

# Management of Closed Landfills

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ENVIRONMENT PROTECTION AUTHORITY



# Reformed PC PAN's – why?

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- Better leachate management needed
- Better landfill gas management needed
- Lack of rehabilitation & aftercare
- Highly variable monitoring requirements and compliance
- Inconsistent statutory documents issued over many years

# Better leachate management needed

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Leachate flowing out of a gas extraction well and breaking out at the surface. Leachate depth from landfill base 28m.



# Better leachate management needed

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Leachate breaking out of a batter, leachate depth from base 11m.





# Better landfill gas management needed

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Landfill gas surface emissions causing vegetation die back. 400 – 60000 ppm Methane. Housing nearby, sub-surface concentrations of Methane up to 30% v/v.





# Better landfill gas management needed

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High surface emissions of methane causing vegetation die back.  
Housing nearby, sub-surface Methane concentrations up to 60% v/v CH<sub>4</sub>.





# Lack of rehabilitation

Significant and widespread cracking and erosion of a cap. Repair and further rehab' needed.





# Lack of rehabilitation

Rehabilitation undertaken to a poor standard. Waste remains exposed





# Lack of aftercare

Leachate management neglected for years. Outbreak from the batter into a residential area



# Closed Landfill Guidelines (Publication 1490)

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- Follow Clause 16 (4) of the landfill waste management policy (S264 14 Dec 2004)
- ONLY apply to formerly licensed landfills
- Require hydrogeological assessments for leachate management
- Standard requirements used, but these can be amended to site conditions.
- Give detailed examples of how to comply with requirements.



# Closed Landfill Guidelines (Publication 1490)

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- Will only require works to be undertaken if necessary. Former EPA approvals and licence conditions honoured.
- Require environmental audits and auditor verified monitoring programs – identical process to reformed EPA licences.
- Provide an end point for the PC PAN – required by the landfill waste management policy.

# Closed Landfill Guidelines (Publication 1490)

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## Environmental audits and auditor verified monitoring programs.

- Should decrease in frequency / extent over time based on monitoring results.
- Ultimately final stabilisation is likely to occur under attenuation / biodegradation i.e. engineering controls (other than liner/cap) cease. PC PAN end point / revocation must recognise this.



# Closed Landfill Guidelines (Publication 1490)

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## End point / PC PAN revocation?

- Summarised in Pub' 1490 – based on WMP
- Evidence provided by monitoring/auditing
- EPA & Auditors protocol needed on what this looks like. In the meantime WMP gives ability of 'the authority' to decide. i.e. EPA officers can make the call based on audit reports. Specialist staff in EPA will have oversight.

# How EPA issues PC PANs

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- Up to 2 Supporting PANs issued prior to the PC PAN – if not needed, won't be issued, standard requirements added / removed as required.
- Supporting PANs require plans / programs which are followed under the PC PAN
- PC PAN issued after Supporting PANs are complied with.



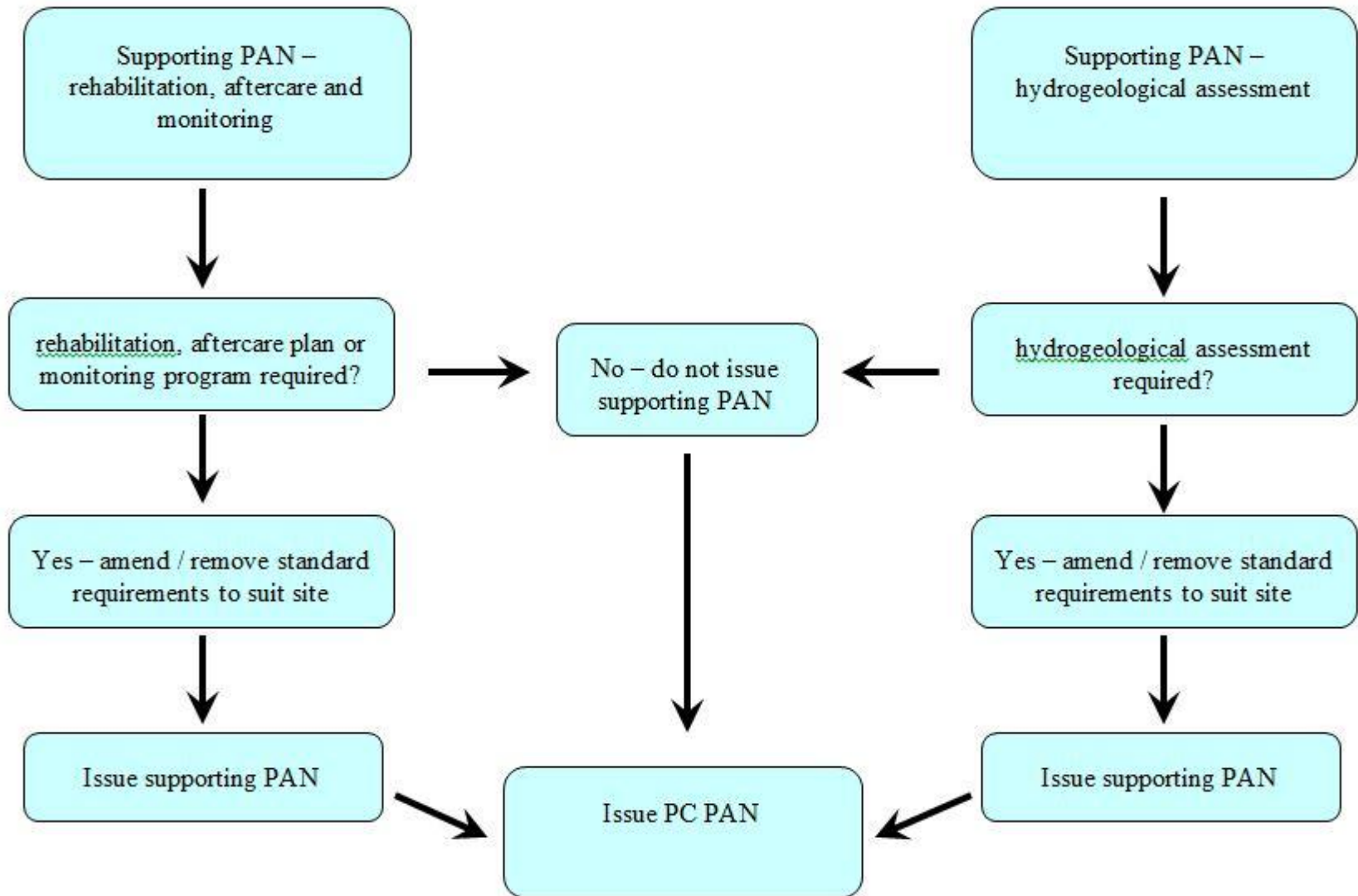
# How EPA issues PC PANs

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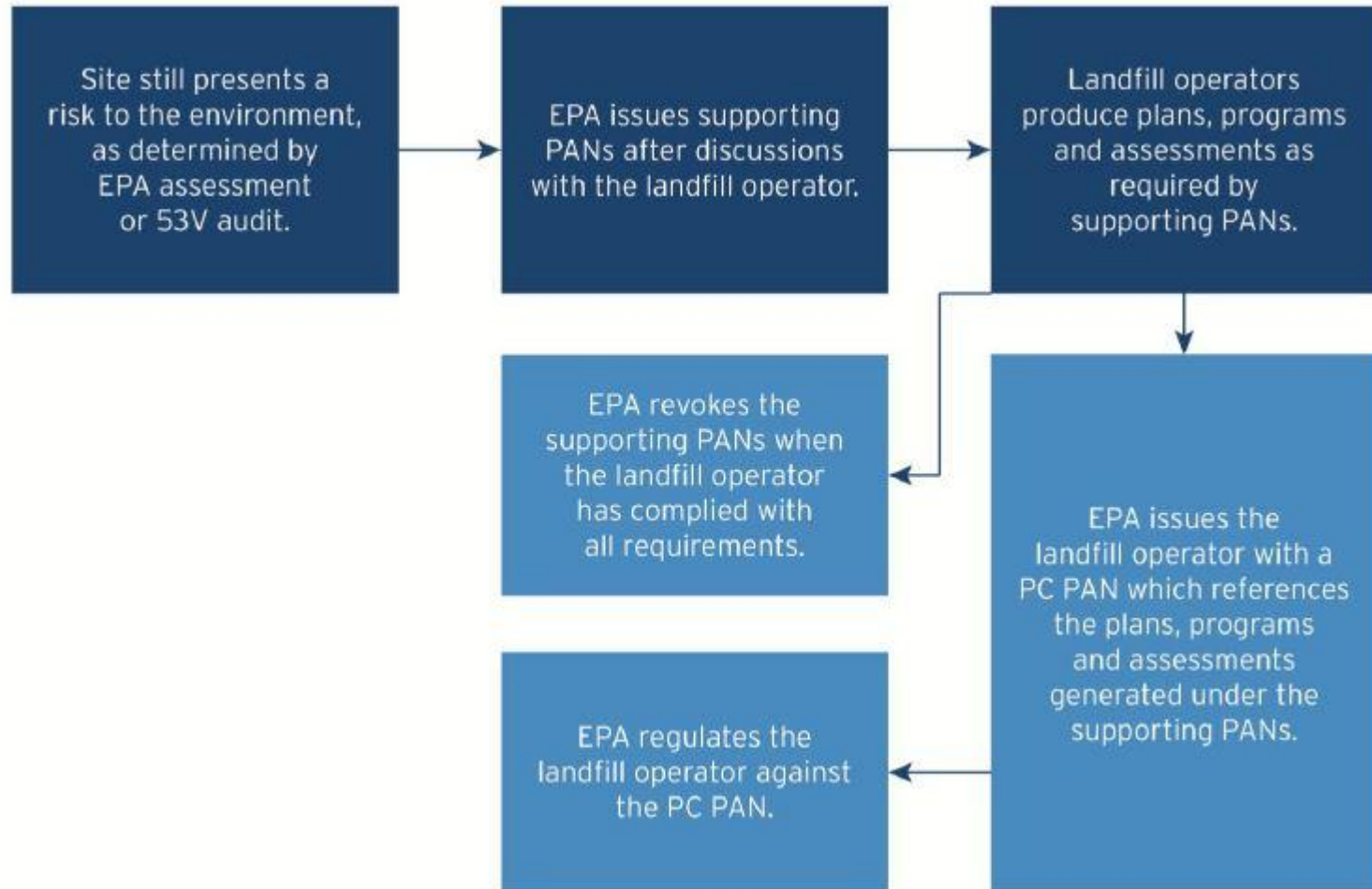
For example:

- Supporting PAN: 'You must have an auditor verified environmental monitoring program'.
- PC PAN: 'Implement the auditor verified monitoring program'.

# How EPA issues PC PANs



# How EPA issues PC PANs





# Supporting PAN – One we did earlier.....

## Rehabilitation, aftercare and monitoring

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### EPA OBSERVATIONS

EPA approved the rehabilitation plan entitled “Technical Specification – [REDACTED] – Final Cap Construction” dated October 2004 (Document No.02613505/063) and “Revised Technical Specification – [REDACTED] Landfill – Final Cap Construction with GCL” dated March 2006 (Document No.02613505/127a) which were submitted to EPA in accordance with condition 2.5 of licence [REDACTED]. The site was capped in 2005 and 2006 in accordance with the [REDACTED] Landfill Cap Construction Report (Golder Associates 2007a), which demonstrated that the cap has been constructed generally in accordance with the approved plans under licence condition 2.5.

The Western portion of the filled area was capped with 500mm of clay and 550mm of subsoil / topsoil. The Eastern portion was capped with a GCL and 800mm of subsoil / topsoil.

During operation or since the premises ceased accepting waste an auditor verified monitoring program has not been produced for the site.

During operation or since the premises ceased accepting waste an Aftercare Management Plan has not been developed for the site.

The landfill will continue to generate landfill gas for several decades. Landfill gas needs to be appropriately managed to prevent emissions to the surrounding ground and atmosphere. Landfill gas migration has been found consistently beyond the site boundary and residential receptors are within 20m of the site boundary. A pumping trial is planned to assess gas yields from the waste mass to inform an appropriate gas management method and monitoring program.

# Supporting PAN – One we did earlier.....

Rehabilitation, aftercare and monitoring

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## REQUIREMENTS - WHAT OUTCOMES ARE REQUIRED TO COMPLY?

### General Requirements

This notice does not have any General Requirements

### Reporting Requirements

LC3.5. By 02.12.2013 you must supply to the Authority an Aftercare Management Plan for the premises that is consistent with Aftercare Management in Section 8.2 of the Landfill BPEM. The Aftercare Management Plan must, as a minimum, contain the following:

- a) inspection and maintenance of the landfill cap to prevent, control and remediate erosion, restore depressions, seal cracks and maintain vegetation.
- b) inspection, maintenance and operation of the leachate collection and treatment system.
- c) inspection, maintenance and operation of the landfill gas management system.
- d) inspection and maintenance of surface water control and collection infrastructure
- e) an environmental monitoring program for the landfill, verified by an environmental auditor appointed pursuant to the EP Act.



# Supporting PAN – One we did earlier.....

## Hydrogeological assessment

### 1

### EPA OBSERVATIONS

The premises have been used as a landfill for disposal of solid inert waste from the 1970s to 2006 under EPA licence number ES432.

In the 2010 Environmental Audit Report, completed by GHD, it was determined that the landfill was partially saturated by groundwater. The report also detected potential landfill leachate indicators in the groundwater monitoring bores BH1, BH4 and BH7.

The Groundwater Risk Assessment, completed by URS in 2010, states bores BH1, BH1S, BH4 and BH7 appear to be impacted by leachate from the landfill.

A site inspection and review of groundwater monitoring data by EPA in 2011 found evidence of leachate impacts in samples of groundwater from down hydraulic gradient groundwater monitoring bores BH1, BH4 and BH7.

The 2010-2011 Annual monitoring review by URS stated that elevated concentrations of key leachate indicator parameters are impacting the groundwater at down hydraulic gradient groundwater monitoring bore BH4 and to a lesser extent bores BH1, BH1S, BH2S, BH3R and BH7. The review report concludes that dissolved leachate is present in groundwater but that a plume of leachate contamination has not been detected at BH8 which is the most down hydraulic gradient groundwater monitoring bore. However the report notes that a limited data set is available for BH8.

Area 4 has some basal engineering around the sump, with a lip to facilitate drainage (URS, 2011) the most recent leachate level data (November 2011) showed that the leachate level was below 300mm above the base of the landfill. The remaining filled areas of the landfill, Areas 1, 2, 3 and 5 are un-lined and sit in clay. A leachate sump exists in Area 3 but appears not to be serviceable due to being dipped to only 6.72mbgl in Area 3 which is estimated to be between 28 and 32 m deep. Leachate extraction is only possible from the sump in Area 4 and the leachate level is noted to be low, suggesting that the leachate contamination of groundwater is from Areas 1,2,3 and 5.



# Supporting PAN – One we did earlier.....

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## REQUIREMENTS - WHAT OUTCOMES ARE REQUIRED TO COMPLY?

### General Requirements

This notice does not have any General Requirements

### Reporting Requirements

LC3.1. By 01.10.2013 you must supply to the Authority a hydrogeological assessment (HA) report for the premises in accordance with EPA Publication 668 (2006) Hydrogeological Assessment (Groundwater Quality) Guidelines, which includes but is not limited to:

- a) measurements of the level of leachate within each area of the landfill and the groundwater elevations in the surrounding strata;
- b) In Schedule 1 of the HA report, the maximum levels of leachate to be maintained within each area of the landfill which minimises the impacts on groundwater and allows effective management of landfill gas;
- c) In Schedule 1 of the HA report, if required, the timeframe within which the maximum leachate level(s) will be achieved in each area with annual draw down targets.
- d) all leachate levels must be reported in Metres Australian Height Datum;
- e) Not applicable
- f) Schedule 1 of the HA report must be in the format shown in the Closed Landfill Guidelines (EPA Publication 1490) (2012).

LC3.2. The HA report referred to in requirement 3.1 must be verified by an environmental auditor appointed pursuant to the EP Act to confirm:

- a) that the maximum leachate levels determined under the HA do not pose an unacceptable risk to the groundwater environment and allow for effective management of landfill gas; and
- b) that where leachate level(s) in any area exceed the maximum level determined under the HA, that the timeframe for achieving the maximum leachate level(s) in these areas appropriately takes into account the significance of the risks to the environment.

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Further info needed on Closed Landfills?

Contact:

EPA Specialist Regulatory Services Landfills Team:

Tim Turnbull – Unit Manager – Specialist Regulatory Services  
03 9695 2552

Annette Proud – Landfills Team Leader 03 9695 2561

Nick Simmons – Principal Waste Expert – Landfill / Senior EPO – Landfills Team  
03 9695 2854

Jeremy Settle – Senior EPO – Landfills Team 03 9695 2640