County Surveyors' Society

GUIDANCE NOTE

ROAD MATERIALS CONTAINING TAR

Purpose of Guidance Note

1. UK roads constructed prior to 1980, or surface dressed prior to the late 1980's may contain tar. Maintenance works on these roads may therefore involve excavation of materials containing tar. Disposing of materials containing tar to landfill is expensive and unsustainable. This Guidance Note describes a process which Local Authorities can follow to assess road materials they propose to excavate and develop designs to recycle the arisings thus avoiding disposal to landfill.

Introduction

2. Coal tar is a potentially hazardous material which was used in road construction and maintenance processes in the UK prior to 1980. European Directives which were implemented in the UK by The Hazardous Waste Regulations 2005 (HWR) and The List of Waste Regulations 2005 (LoWR) classify certain materials containing tar as "Hazardous Waste". This classification then invokes restrictions on methods of use and disposal of these materials. This note gives guidance on identifying and dealing with these materials.

Background

3. From the mid-1800s road tar, derived from the high-temperature distillation of coal in the production of domestic "town" gas, was used on UK roads. It had good adhesive and waterproofing properties which made it eminently suitable for use as a binder in tarmacadam mixes and also as a spray application in surface dressing (which was commonly termed "tar-spray and chippings"). However, an alternative – bitumen – derived from the refining of petroleum oil, became available from the early 1900's and increasingly gained in market share.

4. Coal tar continued in use on UK roads to a certain extent until the late 1970s/early 1980s when it became increasingly scarce due to the closure of town gas works with the advent of natural gas and of other sources such as coke ovens at steelworks. At the same time, concerns were being expressed regarding the possible carcinogenic (cancer-causing) nature of coal tar. For these reasons the use of tar on roads in the UK was largely discontinued by the early/mid 1980's and bitumen became the sole binder for macadam mixes (now generally termed asphalt) and for surface dressing.

5. Apart from coal tar itself, some macadam mixes incorporated small amounts of tar oil flux to aid workability during hand-laying, while pitch, derived from coal tar, was used in hot-rolled asphalt surface courses laid in the 1960s and 1970s. In both cases, the use of these was also discontinued by the early 1980s as alternative materials were shown to be satisfactory.

Difference in hazard between coal tar and bitumen

6. Coal tar and bitumen are two entirely chemically different products and should not be confused. While coal tar has now been classified as carcinogenic, numerous studies have found no link between bitumen and cancer, and bitumen is not classified as carcinogenic anywhere in the world.

7. The difference between the degree of hazard posed by coal tar and bitumen arises from the levels of Polycyclic Aromatic Hydrocarbons (PAHs). Some PAHs are known to have carcinogenic effects and levels of these are very high in the case of tar, but extremely low in bitumen. Indeed, smoke from a domestic barbecue contains concentrations of PAHs many times higher than the fumes from hot bitumen.

The occurrence of bituminous materials containing tar

8. Until the mid 1980s tar was used as a binder in macadams, as a grout in hand pitched forms of construction. Tar was used as a surface dressing binder until the late 1980s. It is therefore likely to be present across most of the highway network in some part of the construction.

9. Records of construction materials were generally not kept in the past and in most authorities there is no readily accessible, reliable information about construction dates of parts of the network. More recently such data may have been collected for Pavement Management Systems but this may not be sufficiently detailed or comprehensive in its coverage.

The definition of Hazardous waste

10. The definitions of hazardous waste are contained in the following Environment Agency publications:-

    - "What is a Hazardous Waste" http://publications.environment-agency.gov.uk/pdf/GEHO0506BKTR-e-e.pdf

    - "WM2 Hazardous waste: Interpretation of the definition and classification of hazardous waste" http://publications.environment-agency.gov.uk/pdf/GEHO0603BIRB-e-e.pdf

11. There are three relevant definitions which relate to construction and demolition wastes of bituminous mixtures contaminated with coal tar arising from the past use of tar in roads. These are within section 17.03 of the European Waste Catalogue and are :-

17 03 bituminous mixtures, coal tar and tarred products

17 03 01* bituminous mixtures containing coal tar M
17 03 02 bituminous mixtures other than those mentioned in 17 03 01
17 03 03* coal tar and tarred products A

The definitions marked with an asterisk and denoted “A” (17 03 03) are Absolute entries in the catalogue and are automatically considered Hazardous Wastes.

The definitions marked with an asterisk and denoted “M” (17 03 01) are Mirror entries in the catalogue and have the potential to be Hazardous Wastes. Further investigation of 17 03 01 products is required to determine whether or not they are hazardous before deciding how to use them or dispose of them. This category could include the arisings from excavations in an old road pavement.

Definitions not marked with an asterisk (17 03 02) are non-hazardous wastes.

The Environment Agency has produced guidance on the use of planings covered by category 17 03 02.
http://www.environment-agency.gov.uk/business/1745440/1745496/1906135/1985714/1985726/1986097/

http://www.environment-agency.gov.uk/ourviews/857198/1433452/?version=1&lang=_e&lang=_e

http://www.environment-agency.gov.uk/commondata/acrobat/plan2_revised_1461531.pdf

QPA Scotland and the Scottish Environment Protection Agency (SEPA) have produced guidance on the use of planings covered by category 17 03 02.
http://www.sepa.org.uk/pdf/guidance/waste/road_planings_guidance.pdf

There are 3 levels of waste; inert, non-hazardous and hazardous.

Site Investigation

12. If any form of excavation in a bituminous pavement is required in a scheme then the Designer or scheme compiler has a duty under the regulations to determine whether or not any of the materials encountered could be hazardous waste. The Designer also has a duty to minimise construction hazards, and inform the Contractor of any remaining hazards, under the Construction (Design and Management) Regulations 2007

13. If the construction records show that no tar is present in the layers that are to be excavated further investigation is unnecessary. If it is known that the layers to be excavated were laid after the mid 1980s and any surface dressing was laid after the late 1980s further investigation is unnecessary.

14. In other cases there is doubt about whether material to be excavated contains tar. Designers have a choice; they can undertake no further investigation, accept that the excavated material may contain tar and follow the requirements in this Guidance Note for materials containing tar. This may be appropriate and cost effective for small scale work such as patching. For larger scale work it will be more cost effective for the Designer to determine whether all or some of the layers to be excavated contain tar. In this case cores should be taken or fragments of bituminous material should be taken from each layer encountered in a trial pit. If it is known that removal will mix the layers a combined sample from all the layers should be analysed. Coring or trial pitting would also provide valuable information of layer thickness to assist in design and in calculating quantities.

15. The number of cores taken or pits excavated will depend on the extent of the scheme, but there should be sufficient to identify the number of layers present and the extent of any material containing tar. Knowledge of the previous maintenance at the site will be helpful in assessing what materials may be present.

16. Some Designers may decide not to take cores prior to the works commencing, but to test the arisings. This has four disadvantages;
    - There is no opportunity to consider whether tar containing materials can be left undisturbed.
    - The removal process cannot be designed in advance to separate tar and non-tar materials if required. If tar is present in some but not all layers, this is likely to result in a larger quantity of material containing tar being produced.
    - Testing will be required after excavation before a decision can be made on how to use the arisings. This carries the risk of delay during the Contract.
    - Under the CDM Regulations, it will be necessary to inform the Contractor that "excavated materials may contain tar"

17. The samples should be tested by a laboratory with UKAS accreditation for speciated PAH testing using GC-FID or GC-MS. Testing for speciated PAH and phenol analysis is required. The detection limit for PAH should be specified as 1 ppm and for Phenol should be specified as 0.1 mg/kg.

18. The laboratory should be required to report the concentration of phenol in a leachate (see para 16) and the components of PAH 17 as defined in Appendix 1 (Note that this is **not** USEPA 17-PAH).

19. The results should be interpreted and the samples should be categorised into category 17 03 01 or 17 03 02.

Threshold levels

20. The Control of Substances Hazardous to Health (COSHH) Regulations are applicable to Health and Safety considerations. COSHH relies on the Chemicals (Hazard Information and Packaging for Supply) (CHIP) Classification for its hazardous designations. For PAHs their CHIP Classifications as carcinogens trigger at 1,000 ppm except for Benzo(a)pyrene which triggers at 100 ppm. Phenols are not hazardous to humans but are strong biocides. COSHH is not applicable, but the Waste Acceptance Criteria consider Phenol to be an inert waste where the concentration in the leachate of a liquid to solid ratio of 10 litres per kg is below 1 mg/kg.

21. It is therefore considered that the threshold level below which road materials can be used as unbound materials is as follows;

    All criteria must be met

    - **The concentration of Benzo(a)pyrene is below 100 ppm.**
    - **The concentration of all other components of PAH17 is below 1,000 ppm.**
    - **The concentration of phenol in the leachate of a liquid to solid ratio of 10 litres per kg is below 1 mg/kg.**

22. In some situations it may be possible to produce a site specific risk assessment which shows that materials with levels exceeding these thresholds can be used as an unbound material.

23. Where the PAH 17 value exceeds 25 ppm asphalt manufacturers do not incorporate the material in hot mixes (QPA advice is that this limit is aspirational for Health and Safety and Environmental reasons, and is not based on technical or legal requirements.)

Assessment of results

24. If tar is identified from the investigation, wherever possible a design should be employed which leaves the product sealed in situ, thus negating the necessity to deal with material containing tar.

25. If tar is confined to discrete layers, then the designer has the option to separate the layers during excavation, thus minimising the amount of tar containing material produced.

Treatment of material containing tar above the threshold limit in paragraph 21

26. The designer may wish to consider whether material containing tar above the threshold limit can be mixed with other material to bring the resultant mixture below the threshold level. The mixed material can then be used as an unbound material.

27. WRAP consider that material containing tar can be recycled by insitu or ex situ methods in agreement with the Environment Agency.

28. Recycling for use as a construction material should always be considered as the first option.

29. It is important that the Environment Agency is consulted about any dealings with Hazardous Waste and any necessary permits or exemptions for the operations are obtained in good time.

30. If it is decided that the material could be reprocessed then it can be used as aggregate in a bitumen bound material such as a cold mix asphalt, a cement bound material or a hydraulically bound material such as a Structural Material for Reinstatement (SMR).

31. QPA advise that bituminous materials containing tar with a PAH 17 value above 25 ppm are not currently used in hot mix asphalt processes because of the fumes generated by re-heating (see para 20). This may change in future if technology is developed which makes it achievable. Potential developments include reductions in mixing temperatures and cold mixes.

32. In some situations it may be possible to produce a site specific risk assessment which shows that bituminous materials containing tar can be used as an unbound material such as sub base.

33. The Pre-construction Health and Safety Information Pack should contain details of the bituminous materials to be excavated during the works, and the hazards these materials present, both to site staff and members of the public, particularly during activities such as planning. The means of minimising these hazards, e.g. by reprocessing into a bound material, should also be included in the Information Pack. Where materials containing tar are incorporated in the finished works, details must be included in the Health and Safety File, so that this information is available for future maintenance schemes

Records to be kept

34. Copies of all information from site investigations, including test results, should be included in the Authority's Pavement Management System or elsewhere in accordance with the record keeping policy of the Local Authority.

Note on other methods of determining tar content

35. A number of simple tests have been considered as screening tools to identify bituminous materials likely to contain tar. It is likely that a negative result in these tests confirms that the material is below the threshold level for use as an unbound material. Local Authorities are encouraged to trial these simple tests in conjunction with PAH and phenol testing to determine the detection level of the tests.

    The simple tests identified are;

    a. White spray paint (goes brown in the presence of tar, little affected by bitumen)
    b. Adding a drop of Methylene Chloride to a fragment of material on a filter paper. Tar gives a yellow-brown stain; bitumen gives a dark brown stain)
    c. Use of PAK marker (available from www.interlab-bv.nl). PAK is Dutch for PAH. PAK Marker is sprayed on the material and left to dry. If the white spray discolours to a light brown/yellow, Interlab state that discolouring shows that the PAH level exceeds 100 ppm. Interlab state that PAK marker gives an indication of PAH presence, but does not give a measurement.
    d. Use of a UV lamp. Interlab recommend the use of a UV lamp in cases of doubt after using PAK marker. Under UV light material the discoloured PAK spray lightens and becomes yellow/ green.

Acknowledgements

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David O'Farrell, Capita Symonds.
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Appendix 1

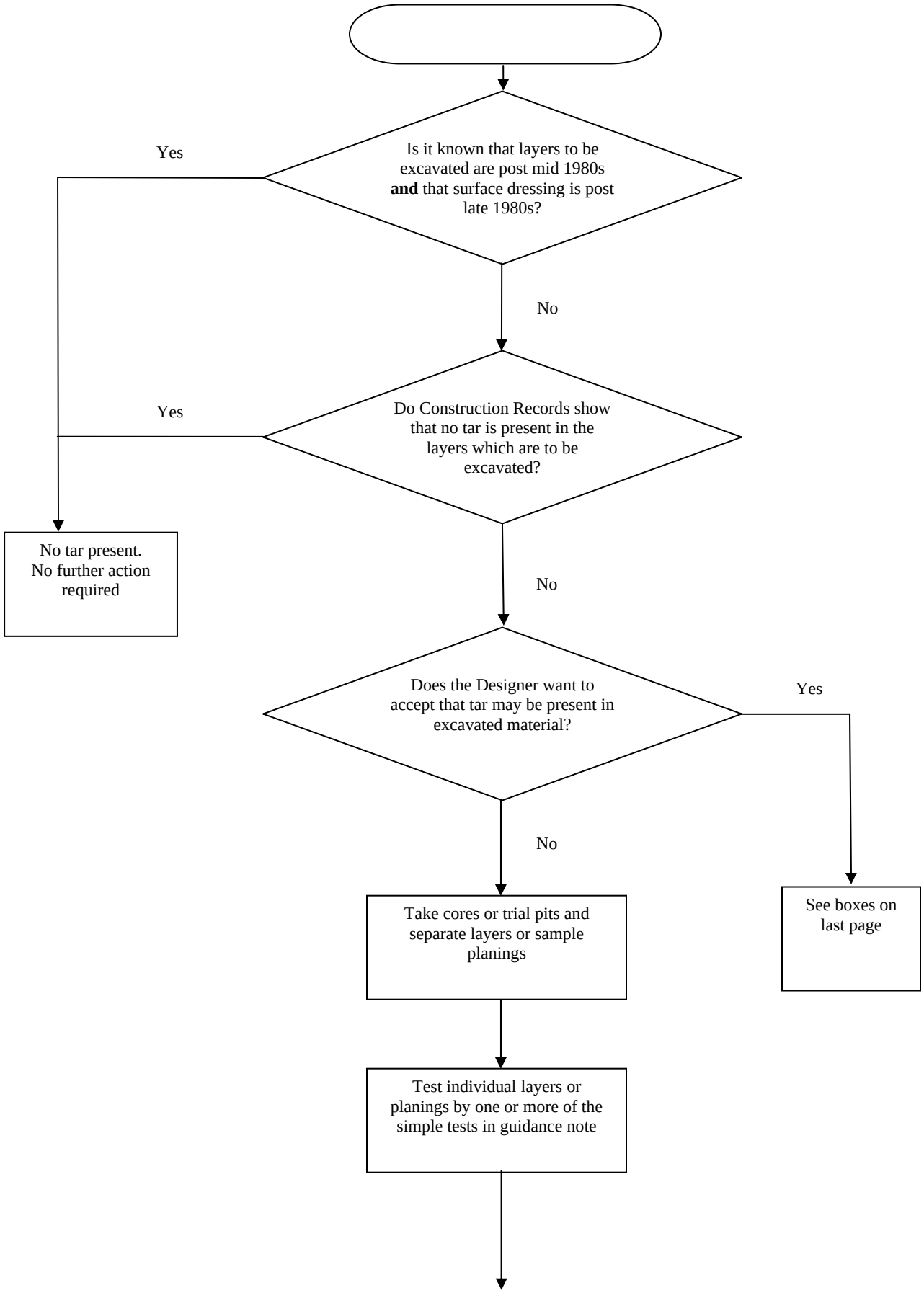
PAH to be tested for

The UK Environment Agency Waste Acceptance Criteria require the following 17 PAH to be tested for.

Acenaphthene
Acenaphthylene
Anthracene
Benz(a)anthracene
Benzo(a)pyrene
Benzo(b)flouranthene
Benzo(g,h,i)perylene
Benzo(k)flouranthene
Chrysene
Coronene
Dibenzo(ah)anthracene
Flouranthene
Flourene
Indeno(1,2,3-c,d)pyrene
Naphthalene
Phenanthrene
Pyrene

Please note that this list differs slightly from the US EPA 17-PAH list, and this should be made clear to the test house when submitting samples.

Recommended Assessment to ensure tar bound materials are safely handled and disposed



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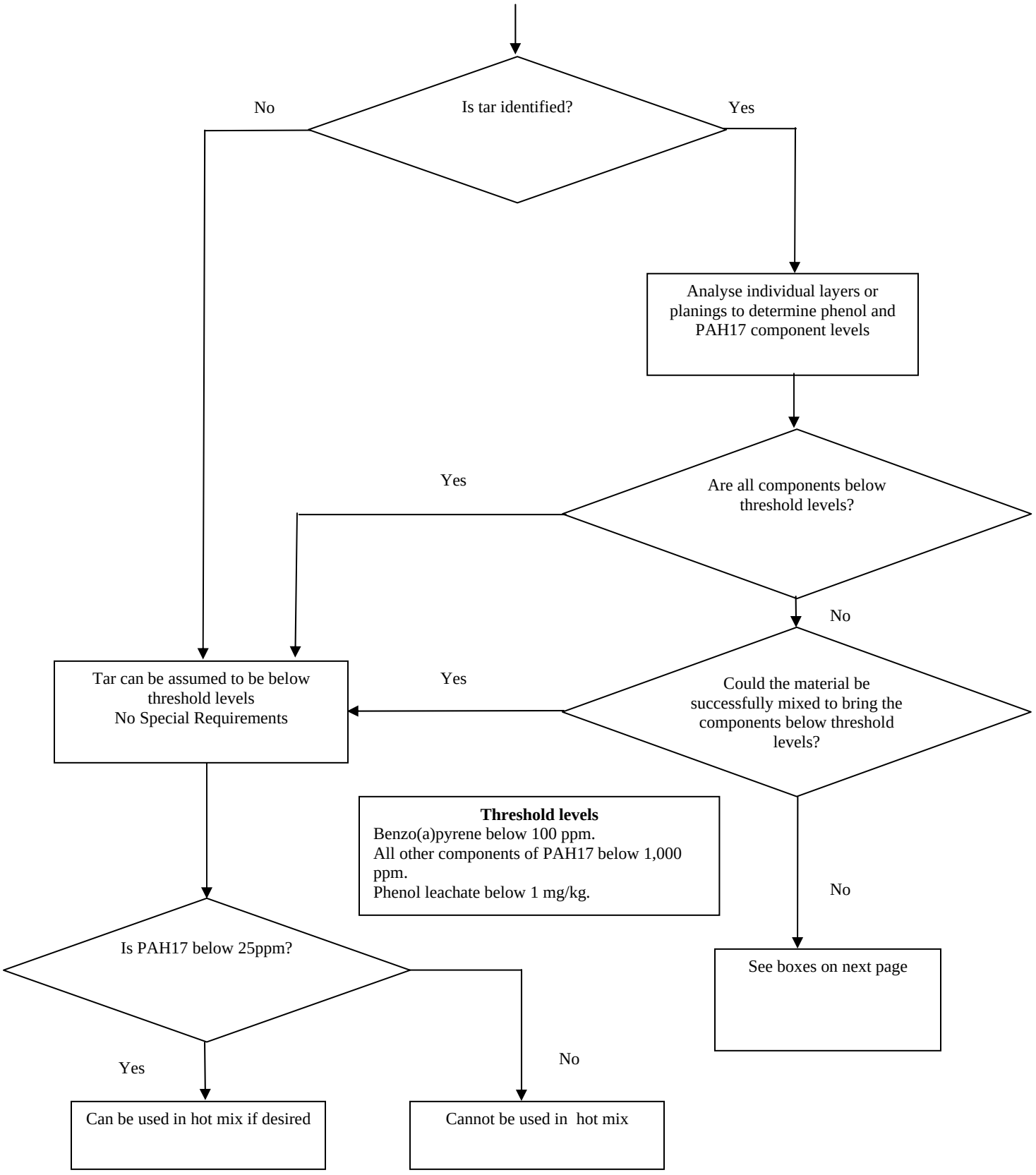

Recommended Assessment to ensure tar bound materials are safely handled and disposed

Eliminate arisings containing tar

Consider redesign to stop short of the tar bound material

Reduce quantity of arisings containing tar

Consider two level planing exercise with non-tar treated separately

Options for dealing with the remaining arisings which contain tar

Consider cold recycling process to produce HBM or Foamed Bitumen Bound Material

If Risk Assessment permits, consider use as Unbound Aggregate