



Sheep Dip Factsheet

SHEEP DIPS IN NEW ZEALAND

Background

Dipping sheep to control external parasites was a legal requirement in New Zealand from 1849 to 1993. As a result, there are an estimated 50,000 former sheep dip sites throughout New Zealand. There are also a limited number of former cattle dip sites. Controlling external parasites on sheep (including keds, ticks and lice) was important for both animal welfare and the economy. The sheep dip chemicals used before 1980 are very persistent in the environment. Arsenic was used from 1840 to 1980 and organochlorine pesticides were used from 1945 to 1961 (Table 1). The use and disposal of these chemicals at sheep dip sites has created a legacy of soil and water contamination by persistent chemicals at levels that are hazardous to humans, livestock and the environment. Concentrations of arsenic and/or organochlorine pesticides hundreds of times the soil guidelines for grazing stock have been measured at sheep dip sites.



Source: Adkin Collection, Alexander Turnbull Library, Wellington NZ

The types of dips typically used on New Zealand sheep farms were sheep plunge dips and shower dips or spray-booths. Examples of dip designs include the swim-through bath, pot bath, round bath, u bath, island and ring baths and power spray dips (Table 1). Plunge and shower dips were typically located adjacent to a water source (surface, roof or bore) or attached to a reticulated water line to fill the sump. The sheep were driven through the dip and then allowed to 'drip-dry' on a draining platform or released to a holding paddock to drip-dry, further spreading the dip chemicals. Footbaths for treating footrot in sheep and mobile dusting units for aldrin and dieldrin were also used for a limited period.

The dip sites were generally used for many years. Leaks, spills and splash from the dip itself, disposal of spent dipping chemicals and residues from dipped animals have led to

significant soil and water contamination at most sites. Common practices for removing spent liquids and sludges from dips included gravity drainage to lower ground, pumping or bucketing liquid from the sump and shovelling of residual sludge onto a 'scooping mound'. The accumulation of contaminants from repeated dipping events during a season and year-to-year dipping operations produced highly contaminated soil around the discharge or dumping zone(s). Spent dip solution and sludge were often discharged into gullies, streams and the foreshore for ease of disposal. Storage of dipping chemicals or containers in barns or wool sheds may also have led to soil and water contamination.



Source: WaipAC

Race, yards and pot dip remains

Hazards

Contaminants of concern

The majority of former sheep dips investigated to date are contaminated with persistent dip chemicals at levels that are hazardous to humans, livestock and the environment. Arsenic and the organochlorine pesticide dieldrin are the two main contaminants found at sheep dips sites. Other organochlorine pesticides that have been found at sheep dips sites in New Zealand are lindane, DDT, aldrin and endrin. Long term exposure to organochlorine pesticides can affect the central nervous system and can cause liver damage in humans and animals. Arsenic is a known human carcinogen and is very toxic to humans and animals. Information on the toxicity of organochlorines and arsenic, and minimising exposure to these contaminants, is available from the accompanying Sheep Dip Factsheets on arsenic and organochlorine pesticides (Sheep Dip Factsheets 2 & 3).

Areas likely to be contaminated

The areas of land most likely to be contaminated around a typical dip site include the dipping sump or shower, draining platform, animal holding yards, scooping mound and the

Table 1: Methods of dipping and dip chemicals

Dip type	Time frame	Arsenic	Rotenone	Organochlorines	Organophosphates	Synthetic Pyrethroids
Pot dip	1800s to present	✓	✓	✓	✓	
Swim-through	1800s to present	✓	✓	✓	✓	✓
Power spray unit	1944 to present	✓	✓	✓	✓	✓
Tip Spraying	1955-1961			✓	✓	
Dusting	1955-1961			✓	✓	
Pour-on					✓	

disposal area for spent dipping chemicals. Storage areas for sheep dip chemicals and adjacent paddocks where sheep dried off may also be contaminated. The area of land potentially contaminated will be larger than the immediate area surrounding the dip. The most contaminated area will not necessarily be immediately adjacent to the dip. Elevated soil concentrations of arsenic and organochlorine pesticides have been measured more than 50 metres away from the dip. The extent of the contamination will depend on the topography around the dip, and soil down-gradient of the dip or disposal sites may be significantly contaminated. Different methods of disposal may have been used by successive generations of dippers at the same site. Any remaining timber and concrete structures may also be contaminated with dip chemicals.

Environmental fate of dip chemicals

Arsenic does not break down in soil or water and organochlorine pesticides can take decades to degrade in the environment. Organochlorine pesticides and arsenic can leach slowly down the soil profile and can contaminate groundwater. The extent of leaching will depend on the soil type, with greater leaching occurring in sandy soils. The amount of rainfall or irrigation will also influence leaching of contaminants through the soil. Leaching may mean that the highest concentrations of contaminants are below the soil surface at some sites. Soil contamination has been measured to a depth of five metres below a former sheep dip.

Contaminated soil can be transported to adjacent paddocks and waterways through surface runoff (rainfall and irrigation water) and wind-blown dust. Contaminated groundwater may discharge into nearby waterways.

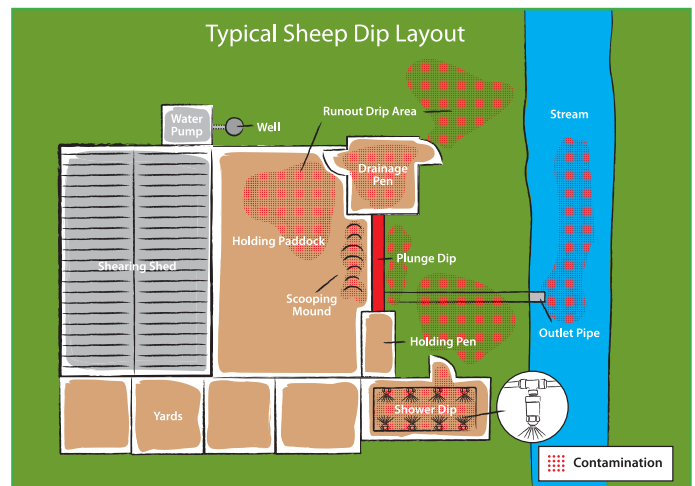
Human exposure

People can be exposed to organochlorine pesticides and arsenic in soil through contact with contaminated soil, drinking or bathing in contaminated water and eating contaminated food produced on the property.

Sheep dips sites are significant hazards for children if they are allowed to play around them. Children ingest soil through hand-to-mouth activities while they are playing. Arsenic concentrations high enough to be fatal to young children even over short exposure times have been measured in soil and water at sheep dip sites. Plunge dips containing water or liquid are a drowning hazard for humans and animals.

Animal welfare

Sheep dip sites are also a hazard for livestock. There have been cattle deaths from grazing on arsenic-contaminated land in the Canterbury and Waikato regions. Long-term exposures to lower levels of contaminants may make livestock sick and result in unacceptable residues in produce.



Contamination of water supplies

Investigations of sheep dip sites in New Zealand have shown that sheep dipping chemicals can contaminate ground and surface water. This is a hazard for livestock, humans and aquatic organisms including fish and eels. Concentrations of organochlorine pesticides and arsenic that exceed the New Zealand drinking water standards have been measured in both surface water and in groundwater, including household bores down-gradient of former dip sites.

Contamination of food

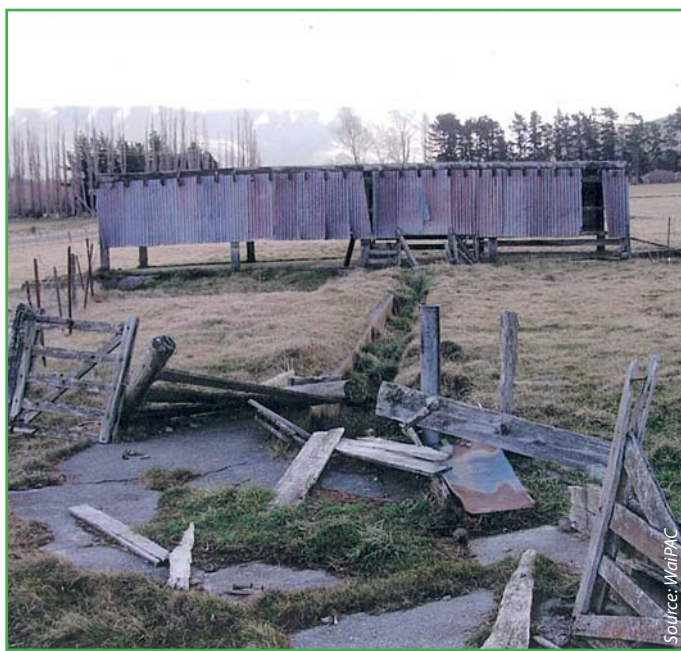
Food contamination with dip chemicals is a hazard for farmers and their families as well as being a significant risk to New Zealand's international trade. Overseas markets have stringent limits for organochlorine pesticides in animal products. Animals grazing on land contaminated with sheep dipping chemicals can accumulate contaminant residues in their meat, milk, fibre and eggs. Animals are exposed to contaminants in soil through soil ingestion (including soil attached to grass roots) and to a lesser extent through feed and by exposure to contaminated dust. Where residues are present, animals that dig in the soil, including pigs, poultry and bulls, will have increased exposure to contaminants. Livestock may also be exposed through drinking contaminated water (surface and bore). There are regulatory limits for organochlorine pesticides and arsenic in animal products including meat, fat, offal, poultry and eggs. Farmers can be prosecuted if residues in food produced for sale exceed Maximum Residue Levels (MRLs) and Maximum Permissible Levels (MPLs).

Edible crops for humans and animal feed should not be grown on or in the vicinity of known or suspected dip sites. Many plants are able to take up arsenic and organochlorine pesticides from soil. The amount taken up will depend on the plant variety. Crops can also become contaminated with soil containing organochlorine pesticides and/or arsenic from dust and mud splash and by irrigation with contaminated water.

Wildfoods may also become contaminated with arsenic and organochlorine pesticides released from sheep dips. Freshwater mussels, koura, tuna (eel), waterfowl and watercress should not be collected downstream from a dip or dip chemical disposal site. In coastal areas mussels and oysters should not be collected near a former dip site as they can accumulate organochlorine pesticides and arsenic in their tissues. Mushrooms and edible plants (e.g. ferns and puha) should not be harvested from the vicinity of a former sheep dip.

Safety of employees and visitors

Occupiers and landowners are required to take all practical steps under the Health and Safety in Employment Act 1992 to 'eliminate, isolate or minimise' any hazards to ensure the safety of their employees and contractors working on or around dips, including during any remediation activities. Landowners and occupiers also have a responsibility to ensure non-work related people, including children and visitors, do not come to harm from the dip site. Accidental drowning has occurred at a plunge dip and personal injury has been known to happen from falls and trips around dips sites. Some dip sites are situated in 'amenity land' - areas of public land or public access (e.g. camping grounds) and owners and occupiers need to ensure visitors and residents are not exposed to unnecessary risk.



Swim through dip

Locating former sheep dip sites

There may be more than one type of historic sheep dip on a farm as farming practices changed over time. Smaller farms may have shared a communal dip with other farmers. Medium-sized sheep farms tend to have one or two dips – often a plunge dip, superseded by a shower or spray booth. Larger farms tended to have multiple dips to avoid having to return mobs of sheep to the main working area. The largest number of dips located on a single property to date is five. The layout of the sheep dip will vary between dips and farms.

Dips were generally located near water sources (bore and surface) or near holding yards and woolsheds. There have been occasional examples of sheep dips being located inside a building or structure (e.g. covered-in yards or night pens). Former dips are in various states of repair ranging from intact dips to complete removal of visible structures. Locating the old

dip becomes more difficult when physical evidence has been buried, modified or removed. If structures have already been removed, evidence of a former dip site can include depressions in the ground where baths were removed, and concrete rubble. Soil sampling may be the only method of proving whether a sheep dip was present on the site or not. Sources of information that may help to locate sheep dips include talking with neighbours, former owners and workers on the property and local historians. Aerial photographs may also help to identify sheep dip sites. A timeline for dip types and typical chemical usage is presented in Table 1.

Managing the risks of former sheep dips

The option chosen for managing the risk associated with a former sheep dip will depend on the amount of information known about the dip, the level of contamination, its location and the other activities occurring in the vicinity of the dip. The management options usually aim to either prevent human and animal access to the site, or to completely remediate the site.

1. Managing contamination

Prevent access to the former sheep dip

Restricting access to the former sheep dip is a suitable management option if the dip is located away from human activity (e.g. residential houses), and groundwater and surface water are not being used for farm supply. The exclusion zone should include the site of sheep dip, the draining platform and animal holding areas plus an additional buffer distance to ensure access by people and livestock to all potentially contaminated land is restricted. Fencing should be permanent and animals should not be grazed within the exclusion zone or able to graze through the fence. Edible crops and hay should not be grown within the exclusion zone. The area should be signposted to warn people and should be marked on any farm management plans.

Capping

In some circumstances capping or placing a barrier over the top of the site to prevent access may be appropriate. Professional advice should always be sought before undertaking any work on a sheep dip site. Care needs to be taken to make sure that any capped area is not disturbed and the area should be marked on any farm management plans.

2. Remediate the site

Remediation may be required when arsenic and/or organochlorine pesticides are leaching or discharging from the site into the groundwater or surface water, and causing a significant adverse effect. The pesticide residues in the groundwater could be contaminating a private or public drinking water supply or recreational area, and/or the surface water discharge could be carrying contaminated sediments or contaminated water into surface water and exceeding the guidelines for the protection of freshwater or marine species. Remediation options include removing and disposing of contaminated soil to an approved facility. Professional advice should always be sought before undertaking any work – you could make the risks higher and the problem worse by disturbing the site. For example bulldozing or mechanically disturbing the site could spread the contamination, so that it affects a wider area and is more expensive to remediate. Sump liquids and sludge can be highly contaminated with dipping chemicals and are likely to require special management. Any remedial activities will need to comply with the Regional and

District Council plans (you may require a consent to remediate) as well as with the Health and Safety in Employment Act 1992 and the Hazardous Substances and New Organisms Act 1996.

Regional Council responsibilities for former sheep dips

Regional Councils are responsible under the Resource Management Act for identifying and monitoring contaminated land. Most regional and unitary councils hold records relating to potentially contaminated sites within their region, and they could add your sheep dip site to their land use register and issue this information if it is requested. District Councils may also release this information in response to a Land Information Memorandum request.

In a situation where contaminants are discharging from a dip area, the Regional Council has a responsibility under section 15 of the Resource Management Act to ensure that there is no significant adverse effect. If there is, enforcement action may follow in the form of an infringement notice, abatement notice (asking you to stop the discharge) or in a worst case scenario, prosecution. The remediation of an old sheep dip may require a resource consent. Resource consent is not required for continuing the normal day-to-day activities associated with managing a farm.

Regional Councils are able to apply for Government funding to assist with the remediation of contaminated land, which will provide part of the costs if an application is successful.



Outline of former plunge dip

Disclaimer

The recommendations, views and opinions expressed represent those of the University of Canterbury. The University disclaims any legal liability arising out of the use of the information and advice given. Every effort has been made to ensure the information presented is correct. The information has been compiled from a wide variety of sources and was current at the time of publication (Dec 2010).

This factsheet was prepared by Sally Gaw and Graham McBride for Tasman District Council through a Foundation for Research Science and Technology Envirolink grant. Sally is a lecturer in environmental chemistry at the University of Canterbury. She has ten years experience in managing contaminated land and was a member of the Ministry for the Environment's Pesticide Advisory Group. Graham is a farmer with national and international experience with managing legacy chemicals from agriculture. He initiated research into sheep dips in New Zealand.

District Council responsibilities for former sheep dips

District Councils are responsible for preventing any adverse effects of the development, subdivision or use of contaminated land. They may be interested in your dip, particularly if you are planning to subdivide the property into smaller blocks, or use the sheep dip area for housing. They will consider the level and extent of the contamination and its potential effect on human health in any subdivision consent or building consent application.

The new National Environmental Standard (NES) for assessing and managing contaminants in soil

It is expected that the new soil NES will be passed into law mid/late 2011, and it has requirements on subdivision and development of sheep dip sites etc....

For further information see www.mfe.govt.nz.

Sources of further information

Sheep Dip Factsheet 2:

Organochlorine Pesticides

Sheep Dip Factsheet 3:

Arsenic

Sheep Dip Factsheet 4:

Checklist for landowners and occupiers

All Sheep Dip Factsheets are available on

www.envirolink.govt.nz. Project number 820-TSDC59

Your Regional Council's contaminated sites officer, District Council environmental health officer or District Health Board health protection officer.

Identifying, Investigating and Managing Risks Associated with Former Sheep-dip Sites (2006). A guide for local authorities, Ministry for the Environment ME 775. <http://www.mfe.govt.nz/publications/hazardous/risks-former-sheep-dip-sites-nov06/risks-former-sheep-dip-sites-nov06.pdf>

Health and Safety Guidelines on the Cleanup of Contaminated Sites (1994). Department of Labour <http://www.osh.dol.govt.nz>

[1] In these sheep dip factsheets the term livestock refers to cattle, sheep, goats, pigs, deer, llamas and poultry. Poultry include chickens, ducks, geese, turkeys and guinea fowl.

[2] Australian and New Zealand Guidelines for fresh and Marine Water Quality (ANZECC, 2000)

For further information contact:

Environment Southland's Pollution Prevention Team

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