Guideline for Identifying Hazardous Pipe Coatings

Doc ID	Custodian
#163240598	Manager – Inspection and Condition Assessment
Version Date 10/11/2023	**Accountability Framework** Level 1 – Manage Technical Engineering Data Services
Next Review Date 06/11/2026	Level 2 - Manage Inspection Services

1 Purpose

The purpose of this document is to enable a non-expert to gain sufficient knowledge to be able to confidently identify the hazardous factory-applied pipe coatings that are commonly encountered by personnel working with Water Corporation assets. Images of a range of pipe examples are presented to illustrate the various ways a pipe coating can appear after many years of service, storage, or neglect.

Note that this guideline focuses on common factory-applied pipe coatings and excludes tape wrap and heat-shrink coating systems commonly applied to pipe joints, fabricated specials and valves. Further investigation is required for coatings that differ to those presented in this document.

Content

2 Scope

This guideline applies to the various protective coatings used on underground steel pipeline assets that are managed and operated by Water Corporation throughout Western Australia.

3 Background

Many buried pipeline assets are coated with materials that are now known to be hazardous to human and environmental health. Generally, this is not a problem if the pipes remain undisturbed but there is a risk that personnel will be exposed to potentially dangerous materials when the asset is uncovered for maintenance, inspection, or replacement.

Although there are dozens of different pipe coatings in use, only the health and safety aspects of the coating material is considered here. In this limited context, all steel pipe coatings fall into one of the following 4 categories:

Category 1 - Coatings that do not contain hazardous substances.

Category 2 - Coatings that contain inert hazardous substances (e.g. asbestos).

Category 3 - Coatings that contain intractable hazardous substances (e.g. PAH, PCB).

Category 4 - Coatings that contain both inert and intractable hazardous substances.

4 Definitions

CTE	Coal Tar Enamel - a polymer-based coating produced from the plasticization of coal tar.
MDPE	Medium Density Polyethylene – Modern polymer pipe coating material such as Sintakote™
MSCL	Mild Steel Cement Lined
Denso	Trade name for various types of corrosion protection wrapping systems for pipes and fittings.
PAH	Polycyclic aromatic hydrocarbons – carcinogen found in coal tar.
PCB	Polychlorinated biphenyls banned chemicals known to harm human and environmental health.
Petrolatum	Non-toxic petroleum-based substance also referred to as petroleum jelly.
RRJ	Rubber Ring Joint – Pipe connecting system
Sintakote	Trade name for MDPE coating which is fusion bonded to the steel pipe surface.

5 References

- Landfill Waste Classification and Waste Definitions 1996 (as amended 2019) - Environmental Protection Act 1986
- https://watercorporation.sharepoint.com/sites/AssetConditionAssessment/SitePages/Pipeline-Repairs.aspx

6 Guideline

Generally, nearly all mild steel pipes manufactured prior to 1990 incorporate hazardous substances in the coating material. The use of Rubber Ring Joint (RRJ) pipe, which first became available in 1989, would suggest that the asset was manufactured after this date.

Pipe coatings containing hazardous substances:

- Factory applied and field-applied bitumen coating – typically found on pipes installed during the period 1900 – 1930 (Category 3 material containing intractable hazardous substances).
- Asbestos-cement wrap and field-applied asbestos-cement mortar coating – found on some pipes installed in the1930s (Category 2 material containing inert hazardous substances).
- Coal tar enamel wrap coating – typically found on pipes installed during the period 1930 – 1990 (Category 4 material containing both inert and intractable hazardous substances).

Non-hazardous pipe coatings

- Fusion-bonded polyethylene (e.g. Sintakote™) and field-applied vinyl tapes – became available after about 1985 (Category 1 material free from hazardous substances).

Note: In addition to the handling precautions that must be exercised, coating material containing PAHs and/or PCBs can only be disposed of at a licenced intractable landfill site.

6.1 Bitumen Coating Identification (Hazardous)

This type of coating was applied during the pipe manufacture process by dipping the pipe section into a hot 50:50 mixture of coal tar and asphalt. The Goldfields trunk main was originally coated (internally and externally) using this method.

Rarely, this type of coating also contains hessian wrap which can lead to possible misidentification as Coal Tar Enamel pipe. Bitumen coated pipes do not normally contain asbestos or PCB.

Hazardous coating category 3 – contains PAHs.

6.1.1 Identification Procedure for Bitumen Coating

Look for clues:

- Black colour
- No fabric wrapping (with exceptions as stated above)
- Not durable and easily displaced by ground movement, tree roots, etc.

Consult as-built information and installation records (e.g., SAP and GIS layers):

- Date of manufacture – Bitumen coating is commonly found on pipes installed before the 1930s.
- Beware - the recorded installation date is not always the same as the date of manufacture because old, stockpiled pipe may have been used or exhumed pipe may have been re-used.

Review Asset Condition Assessment (ACA) Reports:

- Pipe coating material is usually noted when pipeline asset inspection work is undertaken.
- For assistance - consult APDG, Engineering, Inspection and Condition Assessment.

Laboratory testing:

- Test for Polycyclic aromatic hydrocarbons (PAH) – Bitumen coating often contains these known carcinogens.

6.1.2 Bitumen Coating - Example 1

Figure 1 – Decommissioned DN760 locking bar pipe installed above ground near Tammin. This pipe was originally buried but was reinstalled above ground in the 1930s. This example includes various coatings including remnants of the original hot-dipped bitumen coating.

The numbered areas on the image above show:

1. Original hot-dipped bitumen coating.
2. Cement wash applied when the pipe was reinstalled above-ground in the 1930s.
3. Heat reflective paint applied later.

Analysis of a sample of the bituminous material taken from this pipe in 2022 recorded high levels of PAHs.

6.1.3 Bitumen Coating - Example 2

Figure 2 - DN760 pipe with bitumen coating without wrapping fabric installed in Nedlands in 1934.

6.1.4 Bitumen Coating - Example 3

Figure 3 - DN760 locking bar pipe with bitumen coating incorporating non-asbestos hessian fabric. Talbot Road, Mundaring.

6.2 Asbestos-cement Wrap Identification (Hazardous)

This type of coating consists of cement-saturated, woven asbestos fabric spirally wound around the pipe. Field joints are usually hand-coated with an asbestos-cement mortar.

Hazardous coating category 2 – contains asbestos.

6.2.1 Identification Procedure for Asbestos-cement Wrap Coating

Look for clues:

- Bandage spirally wrapped around the steel pipe.
- Coarse weave of the bandage is evident, especially at the overlap.
- Grey in colour but it is usually stained by surrounding soil.
- Very hard and durable - difficult to remove

Consult as-built information and installation records (e.g., SAP and GIS layers):

- Date of manufacture – Asbestos-cement coating is usually found on pipes manufactured during the1930s.
- Beware - the recorded installation date is not always the same as the date of manufacture because old, stockpiled pipe may have been used or exhumed pipe may have been re-used.

Review Asset Condition Assessment (ACA) Reports:

- Pipe coating material is usually noted when pipeline asset inspection work is undertaken.
- For assistance - consult APDG, Engineering, Inspection and Condition Assessment.

Laboratory testing:

- Test for the presence of asbestos.

6.2.2 Asbestos-cement Wrap – Example 1

Figure 4 – DN610 MSCL pipe with factory-applied asbestos cement wrap coating (left of image) and field-applied asbestos mortar over the joint (right).

Figure 5 - A closer look of the coarse weave of the asbestos bandage is evident at the overlap; hand-applied asbestos mortar over the field joint is at the right of the image.

6.2.3 Asbestos-cement Wrap – Example 2

Figure 6 – DN1065 Canning Trunk Main, Albany Hwy, Maddington. Note the coarse weave of the asbestos bandage evident at the overlap of the wrap.

Figure 7 - DN1065 Canning Trunk Main, Albany Hwy, Maddington. Close-up of bandage overlap.

6.2.4 Asbestos-cement Wrap – Example 3

Figure 8 – DN 1065 Canning Trunk Main, Albany Hwy, Maddington. Asbestos cement bandage removed for pipe repair.

Figure 9 - – DN 1065 Canning Trunk Main, Albany Hwy, Maddington. Close-up of asbestos cement bandage

6.3 Coal Tar Enamel Wrap Identification (Hazardous)

Coal tar enamel coated pipe (or simply coal tar pipe) was produced from the 1930s until the 1990s. The coating process varied considerably but usually involved the application of a primer followed by spirally wrapping the pipe with chrysotile asbestos and fibreglass bandage soaked in a hot mixture of coal tar-asphalt. The finished pipe was white-washed to reduce temperature rise during transport and storage.

Hazardous coating category 4 – contains asbestos and PAHs.

Some samples may also contain a plasticizing agent containing PCBs.

6.3.1 Identification Procedure for Coal Tar Enamel Wrap Coating

Most CTE-coated pipe can be identified with a high degree of confidence by looking for the 5 clues listed below. Normally, laboratory testing is only required to classify the waste for disposal purposes.

Look for clues:

- Distinctive spiral wrap - Coating is formed by winding a woven asbestos bandage soaked in Coal Tar Enamel (CTE).
- Smell – CTE has a distinctive smell, however, pipes installed above ground lose this smell after a few years.
- Whitewash coating - new pipe was often whitewashed to reduce softening of the coating by sun exposure during transport and storage. Remnants of this whitewash can often be found, even on pipes stored in the open for decades.
- Pliant coating – The coating of exhumed pipes often shows signs of deformation caused by ground stress or tree root pressure – however, the coating on above-ground pipe will harden and embrittle as the volatiles evaporate.
- Weathered coating fades from black to a grey colour (in a similar way that a bitumen road fades from black to grey over time).

Consult as-built information and installation records (e.g., SAP and GIS layers):

- Date of manufacture - CTE coating predominated on pipes made during the 1930s until at least the mid-1980's.
- Beware - the recorded installation date is not always the same as the date of manufacture because old, stockpiled pipe may have been used or exhumed pipe may have been re-used.

Review Asset Condition Assessment (ACA) Reports:

- Pipe coating material is usually noted when pipeline asset inspection work is undertaken.
- For assistance - consult APDG, Engineering, Inspection and Condition Assessment.

Laboratory testing:

- Test for Polycyclic Aromatic Hydrocarbons (PAH) - All CTE contains these known carcinogens.
- Test for Polychlorinated Biphenyls (PCB) – Some CTE contains this carcinogen. PCB was sometimes added as a plasticizer to the hot CTE during manufacture to prevent coking.
- Test for asbestos – Most CTE pipe coatings contains this carcinogen. It is usually in the form of woven chrysotile bandage but can also be present as a compressed felt-like material. The asbestos fibres are stabilised by the coal tar and hazardous quantities of fibres are rarely released by stripping of the coating.

6.3.2 Coal Tar Enamel Wrap – Example 1

Comparison new coal tar and new fusion-bonded PE coatings

Figure 10 - New coal tar epoxy coating. Note the spiral weld bead of the pipe is evident.
https://www.wldsteel.com/product/coal-tar-epoxy-coating-steel-pipe/

Figure 11 – Near new fusion-bonded polyethylene (Sintakote).

6.3.3 Coal Tar Enamel Wrap – Example 2

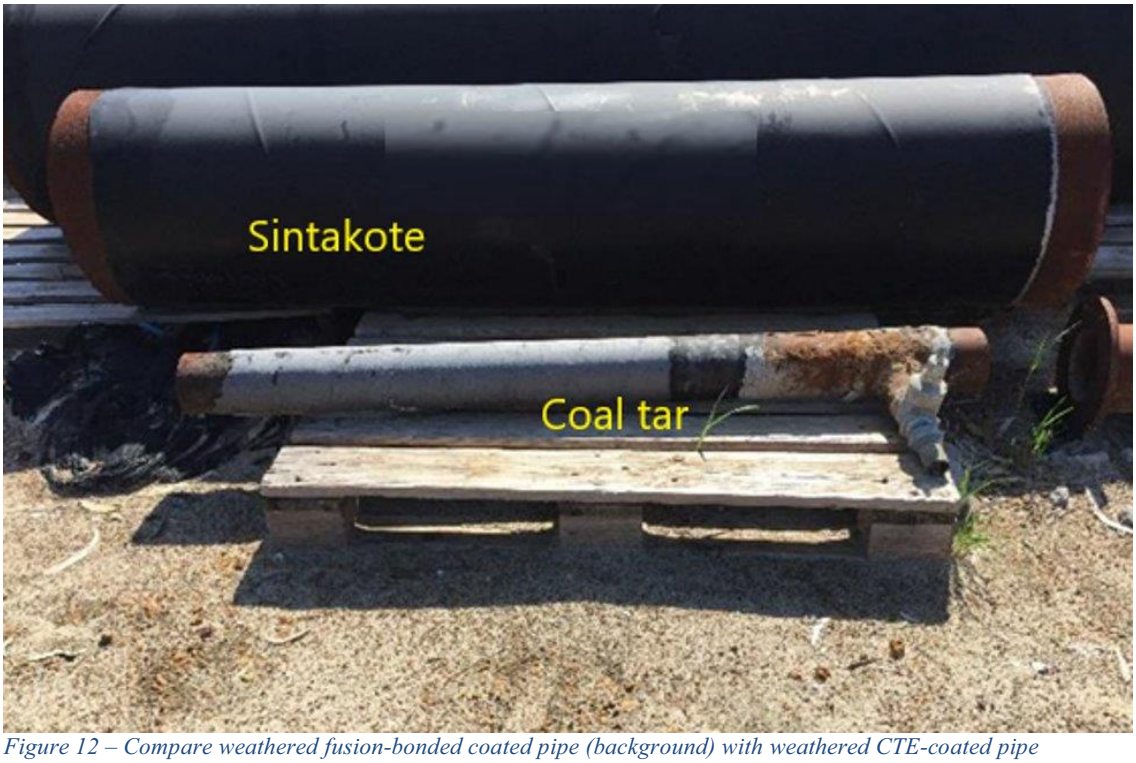

Figure 12 – Compare weathered fusion-bonded coated pipe (background) with weathered CTE-coated pipe (foreground).

6.3.4 Coal Tar Enamel Wrap – Example 3

Figure 13 - Exhumed asbestos coal tar coated pipe originally installed in 1952. Note the coating deformation caused by soil stress and tree roots and the spiral wrap of the asbestos bandage.

Figure 14 - Exhumed asbestos coal tar coated pipe originally installed in 1952. Close-up

6.3.5 Coal Tar Enamel Wrap – Example 4

Figure 15 - DN300 Damaged asbestos coal tar coated pipe at York.

Figure 16 - DN300 Damaged asbestos coal tar coating repaired using non-hazardous repair system (primer, butyl mastic strip and PVC tape) .

6.3.6 Coal Tar Enamel Wrap – Example 5

Figure 17 – Removal of asbestos coal tar coating from DN1400 main prior to welding in East Rockingham. Note the spiral wrapping of the bandage and intact whitewash coating.

6.3.7 Coal Tar Enamel Wrap – Example 6

Figure 18 - DN1220 Serpentine trunk main, Riverton (installed 1953). Note the spiral bandage wrap and a mastic patch repair.

Figure 19 – Underside of the DN1220 Serpentine trunk main, Riverton (installed 1953). Note the remnant whitewash coating.

6.3.8 Coal Tar Enamel Wrap – Example 7

Figure 20 – Damaged asbestos coal tar coating at an unknown location. Note the remnant whitewash, spiral bandage wrap, black substrate.

6.3.9 Coal Tar Enamel Wrap – Example 8

Figure 21 - Weathered asbestos coal tar coated pipe at Bold Park reservoir site. Note the spiral wrap and fading of the coating to a light grey.

6.3.10 Coal Tar Enamel Wrap – Example 9

Figure 22 - Weathered asbestos coal tar coated pipe at Boondi Pump Station. Note the spiral wrap and the remnant whitewash, especially on the underside of the pipe.

6.3.11 Coal Tar Enamel Wrap – Example 10

Figure 23 - Weathered asbestos coal tar coated pipe at Canning Vale Depot. Note the spiral wrap and coating colour weathered to light grey.

6.3.12 Coal Tar Enamel Wrap – Example 11

Figure 24 - Weathered small diameter asbestos coal tar coated pipe at Chidlow Pumping Station. Note the spiral wrap and coating colour weathered to light grey.

6.3.13 Coal Tar Enamel Wrap – Example 12

Figure 25 - Weathered asbestos coal tar coated pipe at Thompson Street WPS, Esperance. Note the spiral wrap, remnant whitewash and coating colour weathered to light grey.

6.3.14 Coal Tar Enamel Wrap – Example 13

Figure 26 - An example of a less common CTE coating - Inner asbestos felt and outer protective layer (possibly fibreglass) at Greenmount Reservoir.

Figure 27 - Close-up of Greenmount pipe with a less common type of CTE coating consisting of an inner asbestos felt and outer protective layer (possibly fibreglass).

6.3.15 Coal Tar Enamel Wrap – Example 14

Figure 28 - Weathered asbestos coal tar coated pipe at Fleay Road, Harvey. Note the spiral wrap, remnant whitewash and coating colour weathered to light grey.

6.3.16 Coal Tar Enamel Wrap – Example 15

Figure 29 - Exhumed pipe at Lilac Place WWPS, Huntingdale. Note spiral wrap, coating colour weathered to grey and remnant whitewash.

6.3.17 Coal Tar Enamel Wrap – Example 16

Figure 30 - Weathered coal tar coating at Kellerberrin Depot.

6.3.18 Coal Tar Enamel Wrap – Example 17

Figure 31 - Weathered asbestos coal tar coated pipes at South Hedland. Note the spiral bandage weathered to a light grey colour on the background pipes. The foreground CTE coated pipe has retained the protective whitewash over-coating.

6.4 Fusion Bonded MDPE Coating Identification (Non-hazardous)

Fusion bonded MDPE (usually referred to by its trade name Sintakote) has been available since 1985 and is now the most common coating used for steel pipe. The coating is tough and durable and does not degrade significantly with exposure to the elements.

6.4.1 Identification Procedure for Fusion Bonded MDPE Coating

Most MDPE-coated pipe can be identified with a high degree of confidence by looking for clues listed below.

Look for clues:

- Smooth, seamless, odourless black coating.
- Pipe fabrication welds and other surface prominences under the coating are often apparent.
- The coating is tough and durable with a degree of “shape-memory”.
- Weathered coating has minimal degradation or fading.

Consult as-built information and installation records (e.g., SAP and GIS layers):

- Date of manufacture - MDPE coating began to predominate after about 1990.
- Beware - the recorded installation date is not always the same as the date of manufacture because old, stockpiled pipe may have been used or exhumed pipe may have been re-used.

Review Asset Condition Assessment (ACA) Reports:

- Pipe coating material is usually noted when pipeline asset inspection work is undertaken.
- For assistance - consult APDG, Engineering, Inspection and Condition Assessment.

Laboratory testing:

- None recommended.

6.4.2 Fusion Bonded MDPE Coating (Sintakote^{TM}) – Example 1

Figure 32 - New Sintakote pipe prior to installation. Note the smooth seamless black coating.

6.4.3 Fusion Bonded MDPE Coating (Sintakote^{TM}) – Example 2

Figure 33 - New Sintakote pipe during installation. Note the smooth seamless black surface and the evident spiral pipe weld seam under the coating.

6.4.4 Fusion Bonded MDPE Coating (Sintakote^{TM}) – Example 3

Figure 34 - New Sintakote pipe (foreground) during installation. Note the smooth seamless black surface and the spiral pipe weld seam evident through the coating. Older Asbestos CTE coated pipe in the background.

Document Revision History	
10/11/2023	New document, approved by HO for publishing #163215051