable preservative chemical present.

Wood waste product	Probable preservative chemical present if treated
Railways sleepers	Creosote
Poles	CCA; PEC/Creosote
Landscaping	CCA ACQ; Creosote
Bridge and harbor piles	CCA; Creosote
Vineyard posts	CCA; Creosote
Paling fences	CCA
Decking	CCA ACQ; Copper azole
Windows	PCP, TBT, dieldrin (mainly in Victoria), azoles,permethrin
Wood from demolition and buildings	All current and past approved wood preservatives except creosote; Coatings, varnishes and impurities
Wood from new building sites	All currently approved wood preservatives except creosote
Solid wood for packaging/pallets	Rarely CCA
Furniture	Boron; Coatings, varnishes, glues
Composite products, internal	Synthetic pyrethroids, imidaclorprid, benzalkonium; chloride (Ruply, low volume), azoles and boron based preservatives
Composite products, external	Synthetic pyrethroids, benzalconium chloride (low volume), azoles, CCA, ACQ
Industry residues (offcuts, chips, shavings, dust)	Not applied but any currently approved wood preservative may be present depending on product

4.2.1. Domestic kerbside waste collection

The Guidelines for Conducting Household Kerbside Residual Waste, Recycling and Garden Organics Audits in NSW Local Government Areas (DECC NSW 2008) and *Addendum* (DECCW NSW, 2010) (the Audit Guidelines) provide local councils with the methods for auditing household domestic residual, recycling and organic waste generation and the composition of a typical household bin at the kerbside.

However, the Audit Guidelines do not provide guidance on capturing data on the specific composition of wood waste in the domestic waste collection system (kerbside bins). These audits typically group treated timber with untreated timber and other wood waste in audits as generic "wood waste" without discrimination based on type. Therefore, there is a general lack of data on the specific composition of wood waste in the domestic kerbside domestic waste collection system (kerbside bins).

This is further reflected in the consultation with local councils undertaken as part of this assessment. Most Councils used an aggregated audit methodology which does not separate wood/timber into treated and non-treated categories. "Wood/timber" for the purpose of these audits is defined as "Milled wood/timber, children's wooden toys, wooden skewers, garden trees (> 20 mm diameter)" as per the Audit Guidelines.

Ku-ring-gai Council engaged A. Prince Consulting to undertake an audit of its four-bin system in 2014 and timber was a material category in this audit. However, the audit did not separate the presence of treated and untreated timber. The audit found no evidence of timber in the garden organics or paper stream but did identify 0.04% wood/timber in the container recycling stream and 0.31% in the residual waste stream. Over 22,000 tonnes of waste was disposed of by Ku-ring-gai Council households in 2012-13. If it assumed that 50% (worst case scenario) of the wood/timber disposed of through this pathway is CCA treated timber, the total amount disposed of would be equivalent to just over 32 tonnes per year or 0.8kg/household/year.

A waste audit carried out by the City of Canterbury Bankstown in 2015 identified 0.3% wood/timber in the residual waste bin, 0.58% in the co-mingled recycling bin and 1.8% in the organics bin. This audit did not distinguish between treated and untreated timber. This Council also classified wood/timber as a contaminant in both the recycling and organics bins. Over 45,000 tonnes of waste was disposed of by the City of Canterbury Bankstown households in 2012-13. If it assumed that 50% (worst case scenario) of the wood/timber disposed of through this pathway is treated timber, the total amount disposed of would be equivalent to just over 75 tonnes per year or 1.2kg/household/year.

Without being able to identify the proportion of timber waste that is treated, a disposal rate from the domestic kerbside waste collection for NSW cannot be established. What the above information does suggest is that treated timber waste disposal through the domestic kerbside waste collection service is low (on average less than 1kg/household/year) using a 'reasonable estimate' of 50% wood/timber waste being CCA treated timber. It is assumed that the major limiting factor is the small amounts of timber that can physically fit in the kerbside waste bins. Given this, it is unlikely that this method is the main pathway for treated timber disposal. Though further audits of this waste disposal pathway would be required to better understand the significance of these waste flows.

4.2.2. Domestic bulky waste collection

A number of Councils provide a regular bulky waste collection service for their residents. These services can be either on-call (where the resident is required to book a service) or offered on a predetermined scheduled (such as quarterly or half yearly). Bulky waste collection services allow residents to place large items on their nature strip to be picked up and taken to landfill or to be recycled. Many councils choose not to accept building waste, including treated and untreated timber, as part of this service. Typically, what is not collected is not measured and therefore available information on the amount of treated timber presented for disposal in the bulky waste collection services is limited, however, some Councils have sought this data and this is presented below.

In the 2014 audit, Ku-ring-gai Council audited its bulky waste collection service. Treated and untreated timber are accepted materials as part of the service and were nominated as material categories in the audit. However, the audit did not distinguish between the different treatment types.

A total of 11 tonnes was collected for the audit which revealed 2.5% (275kg) of material collected was timber/wood. Untreated timber made up 0.4% (46kg) and treated timber was 2.1% (231kg) by weight. In 2012-13 Ku-ring-gai Council provided a bulky waste collection service to over 40,000 households and disposed of 2,589 tonnes of waste to landfill (NSW EPA, 2014b). Using this information, the average Ku-ring-gai LGA household disposes of approximately 1.3kg of treated timber through the bulky waste collection service per year.

In 2011, the City of Bankstown Council audited its bulky waste collection service. The audit found that the average amount of treated timber disposed of per clean-up service was 22.75kg. Between 2011 and 2016, the City of Bankstown Council provided an average of 39,000 clean-up services per year and collected 5,600 tonnes of waste per year. Using this information, treated timber makes up approximately 887 tonnes (or 15% by weight). Assuming that 80% of treated timber is CCA treated (as determined in Section 2.2), this equates to an average of 11.2kg/household/year.

In 2014, Southern Sydney Regional Organisation of Councils (SSROC) commissioned a large waste audit of its 12 member Councils' bulky waste ('clean-up') materials presented at the kerbside. In this study, SSROC sought to gain a better understanding of the quantity and composition of clean-up collection services and sought a 'one-off' audit of council clean-ups. This audit was the largest single audit of kerbside clean-up waste in Australia's history.

Nine out of the 12 Councils allowed timber to be collected as part of its clean-up collection services. However, this study didn't differentiate between treated and untreated timber. The study found that treated timber was one of five of the most common unacceptable materials presented, with general waste, rubble, vegetation and e-waste being the other unacceptable materials. Of the unacceptable waste presented at the kerbside, treated timber made up approximately 15% by weight and 17% by volume. On average, unacceptable waste presented at the kerbside was approximately 10% by weight and 6% by volume of all waste presented.

A total of 30,482 tonnes of clean-up waste was collected from the SSROC Councils in 2012-13. The Australian Bureau of Statistics, Census of Population and Housing (2011) estimated that there were 630,000 dwellings in the SSROC Council member LGAs, with a total population of just over 1.6 million residents. Using the information and the findings of the SSROC study, approximately 0.7kg of treated timber per household or 0.3kg of treated timber per person was presented for kerbside collection in 2012-13. This equates to approximately 450 tonnes of treated timber annually in the SSROC region.

In 2012-13, 89 of the 152 NSW Councils provided a bulky waste collection to over 2.25 million households (NSW EPA, 2014b). From this collection service, a total of over 152,000 tonnes of waste was sent to landfill for disposal. Using a rate of 10% of unacceptable waste presented in kerbside clean-ups, of which, treated timber makes up approximately 15% by weight and 80% would have been treated with CCA (using findings from Section 2.2), the average NSW household disposes of approximately 0.8kg of CCA treated timber through the bulky waste collection service per year.

The above information suggests the bulky waste collection service is a common pathway for the disposal of treated timber waste. The estimated average household disposal rate for treated timber varies between 0.8 to 11.2kg/household/year. Further audits of this waste disposal pathway would be required to better understand the significance of these waste flows.

4.2.3. Composting facilities

Composting facilities located across NSW receive kerbside collected garden organics, and in some cases, co-collected food and garden organics and process these materials into a range of composted landscaping, gardening and agricultural products suitable for improving soils and plant / crop growth. In 2012-13, 667,416 tonnes of organics (both garden and food organics) was collected by councils for compost-recycling across NSW (NSW EPA, 2014b). The majority of this material is sent to EPA licensed composting facilities for processing.

Composting facilities also receive some tied and bundled collections of woody garden organics from council kerbside collections and clean ups, and material self-hauled to public drop off, transfer stations or direct to composting facilities. To understand the flows of CCA treated timber flows through to composting facilities, managers of two large composting businesses with multiple sites each across the Sydney region and NSW were interviewed in March 2017.

Feedback from composting facilities suggested that the presence of CCA treated timber, including engineered, painted or stained timber in organics collections is managed as contamination and is separated out of the process at the point of receival. Facilities generally have thorough inspection processes for identifying contamination, to ensure these waste materials do not contaminate the composting process. Whilst small amounts of clean, untreated timber may be accepted in kerbside collections and at public drop off, transfer stations or direct to composting facilities for garden organics, any other form of timber is rejected and disposed to landfill. Waste loads that are heavily contaminated with CCA treated or engineered timbers are returned to the waste generator. The NSW EPA currently has zero tolerance of CCA treated timber in recovered materials under the Resource Recovery Orders and Resource Recovery Exemptions currently in force in NSW for *Mulch* (2016), *Pasteurised Garden Organics* (2016) and *Compost* (2016).

Generally, CCA treated timber is a very minor contaminant in kerbside council organics collections via mobile garbage bins (MGBs), as it is difficult for a resident to inappropriately dispose of lengths of timber such as decking, poles and posts into small bins. Garden organics physical waste audits by one composting business found that CCA treated and engineered timbers amounted to 0.2% by weight, though separate figures on CCA treated timber are not available. This facility found that over successive waste audits that the presence of CCA treated and engineered timbers as contamination in garden organics bins is generally higher in older suburbs, where residents are more likely to be conducting indoor and outdoor home renovations. In these older suburbs, audits have found that CCA treated and engineered timbers can increase up to 0.38% by weight. Note that separate figures on CCA treated timber is not available.

Consultation suggested that the presence of CCA treated timber is also higher in self-hauled garden organics to public drop off facilities, transfer stations and composting facilities. This occurs as it is generally easier for residents to transport larger lengths of CCA treated timber in a trailer. The consultation also found that the likelihood of CCA treated timber was greatest in garden organics from a construction and demolition waste recycling business. Composting facilities from experience tend to direct much greater attention to waste inspection and contaminant identification in garden organics from construction and demolition waste recycling business.

The consultation suggest that composting facilities do receive small amounts of CCA domestic treated timber at their facilities, though limited data exists on quantities and sources. Further audits of waste received at these facilities would be required to better understand the significance of these waste flows.

4.2.4. Construction and demolition waste recycling facilities

Construction and demolition waste recycling facilities receive, sort, recycle and dispose of building materials that are transported to their premises by householders, commercial skip bin companies, builders and other commercial contractors. CCA treated timber waste is regularly found in mixed loads of waste received by these facilities. In 2010-11, approximately 5.2 million tonnes of construction and demolition waste was recycled in NSW (NSW EPA, 2014c).

Consultation with two construction and demolition recycling facilities in the Sydney region in March 2017 indicated that timber waste from new residential and demolition projects amounts up to 25% by weight of all waste received, though this figure includes engineered and untreated timbers. Facilities have inspection and identification processes for incoming waste materials, and CCA treated timber, including engineered timbers or timbers that are painted, chemically stained or have extensive fasteners (e.g. nails and brackets) are separated out and disposed to landfill. The managers of the two facilities consulted identified the difficulty in sometimes identifying CCA treated timbers, particularly when they are weathered and leached. Facilities generally take a precautionary approach and dispose of timber to landfill that is suspected to have been treated with CCA.

One facility estimated that between 5-10% of all incoming waste into their facility is CCA treated timber, although this is a qualitative estimate and not based on a physical waste audit. This facility receives occasional loads of CCA copper logs, fencing posts and utility poles, which are separated and re-sold for fencing and car park bollard applications. It is not known whether the logs specifically are from a domestic or commercial source. Other forms of CCA treated timber include decking and old landscaping timbers from council parks and gardens, builders and home renovators.

The consultation does suggest that flows of CCA domestic treated timber through to construction and demolition waste and recycling facilities does occur, though limited data exists on quantities and sources. Further audits of waste received at these facilities would be required to better understand the significance of these waste flows.

4.2.5. Landfill disposal

4.2.5.1. Domestic waste disposed to landfill (self-haul)

In 2012–13, 214,056 tonnes of residual waste was self-hauled by residents to drop-off facilities, where the waste is aggregated and then disposed to landfill. Self-haul waste represents approximately 12% of total domestic waste sent to landfill. An additional 19,000 tonnes is disposed as contamination in drop-off garden organics (0.8% of total) and drop-off recyclables (0.3% of total). Data on the composition of this waste is not available.

For the purpose of this assessment, a conservative figure of 15% treated timber makes up this waste (by weight) and 80% would have been treated with CCA (as determined in Section 2.2), the average NSW household disposes of approximately 10kg of CCA treated timber through drop-off facilities per year.

4.2.5.2. Commercial and Industrial waste disposed to landfill

An early study in 2001 found that 174,000 tonnes of commercial and industrial (C&I) wood waste was disposed of annually (6% of total C&I waste), of which 17,400 tonnes (or 10%) was treated timber. Overall, all wood waste (treated and untreated, particleboard and plywood) made up approximately 4% of the 9 million tonnes of waste disposed of from the Sydney metropolitan area. Based on a composition of 10% treated timber, it is estimated that 36,000 tonnes of treated timber was disposed of from the Sydney metropolitan area (Warnken, 2001).

An audit by the Department of Environment and Conservation NSW in 2004 estimated the quantity of treated timber in the commercial and industrial (C&I) waste stream to be approximately 15% by weight (DEC NSW, 2004). However, it is noted that the audit was a 'visual' audit so the results should be used with caution.

The NSW EPA study *Disposal-based audit Commercial and industrial waste stream in the regulated areas of New South Wales* (NSW EPA, 2015) found that C&I waste contains 14% wood (by weight) of which, between 73% and 82% is treated timber (between 10.2% and 11.5% of all C&I waste). The total amount of C&I waste disposed to landfill within the Sydney metropolitan area in 2014 was 1,415,561 tonnes meaning an estimated 150,000 tonnes was treated timber (NSW EPA, 2015).

The data suggests that the proportion of treated timber in C&I waste appears to be between 4 - 15% of wood waste. Factors that influence the disposal of treater timber include new housing and economic factors, as well as a range of variables that affect the lifespan of the treated timber.

C&I waste generation in NSW was about 5.5 million tonnes in 2010–11 (DEE, 2013). With a resource recovery rate of 60 per cent, approximately 2.2 million tonnes of C&I waste was sent to landfill. Of this, approximately 190,960 tonnes are estimated to be treated timber based on the assumption that, on average, 10.85% of all C&I waste is treated timber and 80% would have been treated with CCA. This equates to approximately 6.9kg/household/year of CCA treated timber[4].

Further audits of C&I waste received at landfill facilities would be required to better understand the significance of these waste flows.

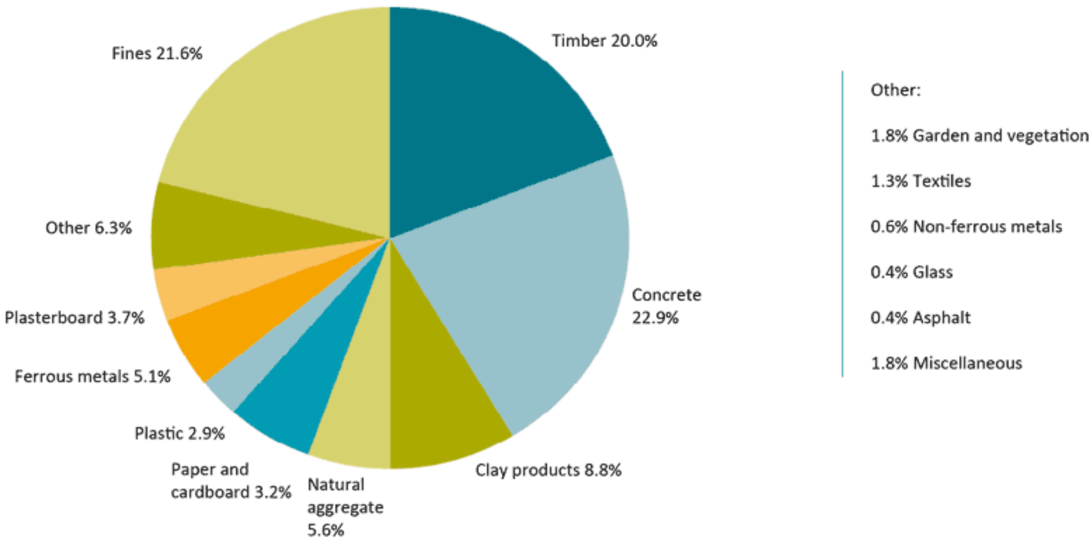
4.2.5.3. Construction and demolition waste disposed to landfill

An audit of Sydney landfills found only 4% of timber in mixed construction and demolition (C&D) waste was treated with CCA (Department of Environment and Climate Change NSW, 2007). This audit has a very high degree of reliability as it undertook representative sampling and chemical analysis to detect levels of copper, chromium and arsenic (as well as lead).

Further supporting this is a more recent study which estimates treated timber, which included CCA timber as well as other painted timbers, accounts for around 6% of total C&D waste wood in NSW (Hyder, 2011).

C&D waste generation was about 6.9 million tonnes in 2010–11. With a resource recovery rate of 75 per cent, approximately 1.725 million tonnes of C&D waste was sent to landfill (DEE, 2013). The NSW Department of Environment and Climate Change's *Report into the Construction and Demolition Waste Stream Audit 2000-2005* (DECC, 2007) provides a compositional study of C&D waste disposed to landfill in the Sydney Metropolitan Area between 2000 and 2005. The composition of mixed C&D waste by weight is shown in Figure 4.3.

Figure 4.3. Composition of mixed C&D waste by weight (DECC, 2007).



Using the above data, of the 1.725 million tonnes of C&D waste that was sent to landfill, approximately 345,000 tonnes was wood/timber. Based on the assumption that, on average, 6% of all C&D timber waste is treated and 80% would

[4,5] In 2012-13, there were over 2.76 million households in NSW (NSW EPA, 2014b).

have been treated with CCA (as determined in Section 2.2), approximately 16,500 tonnes of CCA treated timber was sent to landfill. This equates to approximately 6kg/household/year of CCA treated timber[5]. Further audits of C&D waste received at landfill facilities would be required to better understand the significance of these waste flows.

4.2.6. Illegal dumping

Illegal dumping provides another pathway for the disposal of CCA treated timber. Quantitative data on the amount of illegally dumped waste is unavailable as is the composition of this type of waste. Further studies into the amount of waste being illegally dumped, and the amount of material that is treated timber requires further investigation to better understand the significance of these waste flows.

4.2.7. Total estimated flows of CCA treated timber

The quantity of CCA treated timber being landfilled is difficult to quantify due to the lack of available quantitative data. It is also difficult to identify treated timber at the end of its life as it may be weathered or have been painted or modified in some way (Hann *et al.*, 2010). This creates difficulty in separating and recovering non-treated timber as the slightest amount of treated timber can result in an entire load being deemed contaminated and not recoverable.

Table 4.3 provides a summary of the projected flows via the different pathways for CCA treated timber, where data exists. The amount of CCA treated timber being sent to landfill is expected to continue over the coming years as structures built with CCA treated timber are demolished.

Table 4.3. Summary of the projected flows via the different pathways for CCA treated timber.

Disposal Pathway	Average Projected Waste Flow (kg/household/year)	Tonnes disposed in NSW per year[6]
Domestic Kerbside Waste Collection (bin system)	1	2,760
Domestic Bulky Waste Collection (clean-up)	6	16,560
Composting Facilities	Unknown	-
Construction and Demolition Waste Recycling Facilities	Unknown	-
Domestic waste disposed to landfill (self-haul)	10	27,600
Commercial and Industrial waste disposed to landfill	6.9	19,044
Construction and Demolition waste disposed to landfill	6	16,560
Illegal Dumping	Unknown	-
TOTAL	**29.9**	**82,524**

To put the above data in perspective, in 2012-13 the average NSW household generated 1,227kg of waste per year, consisting of 265kg of recyclables, 275kg of food and garden organics and 608kg of landfill waste (NSW EPA, 2014b). The average disposal rate of CCA treated timber over the different disposal pathways is approximately 6kg/household/year and the total is estimated to be approximately 29.9kg/household/year.

Therefore, the proportion of the average NSW household's total waste that is CCA treated timber is 2.4%. However, assuming that all treated timber is likely to end up in landfill, the proportion of the average NSW household's total waste sent to landfill that is CCA treated timber is 4.9%

Therefore, a minimum of 82,000 tonnes of CCA treated timber is disposed of annually in NSW. This estimate excludes agricultural and infrastructure usage such as farm fencing, vineyard sticks, power poles etc.

[6] In 2012-13, there were over 2.76 million households in NSW (NSW EPA, 2014b).

5. Risks to human health and the environment from the mismanagement of treated timber

Significant research in Australia and overseas has been done to better understand the human health and environmental risks associated with CCA treated timber. This research has been led by the Australian Pesticides and Veterinary Medicines Authority (APVMA) during the review of CCA and Arsenic Trioxide between 2003 and 2005. This section provides a summary of the potential adverse impacts of CCA treated timber on human health and the environment, particularly when CCA treated timber is poorly managed. This includes incorrect handling during demolition of built structures containing CCA; incorrect disposal such as illegal dumping; disposal at an unlicensed or poorly performing landfill facilities; open incineration of CCA treated timber; and the processing of treated timber into mulch at recycling facilities (contaminating wood/timber mulch).

5.1. Findings from Australian Pesticides and Veterinary Medicines Authority investigations

Following concerns raised in the USA and European Union regarding the risks relating to the use of CCA treated timber, APVMA commenced its review on the use CCA treated timber in 2003. The precautionary principle was a major driver behind APVMA's response to the continued use of CCA treated timber in Australia (Lansbury and Beder, 2005).

APVMA concluded its review on the use CCA treated timber in 2005. It found that there was insufficient evidence to conclude that it was safe to continue the use of arsenic treatments for timber in structures that children were likely to have frequent close contact with. It concluded that CCA treated timber should no longer be permitted in structures with which members of the public are likely to come into intimate and frequent contact with. The 'lack of evidence' to quantify the amount of arsenic which can transfer or leach from in-service CCA-treated timber structures was due to the very limited amount of Australian data, based on Australian climatic conditions (APVMA, 2005).

APVMA does not have regulatory authority over existing CCA-treated timber structures and therefore made no recommendations regarding the disposal of existing/in-use CCA-treated timber, only its future production and use. Despite this, the study made a number of findings that are relevant to the management of treated timber:

- Copper, chromium and arsenic are present naturally in the environment at low levels (in air, food, water and soil). Therefore, the public is exposed to these chemicals through sources other than CCA treated-timber;
- APVMA could not determine, for Australian conditions, whether or not exposure to CCA treated timber posed an unacceptable public health risk for some specified uses;
- The toxicological assessment found that copper and chromium in the treated timber do not present an undue risk to public health because estimated exposure levels are below safety thresholds;
- The use of CCA-treated timber clearly does lead to increased levels of arsenic, copper and chromium in the soil environment;
- Deliberate burning of CCA-treated wood or wood waste should be avoided because there is a risk of contamination of the atmosphere with arsenic during combustion, and of soil and water by contaminated ash; and
- A much higher leaching rate occurs if the material is broken up and pulverised into mulch. Leaching from mulch prepared from CCA-treated wood has been confirmed to increase soil arsenic levels.

APVMA advises that incineration of CCA treated timber 'should only occur in very controlled facilities where release of arsenic to the atmosphere is minimised and the potentially highly toxic ash is processed and disposed of appropriately' (APVMA, 2005). However, the limited legislative powers of APVMA meant it is unable to regulate incineration of CCA treated timbers.

Much of the scientific literature suggests that incineration leads to ash that is heavily contaminated with CCA (Solo-Gabriele *et al.,* 2004; Khan *et al.,* 2006; EPA South Australia, 2008). In addition, ash is much more difficult to manage than when it is in its solid timber form, can be more widely spread and therefore have greater impacts on the environment and human health (Lansbury and Beder, 2005). Technology does exist that allows for safer incineration of treated timber by recovering most of the heavy metals as well as the extraction of energy resources (Lansbury and Beder, 2005).

5.2. Findings on the hazards of CCA treated timber from scientific literature

A study on the leaching of Chromium, Copper, and Arsenic from CCA-Treated Utility Poles in Canada found that leaching of Chromium, Copper, and Arsenic metals occurred in soils around CCA-Treated Utility Poles and concentrations decreased with distance from the poles (Coles *et al.,* 2014). The study found that Copper was the most leached of the three elements, followed by Arsenic and then Chromium. Heavier rainfalls and long durations of dampness appear to increase the metal concentrations in the runoff. The study also found that Arsenic and Chromium in rainfall runoff exceeded the Canadian drinking water guideline limits by up to 42 times for Arsenic and 7 times for Chromium. The study concluded that high concentrations of Arsenic could leach from CCA treated timber, migrate to groundwater, and reach wells or ponds, especially if the underlying soil is porous. This could lead to the contamination of drinking water and the natural environment.

The highly toxic and carcinogenic nature of arsenic is well documented (WHO, 2003). Exposure to arsenic alone is known to cause cancers and effect the respiratory, pulmonary, cardiovascular, gastrointestinal, haematological, hepatic, renal, neurological, immunological systems and even death in small amounts (Rahman and Naidu, 2009).

While the potential health effects of chronic exposure to arsenic, chromium and copper in humans depends on a number of factors, the presence of all three in combination can cause either an enhanced or reduced toxicity. For example, Arsenic toxicity in a human nerve cell can be enhanced when accompanied by Copper but reduced when accompanied by Chromium (Hu *et al*, 2013).

Treated timber that is mixed in with other non-treated products also poses a risk to the environment and human health. For example, when this material enters a C&D recycling facility and is not identified and separated out as contamination, the CCA treated timber may re-enter the environment as mulch. Mulch that contains CCA treated timber presents a risk to human health and the environment through an enhanced leaching processes. Mulch contaminated with CCA treated timber also presents a human health risk, where there is direct contact through ingestion (particularly around parks and play areas where children may consume small pieces of mulch), skin absorption or inhalation (particularly during the mulching process).

The use of mulch contaminated with CCA treated timber around food crops and other vegetation increases the risk of exposure through indirect contact via contaminated crops or livestock as a result of uptake by plants and soil organisms thus causing contamination of the food chain (Mercer and Frostick, 2012). This was considered by the APVMA in its review and at that time didn't believe it to be a significant enough risk to restrict this usage.

5.3. Exposure pathways for CCA treated timber

Lansbury and Beder (2005) summarised the major pathways for exposure to CCA treated timber (Table 5.1). The exposure routes highlighted in bold text indicate the principal exposure route for each activity.

Table 5.1. Pathways of Human Exposure to CCA-Treated Timber.

Activity	Contamination Source	Exposure Route	
Sawing, cutting, drilling etc.	Wood dust	Direct contact	**Inhalation**
			Ingestion
			Dermal
Touching	Surface residues	Direct contact	**Ingestion**
			Dermal
Leaching	Soil/Waterways	Direct contact	**Ingestion**
			Dermal
			Inhalation
	Soil/Waterways	Plant uptake	Ingestion
Disposal	Ash, soil, air	Direct contact	**Inhalation**
			Dermal
			Ingestion

5.4. Exposure to children

Children are especially vulnerable to exposure to CCA treated timber because of their hand-to-mouth behaviour leads to greater transfer of contaminants following contact with CCA treated timber (CPSC, 2003). In addition, children are in contact with treated timber more so because they are prone to crawl or sit on surfaces such as desks and play areas that may contain timber preservatives (Lansbury and Beder, 2005). Children typically have a faster metabolic rate (Belluck *et al.*, 2003), which means they are exposed to CCA, metals are absorbed in to the body quicker than adults.

Lansbury and Beder (2005) summarised a number of overseas studies that investigated the amount of arsenic, chromium and copper that can be dislodged and ingested from contact with CCA-treated timber. These studies are summarised in Table 5.2

Table 5.2. Pathways of Human Exposure to CCA-Treated Timber.

Source	Finding
Sharp and Walker (2001)	'A 4-6-year-old child's daily exposure to arsenic has been found to be 5 micrograms/l in food, 23 µg/L in water, 25 µg/L from playing on CCA-treated wood and up to 480 µg/L from playing on CCA treated playground equipment' (p.1). Children could exceed the legally-acceptable lifetime cancer risk in 2 weeks by playing on a treated play set.
Sharp *et al.*, (2001)	Wipe tests the size of an average four-year-old child's hand found 18 to 1,020 µg arsenic, more than the US EPA's proposed 10 µg per day allowable exposure level for arsenic in drinking water. It was estimated that 1 in 500 children regularly playing on treated play sets will develop lung or bladder cancer in later life due to this exposure.
Lerche Davis (2003)	'In the US' southern states, 10% of all children face a cancer risk that is 100 times higher because they spend more time outdoors playing'.
Kwon *et al.*, (2004)	The mean amount of arsenic on children's hands from CCA-treated playgrounds was 0.50 µg, significantly higher than the control mean amount of 0.095 µg. The maximum amount logged, however, was less than the Canadian allowable daily intake of arsenic (4 µg) in water and food.
Enviros Consulting *et al.*, (2003)	Sand from sand play boxes built from treated wood contained a maximum of 12.9 mg arsenic per kilogram of sand 2 to 4 years after construction. Natural soils may contain from 1 to 50 mg arsenic/kg. Little risk to children being poisoned by eating the sand.

6. Alternatives to CCA treated timber

It is recognised that CCA treated timber may remain as the product of choice for certain critical applications (for example marine applications) or where no alternative product exists that has equivalent resistance or reliability. For non-critical applications or where it is appropriate, a number of alternative chemical treatment options exist which are provided in the table below. In addition to these alternatives, consideration must also be given to substitution of treated timber with other products such as naturally durable hardwoods, steel and aluminium, recycled plastic or concrete (Lansbury and Beder, 2005).

This list is neither exhaustive nor implies that these alternative products are any safer or have less environmental impact than CCA. Further studies into the impacts of these alternative products need to be undertaken to help the community to make informed choices of less toxic and safer treated timber options.

Table 6.1. Description of Chemical Alternatives to CCA (modified from Lansbury and Beder, 2005).

	Chemical Alternative	
	ACQ	**LOSP**
Full name	Alkaline copper quaternary	Liquid Organic Solvent Preservative, including azoles and permethrin
Delivery of treatment	Water-based solution	Hydrocarbon solvent
Applications	For all except marine immersion	For above ground applications only
Impact of copper	More leaching than CCA – thus higher aquatic toxicity	
Corrosivity	More corrosive to brass and bronze than CCA	
Other risks		Hydrocarbon solvents risky as air and storm-water pollution at treatment plants; volatile organic compounds make it difficult to work with
Benefits	No leaching of As or Cr; Lower mammalian toxicity than CCA	
Cost	10-30% higher than CCA	Higher than CCA

7. Extended Producer Responsibility

7.1. Extended Producer Responsibility in NSW

Extended producer responsibility (EPR) is a policy concept that places the responsibility for the end-of-life environmental impacts (including physical or financial responsibility) of a product on the producer. In NSW, the *Waste Avoidance and Resource Recovery Act* 2001 (WARR Act) provides powers to the NSW Government to implement 'extended producer responsibility schemes'. While the EPR framework encourages industry producers to undertake voluntary action in order to achieve sustainable and positive environmental outcomes from the manufacturing, consumption and disposal of its product, under Part 4, Section 15 the WARR Act, the Minister has the power to legislate an EPR scheme if a particular industry fails to adequately achieve sustainable and positive environmental outcomes, or if national initiatives are not effective.

Circumstances under which schemes may be implemented are provided in Part 4, Section 17 of the WARR Act and include:

- The volume of waste requiring ultimate disposal or the toxicity of the waste generated;
- Whether there is a national scheme in place that adequately addresses waste issues in New South Wales;
- Whether there is an effective voluntary scheme in place (nationally or State based) that is able to achieve the desired outcomes and is being actively implemented, monitored and reported on;
- Whether economic analysis supports the implementation of the scheme; and
- Whether there are any constitutional or other impediments to New South Wales acting unilaterally in implementing the scheme.

Under Part 4, Section 18 of the WARR Act, the Director General is required to publish an annual priority statement on EPR schemes being considered for implementation under the Act. Treated timber was one of 16 products listed as 'wastes of concern' in the first Priority Statement that was published in March 2004.

7.2. Product Stewardship

Under the WARR Act, 'producers' includes suppliers and brand owners and 'EPR schemes' include 'product stewardship' schemes. However, according to Love (2007):

> "*EPR is a policy concept which places primary responsibility on producers for the reuse, recycling or disposal of their products once they are no longer required by consumers. While conceptually similar to EPR, product stewardship is broader in its scope, engaging manufacturers, brand-owners, retailers, consumers, regulators and waste managers in developing programs to effectively and appropriately manage the impacts of products across their lifespan, rather than at the post-consumer waste stage.*"

The Commonwealth's *Product Stewardship Act* 2011 provides a mechanism for national level EPR schemes that can be either voluntary, co-regulatory and mandatory. As summarised by the Department of Environment and Energy the *Product Stewardship Act* 2011:

> *"…provides the framework to effectively manage the environmental, health and safety impacts of products, and in particular those impacts associated with the disposal of products. The framework includes voluntary, co-regulatory and mandatory product stewardship. The passage of the legislation delivers on a key commitment by the Australian Government under the National Waste Policy which was agreed by governments in November 2009 and endorsed by the Council of Australian Governments in October 2010..."*

The Product Stewardship Act allows for industries and products to be regulated in several ways, including voluntary product stewardship schemes. These voluntary schemes are accredited under the Act to provide the community with confidence the schemes are actually achieving what they claim. Product stewardship organisations that are accredited under the legislation must meet specific requirements that ensure accountability and their activities are transparent. Two accredited voluntary schemes include MobileMuster (http://www.mobilemuster.com.au/) for mobile phone recycling and FluoroCycle (http://www.fluorocycle.org.au/) for mercury-containing lamps. Other voluntary schemes exist for other products, but are not accredited under the *Product Stewardship Act* 2011. These include tyres, agricultural chemical containers, paint, PVC and newspapers.

Under the Act, co-regulatory product stewardship schemes are delivered by industry and regulated by the Australian Government. One co-regulatory scheme exists in Australia; The National Television and Computer Recycling Scheme. This scheme was established in 2011 to provide Australian householders and small business with access to industry-funded collection and recycling services for televisions and computers. More information about the scheme can be found here: https://www.environment.gov.au/protection/national-waste-policy/television-and-computer-recycling-scheme.

Mandatory product stewardship schemes place a legal obligation on parties to take certain actions in relation to a product. Requirements that can be placed on parties using the legislation include the labelling of products, making arrangements for recycling products at end of life, or requiring a deposit and refund to be applied to a product. Currently, there are no mandatory schemes under the *Product Stewardship Act* 2011. The only mandatory product stewardship scheme in Australia is for used oil which is covered by its own legislation.

7.3. Discussion

The Timber Development Association (TDA), together with other industry associations and preservative treatment companies, established the National Timber Product Stewardship Group (NTPSG). This group was set up to identify and facilitate product stewardship initiatives to increase recovery of all end-of-life timber. A focus in this Group's strategy (NTPSG, 2007) was identification and removal of CCA treated timber to prevent contamination of recycled timber streams. A range of resources were developed to support this focus – including guidance on identification of CCA treated timbers.

As zero contamination levels were not seen as helpful to recycled products markets, research was also sponsored into safe limits for a range of preservative treated timbers (including CCA) in recycled products (Hann *et al,* 2010).

A formal EPR scheme has never been developed for treated timber despite being listed as a priority waste for national in March 2011. According to the NSW Extended Producer Responsibility Priority Statement 2010 (DECCW, 2010) "any EPR action would be best handled nationally".

Household waste and recycling services are the responsibility of local councils, funded through the council domestic waste management charge in rates notices. An EPR scheme, in comparison, shifts direct financial responsibility for the costs of waste management to the producer, and away from the local council and taxpayer. An EPR scheme will often involve the producer in the waste management process either through providing logistics and/or infrastructure or the recycling/disposal process itself.

An EPR scheme has the potential to foster innovation through design changes to reduce the costs of end-of-life disposal of their products. This could include making products more readily reused or recycled or reduce the potential for contamination of other materials in the waste stream and the potential to interfere with resource recovery. An EPR scheme can also promote changes to marketing practices so that consumers are more informed of their product choices and the potential to reduce waste through education (OECD, 2005). An EPR scheme would also enable better management of the material prior to disposal, and a more effective means of tracking CCA treated timber waste.

The OECD (2005) presents a range of possible alternative waste minimisation policy instruments that follow the principles of EPR. These are summarised in Table 7.1. In this table, we present an overview of the relevance and appropriateness of each EPR policy instrument to better manage CCA treated timber.

Table 7.1. Waste minimisation policy instrument options under an EPR Scheme.

Policy instrument	Description	Appropriateness to the management of CCA treated timber
Product take-back	Producers are assigned the responsibility of taking-back their products at the end of their useful life	• Given the limited technology available for the safe recovery and/or reuse of CCA treated timber, it is likely that a product take-back scheme will reduce the amount of CCA treated timber sent to landfill, especially in the short term. • Over the longer term, the burden of a product take-back scheme may encourage producers to develop alternative products or means of recovering treated timber. Such a scheme is unlikely to discourage the purchase of CCA treated timber products. • Difficult to establish as producers need additional resources including space for take-back storage prior to disposal/recovery. • Will not influence consumer or producer decisions that affect the quantity or characteristics of waste generated.
End-of-life waste management fees	Consumers are charged all or part of the marginal collection and treatment costs of general household waste or of specific waste products through an "end-of-life" fee. This may be a charge per bag or per kilogram of general household refuse ("pay as you throw"), or a specific charge for the collection and treatment of a particular item (e.g. car tyres, refrigerator, end-of-life vehicle, etc.)	• Increased costs at the point of sale may discourage the purchase of CCA treated timber products in the short term and potentially facilitate the development of alternative products in the longer term. • Potential opportunities for collected fees to also support research and development of recycling and recovering technology. • Funding could also be used to support public education on the management of existing CCA treated timber structures, end of life management of CCA treated timber, and education to encourage use of sustainable alternatives to CCA treated timber. • Difficult to implement and manage due to administration costs for implementation and ongoing management of such a program. • In the short term doesn't reduce amount of CCA treated timber disposed to landfill. • Such fees will normally only influence the disposal choices of waste management organisations (e.g. municipal waste management agencies), and unless supplemented by other measures will not influence consumer or producer decisions that affect the quantity or characteristics of waste generated.

Policy instrument	Description	Appropriateness to the management of CCA treated timber
Advance disposal fee	A tax or charge may be levied at the time a product is sold, at a level intended to reflect the end-of-life waste management costs of the product. Producers may be responsible for collecting the charge and remitting it to the public authorities, but are otherwise not necessarily involved in the collection or disposal of wastes.	• Increased costs at the point of sale may discourage the purchase of CCA treated timber products in the short term and potentially facilitate the development of alternative products in the longer term. • Potential opportunities for collected fees to also support research and development of recycling and recovering technology. • Funding could also be used to support public education on the management of existing CCA treated timber structures, end of life management of CCA treated timber, and education to encourage use of sustainable alternatives to CCA treated timber. • In the short term doesn't reduce amount of CCA treated timer disposed to landfill.
Mandatory deposit-refund system	A deposit is levied at the time the product is sold, and all or part of the deposit is later refunded when the product (or its packaging - e.g. a bottle) is returned for reuse, recycling or safe disposal. Producers (or retailers) may be responsible for collecting the deposit, and for end-of-life collection and refund.	• Current technology and legislation doesn't support the recycling of CCA treated timber. • Waste products returned for refund are likely to end up in landfill until technology is available for efficient and effective recovery of CCA treated timber. • Difficult to implement and manage due to administration costs for implementation and ongoing management. • Difficult to establish as producers need additional resources including space for take-back storage prior to disposal/recovery.
Recycling incentives	Measures to stimulate recycling markets could include subsidies paid for the collection of materials for recycling (or direct public provision of collection facilities), subsidies paid to reprocessing firms, or subsidies to users of recycled materials. The use of recycled materials could also be encouraged by regulations requiring minimum recycled-materials content in certain products, or by taxes on virgin materials.	• Current technology and legislation doesn't support the recycling of CCA treated timber. • Recycling incentives will only work when recycling options become more readily available and cost effective.
Disposal disincentives	Taxes on landfill disposal	• May discourage disposal in any form, compared with recycling and waste-reduction. • Such taxes will normally only influence the disposal choices of waste management organisations (e.g. municipal waste management agencies), and unless supplemented by other measures will not influence consumer or producer decisions that affect the quantity or characteristics of waste generated.

According to Love (2007), the Finnish system is the only true EPR scheme for treated timber in the world. Finland has established a unique recycling system for treated timber. A company, Demolite Recycling Ltd, was established in 2000 to manage the recycling of treated timber. The company is a non-for-profit organisation, working to cover the costs of recycling which is funded through recycling fees.

The scheme is funded through a fee paid by the consumer when timber is purchased and partly by disposal fees for larger quantities. Disposing of up to one cubic metre is free (Love, 2007). Demolite Recycling Ltd processes the timber into wood chips and the chips are incinerated, and energy recovered by another company, Ekokem Oy (Sipila *et al.*, 2007) who combust the CCA treated wood in a hazardous waste incinerator in Norway. The benefits of this scheme include reducing treated timber waste going to landfill as well as recovering the stored energy found in timber and using this to generate electricity.

To set up such a scheme in Australia, this would involve costs for processing and transport infrastructure, processing of timber, education and awareness campaigns and the administration system to operate the scheme. The costs associated with setting up and running this type of scheme would likely see a significant levy placed on the cost of timber at the point of sale. Setting up a facility that could combust the collected CCA would be a significant planning exercise and expense. In the Finland example, an existing hazardous waste incinerator was used to process CCA treated timber.

In addition, current legislation currently excludes treated timber from potential incineration and energy from waste recovery option. The NSW Energy from Waste Policy Statement sets out the framework and criteria that apply to facilities in NSW proposing to thermally treat waste or waste-derived materials for the energy recovery. This Statement provides regulatory and technical criteria that apply to facilities proposing to recover energy from waste in NSW, including eligible waste fuels. Eligible waste fuels are those waste-derived materials that pose a minimal risk of harm to human health and the environment due to their origin, low levels of contaminants and consistency over time. Treated timber such as those treated with water, solvent and/or oil-borne preservatives and including CCA, LOSP and creosote are currently excluded from the list of eligible waste fuels.

Controlled combustion of end-of-life CCA timber and recovery of elements has been the subject of some research including by researchers at the University of Sydney (Stewart *et al*., 2004). The risks associated with open incineration of CCA treated timber are discussed in Section 6.

Regardless of the type of EPR scheme chosen, the lack of alternative disposal or recycling options (mainly limited by economics) means that CCA treated timber is likely to be landfilled at the end of its useful life, albeit more effectively managed. Landfill environments are particularly usefully in managing the potential health and environmental hazards associated with the CCA preservative because it is contained within a lined and reasonably impervious landfill environment, where the chemical preservatives are immobilised and cannot readily move into groundwater and pollute waterways. However, the disposal of treated and untreated forms of timber in landfill consumes valuable landfill space. In addition, the presence of treated timber in waste also prevents opportunities for recovering untreated timber that can be used in other applications, such as a mulch in landscaping applications.

One of the main criticisms of the APVMA review (refer to Section 5.1) was that it did not apply the precautionary principle to existing CCA-treated timber structures already in the community, particularly play equipment, picnic tables and decking (Lansbury and Beder, 2005). The APVMA review did not recommend the removal of existing structures despite concluding that there was insufficient evidence to conclude that it was safe to continue the use of arsenic treatments for timber in structures that children were likely to have frequent close contact with.

Given the lack of alternative management options for end of life treated timber in NSW, except landfill, and evidence demonstrating the potential for health and environmental impacts in the community, a staged phase out of CCA timber treatments and use of safer timber treatment alternatives may be warranted as a long term goal. A phase out of CCA could be supported by an EPR scheme based on an advance disposal fee (ADF) paid at the point of sale of a CCA timber item. This funding could be used to support public education on the management of existing CCA treated timber structures, end of life management of CCA treated timber, and education to encourage use of sustainable alternatives to CCA treated timber.

This approach has two principal benefits. Firstly, it would make alternative treated timber products more cost competitive. Secondly, it will enable government to manage the human health and environmental impacts of the current stock of CCA treated timber in service and at end of life.

A detailed financial, environmental and social cost-benefit analysis is recommended to help establish if an extended producer responsibility scheme for CCA treated timber will result in a net benefit to the community. The OECD's *Extended Producer Responsibility: A Guidance Manual for Governments* (OECD, 2001) and OECD's *Analytical framework for evaluating the costs and benefits of extended producer responsibility programme* (OECD, 2005) would be useful resources for undertaking this assessment. These resources should be used to complement the standard cost benefit analysis tools published by NSW Treasury (2017).

8. Conclusions

Treated timber, in one form or another, has been around for over 2,000 years. Historical timber preservatives included animal, vegetable and mineral oils, as well as coal tar pitches and bitumen. One of the oldest and widely used engineered preservatives is creosote, a coal tar product, that has been used as a timber preservative on a commercial scale since the late 1830's. Treatment with CCA was pioneered in 1933 and dominated the treated wood market in Australia from the late 1970s. CCA was commonly used for treating timber used for telegraph poles, decking, fencing and landscaping posts as well as children's playground equipment. It is still used to treat timber for many applications.

After being used for over 70 years in numerous building products, health and environmental harm concerns about the potential exposure to arsenic found in CCA treated timber have been raised. This exposure was of particular concern in 'frequent and intimate' contact products such as children's play equipment, decking and outdoor furniture.

This discussion paper presents research and evidence in relation to the quantities, disposal pathways, potential for human health and environmental impacts, and opportunities to better manage CCA treated timber products at end of life through Extended Producer Responsibility Schemes. The focus of the discussion paper is domestic use and disposal of CCA treated timber.

The study has found that household consumes approximately 102,000 tonnes of CCA treated timber in NSW per year. This is equivalent to approximately 41kgs of CCA treated timber per year per household. In NSW, CCA treated timber has an expected service life of 30-40 years. CCA treated timber will be present in in the waste stream for the foreseeable future as new outdoor structures are built and old structures are demolished and removed.

Data available suggests that a number of pathways exist for the disposal of treated timber, these include: domestic kerbside waste collection (bin system); domestic bulky waste collection (clean-up); composting facilities; construction and demolition waste recycling facilities; domestic waste disposed to landfill (self-haul); commercial and industrial waste disposed to landfill; construction and demolition waste disposed to landfill; and illegal dumping.

Based on the data available, the average projected waste flow through these pathways is 82,000 tonnes per year, equivalent to 28.9kg/household/year.

As CCA timber reaches the end of its useful life, the material must be managed safely to avoid harm to human health and the environment. Previous research has identified a number of human exposure pathways either through direct contact (dermal contact and ingestion) or through indirect contact through food and water that has been contaminated with arsenic from leaching CCA treated timber. Arsenic is of most concern as it is a known carcinogen and can affect the respiratory, pulmonary, cardiovascular, gastrointestinal, haematological, hepatic, renal, neurological, immunological systems. Children are more susceptible to exposure and the ill effects due to behaviours and physiological factors.

Alternative chemical treatment options are available to the market, many of which have been introduced to replace CCA following restrictions on some uses by APVMA. Alternatives include substitution of treated timber with naturally durable hardwoods as well as other products such as steel and aluminium, recycled plastic and concrete. The environmental impacts of producing and using these alternative products has not been assessed in this study.

A number of Extended Producer Responsibility (state) and Product Stewardship (national) schemes exist for managing problem or hazardous wastes. In NSW, the *Waste Avoidance and Resource Recovery Act* 2001 provides powers under NSW law to implement 'extended producer responsibility schemes' which is a policy tool that places the responsibility for the end-of-life environmental impacts (including physical or financial responsibility) of a product on the producer. Similarly, Product Stewardship schemes can be created under The Commonwealth's *Product Stewardship Act* 2011 which provides a mechanism for national level EPR schemes that can be either voluntary, co-regulatory or mandatory.

The timber industry voluntarily setup a National Timber Product Stewardship Group in response to the listing of CCA treated timber as a waste of concern by the NSW Government. This group, now defunct, developed a national strategy for post-consumer timber – including for treated timber as well as guides to assist timber recyclers identify and remove copper-based preservative treated timber from timber recycling and renewable energy wood products (NTPSG, 2009).

An appropriately designed EPR scheme has the potential to foster innovation through design changes to reduce the costs of end-of-life disposal of CCA products. This could include making products more readily reused or recycled or reduce the potential for contamination of other materials in the waste stream and the potential to interfere with resource recovery. An EPR scheme can also promote changes to marketing practices so that consumers are more informed of their product choices and the potential to reduce waste through education. An EPR scheme would also enable better management of the material prior to disposal, and a more effective means of tracking CCA treated timber waste.

Given the lack of alternative management options for end of life treated timber in NSW, except landfill, and evidence demonstrating the potential for health and environmental impacts in the community, a staged phase out of CCA timber treatments and use of safer timber treatment alternatives may be warranted in the longer term. There are two main kinds of waterborne copper based alternatives to CCA that are recommended by the NSW EPA: alkaline copper quaternary and copper azole. These products do not contain arsenic and while not considered absolutely 'safe', can be considered to be 'safer' for human health and the environment than CCA.

A phase out of CCA could be supported by an EPR scheme based on an advance disposal fee (ADF) paid at the point of sale of a CCA timber item. This funding could be used to support public education on the management of existing CCA treated timber structures, end of life management of CCA treated timber, and education to encourage use of sustainable alternatives to CCA treated timber. This approach has two principal benefits. Firstly, it would make alternative treated timber products more cost competitive. Secondly, it will enable government to manage the human health and environmental impacts of the current stock of CCA treated timber in service and at end of life.

This paper highlights opportunities for engaging in discussions with the building industry, consumers, manufacturers and importers of CCA treated timber, and suppliers of CCA preservatives to consider strategies for longer term adoption of more sustainable and non-CCA timber preservative options. While EPR schemes could play a role in facilitating this change, the overall financial, environmental and social costs and benefits need to be better understood to support policy development.

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