WATER & SOIL
TECHNICAL PUBLICATION NO 1

LIQUID AND WATERBORNE WASTES RESEARCH
IN NEW ZEALAND 1976

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for the National Water & Soil Conservation Organisation
LIQUID AND WATERBORNE WASTES RESEARCH
IN NEW ZEALAND 1976

Compiled by Sally F Davis
Water & Soil Division, MWD, Christchurch
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CLASSIFICATION BY SUBJECT

1 WASTEWATER TREATMENT

1. WASTEWATER COLLECTION

Auckland Regional Authority
E G Hutchinson

Auckland Regional Authority
N Harper

DSIR (Chemistry Division)
A Kennett

Hutt Valley Drainage Board
Chief Engineer

Christchurch Drainage Board
J B Richardson

*Control of sulphide in sewers.
*Effect of refuse grinders on the strength of domestic wastes.
*Deterioration of rubber and plastic rings used in pipe joints when buried in different soil types.

*Infiltration study including a comparison of flow from a number of different types of reticulation subcatchment.
*Fungal attack of rubber rings used in pipe joints.

2 URBAN RUNOFF AND COMBINED SEWER OVERFLOW

DSIR (Freshwater Section, Ecology Division)
E White

Auckland Regional Authority
E G Hutchinson

*Nutrient concentration in groundwater of urban developments, Taupo.
*Nutrient runoff from a defined subcatchment in Taupo Borough.

*Stormwater quality studies — SS, BOD, DO, pH, bacto.

3 PHYSICAL AND CHEMICAL METHODS

Ministry of Works & Development (Trentham)
M H Luo

DSIR (Chemistry Division)
H P Rothbaum

DSIR (Plant Diseases Division)
Director

NZ Forest Service (Forest Products Division)
J A Lloyd

NZ Leather & Shoe Research Association
I G Mason

University of Waikato (Chemistry)

Auckland Regional Authority
E G Hutchinson

Rotorua City Council
City Engineer

City of Palmerston North
J A Anderson

Wellington City Corporation
P Marks

Christchurch Drainage Board
J B Richardson

Alliance Freezing Co.
J Milbum

East Coast Farmers' Fertiliser Co.
F P Crotty

*Jar tests to establish the role Mg plays in lime precipitation of phosphorus (completed).

*Development of processes for removal of silica and arsenic from geothermal waters.

*Ultrafiltration and reverse osmosis techniques to facilitate concentration of wastes.

*Analytical techniques for mechanical pulp discharges.

*Physical-chemical treatment of sulphides.
*Investigation of a manganese catalysed aeration process (proposal).

*Use of allophane as a means of removing pollutants from waste.
*Chemical coagulation of sewage.
*Water quality changes during tip leachate treatment.

*Investigation of mixed media filtration of tertiary wastewater treatment plant effluent.

*Performance monitoring of a primary wastewater treatment plant, particularly with regard to sedimentation tank efficiency.

*Monitoring of treatment plant for tip leachate at Horokiwi landfill (grit removal, alum dosing, aeration, settling and intermittent sand filtration).

*A model study of the secondary sedimentation tanks of the Bromley sewage treatment plant (completed).
*Coagulation and flocculation of loess suspensions.

*Application and performance of several proprietary screening devices (including Bauer Hydrasieve and Anzel Aquasieve) on various meatworks waste streams with particular reference to solids and BOD removal.

*Investigation of dissolved air flotation as a means of treating meatworks waste.
*Pilot-scale investigation into oxidation of sulphide in fellmongery waste streams.

*Removal of suspended solids from fertiliser works effluent, Awatoto.
*Neutralisation of acidic fertiliser effluents.
*Preliminary investigation into the recovery of fluorides.
*Occurrence or otherwise of cadmium in fertiliser works effluents (proposal).
4 BIOLOGICAL FILTERS

NZ Leather & Shoe Research Association
I G Mason
University of Canterbury (Civil Engineering)
F Wilson
Auckland Regional Authority
E G Hutchinson

Wellington City Corporation
P Marks
Christchurch Drainage Board
J B Richardson
Alliance Freezing Co.
J Milburn

5 ACTIVATED SLUDGE

Ministry of Works & Development
(Trentham)
D R Cameron
Massey University (Biotechnology)
H Melcer
City of Palmerston North
J A Anderson
Christchurch Drainage Board
J B Richardson

6 LAGOONS AND OXIDATION PONDS

Ministry of Works & Development
(Wellington)
B R Brown
Victoria University (Botany)
H G Harris
Victoria University (Zoology)
R S Slack
University of Otago (Microbiology)
M W Loutit

Auckland Regional Authority
E G Hutchinson

*Clarigester BOD and suspended solids removal efficiency from an industrial-domestic effluent treatment plant.
*Design, installation and commissioning of prototype wool scour effluent treatment plant utilising a new process developed by DSIR/WRONZ, and subsequent evaluation of the process.
*Characterisation of metal quarry effluents and selection of flocculation techniques for clarification of water for discharge and reuse. Design, installation and commissioning of effluent treatment plant at Lower Hutt.
*Characterisation of meat processing effluents and assessment of physical-chemical treatment techniques in mobile field laboratory; pilot plant performance trials and cost estimates.

*Evaluation of a laboratory scale biodisc unit for treatment of tannery wastes (proposal).

*Use of package plants for sewage treatment.

*Comparative evaluation of performance characteristics of different plastic media for high rate biological filtration treatment of sewage.
*Mathematical modelling of filter performance.
*Treatability factors of trade wastes, using biological filters.
*Use of biological rock and plastic media filters for deodorising sewage gases.

*Evaluation of the potential of biodiscs for treatment of domestic sewage. Pilot plant is later to be shifted to evaluate its potential to treat septic tank effluent.

*Pilot tower studies on Flocor plastic media at Bromley sewage treatment plant (completed).

*Treatment of different types of meatworks effluent by a Flocor packed biological filter and the effects of temperature, recirculation rates, different media and combined use of dissolved air flotation and biological filtration on performance (proposal).

*Nitrification-denitrification studies on a modified extended aeration plant.

*Investigation of problems associated with the bulking of activated sludge in treatment of industrial effluents with high carbohydrate contents.

*Design and building of a pilot-scale extended aeration unit to supply possible design parameters for planned secondary treatment.

*Bench-scale studies of settled sewage.

*Study of oxygen-activated sludge (proposal).

*Performance of an aerated lagoon receiving domestic sewage.

*Some aspects of the biology of the Carterton Borough Council sewage oxidation pond sediments (completed); contact: H W Johnston.

*Growing fish in lagoons and oxidation ponds.

*Investigation of the role of photosynthetic bacteria in oxidation ponds.
*The difference between E. coli and faecal coliform counts in oxidation ponds and an investigation of which organisms are contributing to the faecal coliform count.

*Studies of oxidation pond performance and effluent quality.
*The biology of oxidation ponds.
*The classification of coliform bacteria populations at various stages of sewage treatment, by biochemical and serological methods.
*Multivariate statistical analysis of factors affecting algal growth in oxidation ponds (by University of Auckland); (completed).
7 ANAEROBIC PROCESSES

- DSIR (Applied Biochemistry Division)
  R V Asmundsen
  R T J Clarke
- NZ Leather & Shoe Research Association
  I G Mason
- Massey University (Biotechnology)
  P McFarlane
- Auckland Regional Authority
  P Welsby
- City of Palmerston North
  J A Anderson
- Hutt Valley Drainage Board
  Chief Engineer
- Christchurch Drainage Board
  J B Richardson

- *Succession of algae and the role(s) of Daphnia and Moina in oxidation ponds (proposal).
- *Design of oxidation ponds, with emphasis on flow patterns through ponds and retention time.
- *Effects of a cage aerator on biomass, sulphide and ammonia-nitrogen in a Southland oxidation pond (proposal).
- *Isolation and study of micro-organisms responsible for anaerobic degradation of dairy wastes and for production of methane, to improve the general methane fermentation of organic matter.
- *Effects of varying the basic parameters of fermentation of dairy wastes on reduction of BOD and production of methane.
- *Extension of research into use of purple sulphur bacteria for sulphide removal (proposal).
- *Treatment of fellmongery effluent in anaerobic ponds using photosynthetic purple sulphur bacteria.
- *Effects of circulation and management changes on anaerobic digester performance.
- *Performance monitoring and physical and chemical control of a completely mixed anaerobic sludge digester.
- *Effect of an 18 km anaerobic pressure main on the treatability of Hutt Valley sewage.
- *Assessment of the effects of detention time and temperature on digestion of sewage sludge.

8 SLUDGE TREATMENT, UTILISATION AND DISPOSAL

- DSIR (Chemistry Division)
  M H Timperley
- NZ Leather & Shoe Research Association
  I G Mason
- Wool Research Organisation of New Zealand
  E R Jamison
- Auckland Regional Authority
  E G Hutchinson
- Christchurch Drainage Board
  J B Richardson
- Morrison, Cooper & Partners
  E A Retter
- Morrison, Cooper & Partners
  D N Undrill
- Morrison, Cooper & Partners
  W S Wakelin

- *Survey of toxic element and heavy metal levels in New Zealand sewage sludges.
- *Chromium (3) levels at tannery sludge disposal sites and in associated vegetation. Glasshouse trials to determine the effect of chromium (3)-containing sludges on plant life is being undertaken by Plant Physiology Division, DSIR.
- *Sludge dewatering.
- *Comparative evaluation of sludge density meters.
- *Bioassay of toxic material in sewage sludge.
- *Estimation of helminths and other parasitic organisms in treated sewage sludge.
- *Treatment of alum sludge from potable water treatment plants.
- *Application of digested sewage sludge to farmland and assessment of its value as fertiliser and soil conditioner.
- *Development of analytical methods for the determination of heavy metals in both raw and digested sewage sludge.
- *Treatment of removed solids from wool scour effluent to recover wool grease and separate dirt for disposal.
- *Sludge thickening and dewatering for disposal from chemical flocculation treatment of metal quarry effluent, Lower Hutt.
- *Sludge dewatering, drying and feed trials as animal feed supplement for sludge recovered from pilot plant meatworks effluent treatment process, Wairoa.

9 DISINFECTION

- Christchurch Drainage Board
  J B Richardson

- *Assessment of the relative efficacies of chlorine and ozone for disinfecting sewage.

10 WATER RECLAMATION AND REUSE

- Auckland Regional Authority
  E G Hutchinson
- Morrison, Cooper & Partners
  D N Undrill

- *Prevention of nozzle blockage in sedimentation tank scum removal spray systems.
- *Water clarification from metal quarry effluent and total recycle for use in quarry washing duties, Lower Hutt.

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11 LAND DISPOSAL OF WASTEWATER

Water & Soil Division (Christchurch)
G N Martin
Ministry of Works & Development
(Trentham)
D R Cameron and
Wairarapa Catchment Board
D B Wilmshurst
Rangitikei-Wanganui Catchment Board
C R Fowles
Ministry of Agriculture & Fisheries
(National Dairy Laboratory)
DSIR (Chemistry Division)
C D Stevenson

DSIR (Freshwater Section, Ecology Division)
E White
DSIR (Soil Bureau)
J D Stout
DSIR (Soil Bureau)
C W Childs
Cawthron Institute
A Cooke

Wool Research Organisation of New Zealand
R G Stewart
Massey University (Soil Science)
A N Macgregor et al

Massey University (Soil Science)
J K Syers
Victoria University (Botany)
D R McQueen
Lincoln College (Microbiology)
M J Noonan

Auckland Farmers’ Freezing Co-op
Chief Engineer
G M Keeley

Christchurch Drainage Board
J B Richardson

12 INSTRUMENTATION AND AUTOMATION OF WASTEWATER TREATMENT SYSTEMS

Wool Research Organisation of New Zealand
J Bedford
Auckland Regional Authority
E G Hutchinson

*Evaluation of polishing treatment process for meatworks effluent after physico-chemical treatment, for water reuse, Wairoa.

*Effects of wastewater disposal by land irrigation on groundwater quality in the Burnham-Templeton area (completed).

*Evaluation of overland disposal system using oxidation pond effluent from the Carterton Borough Council sewage treatment plant.

*Monitoring of the Marton oxidation ponds, particularly in relation to the tertiary grass plot treatment of effluent.

*Monitoring of groundwaters where high nitrate levels are suspected to be due to nearby effluent ponds, especially associated with piggeries.

*Assessment of the efficacy of land disposal of treated sewage effluents at (a) Carterton, in collaboration with Public Health Engineering, MWD and Wairarapa Regional Water Board (completed), and (b) Taupo, in collaboration with MAF.

*The fate of septic tank effluents on the shores of Lake Taupo.

*Effect of land disposal of milking shed effluent on pasture (in collaboration with Massey University).

*Effectiveness of ten North Island soils for tertiary treatment of irrigated municipal wastewater (completed).

*Soil column studies with refiner-ground wood pulp effluent in relation to groundwaters (Contract: H Baigent and Son Limited).

*Soil column studies with vegetable crop processing effluent in relation to groundwaters (Contract: Petersville International).

*Land disposal of scouring wastes, Winchester, South Canterbury.

*Evaluation of land disposal (spray irrigation) of untreated dairy shed effluent in terms of pasture production and composition, effects on animal health, changes in amounts and forms of soil N and P, discharges from the area of N, P and coliform bacteria in drainage water.

*Land disposal of domestic sewage effluent (in collaboration with Winchester Irrigation Research Station).

*Effects of treated sewage effluent on growth of Pinus radiata (completed).

*Pasture contamination by micro-organisms from meat wastes (Istington) and milking shed wastes (Lincoln).

*Land application of domestic effluent (Burnham and Templeton) and meatworks waste (Istington).

*Determination of maximum loading of soils by potato processing wastes to avoid groundwater pollution and odour problems, Pebbleton.

*Experimental irrigation of oxidation pond water (after tertiary treatment) onto pasture and tree plantations, with special attention to health aspects, nitrite and nitrate accumulation in plants and soils and soil permeability.

*Land irrigation of meatworks waste, Fairfield.

*The WRONZ turbidimeter (completed).

*Continuous monitoring systems for wastes.

*Sewage sampling and computer processing of alarm functions and treatment plant data.
II INDUSTRIAL WASTES

1 MEAT, FISH AND POULTRY PROCESSING WASTES

Southland Catchment Board
P N Young

Meat Industry Research Institute
R N Cooper

Meat Industry Research Institute
C F Denmead

Meat Industry Research Institute
T Fernando

Meat Industry Research Institute
J F Heddle

Meat Industry Research Institute
I J Kindred

University of Canterbury (Chemical Engineering)
E E Graham

Christchurch Drainage Board
J B Richardson

Alliance Freezing Co.
J Milburn

T Borthwick & Sons Ltd
G L Butcher

2 HIDE AND SKIN PROCESSING WASTES

DSIR (Chemistry Division)
D H Buisson

DSIR (Chemistry Division)
G N S McLachlan

NZ Leather & Shoe Research Association
T G Mason

*Absorption of phosphate from the Hamilton sewage treatment station in the soil floor of the Waikato River.

*Major constituents, including P, N, CNO of domestic, industrial and sewage treatment plant discharges.

*Analysis of bacteriological reports on sea samples taken from Poverty Bay in the locality of the Gisborne submarine sewage outfall (completed).

*Qualitative investigation of Hutt Valley sewage based on data obtained from a pilot primary treatment plant and other related studies.

*Effect of discharge of partially treated meatworks waste on the Mataura River.

*Definition of waste loads of individual processing operations within a meatworks to suggest means of product recovery at source.

*Chemical treatment process on a pilot plant scale for treatment of meat wastes. Dewatered conditioned sludge may be dried as animal feedstuff.

*Evaluation of electrofloaction compared with dissolved air flotation of chemically treated meat wastes.

*Use of a pilot-scale biological filter, packed with ‘Flocor’, for purification of meat wastes (completed).

*Use of anaerobic filter for treating meat wastes.

*Investigation into nitrification of anaerobic effluent to determine whether ammonia levels may be substantially reduced.

*Composting of solid material (mainly paunch contents) removed from meat wastes during primary treatment (completed).

*Recovery of blood from blood-containing wastes and protein from paunch liquid by ultrafiltration on a pilot plant scale.

*Investigations into various modes of aerobic biological treatment of meat wastes.

*Rate of oxygen uptake by meat wastes and determination of the stage at which nitrification occurs, if at all.

*Development of improved, more rapid analytical methods for determination of fat, grease, proteins and other nitrogenous compounds in meat wastes.

*Analytical methods to characterise meat wastes.

*Treatment of meatworks effluent to recover protein.

*Treatment of meat waste using plastic medium trickling filters and activated sludge.

* digestibility of meat waste sludge.

*Assessment of performance of dissolved air flotation treatment on different meatworks waste streams and of effects of chemical treatment on performance.

*Means of reducing levels of ammonia-nitrogen and sulphide in meatworks waste under the prevailing climatic conditions in Southland.

*Continual testing of freezing works effluent quality (Waitara, Feilding, Waingawa), with short-term investigations of treatment efficiency.
Meat Industry Research Institute
R N Cooper

Meat Industry Research Institute
I J Kindred

Wool Research Organisation of New Zealand
G V Barker

Wool Research Organisation of New Zealand
R G Jamieson

Wool Research Organisation of New Zealand
R G Stewart

University of Canterbury (Chemical Engineering)
N J Peet

University of Canterbury (Joint Centre for Environmental Sciences)
L A Halliday

Christchurch Drainage Board
J B Richardson

Auckland Farmers' Freezing Co-op.
Chief Engineer

Canterbury Frozen Meat Co.
G M Keeley

Morrison, Cooper & Partners
E A Retter

3 DAIRY FACTORY WASTES
Southland Catchment Board
P N Young

Ministry of Works & Development (Wellington)
E G Fox

4 LIVESTOCK WASTES
Taranaki Catchment Commission
Secretary

Wairarapa Catchment Board
D B Wilmshurst

Southland Catchment Board
P N Young

Ministry of Agriculture & Fisheries (Invermay Agricultural Research Centre)
D J Stewart

Ministry of Agriculture & Fisheries (National Dairy Laboratory)

NZ Agricultural Engineering Institute
A B Drysdale

NZ Agricultural Engineering Institute
D J Hills

*Sedimentation of lime and removal of sulphide from fellmongery wastes.

*Development of improved, more rapid analytical methods for determination of sulphides, thiosulphates, sulphites, sulphates and elemental sulphur in fellmongery wastes.

*Removal of sulphide from settled fellmongery wastes.

*Alcohol destabilisation of wool scouring wastes, Sawyers Bay, Dunedin.

*By-product recovery from wool scouring liquors.

*The WRONZ comprehensive scouring system — prototype at Timaru (completed).

*Treatment of fellmongery wastes with particular reference to reduction of depilatory sulphides in discharged effluents.

*Pollution control and by-product recovery in the New Zealand wool-scouring industry (completed).

*Removal of chrome from tannery wastes.

*Treatment methods for strong chemical wastes from fellmongery, hide curing and casings departments.

*Chemical treatment of fellmongery wastes, Belfast.

*Evaluation of biological filters on fellmongery effluents based on pilot plant operations, Christchurch.

*Design, installation and commissioning of prototype physico-chemical wool scour effluent treatment plant, incorporating a by-product recovery plant, Sawyers Bay, Dunedin.

*Effect of discharge of partially treated dairy wastes on the Mataura River.

*Evaluation of high rate stone media filter.

*Survey of farm dairy oxidation ponds of varying forms to assess effectiveness of designs.

*Monitoring of the effectiveness of several anaerobic/aerobic dairy effluent treatment systems (proposal).

*Measurement of nutrient, faecal bacteria and sediment runoff from farm-lands at both flood and low water levels — Aparima, Oreti, Makarowa and Waihopai Rivers — and their effects on settling up and possible over-fertilisation of the New River Estuary (Invercargill).

*Volumes of methane gas obtainable from crop wastes, manure and dairy wastes by anaerobic fermentation.

*Investigation of possibilities of improving gas yields with additives or recycling of CO2 produced with methane.

*Composition of sludge remaining after anaerobic treatment and tests of its value as a fertiliser, including comparison of spray irrigation of sludge and spray irrigation of raw manure on growth of various crops and pasture.

*Monitoring of dairy shed effluent oxidation ponds, Waikato — pH, DO, BOD.

*Solids separation of dairy shed effluent by mechanical vibrating bar screens.

*Surface aeration of livestock wastes — pilot plant investigations.

*Pumping and sprinkler testing research for spray irrigation of livestock wastes.
*Investigations into proper construction techniques for livestock pond treatment systems.
*Monitoring of effluents from dairy shed anaerobic and aerobic ponds.
*Monitoring of performance and working environment of a variety of pumps for dairy waste spray disposal, including component redesign and testing.
*Evaluation of dairy shed effluent treatment by short-term (5–10 days) unmixed anaerobic treatment, followed by 1–3 days aeration over a biological filter.
*Survival of indicator organisms in milking shed wastes undergoing aerobic treatment.

*Effect of discharge of partially treated paper mill wastes on the Mataura River.
*Treatment of pulp and paper wastes.
*Treatment of rueping plant wastes.
*The composition of refiner pulp mill discharges and their effects on water quality (completed).
*Effects of water recycling on dissolved solids content of refiner pulp mill effluent.
*Pulping and bleaching effluents.

*Chemical investigations of ground wood pulp effluent (Contract: Winstone Limited).
*Mathematical model to predict water quality parameters at the mill’s classified outfall from known effluent losses from the mill. Kinleith Technical Department.

*Treatment of starch wastes.
*Preliminary investigations of waste from apple and citrus processing plants with the possibility of recovering pectins and sugars.
*Removal of large particulate material from fruit and vegetable processing wastes.
*Chemical examination of vegetable crop processing effluent (Contract: Petersville International).
*Treatment of latex wastes from carpet manufacturers.
*Biological treatment of suint solutions (proposal).

*Treatment of coal carbonisation wastes.
*Coal mine effluent characterisation, flocculation process evaluation, design, installation and commissioning of prototype plant, Lower Hutt.

*Report on the effluent from an electroplating shop and methods of treatment (completed).
*Assessment of treatment processes for electroplating industry wastes.
*Destruction of cyanide, both liquid and solid forms, the latter from case-hardening processes.
*Disposal of hazardous wastes – solvents, heavy metal sludges.
NZ Aluminium Smelters Ltd
F I Coates

*Treatment methods for effluent containing cyanide.

13 SOLID WASTES AND WATER QUALITY
Department of Health
(Division of Public Health)


NZ Forest Service (Forest Products Division)
J M Uprichard

*Effect of drainage from wood waste dumps on stream water quality (completed).

14 RADIOACTIVE WASTES
Department of Health (National Radiation Laboratory)
Director


15 CHEMICAL AND ALLIED PRODUCTS
Victoria University (Botany)
D R McQueen

*Presence of exogenous metallic ions and other chemical substances in soil and plants of estuarine areas in Wellington district, resulting from waterborne wastes.

16 GENERAL
Auckland Regional Authority
E G Hutchinson
Hutt Valley Drainage Board
Chief Engineer

*Strengths of trade wastes.

*Trade waste survey — collating information of all industrial discharges and potential discharges in the Hutt Valley.
## CLASSIFICATION BY ORGANISATION

### I NATIONAL WATER AND SOIL CONSERVATION ORGANISATION

<table>
<thead>
<tr>
<th>(a) Water &amp; Soil Division</th>
<th>*Effects of wastewater disposal by land irrigation on groundwater quality in the Burnham-Templeton area (completed).</th>
</tr>
</thead>
<tbody>
<tr>
<td>G N Martin (Christchurch)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>(b) Regional Water Boards</th>
<th>*Monitoring of the Marton oxidation ponds, particularly in relation to the tertiary grass plot treatment of effluent.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rangitikei-Wanganui Catchment Board C R Fowles</td>
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<tr>
<td>Southland Catchment Board P N Young</td>
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<tr>
<td>Taranaki Catchment Commission Secretary</td>
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<tr>
<td>Wairarapa Catchment Board D B Wilmshurst</td>
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</tbody>
</table>

### II GOVERNMENT DEPARTMENTS

<table>
<thead>
<tr>
<th>Ministry of Agriculture &amp; Fisheries (National Dairy Laboratory)</th>
<th>*Monitoring of dairy shed effluent oxidation ponds, Waikato - pH, DO, BOD.</th>
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</thead>
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<tr>
<td>Ministry of Agriculture &amp; Fisheries (Invermay Agricultural Research Centre) D J Stewart</td>
<td>*Monitoring of groundwaters where high nitrate levels are suspected to be due to nearby effluent ponds, especially associated with piggeries.</td>
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<td>Ministry of Works &amp; Development (Trentham) D R Cameron</td>
<td>*Volumes of methane gas obtainable from crop wastes, manure and dairy wastes by anaerobic fermentation.</td>
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<td>M H Luo</td>
<td>*Investigation of possibilities of improving gas yields with additives or recycling of CO₂ produced with methane.</td>
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<td>Ministry of Works &amp; Development (Wellington) B R Brown E G Fox</td>
<td>*Composition of sludge remaining after anaerobic treatment and tests of its value as a fertiliser, including comparison of spray irrigation of sludge and spray irrigation of raw manure on growth of various crops and pasture.</td>
</tr>
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<td>DSIR (Applied Biochemistry Division) R V Asmundsen R T J Clark</td>
<td>*Nitrification-denitrification studies on a modified extended aeration plant.</td>
</tr>
<tr>
<td>DSIR (Auckland Industrial Development Division) H C Green</td>
<td>*Evaluation of overland disposal system using oxidation pond effluent from the Carterton Borough Council sewage treatment plant (in collaboration with MWD, Trentham).</td>
</tr>
<tr>
<td>DSIR (Chemistry Division) D H Buisson</td>
<td>*Monitoring of the effectiveness of several anaerobic/aerobic dairy effluent treatment systems (proposal).</td>
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<td>*Jar tests to establish the role Mg plays in lime precipitation of phosphorus (completed).</td>
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<td>*Treatment of pulp and paper wastes.</td>
</tr>
</tbody>
</table>

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*Treatment of latex wastes from carpet manufacturers.

*Treatment of reuse of plant wastes.

*Deterioration of rubber and plastic rings used in pipe joints when buried in different soil types (in collaboration with ARA).

*Treatment of woolscour effluent.

*Treatment of coal carbonisation wastes.

*Development of processes for removal of silica and arsenic from geothermal waters.

*Assessment of the efficacy of land disposal of treated sewage effluents at (a) Carterton, in collaboration with Public Health Engineering, MWD and Wairarapa Regional Water Board (completed), and (b) Taupo, in collaboration with MAF.

*Mining of toxic element and heavy metal levels in New Zealand sewage sludges.

*Assessment of treatment processes for electropolluting industry wastes.

*) The fate of septic tank effluents on the shores of Lake Taupo.

*Nutrient concentration in groundwater of urban developments, Taupo.

*Nutrient runoff from a defined sub-catchment in Taupo Borough.

*Ultrafiltration and reverse osmosis techniques to facilitate concentration of wastes.

*Preliminary investigations of waste from apple and citrus processing plants with the possibility of recovering pectins and sugars.

*Removal of large particulate material from fruit and vegetable processing wastes.

*Effectiveness of ten North Island soils for tertiary treatment of irrigated municipal wastewater (completed).

*Effect of land disposal of milking shed effluent on pasture (in collaboration with Massey University).


*Analytical techniques for mechanical pulp discharges.

*The composition of refiner pulp mill discharges and their effects on water quality (completed).

*Effects of water recycling on dissolved solids content of refiner pulp mill effluent.

*Pulping and bleaching effluents.

*The effect of drainage from wood waste dumps on stream water quality (completed).

III RESEARCH ORGANISATIONS

Cawthron Institute
A Cooke

*Soil column studies with refiner-ground wood pulp effluent in relation to groundwaters (Contract: H Baigent and Son Limited).

*Soil column studies with vegetable crop processing effluent in relation to groundwaters (Contract: Petersville International).

*Chemical examination of vegetable crop processing effluent (Contract: Petersville International).

*Chemical investigations of ground wood pulp effluent (Contract: Winstone Limited).

*Solid separation of dairy shed effluent by mechanical vibrating bar screens.

*Surface aeration of livestock wastes — pilot plant investigations.

*Pumping and sprinkler testing research for spray irrigation of livestock wastes.

*Investigations into proper construction techniques for livestock pond treatment systems.

*Monitoring of effluents from dairy shed anaerobic and aerobic ponds.

*Physical-chemical treatment of sulphides.

*Investigation of a manganese catalysed aeration process (proposal).

*Evaluation of a laboratory scale biodisc unit for treatment of tannery wastes (proposal).

*Extension of research into use of purple sulphur bacteria for sulphide removal (proposal).
Meat Industry Research Institute
R N Cooper

Wool Research Organisation of New Zealand
G V Barker

C F Denmead

T Fernando

J F Heddle

I J Kindred

IV UNIVERSITIES
University of Waikato (Chemistry)
J Bedford
E R Jamison
R G Jamieson
R G Stewart

Massey University (Biotechnology)
P McFarlane
H Melcer

Massey University (Soil Science)
A N Macgregor et al

J K Syers

*Chromium (3) levels at tannery sludge disposal sites and in associated vegetation. Glasshouse trials to determine the effect of chromium (3)-containing sludges on plant life is being undertaken by Plant Physiology Division, DSIR.


*Feimongery effluent survey (completed).

*Tannery effluent survey.

*Definition of waste loads of individual processing operations within a meatworks to suggest means of product recovery at source.

*Chemical treatment process on a pilot plant scale for treatment of meat wastes. Dewatered conditioned sludge may be dried as an animal feed stuff.

*Sedimentation of lime and removal of sulphide from fellmongery wastes.

*Evaluation of electrofloitation compared with dissolved air flotation of chemically treated meat wastes.

*Use of a pilot-scale biological filter, packed with 'Flocor', for purification of meat wastes (completed).

*Use of an anaerobic filter for treating meat wastes.

*Investigation into nitrification of anaerobic effluent to determine whether ammonia levels may be substantially reduced.

*Composting of solid materials (mainly paunch contents) removed from meat wastes during primary treatment (completed).

*Recovery of blood from blood-containing wastes and protein from paunch liquid by ultrafiltration on a pilot plant scale.

*Investigations into various modes of aerobic biological treatment of meat wastes.

*Rate of oxygen uptake by meat wastes and determination of the stage at which nitrification occurs, if at all.

*Development of improved, more rapid analytical methods for determination of fat, grease, proteins and other nitrogenous compounds in meat wastes.

*Analytical methods to characterise meat wastes.

*Development of improved, more rapid analytical methods for determination of sulphides, thiosulphates, sulphites, sulphates and elemental sulphur in fellmongery wastes.

*Removal of sulphide from settled fellmongery wastes.

*Alcohol destabilisation of wool scouring wastes, Sawyers Bay, Dunedin.

*The WRONZ turbidimeter (completed).

*Sludge dewatering.

*By-product recovery from wool scouring liquors.

*Biological treatment of scuint solutions (proposal).

*Land disposal of scurring wastes, Winchester, South Canterbury.

*The WRONZ comprehensive scouring system — prototype at Timaru (completed).

*Use of allophane as a means of removing pollutants from waste.

*Absorption of phosphate from the Hamilton sewage treatment station in the soil floor of the Waikato River.

*Treatment of fellmongery effluent in anaerobic ponds using photosynthetic purple sulphur bacteria.

*Investigation of problems associated with the bulking of activated sludge in treatment of industrial effluents with high carbohydrate contents.

*Evaluation of land disposal (spray irrigation) of untreated dairy shed effluent in terms of pasture production and composition, effects on animal health, changes in amounts and forms of soil N and P, discharges from the area of N, P and coliform bacteria in drainage water.

*Land disposal of domestic sewage effluent (in collaboration with Winchmore Irrigation Research Station).
Massey University (Agricultural Engineering)  
R M Clarke  
D J Warburton

Victoria University (Botany)  
H G Harris  
D R McQueen

Victoria University (Zoology)  
R S Slack

University of Canterbury (Civil Engineering)  
P Wilson

University of Canterbury (Chemical Engineering)  
E E Graham  
N J Poet

Lincoln College (Microbiology)  
M J Noonan

University of Otago (Microbiology)  
M W Loutit

V TERRITORIAL LOCAL BODIES AND DRAINAGE BOARDS

Auckland Regional Authority  
N Harper  
E G Hutchinson

*Monitoring of performance and working environment of a variety of pumps for dairy waste spray disposal, including component redesign and testing.

*Evaluation of dairy shed effluent treatment by short-term (5–10 days) unmixed anaerobic treatment, followed by 1–3 days aeration over a biological filter.

*Some aspects of the biology of the Carterton Borough Council sewage oxidation pond sediments (completed); (cont act: H W Johnston).

*Presence of exogenous metallic ions and other chemical substances in soil and plants of estuarine areas in Wellington district, resulting from waterborne wastes.

*Effects of treated sewage effluent on growth of Pinus radiata (completed).

*Growing fish in lagoons and oxidation ponds.

*Use of package plants for sewage treatment.

*Treatment of meatworks effluent to recover protein.

*Treatment of fellmongery wastes with particular reference to reduction of depilatory sulphides in discharged effluents.

*Pollution control and by-product recovery in the New Zealand wool scouring industry (completed).

*Pasture contamination by micro-organisms from meat wastes (Islington) and milking shed wastes (Lincoln).

*Land application of domestic effluent (Burnham and Templeton) and meatworks waste (Islington).

*Determination of maximum loading of soils by potato processing wastes to avoid groundwater pollution and odour problems, Prebbleton.

*Survival of indicator organisms in milking shed wastes undergoing aerobic treatment.

*Investigation of the role of photosynthetic bacteria in oxidation ponds.

*The difference between E. coli and faecal coliform counts in oxidation ponds and an investigation of which organisms are contributing to the faecal coliform count.

*Deterioration of rubber and plastic rings used in pipe joints when buried in different soil types (in collaboration with DSIR).

*Chemical coagulation of sewage.

*Water quality changes during tip leachate treatment.

*Comparative evaluation of performance characteristics of different plastic media for high rate biological filtration treatment of sewage.

*Mathematical modelling of filter performance.

*Treatability factors of trade wastes, using biological filters.

*Use of biological rock and plastic media filters for deodorising sewage gases.

*Studies of oxidation pond performance and effluent quality.

*The biology of oxidation ponds.

*The classification of coliform bacteria populations at various stages of sewage treatment, by biochemical and serological methods.

*Multivariate statistical analysis of factors affecting algal growth in oxidation ponds (by University of Auckland); (completed).

*Detergent levels in sewage.

*Comparative evaluation of sludge density meters.

*Sewage sludge thickening and drying. Cost/benefit analysis of various processes.

*Bioassay of toxic material in sewage sludge.

*Estimation of helminths and other parasitic organisms in treated sewage sludge.

*Treatment of alum sludge from potable water treatment plants.

*Control of sulphide in sewers.

*Effect of refuse grinders on the strength of domestic wastes.

*Prevention of nozzle blockage in sedimentation tank scum removal spray systems.

*Stormwater quality studies – SS, BOD, DO, pH, bacto.
*Continuous monitoring systems for wastes.
*Major constituents, including P, N, CN, of domestic, industrial and sewage treatment plant discharges.
*Strengths of trade wastes.
*Effects of circulation and management changes on anaerobic digester performance.
*Investigation of mixed media filtration of tertiary wastewater treatment plant effluent.
*Analysis of bacteriological reports on sea samples taken from Poverty Bay in the locality of the Gisborne submarine sewage outfall (completed).
*Performance monitoring of a primary wastewater treatment plant, particularly with regard to sedimentation tank efficiency.
*Design and building of a pilot-scale extended aeration unit to supply possible design parameters for planned secondary treatment.
*Performance monitoring and physical and chemical control of a completely mixed anaerobic sludge digester.
*Qualitative investigation of Hutt Valley sewage based on data obtained from a pilot primary treatment plant and other related studies.
*Effect of an 18 km anaerobic pressure main on the treatability of Hutt Valley sewage.
*Infiltration study including a comparison of flow from a number of different types of reticulation subcatchment.
*Trade waste survey — collating information of all industrial discharges and potential discharges in the Hutt Valley.
*Monitoring of treatment plant for tip leachate at Horokiwi landfill (grit removal, alum dosing, aeration, settling and intermittent sand filtration).
*Evaluation of the potential of biodiscs for treatment of domestic sewage. Pilot plant is later to be shifted to evaluate its potential to treat septic tank effluent.
*A model study of the secondary sedimentation tanks of the Bromley sewage treatment plant (completed).
*Coagulation and flocculation of loess suspensions.
*Pilot tower studies on Flocor plastic media at Bromley sewage treatment plant (completed).
*Bench-scale studies of settled sewage.
*Study of oxygen-activated sludge (proposal).
*Succession of algae and the role(s) of Daphnia and Moina in oxidation ponds (proposal).
*Assessment of the effects of detention time and temperature on digestion of sewage sludge.
*Application of digested sewage sludge to farmland and assessment of its value as fertiliser and soil conditioner.
*Development of analytical methods for the determination of heavy metals in both raw and digested sewage sludge.
*Assessment of the relative efficacies of chlorine and ozone for disinfecting sewage.
*Fungal attack of rubber rings used in pipe joints.
*Sewage sampling and computer processing of alarm functions and treatment plant data.
*Treatment of meat waste using plastic medium trickling filters and activated sludge.
*Digestibility of meat waste sludge.
*Removal of chrome from tannery wastes.
* Destruction of cyanide, both liquid and solid forms, the latter from case-hardening processes.
*Disposal of hazardous wastes — solvents, heavy metal sludges.

VI PRIVATE ORGANISATIONS

Alliance Freezing Co.
J Milburn

*Application and performance of several proprietary screening devices (including Bauer Hydrasieve and Anziel Aquasieve) on various meatworks waste streams with particular reference to solids and BOD removal.
*Investigation of dissolved air flotation as a means of treating meatworks waste.
*Pilot-scale investigations into oxidation of sulphide in fellmongery waste streams.
*Treatment of different types of meatworks effluent by a Flocor packed biological filter and the effects of temperature, recirculation rates, different media and combined use of dissolved air flotation and biological filtration on performance (proposal).
*Design of oxidation ponds, with emphasis on flow patterns through ponds and retention time.
*Effects of a cage aerator on biomass, sulphide and ammonia-nitrogen in a Southland oxidation pond (proposal).
*Assessment of performance of dissolved air flotation treatment on different meatworks waste streams and of effects of chemical treatment on performance.
*Means of reducing levels of ammonia-nitrogen and sulphide in meatworks waste under the prevailing climatic conditions in Southland.
*Experimental irrigation of oxidation pond water (after tertiary treatment) onto pasture and tree plantations, with special attention to health aspects, nitrite and nitrate accumulation in plants and soils and soil permeability.
*Treatment methods for strong chemical wastes from fellmongery, hide curing and casings departments.
*Continual testing of freezing works effluent quality (Waitara, Feilding, Waingawa), with short-term investigations of treatment efficiency.
*Land irrigation of meatworks waste, Fairfield.
*Chemical treatment of fellmongery wastes, Belfast.
*Removal of suspended solids from fertiliser works effluent, Awatoto.
*Neutralisation of acidic fertiliser effluents.
*Preliminary investigation into the recovery of fluorides.
*Occurrence or otherwise of cadmium in fertiliser works effluents (proposal).
*Design, installation and commissioning of prototype wool scour effluent treatment plant utilising a new process developed by DSIR/WRONZ, and subsequent evaluation of the process.
*Treatment of removed solids from wool scour effluent to recover wool grease and separate dirt for disposal.
*Evaluation of biological filters on fellmongery effluents based on pilot plant operations, Christchurch.
*Design, installation and commissioning of prototype physico-chemical wool scour effluent treatment plant, incorporating a by-product recovery plant, Sawyers Bay, Dunedin.
*Characterisation of metal quarry effluents and selection of flocculation techniques for clarification of water for discharge and reuse. Design, installation and commissioning of effluent treatment plant at Lower Hutt.
*Sludge thickening and dewatering for disposal from chemical flocculation treatment of metal quarry effluent, Lower Hutt.
*Water clarification from metal quarry effluent and total recycle for use in quarry washing duties, Lower Hutt.
*Coal mine effluent characterisation, flocculation process evaluation, design, installation and commissioning of prototype plant, Lower Hutt.
*Characterisation of meat processing effluents and assessment of physical-chemical treatment techniques in mobile field laboratory; pilot plant performance trials and cost estimates.
*Sludge dewatering, drying and feed trials as animal feed supplement for sludge recovered from pilot plant meatworks effluent treatment process, Wairoa.
*Evaluation of polishing treatment process for meatworks effluent after physicochemical treatment, for water reuse, Wairoa.
*Treatment methods for effluent containing cyanide.
*Clariqester BOD and suspended solids removal efficiency from an industrial-domestic effluent treatment plant.
*Mathematical model to predict water quality parameters at the mill's classified outfall from known effluent losses from the mill, Kinleith Technical Department.
ADDRESSES OF CONTRIBUTORS

I  NATIONAL WATER AND SOIL CONSERVATION ORGANISATION

(a) Water and Soil Division
District Commissioner of Works
P O Box 1479
CHRISTCHURCH

(b) Regional Water Boards
Rangitikei-Wanganui Catchment Board
P O Box 92
MARTON
Taranaki Catchment Commission
P O Box 159
STRATFORD

II GOVERNMENT DEPARTMENTS

National Dairy Laboratory
Ministry of Agriculture & Fisheries
Private Bag
HAMILTON

Applied Biochemistry Division
DSIR
Private Bag
PALMERSTON NORTH

Chemistry Division
DSIR
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PETONE

Plant Diseases Division
DSIR
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AUCKLAND

Division of Public Health
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WELLINGTON

Forest Products Division
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ROTORUA

III  RESEARCH ORGANISATIONS

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NELSON

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PALMERSTON NORTH

Wool Research Organisation of NZ
Private Bag
CHRISTCHURCH

IV UNIVERSITIES

University of Auckland
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AUCKLAND

Massey University
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PALMERSTON NORTH

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V TERRITORIAL LOCAL BODIES AND DRAINAGE BOARDS

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GISBORNE

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LOWER HUTT

Christchurch Drainage Board
P O Box 13-006
CHRISTCHURCH

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ROTORUA

City of Palmerston North
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PALMERSTON NORTH

Wellington City Corporation
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WELLINGTON

VI PRIVATE ORGANISATIONS

Alliance Freezing Co.
P O Box 845
INVERCARGILL

T Borthwick & Sons Ltd
P O Box 448
MASTERTON

East Coast Farmers' Fertiliser Co.
P O Box 442
NAPIER

NZ Aluminium Smelters Ltd
Private Bag
INVERCARGILL

Auckland Farmers' Freezing Co-op. Ltd
P O Box 90
AUCKLAND

Canterbury Frozen Meat Co.
P O Box 283
CHRISTCHURCH

Morrison, Cooper & Partners
P O Box 6214
WELLINGTON

NZ Forest Products Ltd
Private Bag
TOKOROA
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