SITE MANAGEMENT PLAN (SMP)

71 TRIG ROAD, WHENUAPAI, AUCKLAND

Reference Number: REP-J1525A/SMP/FEB21(REV1)

PREPARED FOR: NEIL CONSTRUCTION LIMITED

4 FEBRUARY 2021

REVISED 22 JULY 2021

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STATEMENT

This plan has been prepared in acknowledgement of the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011. It has been authorised by a suitably qualified and experienced practitioner (SQEP); and has been prepared with the intention of providing practices and procedures for the management of potentially contaminated land that meets the criteria of the NES, the MfE guidelines and the requirements of Neil Construction Ltd.'s development plans.

Report prepared on behalf of GSL by:	Report and authorised on behalf of GSL by:
David Wilkinson	Carl O'Brien
Environmental Scientist	General Manager
Geosciences Ltd	Geosciences Ltd

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1 INTRODUCTION

It is proposed to undertake a commercial / industrial subdivision and development of the piece of land located at 71 Trig Road. While earthworks plans are not available at the time of writing this draft site management plan (SMP), it is expected that site wide bulk earthworks will be required in order to prepare the site for the intended commercial / industrial landuse.

A detailed site investigation (DSI) conducted by Geosciences Ltd (GSL) and provided alongside this SMP, identified that a discrete portion of the site has been impacted to a minor degree through the potential storage of petroleum hydrocarbons, end of life farm machinery and vehicles. This site management plan has been prepared to address the requirements of the NES with relation to the disturbance of soil containing detectable hydrocarbons in a small, discrete portion of the site, and provides general earthworks controls to be in place for the duration of soil disturbance works on site.

This site management plan (SMP) has been prepared to provide earthworks practises to be in place for soil disturbance in order to ensure any risks to human and environmental health are managed to an acceptably low level. This SMP will be submitted to Auckland Council for approval prior to the commencement of earthworks on site.

2 PREVIOUS INVESTIGATIONS

GSL has undertaken the following investigations on the site:

2.1 PRELIMINARY SITE INVESTIGATION - FEBRUARY 2021

GSL undertook a preliminary site investigation (PSI) of the site in February 2021, the PSI identified the potential for activities included on the MfE HAIL to have been undertaken on site. Site conditions at the time of the investigation prevented the complete investigation of the site.

The PSI included a limited soil sampling regime including a composite soil sampling methodology across formerly cropped, market garden areas of the site. No composite soil sample returned detectable organochlorine pesticides (OCPs), and returned concentration of arsenic, copper, and lead within the expected naturally occurring background concentration ranges for non-volcanic soils in the Auckland Region. Two discrete soil samples collected adjacent to the barn, where disused and discarded above ground fuel storage tanks were noted amongst other general waste and end of life farm machinery returned elevated concentrations of cadmium, copper, and lead and detectable petroleum hydrocarbons.

The potential for hotspots within and around the barn was noted in the PSI, with the recommendation that further intrusive investigation be undertaken following site clearance works in order to assess any actual or potential risks to human health or the environment.

2.2 DETAILED SITE INVESTIGATION – JULY 2021

Following application for earthworks consent for the site preparatory earthworks, and a request for information from Auckland Council, GSL were engaged to undertake a detailed site investigation based on the recommendations of the PSI and the previous iteration of this SMP.

The DSI included the collection of 16 discrete soil samples from in and around the barn on site where refuse, horticultural packing materials, farm machinery and vehicles have been stored. Soil samples were analysed for a suite of heavy metals, organochlorine pesticides (OCPs), polycyclic aromatic hydrocarbons (PAHs), total petroleum hydrocarbons (TPH) and presence / absence of asbestos as required based on visual observations.

Analysis of the soil samples revealed:

- no soil sample returned concentrations of any contaminant of concern in excess of the NES commercial / industrial SCS;
- one soil sample returned an apparent exceedance of the AUP(OP) permitted activity soil acceptance criteria for zinc, however, this is shown to be a statistical outlier and the concentration of zinc across the investigation area is shown with 95% confidence to not exceed 161.6 mg/kg which falls within the expected naturally occurring background concentration range for non-volcanic soil in the Auckland Region;
- two soil samples from within the barn returned detectable concentrations of petroleum hydrocarbons, while two soil samples to the north of the barn returned detectable traces of OCPs (endrin and endosulfan), these are considered to be indistinguishable from the laboratory limit of reporting and are disregarded;
- detectable traces of PAH compounds one soil sample, however given these concentrations fall on or marginally above the laboratory reporting limit, they are considered to be a result of potential interference from organic matter in the soil matrix;
- statistical analysis of the soil sampling data indicates with 95% confidence that concentrations of heavy metals fall within the expected naturally occurring background concentration ranges for non-volcanic soil in the Auckland Region.

It was concluded that the proposed subdivision, change in landuse and development were highly unlikely to result in any risk to human or environmental health. As a result the change in landuse and subdivision of the site are considered to meet the permitted activity requirements of the NES. While a small discrete area was identified in and around the barn where concentrations of TPH were noted, the volume of soil disturbance proposed for bulk earthworks is likely to prevent the activity from being completed and the site re-stabilised with the timeframe allowed by Regulation 8(3) of the NES as a permitted activity. Consequently, it was concluded that a controlled activity consent is required for the earthworks only.

As no soil sample returned concentrations of contaminants in excess of the NES or AUP(OP) criteria it was concluded that all soil may remain on site, however, should any soil from within the area indicated on Figure 2 be removed from site, it was concluded that this soil would not meet the definition of cleanfill.

3 STATUTORY REQUIREMENTS

As a result of the findings of the PSI and DSI, and in order to ensure any risks to human or environmental health or the environment are managed to an acceptably low level, this site management plan is required that will provide practises and procedures to be followed during the earthworks to ensure the protection of human and environmental health and to ensure that any

impacted soil from the area shown on Figure 2 site is appropriately handled and, if required, appropriately disposed of at a suitably licensed facility.

This SMP has been prepared to address the controlled activity requirements of Regulation 9 of the NES and provides the controls to be in place and effective for the duration of soil disturbance activities on site commensurate to the low level of risk involved with the disturbance of soil of the quality identified in the DSI.

4 SITE MANAGEMENT PLAN

The practises and procedures in this plan are intended to ensure that health, safety and environmental risks associated with the proposed earthworks activities at 71 Trig Road are managed to an acceptably low level. It is not intended that this SMP should replace the contractor's site-specific health and safety plan or earthworks and sediment control plan but should be enacted in conjunction with these documents.

4.1 RESPONSIBILITIES AND SITE MANAGEMENT

Neil Construction Ltd.'s appointed earthworks contractor will assign a 'site manager' to the project that will be responsible for the implementation of this SMP, pending its acceptance by the Council Consents Team, for the proposed works at the site. The site manager will be responsible for liaising with a multitude of consultants during the works to ensure that numerous facets of risk management are achieved.

4.2 ENGAGEMENT OF CONTAMINATED LAND ADVISOR

GSL will act as Contaminated Land Advisor (CLA) and will provide on-call direction in relation to contamination / disposal issues for the project. GSL are a professional advisor, suitably qualified and experienced in the investigation, reporting, remediation, and validation of contaminated land.

GSL's main functions as CLA are to:

- Assist in inspecting / screening potentially contaminated material;
- Assess the effectiveness of environmental control measures;
- Manage the collection and analysis of any soil samples (if required) in accordance with the Ministry for the Environment's (MfE) Contaminated Land Management Guideline No 1, (Reference 5);
- Provide assessments of the investigation;
- Make recommendations based on findings; and
- Maintain regular liaison with the authorities if necessary.

4.3 BRIEFING SESSIONS

The site manager is to commission a briefing session for relevant staff and subcontractors prior to the commencement of works. The briefing session will include as a minimum:

- Known areas of impacted soil material;
- Appropriate PPE and safety measures;
- Familiarisation with the requirements of the SMP;
- Guidance for identifying contaminated material as works progress (Appendix B); and
- Procedures to be followed should contaminated material be encountered (Appendix B).

4.4 HEALTH AND SAFETY PROCEDURES

While this SMP provides steps that are required because of the detectable concentrations of THP and OCPs identified during the DSI, the earthworks contractor is ultimately responsible for the H&S procedures related to the earthworks.

As no soil sample returned concentrations of any contaminants of concern in excess of the NES soil contaminant standard for site workers, the disturbance of soil in and around the barn is considered highly unlikely to present a risk to the health of workers on the site. However, it is important to ensure that conservative controls and procedures are in place to ensure that any unnecessary exposure of personnel to impacted soil occurs. The primary methods of protection will be to minimise any direct contact with soil by personnel through the use of mechanical excavation methods and appropriate dust controls. Potential environmental impacts will be mitigated through appropriate erosion and sediment control measures.

That said, inhalation and ingestion are generally the most important exposure pathways related to airborne contaminants in dust, while direct contact with skin or eyes provide a secondary route of entry.

The Health and Safety Guidelines on the Clean-up of Contaminated Sites developed by Occupational Safety and Health Services (OSH) provides reference to appropriate H&S measures that can be adopted for contaminated sites. A copy of this guideline can be provided on request.

4.5 PERSONAL PROTECTIVE EQUIPMENT

The minimum Personal Protective Equipment (PPE) which should be available on-site will be in accordance with the contractor's specific health and safety plan. While the DSI indicates that the soil on site is highly unlikely to present a risk to the health of site workers, and no specific PPE is necessary, the contractor may wish to provide the following PPE:

- Protective leather or rubber gloves
- Safety glasses
- Dust masks

The site manager will use his discretion with regard to the use of the additional PPE and might call on the CLA for advice on this matter.

5 GENERAL EARTHWORKS METHODOLOGY

While the findings of the DSI show that no specific remedial works are required on site, and that all soil onsite is suitable to remain on site should earthworks plans allow, should disturbance activities be undertaken in the following area (Figure 2), the procedures in this section must be adhered to.

The following extent of soil is considered to be of managed fill quality:

1. Area north of barn encompassing barn footprint with low level hydrocarbon and OCP impacts:

   Area: 88 m^2

   Depth: 300 mm

   Volume: 36.4 m^3

   Tonnage: approx. 42 tonnes

   (1.6 tonnes / m^3, actual conversion factor may vary depending on soil moisture and bulking factors)

All soil on stie from outside of the above area is considered to meet the AUP(OP) definition of cleanfill material and can be treated as such.

Prior to the commencement of any remedial works commencing, the extent of the managed fill area above will be marked out in the field using fluorescent paint or marker pegs to clearly demarcate their extents. As the soil within the managed fill area does not present a risk to human of environmental health there is no reason the soil cannot be retained on site and utilised in landscaping or as top cover, however, if removed from site it must be disposed of at a suitably licensed facility.

The following steps will generally be followed:

- access and haul roads will be established to facilitate access to the managed fill area;
- erosion and sediment control measures will be installed in accordance with the earthworks contractors specific erosion and sediment control plan, and will be in accordance with Auckland Council Guidance Document GD05 "*Erosion and Sediment Control Guide for Land Disturbing Activities in the Auckland Region*";
- the site manager will arrange for disposal of all excess soil prior to works commencing to a facility licensed to accept material as defined by intrusive investigations;
- trucks hauling managed fill will be covered prior to leaving the site and the site manager will be responsible for overseeing loadout to ensure that no debris will be discharged during transport on public roads;
- An area on site will be prepared for the temporarily stockpiling of material of suspicious nature that might be encountered during the earthworks;
- Temporary stockpiles will be managed (kept damp) to ensure that there is no excess dust generated from the stockpiles;
- Silt fencing will be placed around the temporary stockpiles to ensure that there is no excess sediment run-off from the stockpiles;

- The CLA will be notified and inspect any suspicious or noxious material that might be encountered during the earthworks. If necessary, the CLA will take soil samples for analysis of any foreign material that is discovered. The CLA will advise on the disposal of any such material;
- Upon completion of the excavation the site manager shall ensure that plant and equipment are cleaned and decontaminated appropriately; and
- A landfill manifest or weigh bridge dockets of all material disposed of at a managed fill or landfill facility will be kept;

5.1 DUST CONTROL

Dust controls are required to minimise pollutants becoming airborne and reduce stormwater sediment loads. If the proposed earthworks are undertaken in dry conditions, dust can be controlled by light frequent water spraying. Water spraying should be frequent enough to suppress the generation of dust but not as heavy as to generate sediment laden water run-off.

The site manager will use his discretion with regard to dust suppression and will be ultimately responsible for ensuring the control of dust during earthworks on site

6 CONTINGENCIES

In the event that other contamination is encountered on the site during the works, the site manager, in consultation with the CLA, will either:

- Identify the material in situ if possible (staining, odour, visible fibres or refuse etc.); or
- Excavate the material to a suitable leak proof and covered skip-bin or truck and take representative samples for analysis, placing the material on hold for appropriate disposal; or
- Halt excavations in the immediate vicinity of the discovery while the material is sampled in-situ, and removal / disposal options explored once the analytical results are returned.

An appropriate log will be kept by the site manager of any unidentified contamination encountered during the excavations.

GSL has produced a contaminated soil discovery guideline (CSDG) document that outlines the signs, risks, and remedial actions required for contamination scenarios that may be encountered during remedial earthworks (Appendix B).

Suspicious material will be investigated by the CLA and laboratory analysed if deemed necessary. The CLA will advise on the disposal options of any uncertain materials. Disposal options can include:

- remove to an appropriate temporary stockpile area for further testing and analysis; or
- disposal at a cleanfill, managed fill or landfill facility.

The appointed contractor might have their own discovery procedures based upon their specific experiences in working with contaminated land of various natures (urban to rural). Contractor specific documents may be used alongside or in conjunction with this SMP.

If any staff, contractors, or consultants discover contamination, they should notify the site manager immediately, who should enact the provisions of the plan.

6.1 FIBROUS MATERIAL (ASBESTOS)

It is not anticipated that any asbestos materials will be encountered on the site. However, where asbestos containing materials (ACM) are identified in the soil matrix, all works shall cease (including the excavation and disposal of affected materials) until the provisions of the *Health and Safety at Work (Asbestos) Regulations* are exercised.

ACM identification will primarily be through visual identification by a suitably competent person. Any fibrous material observed during excavations will be visually inspected, photographed and representative sample submitted to an accredited laboratory for analysis. Following receipt of results, the site manager in conjunction with the CLA shall determine what, if any, further remedial steps may be required, including the provisions of asbestos removal control plans, semi-quantitative analysis, or site assessment under the WokSafe endorsed *BRANZ New Zealand Guidelines for Assessing and Managing Asbestos in Soils* (November 2017).

7 REPORTING AND RECORD KEEPING

At completion of the earthworks, the site manager shall provide a report to Neil Construction Ltd that shall include records of the:

- volume and nature of any material removed from site and all managed fill / landfill disposal dockets;
- a log of any unknown or suspicious materials encountered during the earthworks;
- laboratory transcripts, if any;
- any complaints or incidents; and
- site photographs of all excavations and re-instatement works.

7.1 SITE CLOSURE REPORT

Upon completion of the works, a site closure report (SCR) will be completed and provided to Auckland Council. The SCR will include:

- The quantity of soil material removed from site, including copies of the disposal manifests;
- A description of any unforeseen contaminated soil material encountered during the remedial works;
- Laboratory analytical results from any soil testing that occurred during the remedial works; and
- Any incidences or complaints that occurred during the earthworks.

8 REFERENCES

1. Ministry for the Environment (2011) - Draft Users Guide National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health. Ministry for the Environment, Wellington, New Zealand.
2. Ministry for the Environment (2011) – *Methodology for Deriving Standards for contaminants in Soil to Protect Human Health.* Ministry for the Environment, Wellington, New Zealand.
3. Ministry for the Environment (2011) — *Contaminated Land Management Guidelines No.1: Reporting on contaminated Sites in New Zealand*. Ministry for the Environment, Wellington, New Zealand.
4. Ministry for the Environment (2003) — *Contaminated Land Management Guidelines No.5: Site Investigation and Analysis of Soils*. Ministry for the Environment, Wellington, New Zealand.
5. Department of Labour (1999) — *Health and Safety Guidelines on the Cleanup of Contaminated Sites.* Occupational Safety and Health Services. Department of Labour. Wellington. ISBN 0-477-03546-9.

FIGURES

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Figure 1 - Site Locality

71 Trig Road, Whenuapai

Reference:	J1525
Date:	21/09/2020
Drawn:	DW
Approved:	COB

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Figure 2 - Managed Fill Extent

71 Trig Road, Whenuapai

Reference:	J1525b
Date:	21/07/2021
Drawn:	DW
Approved:	COB

APPENDIX A: PREVIOUS INVESTIGATION

EXECUTIVE SUMMARY

Neil Construction Limited propose to develop the piece of land located at 71 Trig Road through the change in landuse from rural production / vacant rural land to commercial / industrial landuse, the subdivision of the title creating new commercial lots, and site preparatory earthworks involving the disturbance of 51,500 m^3 of soil across the sites 6.7 Ha area.

Geosciences Ltd (GSL) previously conducted a preliminary site investigation on site which identified a portion of the property which was considered to be potentially contaminated as a result of the storage of refuse, horticultural packing materials, and end of life farm machinery, vehicles and above ground fuel storage tanks. A site management plan was provided alongside the PSI which documented the required intrusive investigation of the area following the clearance of the above materials. Following application for earthworks consent, Auckland Council requested that a detailed site investigation be undertaken in order to confirm the activity status of the development under the NES and the associated risks to human and environmental health as a result of the disturbance of soil on the potentially contaminated area. This DSI has been prepared to meet the requirements of Auckland Councils request for information and the requirements of the *National Environmental Standards for Assessing and Managing Contaminants in Soil to Protect Human Health* (NES) and Chapter E.30 of the *Auckland Unitary Plan (Operative in Part)* (AUP(OP)).

This DSI involved the collection of 16 discrete soil samples from in and around the barn on site where refuse, horticultural packing materials, farm machinery and vehicles have been stored to supplement the findings of previous investigations. Soil samples were analysed for a suite of heavy metals, organochlorine pesticides (OCPs), polycyclic aromatic hydrocarbons (PAHs), total petroleum hydrocarbons (TPH) and presence / absence of asbestos as required based on visual observations.

Analysis of the soil samples revealed:

- no soil sample returned concentrations of any contaminant of concern in excess of the NES commercial / industrial SCS;
- one soil sample returned an apparent exceedance of the AUP(OP) permitted activity soil acceptance criteria for zinc, however, this is shown to be a statistical outlier and the concentration of zinc across the investigation area is shown with 95% confidence to not exceed 161.6 mg/kg which falls within the expected naturally occurring background concentration range for non-volcanic soil in the Auckland Region;
- two soil samples from within the barn returned detectable concentrations of petroleum hydrocarbons, while two soil samples to the north of the barn returned detectable traces of OCPs (endrin and endosulfan);
- detectable traces of PAH compounds in one soil sample, however given these concentrations fall on or marginally above the laboratory reporting limit, they are considered to be a result of potential interference from organic matter in the soil matrix;
- statistical analysis of the soil sampling data indicates with 95% confidence that concentrations of heavy metals fall within the expected naturally occurring background concentration ranges for non-volcanic soil in the Auckland Region

It is concluded that the proposed change in landuse, subdivision, and development of the site area highly unlikely to result in any risk to human health or the environment. As a result, the proposed change in landuse and development of the site can be undertaken as a permitted activity under Regulation 8(4) of the NES. With respect to soil disturbance activities, while these concentrations are trace only and the proposed development is highly unlikely to result in any risk to human or environmental health, soil disturbance is unlikely to be able to comply with all aspects of Regulation 8(3). Consequently, soil disturbance will likely trigger Regulation 9 of the NES.

As no soil sample returned concentrations of any contaminant of concern above the AUP(OP) permitted activity soil acceptance criteria, the provisions of Chapter E.30 are not considered to be applicable to the proposed development and no further work, with respect to Chapter E.30 of the AUP(OP) is required.

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Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand (Petroleum Guidelines).

The soil sampling plan from the investigation is provided in Figure 2, while tabulated analytical results of this investigation are attached in Table 1 below.

Table 1: February 2021 Analytical Results[1]

	Arsenic	Cadmium	Chromium	Copper	Lead	Nickel	Zinc	C15-C36[5]
SS1	5.1	**0.830**	12.7	**52.5**	19.3	8.91	**211**	**123**
SS2	12	0.43	24.0	**146**	**128**	22.4	165	<50
SC1	1.1	-	-	6.5	6.12	-	-	-
SC2	1.4	-	-	8.12	5.29	-	-	-
SC3	2.7	-	-	9.33	10.3	-	-	-
NES[2]	70	1,300	6,300	>10,000	3,300	NL	NL	NA[6,7]
AUP(OP)[3]	100	7.5	400	352	250	325	250	NA[7,8]
Background[4]	0.4-12	<0.1-0.65	2-55	1-45	<5-65	0.9-35	9-180	ND

Notes:

1. All concentrations measured in mg/kg
2. National Environmental Standards for Assessing and Managing Contaminants in Soil to Protect Human Health – commercial / industrial outdoor worker (unpaved)
3. Auckland Unitary Plan (Operative in Part) - Table E.30.6.1.4.1 Permitted activity soil acceptance criteria
4. Auckland Regional Council Technical Publication No. 153 - Expected naturally occurring background concentration ranges for non-volcanic soils in the Auckland region
5. No detection in the <C15 chain length hydrocarbons
6. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand – Tier 1 soil acceptance criteria for TPH (C15-C36) commercial / industrial use all pathways for silty clay surface (<1m) soil
7. NA indicates the estimated criterion exceeds 20,000 mg/kg. at 20,000 mg/kg residual sperate phase is expected to have formed in the soil matrix
8. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminates Sites in New Zealand – Soil acceptance criteria for protection of groundwater, silty clay surface soils GW depth 2m
9. Values in **BOLD** exceed the NES criteria, values in **BOLD** exceed the AUP(OP) criteria, values in **BOLD** exceed the Background ranges
10. ND = not detected / NL = no limit

The PSI concluded that the soil on the wider site area was highly unlikely to present a risk to human or environmental health as a result of the proposed development. However, as a result of the detection of hydrocarbons an elevated heavy metal concentrations around the barn the regulations of the NES would be applicable to the proposed development of the site and recommended that further investigation of the area surrounding the barn was required in order to establish the level or risk involved and to provide a full assessment of the activity status under the NES and AUP(OP).

Table 2: July 2021 Heavy Metal Analytical Results[1]

	Arsenic	Cadmium	Chromium	Copper	Lead	Nickel	Zinc
DS1	8.7	0.17	16	13	22	10	57
DS2	4.5	0.37	10	25	16	6.8	81
DS3	6.2	0.29	12	20	19	6.3	120
DS4	4.6	0.13	10	11	14	6.5	34
DS5	11	**1.6**	12	26	28	9.8	64
DS6	3.8	0.22	7.4	6.7	11	4.0	21
DS7	7.5	0.12	12	19	22	7.8	54
DS8	6.7	0.40	9.2	13	18	8.8	140
DS9	-	-	-	-	47	-	-
DS10	7.6	0.52	11	16	34	5.0	**490**
DS11	11	0.14	14	11	22	9.3	89
DS12	2.1	0.23	6.2	4.5	7.3	2.8	14
DS13	1.7	0.09	5.1	14	7.2	3.2	27
DS14	2.8	0.29	6.9	8.4	18	3.8	35
DS15	-	-	-	-	45	-	-
DS16	-	-	-	-	34	-	-
NES	70	1,300	6,300	>10,000	3,300	NL	NL
AUP(OP)	100	7.5	400	325	250	105	400
Background	0.7-12	<0.1-0.65	2-55	1-45	<5-65	0.9-35	9-180

Notes:

1. All concentrations measured in mg/kg
2. National Environmental Standards for Assessing and Managing Contaminants in Soil to Protect Human Health – commercial / industrial outdoor worker (unpaved)
3. Auckland Unitary Plan (Operative in Part) - Table E.30.6.1.4.1 Permitted activity soil acceptance criteria
4. Auckland Regional Council Technical Publication No. 153 - Expected naturally occurring background concentration ranges for non-volcanic soils in the Auckland region
5. Values in **BOLD** exceed the NES criteria, values in **BOLD** exceed the AUP(OP) criteria, values in **BOLD** exceed the Background ranges
6. ND = not detected / NL = no limit

Table 3: July 2021 Organic Compounds Analytical Results[1]

	C15-C36[5]	Flouranthene	Pyrene	Endrin	Endosulfan
DS1	<20	<0.03	<0.03	<0.01	<0.01
DS2	**61**	<0.03	<0.03	<0.01	<0.01
DS3	<20	<0.03	<0.03	**0.02**	<0.01
DS4	-	<0.03	<0.03	<0.01	<0.01
DS5	-	<0.03	<0.03	<0.01	**0.01**
DS6	-	<0.03	<0.03	<0.01	<0.01
DS7	<20	<0.03	<0.03	<0.01	<0.01
DS8	<20	<0.03	<0.03	<0.01	<0.01
DS9	-	<0.03	<0.03	<0.01	<0.01
DS10	-	<0.03	<0.03	<0.01	<0.01
DS11	-	<0.03	<0.03	<0.01	<0.01
DS12	-	**0.04**	**0.04**	<0.01	<0.01
DS13	-	<0.03	<0.03	<0.01	<0.01
DS14	-	<0.03	<0.03	<0.01	<0.01
NES[2]	NA[6,7]	82,000[9]	NA[7]	340[10]	6,800[10]
AUP(OP)[3]	NA[7,8]	210[11]	1.3	0.05[11]	0.9[11]
Background[4]	ND	ND	ND	ND	ND

Notes:

1. All concentrations measured in mg/kg
2. National Environmental Standards for Assessing and Managing Contaminants in Soil to Protect Human Health – commercial / industrial outdoor worker (unpaved)
3. Auckland Unitary Plan (Operative in Part) - Table E.30.6.1.4.1 Permitted activity soil acceptance criteria
4. Auckland Regional Council Technical Publication No. 153 - Expected naturally occurring background concentration ranges for non-volcanic soils in the Auckland region
5. No detection in the <C15 chain length hydrocarbons
6. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand – Tier 1 soil acceptance criteria for TPH (C15-C36) commercial / industrial use all pathways for silty clay surface (<1m) soil
7. NA indicates the estimated criterion exceeds 20,000 mg/kg. at 20,000 mg/kg residual sperate phase is expected to have formed in the soil matrix
8. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminates Sites in New Zealand – Soil acceptance criteria for protection of groundwater, silty clay surface soils GW depth 2m
9. Supplemental Guidance for Developing Soil Screening Levels at Superfund Sites (US EPA) – Commercial / industrial landuse, ingestion-dermal pathway indoor worker receptor
10. Supplemental Guidance for Developing Soi Screening Levels at Superfund Sites (US EPA) – Soil screening levels outdoor worker receptor ingestion-dermal pathway
11. Supplemental Guidance for Developing Soi Screening Levels at Superfund Sites (US EPA) – Soil screening level, migration to groundwater, dilution factor = 1

12. Values in **BOLD** exceed the NES criteria, values in **BOLD** exceed the AUP(OP) criteria, values in **BOLD** exceed the Background ranges
13. ND = not detected / NL = no limit

10.1 HEAVY METALS

No soil sample returned concentrations of heavy metals in excess of the NES commercial / industrial SCS. Only soil sample DS10 returned a concentration of zinc which marginally exceeds the AUP(OP) permitted activity soil acceptance criteria.

Soil sample DS5 returned a concentration of cadmium which exceeds the expected naturally occurring background concentration range.

All other soil samples returned concentrations of heavy metals within the expected naturally occurring background concentration ranges for non-volcanic soil in the Auckland Region.

Statistical analysis through the 95% Upper Confidence Limit Calculations in accordance with CLMG No. 5 is included in Section 10.6.

10.2 ORGANOCHLORINE PESTICIDES (OCPS)

No soil sample returned concentrations of any OCPs above the NES commercial / industrial SCS or the AUP(OP) permitted activity soil acceptance criteria.

Soil samples DS2 and DS5 returned trace detections of endrin (0.02 mg/kg) and endosulfan (0.01 mg/kg)respectively, both of the returned concentrations are marginally above the laboratory reporting limits and well within the applicable human health and environmental protection criteria. As the detections fall on or marginally above the laboratory limit of reporting and are within the laboratory error margins, these detections are considered to be indistinguishable from the limit of reporting and are therefore considered to be inconsequential and are disregarded.

No other soil returned detectable concentrations of OCPs at the laboratory limits of reporting.

10.3 POLYCYCLIC AROMATIC HYDROCARBONS (PAHS)

No soil sample returned detections of PAHs in excess of the NES commercial / industrial SCS or the AUP(OP) permitted activity soil acceptance criteria.

Only soil sample DS12 returned detectable traces of non-carcinogenic PAHs fluoranthene and pyrene which fall well within the landuse criteria, and only marginally above the laboratory detection limits. For the same reasons as the OCP detections described in Section 10.2 above, and given the high organic content of the soil, and as DS12 was located outside of the refuse / packing materials area, it is considered highly likely that these detections are as a result of organic interference in the soil matrix and are indistinguishable from the limit of reporting. These detections can therefore be considered to be erroneous.

10.4 TOTAL PETROLEUM HYDROCARBONS (TPHS)

No soil sample returned detections of TPH above the Petroleum Guidelines criteria for the protection of human health or groundwater. Soil sample DS2 from within the barn returned a trace detection (61 mg/kg) of long chain (C15-C36) hydrocarbons which falls well within the Petroleum Guidelines criteria.

10.5 ASBESTOS

No soil sample submitted for the analysis of asbestos returned detectable asbestos fibres or respirable fibres at the laboratory limit of reporting.

10.6 95% UPPER CONFIDENCE LIMIT CALCULATIONS

The 95% Upper Confidence Limit (95% UCL) is used where a statistically designed sampling regime is employed in order to be representative of the actual environmental conditions on site. GSL utilised a judgemental grid based soil sampling regime across the area, given the broadly systematic approach utilised (noting that a grid based approach was modified on site due to the concrete surface), the 95% UCL method is therefore an appropriate statistical approach.

Statistical analysis of the analytical results confirms a normal distribution of contaminants in the surface soil horizons. Consequently, the use of the 95% UCL is justified as the method calculates the mean concentration plus or minus the confidence limit, in this case indicating that there is only a 5% probability that concentrations will exceed the calculated arithmetic mean concentration described below.

Copies of the 95% UCL calculation sheets for the elements below are included as Appendix D.

10.6.1 95% UCL - ZINC

The calculated 95% UCL average concentration for zinc in the area of the investigation, is **161.594** mg/kg indicating with 95% confidence that the concentration of zinc in the topsoil across this area will not exceed that value. As a result, it is noted that the apparent DS10 zinc exceedance is a statistical outlier and can be disregarded.

The concentration of zinc in the topsoil horizon across the investigation area is considered to be within the expected naturally occurring background concentration range for non-volcanic soil in the Auckland Region.

10.6.2 95% UCL - CADMIUM

The calculated 95% UCL average concentration for cadmium in the investigation area is **0.56** mg/kg indicating with 95% confidence that the cadmium concentration in the topsoil will not exceed this value.

The cadmium concentrations in the area of investigation are considered to be within the expected naturally occurring background concentration range for non-volcanic soil in the Auckland Region.

10.6.3 95% UCL - COPPER

The calculated 95% UCL average concentration for copper in the investigation area is **41.92** mg/kg indicating with 95% confidence that the cadmium concentration in the topsoil will not exceed this value.

The copper concentrations in the area of investigation are considered to be within the expected naturally occurring background concentration range for non-volcanic soil in the Auckland Region

10.6.4 95% UCL - LEAD

The calculated 95% UCL average concentration for lead in the investigation area is **39.63** mg/kg indicating with 95% confidence that the cadmium concentration in the topsoil will not exceed this value.

The lead concentrations in the area of investigation are considered to be within the expected naturally occurring background concentration range for non-volcanic soil in the Auckland Region

11 CONCLUSIONS

GSL conducted a detailed site investigation on a portion of the piece of land at 71 Trig Road Whenuapai previously identified as potentially contaminated as a result of the storage of horticultural packing materials, refuse, disused fuel tanks and machinery. The DSI included the collection of 16 discrete surface soil samples on a judgemental, grid based soil sampling regime around the identified area with a judgemental bias towards sampling at the margins of a residual concrete slab adjacent to the barn and surrounding the immediate curtilage of the barn.

Soil samples were analysed for heavy metals, OCPs, PAHs, and TPH or asbestos as appropriate, analysis of the results revealed:

- no soil sample returned concentrations of any contaminant of concern in excess of the NES commercial / industrial SCS, or any other SCS threshold;
- one soil sample returned an apparent exceedance of the AUP(OP) permitted activity soil acceptance criteria for zinc, however, this is shown to be a statistical outlier and the concentration of zinc across the investigation area is shown with 95% confidence to not exceed 161.6 mg/kg which falls within the expected naturally occurring background concentration range for non-volcanic soil in the Auckland Region;
- two soil samples from within the barn returned detectable concentrations of petroleum hydrocarbons;
- detectable traces of PAH compounds one soil sample and OCPs in two soil samples, however given these concentrations fall on or marginally above the laboratory reporting limit, they are considered to be indistinguishable from the limit of reporting and a result of potential interference from organic matter in the soil matrix;
- statistical analysis of the soil sampling data indicates with 95% confidence that concentrations of heavy metals fall within the expected naturally occurring background concentration ranges for non-volcanic soil in the Auckland Region

- It is concluded that the proposed change in landuse, subdivision, and development are highly unlikely to result in any risk to human or environmental health.

11.1 NATIONAL ENVIRONMENTAL STANDARDS

Due to the low-level detection of petroleum hydrocarbons with the footprint of the barn, where vehicles and machinery have historically been stored, the regulations of the NES will be applicable to the proposed change in landuse, subdivision, and development. While these concentrations are trace only and the proposed development is highly unlikely to result in any risk to human or environmental health, soil disturbance is unlikely to be able to comply with all aspects of Regulation 8(3). Consequently, soil disturbance will likely trigger Regulation 9 of the NES. Should Neil Construction Ltd wish to address matters in an alternative manner, the location and extent of hydrocarbon impacted soil could be removed from site and disposed under the permitted activity rules prior to any site wide earthworks commencing. To achieve this, stabilisation and separation between two earthworks phases would be required.

GSL notes that any future change in landuse and subdivision aspects of the proposed development can be undertaken as a permitted activity under Regulation 8(4) of the NES.

A revised version of the SMP has been provided alongside this DSI for submission to Auckland Council for approval and in order to address the request for information under Section 92 of the RMA.

11.2 AUCKLAND UNITARY PLAN (OPERATIVE IN PART)

As statistical analysis of the soil sampling data has indicated that no concentrations of any contaminants are above the AUP(OP) permitted activity soil acceptance criteria, the piece of land does not meet the AUP(OP) definition of *"land containing elevated levels of contaminants"*. As a result, the provisions of Chapter E.30 of the AUP(OP) will not be applicable to the proposed change in landuse, subdivision, or development of the piece of land.

12 ASSESSMENT OF SOIL QUALITY

As documented in Section 10 above, statistical analysis of the soil sampling data indicates with 95% confidence that heavy metal concentrations fall within the expected naturally occurring background concentration ranges for non-volcanic soils in the Auckland Region. While trace detections of noncarcinogenic PAH compounds were returned in one soil sample, it is noted that these concentrations can potentially be attributed to organic interference in the soil matrix as a result of the peat content of the soil and / or breakdown of vegetation underlying the packing materials. Additionally, the process of excavation and loading of this soil will likely dilute those concentrations to a level of non-detection and therefore full compliance with the cleanfill definition.

As a result, GSL considers that outside of the area impacted by low level hydrocarbons and OCPs contained the barn and a small area to the north, the soil across the site is consistent with the AUP(OP) definition of cleanfill and can be disposed of as such.

The following extent of soil is considered to be of managed fill quality (Figure 5):

1. Area north of barn encompassing barn footprint with low level hydrocarbon and OCP impacts:

   Area: 88 m^2

   Depth: 300 mm

   Volume: 26.4 m^3

   Tonnage: approx. 42 tonnes (1.6 tonnes / m^3, actual conversion may vary)

GSL notes that all soil is suitable to remain on site if development and earthworks plans allow for the use of soil as cut to fill and top cover.

Depending on earthworks requirements GSL notes that any disposal of topsoil from across the site should in the first instance be biased toward the offsite disposal of cleanfill from across the full extent of the property in order to minimise disposal costs for controlled disposal of the non cleanfill area.

APPENDIX B: CONTAMINATED SOIL DISCOVERY GUIDELINES

CONTAMINATED SOIL DISCOVERY GUIDELINES (CSDG)

Reference Number: GSL/CSDG

Geosciences Limited
47 Clyde Road, Browns Bay, Auckland
PO Box 35-366, Browns Bay, Auckland
(09) 475 0222
info@geosciences.co.nz www.geosciences.co.nz

DISCLAIMER

These guidelines are provided on the condition that Geosciences Ltd disclaims all liability to any person or entity in respect of anything done or omitted to be done and of the consequence of anything done or omitted to be done by any such person in reliance, whether in whole or in part, on the contents of these guidelines. Furthermore, Geosciences Ltd disclaims all liability in respect of anything done or omitted to be done and of the consequence of anything done or omitted to be done by any such person in reliance, whether in whole or any part of the contents of these guidelines of all matters not explicitly stated within the guidelines and according to our general terms and conditions and special terms and conditions for contaminated sites.

STATEMENT

These guidelines have been prepared in acknowledgement of the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011. They have been authorised by a suitably qualified and experienced practitioner (SQEP); and have been prepared with the intention of providing practices and procedures for the management of potentially contaminated land which meets the criteria of the NES and the MfE guidelines.

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Reviewed and authorised on behalf of GSL by:

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1 INTRODUCTION

Contaminated land can be defined as, '*any land that has been adversely affected through the impact of human activity that has resulted in a significant alteration to the chemical, inorganic or organic characteristics of the naturally occurring soil material of the land'*.

Such a definition leaves a broad spectrum of potential physico-chemical characteristics which may apply. It is not the purpose of these guidelines to attempt to define all of the possible activities, characteristics, processes, or chemical compounds which may have an adverse impact upon naturally occurring soil material.

However, in the current field of contaminated soil investigation, disturbance, remediation and validation, and within the context of the *National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health* (NES) there are situations that may be uncovered, or may present themselves in other ways, where the impact of man-made activities are both hazardous, in terms of human risk, and significant, in terms of environmental risk.

It should be noted that not all hazardous and significant contamination sources can be discerned by the eye, the ear or the nose and that any suspected occurrence of soil contamination should be scientifically investigated through the most appropriate means available.

It is hoped that this document can provide some additional guidance, examples, and discussion points around the investigation and assessment of particularly 'gross' or visually, olfactory and auditory significant contamination events, sources or plumes. It should not be taken that this document can replace suitable qualifications and experience, but rather can be used as general guide to the field practical methods used to immediately assess, prepare, and undertake the safe handling and immediate containment or excavation of contaminated soil materials.

2 PURPOSE

The practices and procedures in this report are intended to provide a field-practical process for the identification, assessment and management of grossly contaminated soil that may be encountered during earth breaking activities or other sub surface soil disturbance. These processes are intended to provide guidance on health, safety and environmental risks and risk management associated with earth breaking activities when gross evidence of contamination is encountered.

The practices and procedures outlined provide for first layer risk control and are one of many stages in the applicable health, safety and environmental risk management process. It is not intended to replace site specific health and safety plans, nor can it provide for every possible eventuality encountered in the field and cannot be reasonably expected to replace significant relevant on-the-job experience.

The *Health and Safety Guidelines on the Clean-up of Contaminated Sites* developed by Occupational Safety and Health Services (OSH) provides reference to appropriate H&S measures that can be adopted for contaminated sites and this is a key reference document when dealing with contaminated materials. These guidelines do not intend to replace the

guidance provided in that document and, if in doubt, it is the more preferable guidance document on provisions for Health and Safety when operating on contaminated soil sites.

3 INADVERTENT DISCOVERY OF CONTAMINATION

It is assumed that a site which has already been identified as 'contaminated' has been assessed with respect of the inorganic or organic characteristics which exceed the applicable criteria or threshold values as defined by the relevant legislation, rules, or plans. Identified contaminated sites will therefore already have appropriate protocols in place for the ongoing assessment, investigation, remediation and validation of the areas that have been defined as contaminated and have plans and procedures in place to protect both human health and the environment.

It still remains possible however, that unknown, unidentified or even identified but under-estimated, contamination may exist on such a site, or on a supposed 'non-contaminated' site. Such unknown contamination may be encountered as underground lenses (conglomerates of contamination in a localised zone), layers (widespread zone of contamination occurring along a stratified zone), hotspots (individual occurrences in a single location not otherwise connected), columns (vertical bands of contamination) or a plume (a zone of contamination moving along or through an aquifer / underground flow path and usually associated with seasonal or permanent groundwater flow).

In the event that 'unknown contamination' is encountered then it is advisable to have available some form of reference documentation that can provide insight to the frontline staff on the immediate signs, symptoms and actions that should be identified, assessed or considered while further advice is sought.

In all events encountering unknown soil contamination, a suitably qualified and experienced practitioner (SQEP) should be contacted for further advice, assessment and investigation.

4 GENERAL PROCEDURES

Below is a summarized guide of applicable steps which should be considered if any grossly contaminated material is encountered. The contaminated soil discovery guideline factsheets at the back of the report provide further details on the explicit health, safety and environmental risks associated with particular contamination scenarios, and the procedures to follow, however, in all instances the following general procedures summarized within the headings below should be considered. The steps highlighted below should not be considered exhaustive nor considered solely in step-by-step fashion, it may be necessary to conduct one or more actions at the same time or in differing order as a result of changing circumstances 'on the ground'.

4.1. STOP

- Stop working immediately and exclude others from working in the immediate area.
- Switch off machinery, generators etc., and establish a safe zone around the area dependent upon the assumed risk.

  - For example, a gas release from an old landfill can be considered potentially toxic and / or explosive and a zone of approximately 10m may be considered appropriate depending upon the scale of the event.
  - A series of dark red, brown or black stains in a pit with no odorous or free liquid discharges is unlikely to be immediately hazardous and the safe zone may extend to only the excavation edges.
- Prevent ingress or egress of stormwater, rainwater or wash water and stop all further activity immediately associated with the area.
- At this stage the extent, type and risk to health as a result of contamination is unknown – proceed with care and caution.

4.2. ADVISE THE SITE MANAGER

The site manager (or designated person) is the person principally in charge of health and safety on the site. They should also be familiar with these guidelines. The following steps are generally completed by the site manager or completed on the manager's delegation.

4.3. CONTAIN

If the contamination is leaving the site, or has the potential to leave the work site, then it should be contained. At this stage, the exact nature and risk of the contamination may not be known, so appropriate care and caution should be exercised. Some or all of the following methods may be used to contain the contamination:

- Sediment fences and straw bales;
- drain covers and sandbags;
- absorbent booms, spill mats, 'kitty litter' etc. can all be utilized to protect the environment from further release; and
- If containment is not possible, immediately contact:
  - ***Auckland Pollution Hotline*** **(09) 377 3107**.

4.4. ASSESS THE RISK

Not all contaminants, or all instances of contamination, will require special provisions or procedures. Similarly, an instance of contamination may be falsely or incorrectly reported. Not all stains are contamination, or all apparent plumes of oil on a liquid surface, are man-made occurrences.

- Refer to the factsheets at the back of these guidelines.
- Make a note of any or all of the following. It may be necessary to document and record some or all of the findings, for forwarding to the SQEP, as odours may dissipate and water may dry up or soak back into the soil:
  - Appearance – staining, trickling, flowing, bubbling (gas escape), thick, sticking to tools and equipment, sliding off tools etc.

- Odour – sweet, sour, petrol-like, tar-like, sharp etc.
- Colour or colours
- Miscibility i.e. does it or does not mix with water. Oil / solvents etc. do not mix with water and creates a coloured sheen on the water surface.

- If gross contamination is confirmed (or strongly suspected) then the appropriate measures should be put in place, dependent upon the risks concerned as defined in the factsheets. A half buried rusted drum of waste batteries will require different safety procedures to the discovery of a buried pile of asbestos cement board, for example.

4.5. CONTACT THE CLA (SQEP)

Contact the on-call contaminated land advisor – provide digital photographs if safely possible to do so. Talk to the CLA. They may advise additional steps to follow; they may be required to come to site.

4.6. RESTRICT ACCESS

Following the assessment of the risk, the safety zone can now be better defined.

- With reference to the factsheets, restrict access to the safe zone to only those members of the team that need to be there. It may be necessary in the case of potentially explosive vapour release, to cordon off a significant sized area and prevent working, or vehicular access, within that area.
- Consider the potential flow paths of vapours along trenches, down slopes, through drains etc.
- Access can be restricted through purely visual means, e.g. warning sings, via fencing or by staff management (security guard for example) or a mixture of all three based upon the site manager's assessment and the extent of the contamination.

4.7. ESTABLISH A WORKING TEAM AND PROVIDE WITH APPROPRIATE PPE

Before continuing, establish a team of competent trained individuals who can deal with the matter and ensure that they have, and are correctly wearing, the appropriate PPE for the situation at hand as defined in the factsheets. Consider the following when establishing the team:

- Experience – have they handled such a situation before?
- Competence – are they familiar with the tools, equipment, PPE and procedures that will be employed?
- Comfort – not all staff are comfortable with unknown situations. Will they be comfortable in this situation?

4.8. EXCAVATE

At some point, the contamination is likely to be removed. This may not be the case in every instance and the regulations allow for other actions such as in-situ remediation, stabilisation, encapsulation etc. and the SQEP will advise on the specific methodologies required. In certain circumstances a more detailed remedial plan may have to be compiled which will document specific goals, validations and disposal actions. The SQEP will advise on the requirements of the regulations. In most cases of localised acute instances of gross contamination, they can be safely managed immediately in the interests of protecting human health and the environment. In this case, some or all of the following processes should be followed:

- Excavation / Isolation – solid contaminants, soil, drums, refuse etc. can be excavated, by machine or by hand, directly into a covered truck or sealed skip, preventing further potential spread and isolating the contaminants for assessment and disposal;
- Vacuum extraction – contaminated water may be sucked up into a vacuum tanker, provided that there is no risk of reaction or explosion, where it can be isolated for assessment and disposal. DO NOT MIX water / liquid from more than one event in a vacuum truck;
- Separation – large separate items, such as asbestos sheet fragments, can be collected by hand, separated from the soil matrix and placed in double skinned plastic bags for appropriate disposal; and
- Absorbance – contaminated water, hydrocarbons and chemicals can all be absorbed through the use of contaminated pads, pillows and booms which can then be placed in sealed skips or bags and isolated for appropriate disposal.

4.9. DOCUMENT

Keep written documents, including digital photographs, of all measures used to contain or cleanup the contamination. This might include some or all of the following:

- Assessment measures used e.g. laboratory analysis, in-situ analysis (e.g. XRF), smell, behaviour in water (miscibility etc.), pH indicator test etc.;
- Staff involved in clean-up and experience;
- Methods used, problems encountered, discussions with SQEP;
- Complaints by third parties (e.g. odours, colour changes to local waterways etc.);
- Excavation or separation methods used, names of contractors etc.;
- Volumes extracted;
- Conditions of cartage, e.g. skip bin, covered truck, closed wheelie bins etc.
- Location of final disposal and disposal documentation e.g. tip dockets, weighbridge receipts etc.

4.10. DISPOSE

In order to ensure that all material is disposed of correctly, ensure the safe and licensed disposal of the material in accordance with the requirements outlined by the SQEP. In the majority of cases, examples of gross contamination are likely to require disposal at a licensed landfill facility e.g. Redvale Landfill or Hampton Downs Landfill. Other licensed facilities may exist that can handle potentially contaminated material, that may also be able to provide assistance.

- Contaminated liquids will not be received at landfill for disposal and must go to a licensed liquid disposal facility. Sewerage contaminated liquids can probably go directly to the nearest local sewer treatment facility, but chemical contaminated liquid will be required to go to an appropriate liquid treatment plant.
- Drums of unknown or unidentified waste may have to go to a solid / liquid hazardous waste handling plant.
- Contaminated PPE will also require appropriate disposal.
- In all instances, the receiving facility will be unlikely to receive and handle the material without some form of analysis or assessment of the composition of the waste.
- Keep all transport and disposal dockets for the final report.

4.11. REPORT

Communications and documentation will be kept during the procedures but a final report should be provided to the project manager detailing all of the steps, communications and records as required.

This report provides assurance to the regulatory authority that all the necessary steps have been followed and the matter has been adequately and professionally dealt with.

5 FACTSHEETS

5.1. PETROLEUM HYDROCARBONS

ACTIVITY

- Petroleum service station
- Vehicle workshop
- Gasworks sites

POTENTIAL CONTAMINATION

- Total Petroleum Hydrocarbons (TPHs)
- Polycyclic Aromatic Hydrocarbons (PAHs)
- Benzene, Toluene, Ethylxylene, and Xylenes (BTEX)
- Heavy Metals

DESCRIPTION

Petroleum-contaminated soils have a brown / black discolouration and an 'oily' consistency. Petroleum products, such as diesel and petrol, are insoluble in water and can form oil slicks in excavated areas such as trenches. Petroleum products in soil can be detected by the characteristic odour of petrol and diesel. BTEX produces a much 'sweeter' odour similar to that of paint-thinners.

HUMAN HEALTH AND ENVIRONMENTAL RISKS

Adverse reactions to strong hydrocarbon odours are possible, e.g. headaches, blurred vision, nausea. Contaminants can be absorbed into body via inhalation of dust, contact with skin, or ingestion. Leaked fuels can migrate into groundwater, potentially contaminating drinking water.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Required PPE for handling soil of this kind: (1) chemical / oil resistant steel-capped boots; (2) disposable coveralls; (3) chemical-resistant gloves; (4) safety glasses; (5) suitably graded half-face or full face respirator.

HANDLING AND DISPOSAL

Pooled hydrocarbon spills can be removed using suitable absorbent materials or collected by a suitably rated vacuum tanker. Spills can also be transferred to a sealed container by an appropriately rated vacuum pump or similar. Hydrocarbon contaminated soil can be placed in a sealed leak proof skip bin or truck for disposal at a facility authorised to receive material of that kind.

5.2. HEAVY METALS

ACTIVITY

- Metal workshop
- Metallisation works
- Electroplating industries
- Timber treatment facilities

POTENTIAL CONTAMINATION

- Heavy Metals

DESCRIPTION

Gross contamination of heavy metals in soils can cause bands of discolouration within the soil profile. Pools of discoloured water (yellow, blue, red, orange) in excavated areas, such as trenches, are indicative heavy metal contamination. Solvents used for metal preparation, like BTEX, can form 'sheen' on the surface of water and produce a 'sweet' odour similar to that of paint-thinners.

HUMAN HEALTH AND ENVIRONMENTAL RISKS

Contaminants can be absorbed into body via inhalation of dust, contact with skin, or ingestion. Heavy metals have the ability to leach further into soil and eventually into groundwater, potentially contaminating drinking water. A consideration should be given to the potential of pH alteration as metal finishing plants often employ acidic solutions for metal preparation.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Required PPE for handling soil of this kind: (1) chemical / oil resistant steel-capped boots; (2) disposable coveralls; (3) chemical resistant gloves; (4) safety glasses; (5) suitably graded half-face or full face mask or respirator.

HANDLING AND DISPOSAL

Heavy metal-contaminated soil can be placed in a truck and covered with tarpaulin for disposal at a facility authorised to receive material of that kind.

5.3. DRY CLEANERS

ACTIVITY

- Dry-cleaners

POTENTIAL CONTAMINATION

- Volatile hydrocarbons (trichloroethylene, tetrachloroethylene, carbon tetrachloride)

DESCRIPTION

It is difficult to distinguish soil contamination by solvents used for dry-cleaning. However, the solvents can form a bilayer with water they are less dense than water. The odours associated with dry-cleaning agents are very distinctive and can be described as 'sickly sweet', causing dizziness and nausea.

HUMAN HEALTH AND ENVIRONMENTAL RISKS

Contaminants can be absorbed into body via inhalation of vapours, contact with skin, or ingestion. Depending on atmospheric conditions, dry-cleaning agents may readily evaporate. Extended exposure to dry-cleaning agents can affect the central nervous system. Gross contamination of dry-cleaning agents in soil can migrate past the water table, making remediation complex.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Required PPE for handling soil of this kind: (1) chemical / oil resistant steel-capped boots; (2) disposable coveralls; (3) chemical-resistant gloves; (4) safety glasses; (5) suitably graded half-face or full face respirator.

HANDLING AND DISPOSAL

Pooled hydrocarbon spills can be removed using suitable absorbent materials or collected by a suitably rated vacuum tanker. Spills can also be transferred to a sealed container by a suitably rated vacuum pump or similar. Solvent contaminated soil, including drums or containers, can be placed in a sealed leak proof skip bin for disposal at a facility authorised to receive material of that kind.

5.4. TANNERY / LEATHER PROCESSING

ACTIVITY

- Leather manufacture / treating facility

POTENTIAL CONTAMINATION

- Heavy Metals (particularly chromium)
- Solvents
- Pesticides
- Bleaching agents

DESCRIPTION

Gross contamination of chromium in soils, caused in the tanning stage of treating leather, can cause orange and blue bands of discolouration within the soil profile. Pools of discoloured water (orange, blue, green) in excavated areas, such as trenches, are indicative chromium and metal contamination.

HUMAN HEALTH AND ENVIRONMENTAL RISKS

Contaminants can be absorbed into body via inhalation of vapours and dust, contact with skin, or ingestion. Wastewater produced from the tanning process can have excessive levels of chromium and sulphides which can cause gross soil contamination if inadequately handled.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Required PPE for handling soil of this kind: (1) chemical / oil resistant steel-capped boots; (2) disposable coveralls; (3) chemical-resistant gloves; (4) safety glasses; (5) suitably graded half-face or full face mask or respirator.

HANDLING AND DISPOSAL

Pooled liquid spills can be removed by using tailor-designed absorbent materials and via tanker or pump. Contaminated soil can be placed in a sealed skip bin or covered truck for disposal at a facility authorised to receive material of that kind.

5.5. ASBESTOS

ACTIVITY

- Improper disposal of asbestos-containing building materials

POTENTIAL CONTAMINATION

- Asbestos (fibres)

DESCRIPTION

Asbestos in soil is most likely due to burial of building materials. Asbestos fibres are usually entrained in a substrate material, making identification difficult. Broken cement, floor tiles, roof shingles, insulation, heat shields, and textured ceiling tiles manufactured between the 1950s and 1980s are likely to contain asbestos.

HUMAN HEALTH AND ENVIRONMENTAL RISKS

Asbestos can be absorbed into the lungs via inhalation of fibres. A significant acute or chronic exposure can lead to mesothelioma, asbestosis and lung cancer. Buried asbestos is relatively stable; however, disturbing asbestos during excavations could lead to the production of harmful fibres.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Required PPE for handling soil of this kind: (1) disposable coveralls; (2) washable PVC gloves; (4) safety glasses; (5) suitably graded full face or half face P3 respirator.

HANDLING AND DISPOSAL

KEEP DAMP to suppress fibre generation. Large fragments may be collected by hand and place in double skinned plastic bags. Asbestos-contaminated soil can be placed in a sealed skip bin for disposal at a facility authorised to receive material of that kind. Soil of this kind can also be transported via sealed doubled bags or a sealed skip bin.

5.6. REFUSE

ACTIVITY

- Inorganic / Organic refuse disposal

POTENTIAL CONTAMINATION

- Variable, dependant on the type of refuse
- Contaminants could arise from liquid waste, putrid organic waste, and any material that would normally be sent to a licensed landfill

DESCRIPTION

Refuse in soil is most likely due to burial of waste materials that should have normally been sent to landfill. Waste could include, but not limited to, paint cans, oil / hydrocarbon containers, and putrid household waste. The odour of buried refuse is likely to be extremely pungent.

HUMAN HEALTH AND ENVIRONMENTAL RISKS

Due to the variability of types of refuse and waste, it is difficult to distinguish human health and environmental risks. Individual assessment of the risks will be required.

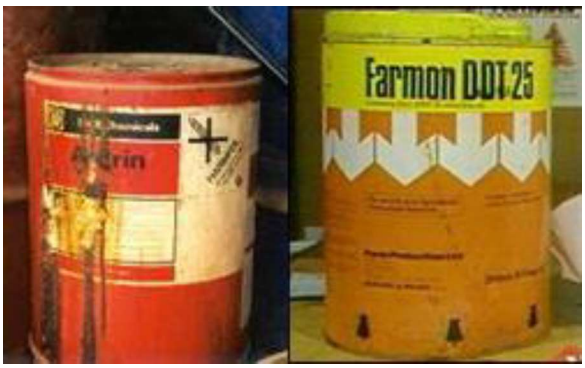
PERSONAL PROTECTIVE EQUIPMENT (PPE)

Required PPE for handling soil of this kind: (1) chemical-resistant steel-capped boots; (2) disposable coveralls; (3) chemical-resistant gloves; (4) safety glasses; (5) suitably graded half-face or full face mask or respirator.

HANDLING AND DISPOSAL

Handling and disposal of refuse will be dependent upon the waste material identified.

5.7. PESTICIDES



ACTIVITY

- Horticultural activity
- Pesticide manufacture

POTENTIAL CONTAMINATION

- Pesticides, including DDT, dieldrin, and other organochloride pesticides (OCPs)

DESCRIPTION

Persistent use and storage of pesticides associated with horticultural activities are the main contributors to pesticide-related contamination in soil. Illegal burial of pesticide drums and containers may be encountered on production and agricultural sites. Pesticides are often found as fine, white powders.

HUMAN HEALTH AND ENVIRONMENTAL RISKS

Pesticide contaminants can be absorbed into body via inhalation of dust, contact with skin, or ingestion. Extended exposure to organochloride pesticides can disrupt the endocrine system as well as affecting DNA. DDT and its breakdown products, DDD and DDE, are highly persistent and do not breakdown easily in soil. DDT and its isomers have the ability to magnify through the food chain (bioaccumulate).

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Required PPE for handling soil of this kind: (1) chemical-resistant steel-capped boots; (2) disposable coveralls; (3) chemical-resistant gloves; (4) safety glasses; (5) suitably graded half-face or full face mask or respirator.

HANDLING AND DISPOSAL

If bulk pesticide storage containers are found, the site manager must be advised. Pesticide-contaminated soil can be placed in a truck and covered with tarpaulin for disposal at a facility authorised to receive material of that kind.

5.8. SEWAGE

ACTIVITY

- Underground sewage tanks / pipelines

POTENTIAL CONTAMINATION

- Raw sewage
- Bacteria / pathogens (*Escherichia coli*, *Vibrio cholerae*, etc.)

DESCRIPTION

Sewage in soil is most likely due to leaking underground septic tanks and / or sewer pipelines. The odour of sewage is likely to be extremely pungent.

HUMAN HEALTH AND ENVIRONMENTAL RISKS

Pathogens in sewage-contaminated soil can be absorbed into body via contact with skin or ingestion. Exposure to raw sewage can infect a person with an array of harmful pathogens, such as E. coli, which originate from faecal matter in wastewater. Gross contamination of raw sewage can lead to eutrophication of lakes, rivers, and other receiving bodies of water.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Required PPE for handling soil of this kind: (1) chemical-resistant steel-capped boots; (2) disposable / liquid repellent coveralls; (3) chemical-resistant / waterproof gloves; (4) safety glasses; (5) suitably full face mask or face shield.

HANDLING AND DISPOSAL

If raw sewage is encountered, the site manager must be advised. Sewage-contaminated soil can be placed in a truck and covered with tarpaulin for disposal at a facility authorised to receive material of that kind.