



Byron Shire Council

Contaminated Sites
(Preliminary Investigation Guideline)

CONTAMINATED SITES

Guiding Principles

In some situations, the use of land can result in its contamination by chemicals, posing a risk to human health or the environment and precluding later development of the site for more sensitive uses.

Council has listed the following objectives and targets in its Management Plan:

- To provide and implement procedures to protect the health of residents and visitors.
- To improve the quality of the natural environment
- To ensure Council has effective environmental controls and guidelines

Precautionary Principle - Carefully consider the impact of your proposal on others! If in doubt – don't do it.

Inter-generational equity - Don't leave a mess for the kids or grandkids to clean up!

Sustainability - We need long term solutions! Lets not use the "quick fix" option.

Biological and Ecological Diversity - Preserve and conserve what's left!

Good Site Management - Consider contamination issues early in the land use planning process

Guidelines - Non prescriptive. Guidelines allow for flexibility, innovation and a range of technical issues.

Appeals - All research and administrative decisions are open to review - so document everything

Failure to consider the possibility of contamination at the correct time in a planning decision process may result in:

- inappropriate land use decisions
- risk to human health
- harmful effects on the biophysical environment
- impacts on the safety of new and existing structures
- delays in processing development applications
- Impacts upon community land values and the passing of unanticipated development costs to other parties.

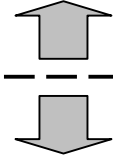
SYSTEM OVERVIEW

**Stage 1
Preliminary Site Investigation**
(See later sections to advise on more complete methodology)
The preliminary investigation may either be:

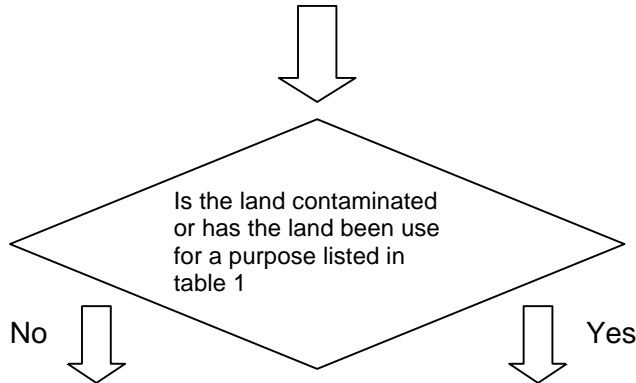
1. A continuous and accurate historical record of the previous land uses; or
2. A preliminary sampling and analysis program

In most cases detailed historical information covering the history of usage is not available and testing and analysis is required. This is covered broadly in this guideline.

*Above the Line
Scope of this
Information Guideline*



*Below the Line
Beyond this Guideline -
see "Other Useful
References" for further
assistance*



**Stage 2
Detailed Investigation**
Defines the nature, extent and degree of the contamination. Assesses likely risks to health and the environment. Allows for the formulation of a remedial action plan

**Stage 3
Remedial Action Plan**
Set clear objectives and fully document the process to remediate the site

**Stage 4
Validation & Monitoring**
Demonstrate that the objectives of Stage 3 have been met and conditions of development have been achieved

Assessment of development application or rezoning can proceed

Note: Not every site will require all 4 stages of investigation. For many sites only Stage 1, Preliminary Site Investigation, will be required. For other sites it may be clear that the site has been used for an activity listed in Table 1 and the proposed change of use would increase the risk of contamination and the investigation would commence at Stage 2, Detailed Investigation.

A site can never be guaranteed to be completely free of contamination.

TABLE 1 - ACTIVITIES THAT MAY CAUSE CONTAMINATION

- Acid/alkali plant and formulation
- Agricultural and horticultural activities
 - Fertiliser* (calcium phosphate, calcium sulfate, nitrates, ammonium sulfate, carbonates, potassium, copper, magnesium, molybdenum, boron, cadmium)
 - Fungicides* (carbonates, copper sulfate, copper chloride, sulfur, chromium, zinc)
 - Herbicides* (ammonium thiocyanate, carbamates, organochlorines, organophosphates, arsenic, mercury, triazines)
 - Pesticides* (arsenic, lead, organochlorines, organophosphates, sodium tetraborate, carbamates, sulfur, synthetic pyrethroids, xylene, kerosene, methyl isobutyl ketone, amyl acetate, chlorinated solvents)
- Airports
- Asbestos Production and Disposal
- Chemical Manufacture and Formulation
- Defence Works
- Drum-re-conditioning works
- Dry cleaning establishments
- Electrical manufacturing (transformers)
- Electroplating and Heat Treatment Premises
- Engine Works
 - Hydrocarbons, Metals, Solvents, Acids/alkalis, Refrigerants*
(e.g. chlorofluorocarbons, hydrochlorofluorocarbons, hydrofluorocarbons),
Antifreeze (e.g. ethylene glycol, nitrates, phosphates, silicates)
- Explosive Industry
- Gas Works
- Iron and Steel Works
- Landfill Sites
- Metal Treatment, fabrication and storage
- Mining and Extractive Industries
- Oil Production and Storage
 - Hydrocarbons, Metals, Solvents, Aliphatic hydrocarbons BTEX* (i.e. benzene, toluene, ethylbenzene, xylene), *PAHs* (i.e. Polyaromatic Hydrocarbons), *Phenols, Lead*
- Power Stations
- Railway Yards
- Scrap Yards
 - Hydrocarbons, Metals, Solvents.*
- Service Stations
 - Aliphatic hydrocarbons BTEX* (i.e. benzene, toluene, ethylbenzene, xylene), *PAHs, Phenols, Lead*
- Sheep and Cattle Dips
 - Arsenic, Organochlorines, Organophosphates, Carbamates, Synthetic Pyrethroids*
- Smelting and Refining
- Tanning and Associated Trades
- Waste Storage and Treatment
- Wood Preservation
 - Copper, Creosote, Chromium, Arsenic, Lead.*

THE NEED FOR A SITE CONTAMINATION REPORT

The Environmental Planning and Assessment Act 1993 (EP&A Act) and State Environmental Protection Policy 55 (SEPP 55) require Council to consider the suitability of land for a proposed development. The risk to health and the environment from contamination must be included in this assessment. SEPP 55 requires that Council be satisfied that a site is suitable for its proposed use or can and will be made suitable.

Generally, a preliminary site assessment for contaminated land issues is required for all development applications and rezonings. This preliminary site assessment may be a thorough detail of the historical knowledge of the site, with a statutory declaration supplied covering the history of usage. Council must be completely satisfied that there is no risk from contamination issues. In most cases the preliminary site investigation will need to include soil sampling, as there are gaps in historical information and past land uses that cannot be sufficiently described. In a few cases the preliminary investigation will highlight a need for further investigative works through higher than anticipated soil analysis results or the use for an activity listed in Table 1.

SCOPE OF THIS INFORMATION GUIDELINE

The major objectives of this information guideline is to provide:

- An overview of the investigation stages for contaminated land investigation; and
- Information on how to conduct a preliminary site investigation where the previous uses of the land which potentially has caused contamination is not known.

The guideline is not intended to provide specific details on:

- The conduct of detailed site investigations if the initial investigation highlights that further investigation is required;
- Procedures for remediation and ongoing monitoring; and
- The assessment of land where the likely contamination source is known (e.g. banana plantation sites, cattle dip sites, fuel storage sites etc).

In these cases, attention is directed to the attached list of other useful references.

The guideline is a broad summary for use by professional environmental consultants. As the investigation of contaminated land is a scientific process, these guidelines provide a recommended course of action only. A consultant should be able to justify the choices he/she has made in the preparation of the report.

STAGE 1 – PRELIMINARY SITE INVESTIGATION

These guidelines represent the minimum standard of preliminary site investigation. The information provided also relates only to the most common format and type of preliminary investigation. It should be noted that the information contained in this guideline is not appropriate for all sites and in some cases Council may require further information or testing.

a) Summary

The preliminary site investigation report should:

- Identify all past and present potentially contaminating activities;
- Identify potential contamination types;
- Discuss the site condition;
- Provide a preliminary assessment of site contamination; and
- Assess the need for further investigations.

Where a complete site history demonstrates that the site activities were unlikely to contaminate the land, there may be no need for further investigation or site sampling. The preliminary site investigation report should include a statutory declaration/s relating to the history of usage of activities and any chemicals on the site. However, if there are gaps in the historical information, or the land uses are not described in sufficient detail to identify the presence or absence of potentially contaminating uses, a preliminary sampling and analysis program may be required.

In most cases preliminary sampling and analysis will be required.

With every site contamination report the author must supply a written summary of relevant experience and qualifications to demonstrate that he/she is a suitable person to undertake the report and work.

A copy of a current \$10 million public liability insurance cover which specifically includes contaminated land investigations must be provided to support the summary of competence.

b) Sampling Selection

When the previous use of the land is uncertain but there is enough information on the probable locations of contamination, the most common form of sampling pattern used is the Judgmental Sampling Pattern. For this method, sampling points are chosen based on the investigator's knowledge of the probable distribution of contaminants. The method makes use of the site history and the field observations of the site. The principal disadvantage of this method is the potential for bias or complete misrepresentation of site contamination.

Site History reviews may include (but should not be limited to):

- Zoning (previous, current & proposed)
- Land Use (previous, current & proposed)
- Rezoning, development and building approvals
- List of Site Uses (including information gaps and unoccupied periods)
- Aerial photo review
- Site photograph
- List of Chemicals and wastes used and the storage location
- Contaminant sources and off-site effects
- Location of past and present industrial processes
- Sewer and service plans etc

Field Observations may include (but should not be limited to):

- Topographical features
- soil types, stability and erosion
- visible signs of contamination such as discoloration, bare soil patches etc
- signs of plant stress
- presence of drums, fill or waste materials
- odours
- presence of fill
- Quality of surface waters.
- Flood potential
- relevant sensitive environments

Every care should be taken to ensure that the sampling locations are appropriate for the site. In the selection of sampling sites consideration should be given to the most probable uses of the site and their likely location and the accumulation of contaminants in drainage lines or gullies etc.

A Systematic Sampling Pattern is used where there is insufficient information about the site to indicate the probable location of contaminants. In this method sampling points are chosen at regular and even intervals across the site with the square grid being the most common form.

c) Number of Samples

In the absence of site-specific requirements based on a more detailed knowledge of the site, the minimum number of samples is provided in the table below:

Table 2 – Minimum Sampling Points Required

Site Size (Hectare)*	Recommended No of Sampling Points	Site Size (Hectare)*	Recommended No of Sampling Points	Site Size (Hectare)*	Recommended No of Sampling Points
0.05	5	0.7	17	2.5	35
0.1	6	0.8	19	3.0	40
0.2	7	0.9	20	3.5	45
0.3	9	1.0	21	4.0	50
0.4	11	1.5	25	4.5	52
0.5	13	2.0	30	5.0	55
0.6	15				

*Note 1 hectare = 10,000m²

d) Sampling Method

To establish the depth of contamination, samples should be collected at two or more different depths at each location:

- At the surface (between 0 and 150mm below the surface) Note: the sample depth may vary according to the type of contaminant being tested;
- At depth or a number of different depths. Sites are usually taken in each identifiable horizon.

The implement used to extract the soil sample should be decontaminated after each sample to avoid cross contamination. The decontamination procedure consists of:

1. Remove caked or encrusted material;
2. Wash in detergent and tap-water (or organic solvent if testing for organochlorines);
3. Triple rinse in clean tap water; and
4. Air dry or wipe dry with a clean paper towel

The sample size is generally in excess of 1kg and is often stored on ice. Depending on the contaminants being tested, there may also be requirements about the type of sample container. Advice should be sought from the analytical laboratory performing the analysis.

e) Composite Sampling

Composite sampling is often used to reduce analytical costs by mixing of individual samples into one composite sample. The rules of composite sampling are:

- No more than 4 sub-samples in a composite sample;
- Only use for inorganic substances or those with low volatility;
- Not to be used for volatile substances such as hydrocarbons;
- Sub-samples to be composited must be collected from the same depth;
- Clay soils cannot be composited because they will not mix;
- Sub-samples must be of equal size; and
- Sub-samples must be from immediately adjacent points and at evenly spaced intervals.

f) Sample Identification

You must carefully identify the sample containers and your analysis results to show:

- Sample No.;
- Date and Time Sampled;
- Sample Site;
- Depth of sample;
- If a composite sample, it should be clear where the sub-samples have been obtained from and the composite labeled accordingly.

A map of the site showing all relevant matters should also be provided.

g) Chain of Custody

A chain of custody form should be presented with the preliminary site investigation which identifies who handled the sample and when and is used to ensure security of the sample. A sample chain of custody form is presented in Appendix 1. This form can be amended to suit the needs of the sampling program conducted.

h) Interpreting Sampling Results

The acceptable limit is the threshold concentration value below which the concentration of a contaminant is generally considered acceptable. An acceptable limit is usually adopted from Tables 1 and 2 of the ANZECC/NHMRC 1992 Guidelines (Note: New Guidelines proposed).

With composite samples, the composite result is multiplied by the number of sub-samples making up the composite. The resultant value is then compared against the acceptable limit.

If the results are below the investigation threshold value, the report can be submitted to Council for the continued assessment of the development or rezoning application. Generally if the contaminant levels are above the investigation threshold, the assessment will proceed to Stage 2 for detailed investigation etc.

OTHER USEFUL REFERENCES

The purpose of this guideline was to present a broad overview only and the following publications provide a more comprehensive covering of the subject. If you are undertaking a site assessment you should ensure that you are familiar with the sampling procedure, sample preservation and interpretation of results etc that is required for the particular contaminant/s under consideration.

- ANZECC & NHMRC 1992 *The Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites*
- Australian Standard AS4482.1 - 1997, *Guide to Sampling and Investigation of Potentially Contaminated Soil Part 1 Non-Volatile and Semi-Volatile Compounds*
- Contaminated Land Management Act 1997
- Department of Urban Affairs and Planning and Environmental Protection Agency 1998 *Managing Land Contamination: Planning Guidelines SEPP 55 - Remediation of Land*
- Environmental Protection Agency 1992 *Draft Environmental Guidelines for Cattle-Tick Dip Sites*
- Environmental Protection Agency 1994a *Contaminated Sites: Guidelines for Assessing Service Station Sites.*
- Environmental Protection Agency 1994b *Guideline for the Management of Material Containing Polychlorinated Biphenyls (PCBs) below 50 Milligrams per Kilogram*
- Environmental Protection Agency 1995a *Contaminated Sites: Sampling Design Guidelines*
- Environmental Protection Agency 1995b *Contaminated Sites: Guidelines for the Vertical Mixing of Soil on Former Broad-Acre Agricultural Land*
- Environmental Protection Agency 1997a *Guidelines for Assessing Banana Plantation Sites*
- Environmental Protection Agency 1997b *Guidelines for Consultants Reporting on Contaminated Sites*
- Environmental Protection Agency 1998a *Guidelines for the NSW Auditor Scheme*
- Environmental Protection Agency 1998b *Guidelines on Significant Risk of Harm from Contamination of the Land and the Duty to Report*
- National Environment Protection Council *National Environmental Protection Measure for the Assessment of Site Contamination - Impact Statement and Draft Guidelines 1-10.*
- State Environmental Planning Policy No 55 - Remediation of Land 1998
- NSW Agriculture and CMPS&F 1996 *Guidelines for the Assessment and cleanup of cattle tick dip sites for residential purposes, Wollongbar*

Appendix 1 – SAMPLE CHAIN OF CUSTODY FORM