Research and Development Program 2013–16

EPA's strategic research priorities

ENVIRONMENT PROTECTION AUTHORITY

EPA VICTORIA

State Government Victoria

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Foreword

Environment Protection Authority Victoria (EPA) is committed to protecting Victoria's environment to meet the needs of current and future generations. Our vision is a healthy environment that supports a liveable and prosperous Victoria. We support the achievement of environmental outcomes that allow all Victorians to have clean air, healthy water, safe land and minimal disturbances from noise and odour.

Cheryl Batagol, Chairman and John Merritt, CEO

EPA aspires to be a leader in environmental protection and to do this we need to ensure our science, knowledge and evidence underpins everything we do. Our Research and Development Program is a major contributor to achieving this. It focuses on the research and development to support delivery of the current EPA 5 Year Plan and development of future plans. To do this, our Research and Development Program aims to address our short-term knowledge needs for our current work, as well as the priority issues and opportunities we need to be ready to tackle in the future.

An important part of EPA's Research and Development Program is our partnerships with leading external research institutes. These partnerships offer immense value to EPA and given the broad nature of the environmental opportunities and challenges facing EPA, they are essential to complementing our core internal research capacity. Our partnerships provide us with the best range and depth of expertise to address our research needs, and link us with leading thinkers to help us deliver better environmental outcomes.

We encourage you to learn more about EPA's research and development priorities, and the research partners we are working with to achieve our goals.

Summary

EPA's Research and Development Program supports our core role as the regulator of pollution in Victoria and our role as an influential authority. This publication describes how EPA approaches research and development and sets out our priorities for the next 4 years. It provides information on:

- the framework EPA uses to procure and conduct research and development
- our research and development partners
- EPA's research program and current projects.

EPA's Research and Development program 2013–2016 is made up of five integrated research areas:

1. Compliance and Enforcement
2. Improving Environmental Outcomes (water, air, land, noise, odour)
3. Environmental Citizenship
4. Contaminated Land and Groundwater
5. Regulating Waste.

These priority areas for research activities aim to provide the knowledge and evidence EPA needs to support delivery of our current 5 Year Plan, and the development of future plans. These program areas are the focus of EPA's research and development over the next 4 years.

The majority of EPA's Research and Development Program 2013–2016 will be delivered through our strategic research partnerships. These include a collaborative university partnership with Monash University, RMIT University and The University of Melbourne as well as collaborations with the Cooperative Research Centre for Contamination Assessment and Remediation of the Environment (CRC CARE), the Centre for Aquatic Pollution, Identification and Management (CAPIM), BehaviourWorks Australia and the Victorian Centre for Sustainable Chemical Manufacturing (VCSCM).

Annual updates on EPA research and development projects in these program areas will be provided on the EPA website.

About EPA

EPA is part of the environment portfolio (along with the Department of Environment and Primary Industries) charged with protecting the Victorian environment. EPA's core role is to regulate pollution and EPA has independent authority to make regulatory decisions under the *Environment Protection Act* 1970.

EPA's vision is to create a healthy environment that supports a liveable and prosperous Victoria. By effectively regulating pollution in Victoria, we strive to deliver clean air, healthy waterways, safe land and minimal disturbances from noise and odour for Victorians.

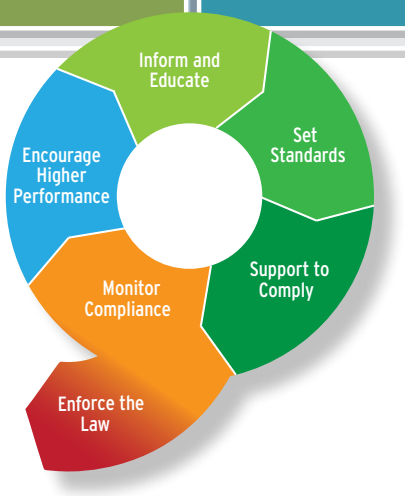
5 Year Plan 2011–2016

EPA's *5 Year Plan 2011–2016* provides the blueprint to realise the vision and support the achievement of the **environmental outcomes** by 2030 for all Victorians. EPA's **strategic priorities and corporate capabilities** show what we will focus on and what we need to excel at to achieve these outcomes. To support delivery of the strategic priorities, EPA has developed a process to identify the **environmental problems** we tackle.

EPA's regulatory model and approach

EPA endeavours to focus its efforts where there is the greatest chance of harm to the environment, health, safety or wellbeing or by focusing effort on people and businesses that are less likely to comply with environmental regulations. This allows us to allocate our resources in the most effective manner to target the right things and to make the biggest difference to Victoria's environment.

EPA uses a balanced regulatory approach with a mix of compulsory and voluntary methods. Our approach to regulation involves a number of key steps: inform and educate, set standards, support to comply, monitor compliance, enforce the law and encourage higher performance.



EPA's Research and Development Framework

Governance

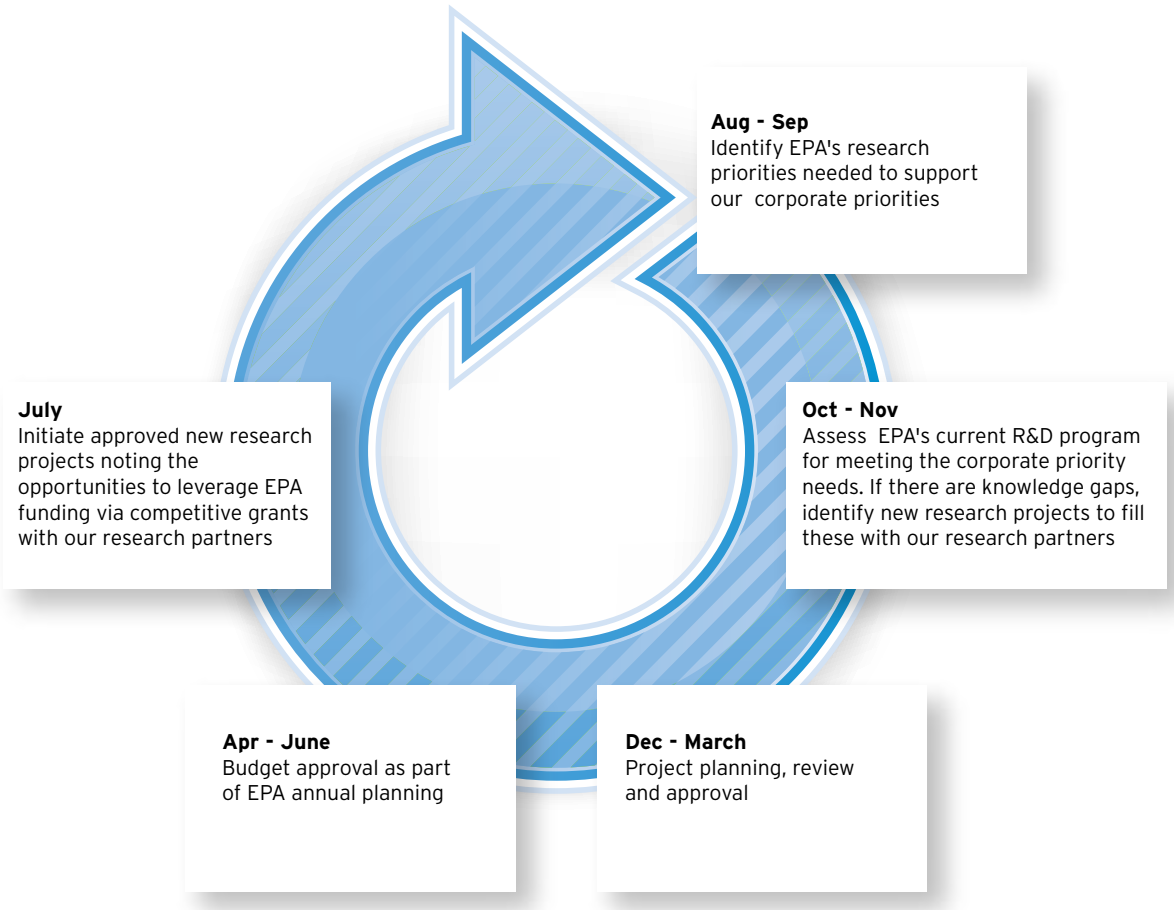
EPA's Research and Development Program is governed by three complementary groups:

- EPA Research Steering Group – made up of a representative from each directorate in EPA to set research and development priorities and provide strategic oversight of the content of EPA's Research and Development Program.
- EPA Project Steering Group – cross EPA managerial group that endorses and provides oversight for delivery of EPA projects.
- University Partnership Reference Group – made up of at least one representative from EPA and each university in our strategic university partnership to guide the broad direction of research programs and oversee collaboration across the partnership.

Monitoring and evaluation of the program

EPA's investment in research and development is aligned to EPA's 5-year planning priorities and produces high quality results and products used by EPA that are delivered collaboratively with our university partners. Ultimately we expect our Research and Development Program to provide new information and knowledge that helps drive EPA's future strategic direction, connects EPA with national and international experts, provides evidence and understanding for decision-making, and enables leverage of additional resources to co-fund mutually relevant research and development. EPA will regularly gather information and evidence to assess if these outcomes are being achieved.

Annual process and timelines in EPA's Research and Development Framework



EPA's research and development partnerships

EPA's main vehicle for delivering research and development is through our strategic research partnerships outlined below. The majority of EPA's Research and Development Program 2013–2016 will be delivered through these partnerships.

EPA's Strategic University Partnerships

EPA established a collaborative university partnership with Monash University, RMIT University and The University of Melbourne in December 2011. These partners were selected through an open expression of interest process advertised in July 2011.

The partnership's vision is *to be a trusted knowledge-driven collaboration, strategically driving evidence-based environmental protection*. The collaborative development of EPA's 2013–2016 Research and Development Program is a core part of this partnership.

Cooperative Research Centre for Contamination Assessment and Remediation of the Environment (CRC CARE)

EPA is a supporting partner of CRC CARE, which involves 25 partners across universities, industry and government.

CRC CARE provides technologies and knowledge in assessing, preventing and remediating contamination of soil, water and air. This includes: assessing contamination risks in land, groundwater and air; managing and/or remediating contamination; developing safe options for land use and the reuse of wastes on land; developing solutions that are acceptable to regulatory agencies and the public; and capacity building. For more information see www.crccare.com

Centre for Aquatic Pollution, Identification and Management (CAPIM)

CAPIM is a collaboration between The University of Melbourne, EPA, RMIT University, Melbourne Water, Department of Environment and Primary Industries, Department of Health and local catchment management authorities.

CAPIM provides information about pollutants across Victoria, including where they are impacting the environment, and sources of pollutants from the surrounding catchment. CAPIM also conducts extensive research on the development of better tools and methods for assessing current aquatic pollution and future threats. For more information see www.capim.com.au

BehaviourWorks Australia

BehaviourWorks Australia is a collaboration between Monash Sustainability Institute, EPA Victoria, The Shannon Company, the NSW Office of Environment and Heritage and Sustainability Victoria.

BehaviourWorks Australia brings together interdisciplinary researchers with leading practitioners in government and business who share an interest in behaviour change research and environmental sustainability. For more information see www.behaviourworksaustralia.org

Victorian Centre for Sustainable Chemical Manufacturing (VCSCM)

VCSCM is a collaboration between the CSIRO, EPA Victoria and PACIA.

VCSCM provides an important platform to support Victorian manufacturing to become more globally competitive and thus sustainable. The technology and training services available through the VCSCM and its partners will help Victorian chemical manufacturers to understand, evaluate, select, adapt, fund, demonstrate and ultimately install and operate environmentally friendly cost efficient product and process technologies.

Recent collaborations between EPA and our university partners

Monash University – illegal dumping of waste in public spaces

The illegal dumping of waste in public spaces costs Victoria millions of dollars each year to clean up. This cost is borne by local councils, who spend considerable resources collecting and disposing of illegally-dumped items, as well as charity organisations, which are often the targets of illegal dumping and have to sort through and dispose of this waste.

BehaviourWorks Australia at Monash University is collaborating with EPA Victoria, Sustainability Victoria and the National Association of Charitable Recycling Organisations to evaluate the effectiveness of different strategies for reducing the amount of waste being dumped outside charity stores (phase 1) and in public places (phase 2). Interventions being examined in the first phase include CCTV cameras, sensor lighting, fencing, and signs that highlight either the personal impact of dumping (e.g. being fined) or the social impact of dumping (e.g. reducing charity's capacity to help those in need). This project will identify strategies that charity stores and local councils can implement to reduce illegal dumping outside charity stores and in public places.

RMIT University – the potential for sustainable application of industrial waste in agricultural landscapes

RMIT University researchers did a research literature review in 2012 to investigate the potential for sustainable application of industrial waste in agricultural landscapes. This review analysed literature on industrial waste applications to agricultural soils and assessed the associated risks and potential benefits. Applying waste to land can have beneficial outcomes including reducing waste sent to landfill and providing alternative sources of nutrients for agricultural systems. However, there are also potential hazards, including contamination of soils, groundwater, and human and animal food sources.

The review investigated wastes in relation to soil characteristics, explored the dynamics between soils and waste constituents and considered the possible impacts on plants, animals and humans as a result of industrial waste amendments. The current legislation and guidelines governing the use of industrial waste in agriculture was also summarised.

The review found a potential for the application of industrial waste to agricultural soils and prospects for linking sustainable waste management and farming practices. However, it also highlighted that most research has occurred on a site by site and waste by waste basis and there is little information currently available on how to create a general and sustainable system for applying industrial wastes to agricultural lands.

The University of Melbourne – Assessing pesticide impacts in the Latrobe River

EPA Victoria worked with the Centre for Aquatic Pollution Identification and Management (CAPIM) at The University of Melbourne to assess pesticide impacts in the Latrobe River around the Narracan and Middle Creek areas. The study used a 'multiple lines of evidence approach' that combined new CAPIM research tools with traditional assessment methods.

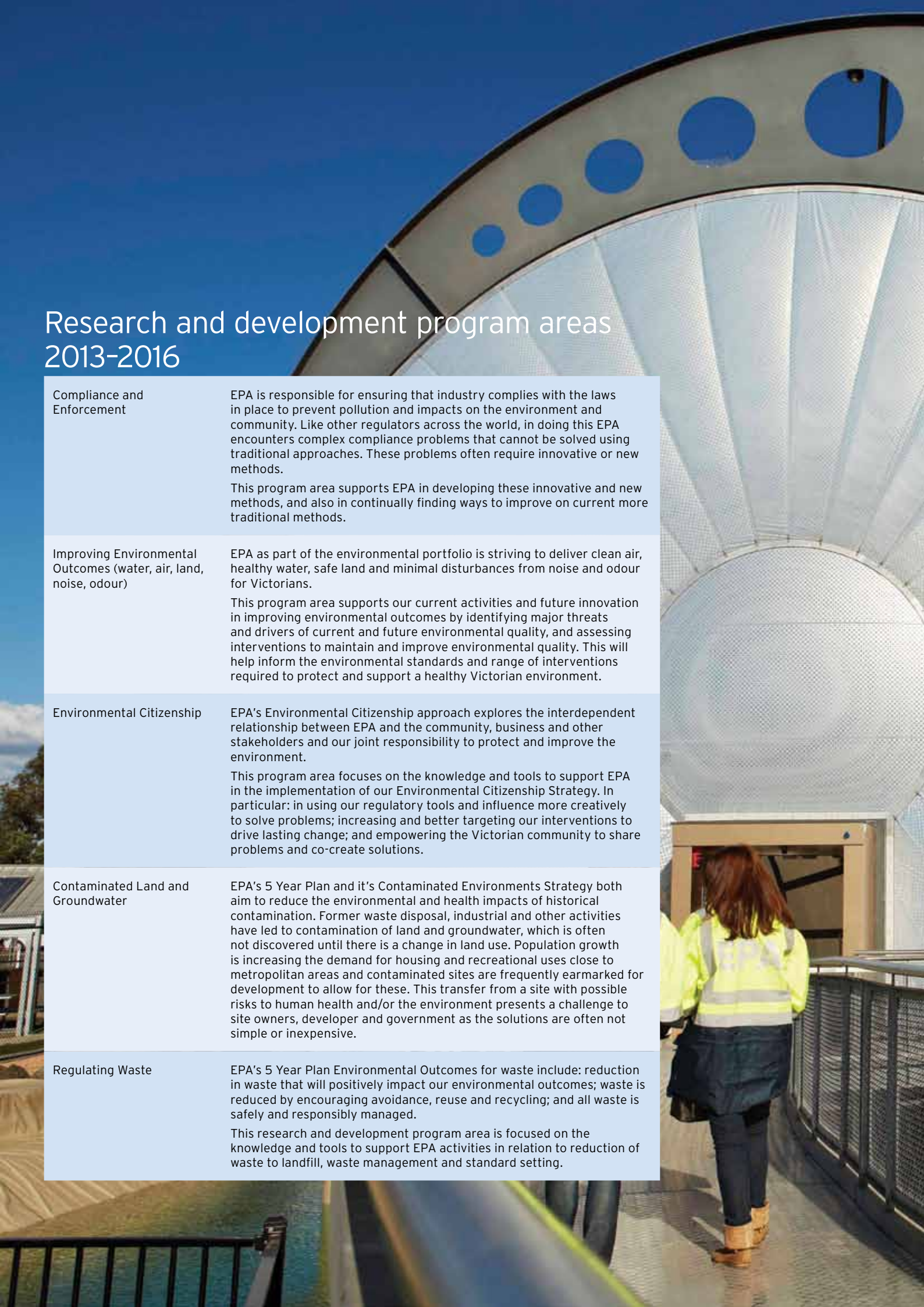
The study found minor impacts to the ecology of the LaTrobe River from pesticides in these areas. Most importantly, this collaboration gave EPA the opportunity to use and apply new technologies and approaches developed by CAPIM for pollution detection and assessment. EPA can now apply these new technologies and approaches more broadly to other pollution assessment activities. These new methods, combined with EPA's current assessment tools, can provide EPA with information and evidence that allow us to make more confident decisions on potential pollution issues.

EPA's Research and Development Program

Program overview

EPA's Research and Development Program supports our core role as the regulator of pollution in Victoria. EPA uses a balanced regulatory approach with a mix of compulsory and voluntary methods. This approach to regulation involves a number of key steps: inform and educate; set standards; support to comply; monitor compliance; and enforce the law and encourage higher performance (see EPAs regulatory model and approach on page 3).

EPA's current Research and Development program is made up of five integrated program areas that are outlined below and described in more detail in the following sections. These are the priority areas for research activities to provide the knowledge and evidence EPA needs to support delivery of our current 5 Year Plan and development of future Plans. These five program areas are the focus of EPA's research and development over the next 4 years.



Research and development program areas 2013–2016

Compliance and Enforcement	EPA is responsible for ensuring that industry complies with the laws in place to prevent pollution and impacts on the environment and community. Like other regulators across the world, in doing this EPA encounters complex compliance problems that cannot be solved using traditional approaches. These problems often require innovative or new methods. This program area supports EPA in developing these innovative and new methods, and also in continually finding ways to improve on current more traditional methods.
Improving Environmental Outcomes (water, air, land, noise, odour)	EPA as part of the environmental portfolio is striving to deliver clean air, healthy water, safe land and minimal disturbances from noise and odour for Victorians. This program area supports our current activities and future innovation in improving environmental outcomes by identifying major threats and drivers of current and future environmental quality, and assessing interventions to maintain and improve environmental quality. This will help inform the environmental standards and range of interventions required to protect and support a healthy Victorian environment.
Environmental Citizenship	EPA's Environmental Citizenship approach explores the interdependent relationship between EPA and the community, business and other stakeholders and our joint responsibility to protect and improve the environment. This program area focuses on the knowledge and tools to support EPA in the implementation of our Environmental Citizenship Strategy. In particular: in using our regulatory tools and influence more creatively to solve problems; increasing and better targeting our interventions to drive lasting change; and empowering the Victorian community to share problems and co-create solutions.
Contaminated Land and Groundwater	EPA's 5 Year Plan and it's Contaminated Environments Strategy both aim to reduce the environmental and health impacts of historical contamination. Former waste disposal, industrial and other activities have led to contamination of land and groundwater, which is often not discovered until there is a change in land use. Population growth is increasing the demand for housing and recreational uses close to metropolitan areas and contaminated sites are frequently earmarked for development to allow for these. This transfer from a site with possible risks to human health and/or the environment presents a challenge to site owners, developer and government as the solutions are often not simple or inexpensive.
Regulating Waste	EPA's 5 Year Plan Environmental Outcomes for waste include: reduction in waste that will positively impact our environmental outcomes; waste is reduced by encouraging avoidance, reuse and recycling; and all waste is safely and responsibly managed. This research and development program area is focused on the knowledge and tools to support EPA activities in relation to reduction of waste to landfill, waste management and standard setting.

Compliance and Enforcement

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EPA's main research and development questions in this program area:

- What are the main drivers and barriers of business compliance?
- With the above understanding, what are the most effective approaches EPA can use with different businesses and scenarios to support compliance and better environmental outcomes?
- What technologies and approaches can EPA use or develop to more effectively detect and track sources of pollution?

Priorities and projects in this program area

EPA is conducting eight projects with 12 partner organisations under the following priority areas:

- Understanding business behaviour to drive compliance outcomes – two projects
- Technologies and methods for pollution detection and source tracking – five projects
- Risk based approaches to tackling pollution – one project

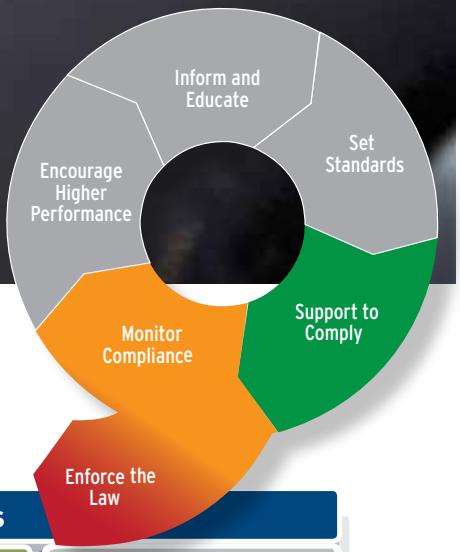
Details of these projects and the partner organisations is provided on page 21.

Susan Carter,
Senior Engagement Facilitator, Strategic Partnerships Unit, EPA

"We developed EPA's Behaviour Change Strategy in 2012. One of the focus areas of this strategy is how we work with industry and businesses to achieve compliance.

Ultimately, achieving compliance requires behaviour change. The research project we are starting with Monash and RMIT universities aims to help us understand barriers and drivers for compliance, and what tools and communication techniques we can use to achieve compliance.

The first step will be to work with our field officers and businesses. With this knowledge, we can then develop tools and behaviour change approaches to best support EPA staff to achieve compliance outcomes. This will include the range of tools needed for the different situations they are experiencing."



How this supports our 5 Year Plan priorities

CORPORATE CAPABILITIES

- Exercise our Regulatory Powers
- Apply our Knowledge and Authority
- Build Strong Partnerships
- Transform to an Effective Organisation

Strategic Priorities

Deal with past pollution	Tackle current environmental issues	Shape the environmental future
Reduce environmental and health impacts of historical contamination	Prevent pollution and improve efficiency of resource use	Avoid future impacts by anticipating and acting

Improving Environmental Outcomes (water, air, land, noise, odour)

By effectively regulating pollution in Victoria, EPA is striving to deliver clean air, healthy water, safe land and minimal disturbances from noise and odour for Victorians. As an influential authority we also work with our partners in the environmental portfolio in setting longer-term strategies and objectives for environmental quality.

This program area supports our work for improving environmental outcomes by providing knowledge and tools that will give us a better understanding of the issues and opportunities we need to focus on now and in the future. This will help inform the environmental standards and interventions that will be most effective to protect and support a healthy Victorian environment.

EPA's main research and development questions in this program area:

- What are the major threats and drivers of current and future environmental quality?
- Which interventions would be most effective in maintaining or improving environmental quality?
- What are the environmental quality standards required to protect and support a healthy Victorian environment?
- What is the exposure of Melbourne's population to environmental noise sources? What is the health burden from environmental noise in disability-adjusted life years (DALYs)?
- How can EPA combine our air quality monitoring station data with our air dispersion model to provide a greater coverage of air quality information across Melbourne and Victoria in real-time?

Priorities and projects in this program area

EPA is conducting eleven projects with 31 partner organisations under the following priority areas:

- Future air quality in Victoria – one project
- Current air quality and impacts in Victoria – two projects
- Health burden from noise to Victorians – one project
- Future water quality in Victoria – seven projects

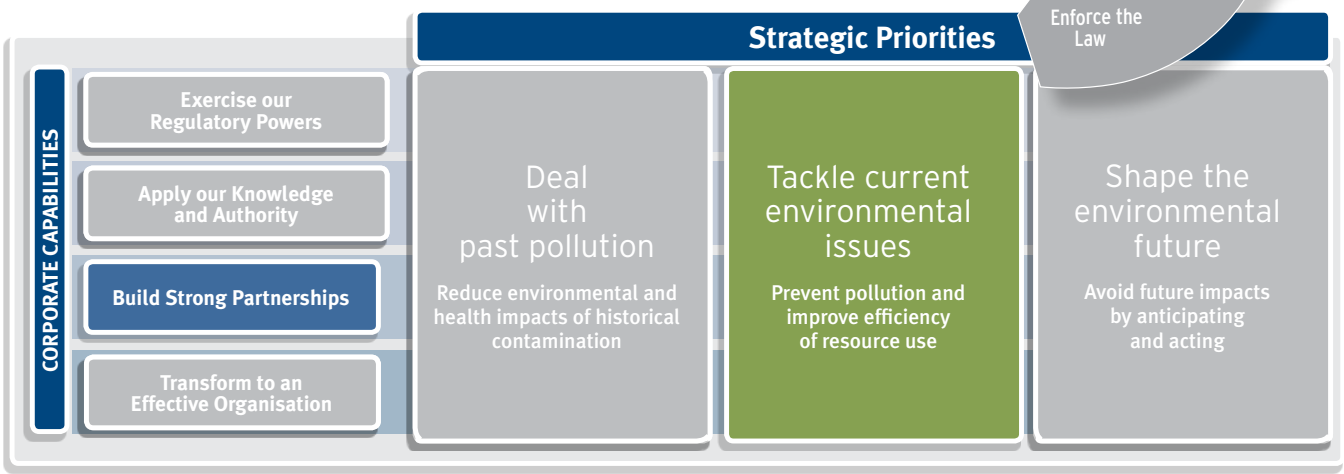
Details of these projects and the partner organisations is provided on page 23.

Steve Lansdell,
Team Leader – Water, Policy and Regulation Unit, EPA

"We need to focus on what healthy water will look like in the future. This involves working with other agencies on policies that set the longer-term water quality objectives to support community expectations, and working out the most effective interventions for achieving this. Under this broader policy, we then work on developing the more detailed guidelines and standards that EPA needs as the regulator to drive these future water quality outcomes.

The research we are doing in the Future Water project will give us a much better understanding of the future scenarios for water quality in Victoria, and help us to identify the most important issues and opportunities we need to be planning for. This includes identifying the new threats and drivers of water quality, and also the current issues that will still be important to deal with into the future. The research will also provide information on the effectiveness and flexibility of different interventions for protecting or improving water quality under these conditions. We need this evidence to be able to make sound decisions on our longer-term policies, strategies and regulations."

How this supports our 5 Year Plan priorities



Environmental Citizenship

EPA's Environmental Citizenship approach explores the interdependent relationship between EPA and the community, business and other stakeholders and our joint responsibility to protect and improve the environment. Our strategy released in January 2013 has three main drivers: Accessibility, Participation and Responsibility; Environmental Equity and Restorative Action; and Environmental Leadership.

This program area focuses on the knowledge and tools to support EPA in the implementation of our Environmental Citizenship Strategy. In particular: in using our regulatory tools and influence more creatively to solve problems; increasing and better targeting our interventions to drive lasting change; and empowering the Victorian community to share problems and co-create solutions.

EPA's main research and development questions in this program area:

- What are the drivers of disproportionately impacted communities?
- How can EPA create resilience and empower communities, and which communities (including local businesses) do we need to do this with?
- How do we characterise the wellbeing impact on Victorians from odour?
- How can EPA drive lasting behaviour change and promote joint responsibility with community, business and other stakeholders?

Priorities and projects in this program area

EPA is conducting four projects with six partner organisations under the following priority areas:

- Enviornmental equity, state of the environment and transforming disempowered communities – two projects
- Driving lasting behaviour change and promoting joint responsibility with community, business and other stakeholders – two projects

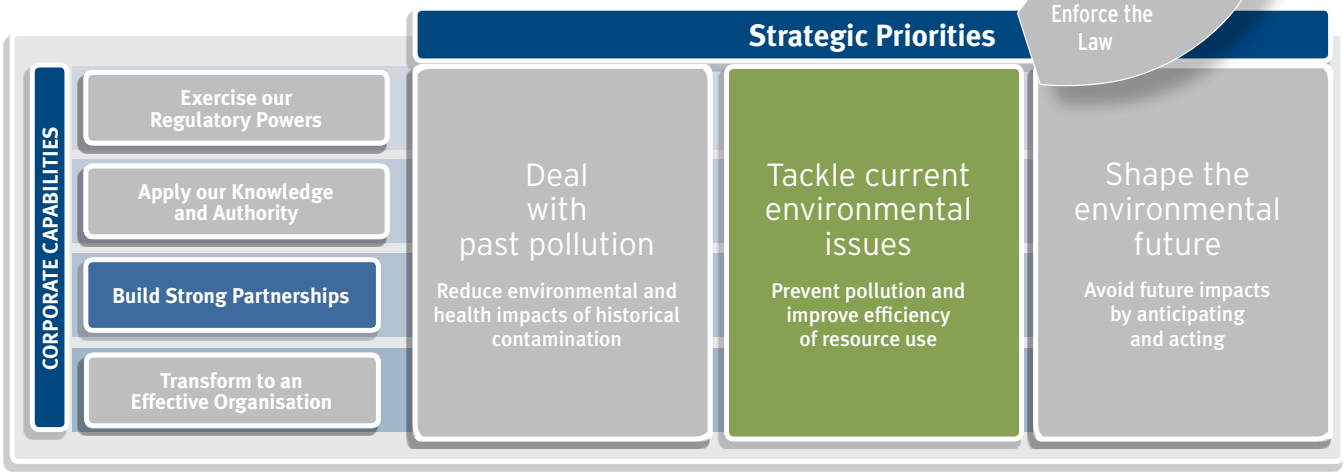
Details of the these projects and the partner organisations is provided on page 25.

Marg Renwick,
Senior Adviser
Community & Environmental Partners, Strategic Partnerships Unit, EPA

"My role involves leading implementation of EPA's Environmental Citizenship Strategy that was released in March 2013. Using environmental citizenship as a regulator is a relatively new thing. One of the first big challenges will be identifying the opportunities to use environmental citizenship to achieve a better outcome. To do this will really need to think differently about how we can approach some of our work. The outcome we are looking for is to empower the community, businesses and other agencies to have a bigger role in protecting the environment.

There are three main drivers of our Environmental Citizenship Strategy, one of which is Environmental Equity and Restorative Action. The Environmental Equity Research being undertaken in this program area will really help us to identify opportunities for using environmental citizenship in our work. It will provide us with the knowledge we need to better take into account vulnerable communities in the work we do, and to be able to think more strategically about how we work with those communities and our other environmental partners."

How this supports our 5 Year Plan priorities



Contaminated Land and Groundwater

The main objective of EPA's Contaminated Environments Strategy is to reduce the environmental and health impacts of historical contamination. Former waste disposal, industrial and other activities have led to contamination of land and groundwater, which is often not discovered until there is a change in land use. As Victoria's population continues to grow, demand will increase for land development, especially close to urban areas, where contaminated sites are frequently earmarked for re-development. These re-developments create opportunities to locate people close to jobs, services and transport and unlock opportunities for growth. They also create opportunities to clean up legacy contamination and improve local amenity. This transfer from a site with possible risks to human health and/or the environment presents a challenge to site owners, developers and government as the solutions are often not simple or inexpensive.

This program area focuses on the knowledge and tools to support EPA in more innovative approaches to manage the regulation of contaminated environments from historical activities.

EPA's main research and development questions in this program area:

- As part of EPA's current work in developing regulatory frameworks to apply risk-based approach to management decisions for contaminated land and groundwater, we will be determining our specific research questions to support this work, which will be available in the next annual update.

Priorities and projects in this program area

EPA is conducting two projects with five partner organisations under the following priority areas:

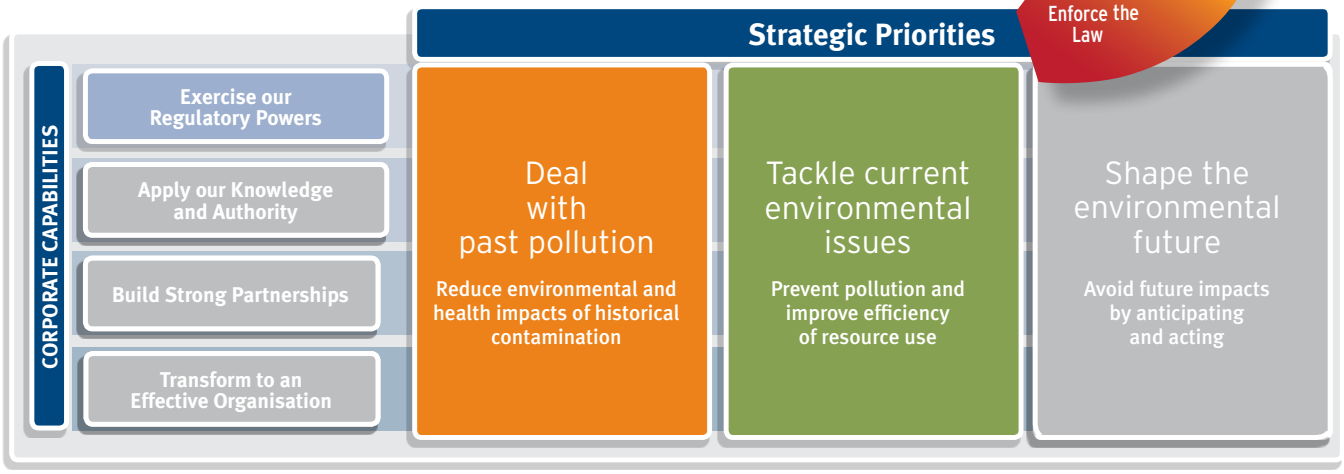
- Technologies for cleaning up contaminated sites – one project
- Regulatory Frameworks - one project.

Details of the these projects and the partner organisations is provided on page 26.

Jason Borg, Director
Strategy and Support, EPA

"EPA's role as the environmental regulator in contaminated environments is to enable efficient clean-up decisions and ensure that the environment is protected from harm for the benefit of current and future generations. Our regulatory frameworks must continually improve and keep pace with the latest scientific evidence. In this program we are interested in research that will enable us to be a world leader in regulating contaminated environments."

How this supports our 5 Year Plan priorities



Regulating Waste

The wastes hierarchy is one of the 11 principles of environment protection in the *Environment Protection Act 1970*. This hierarchy lists a general environmental order of preference for waste management with avoidance being the most preferred option and disposal being the least. While landfills represent the least preferred waste management option from an environmental perspective, they will continue to be required for the foreseeable future to manage those wastes that cannot currently be avoided, recycled, reused or energy recovered in an environmentally sustainable manner. EPA's 5 Year Plan Environmental Outcomes for waste are: reduce waste that will positively impact our environmental outcomes; reduce waste by encouraging avoidance, reuse and recycling; and all waste is safely and responsibly managed.

This program area focuses on developing the knowledge and tools to support EPA activities relating to reduction of waste to landfill, waste management and standard setting.

EPA's main research and development questions in this program area:

- What are the benefits and risks of wastes in their application to land as fertilisers, compost and soil enhancers? How should EPA assess wastes applied to land such that the wastes are managed to meet standards and do not impact the environment?
- How will EPA link waste acceptance criteria (contamination loads in waste) with landfill engineering and management?
- Are the current waste acceptance criteria adequate, should they be updated to reflect changes in supporting legislation or is there a better way to regulate contamination levels into landfill?

Priorities and projects in this program area

EPA is conducting four projects with six partner organisations under the following priority area:

- An integrated assessment model for land application of waste - four projects

Details of the these projects and the partner organisations is provided on page 27.

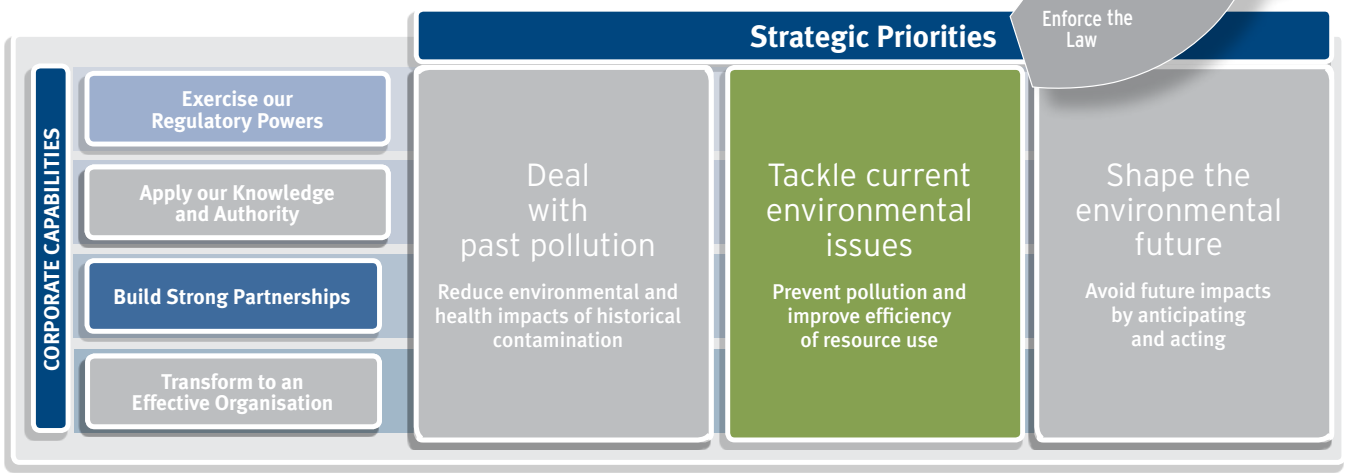
Fergal Grahame,
Team Leader Compliance and Strategy Support Team, North East Office, EPA

"I work in EPA's North East Office in a team that focuses on solving some of the more complex issues we have in our region. One of these relates to the application of wastes to land.

More businesses are looking at different ways to reuse the waste they generate. One option available is using organic wastes, including food waste, as compost and soil enhancers on land. One of the challenges in making decisions for these proposals is understanding what the land is capable of sustaining and what is beneficial for the land. Once this is understood we need to translate this information into a Standard that has clear criteria to assess what is acceptable and what is not. We currently have this clear criteria for the classification of industrial wastes for the purposes of determining disposal and clean fill options. However, there is a bit more complexity in doing this for the application of wastes to agricultural land and we need to do some more work in this area.

This research project will help provide the information we need to develop a clearer understanding of what our compliance standards will be for applying organic wastes to land. This will ensure we can support those proposals that will be beneficial for best practice waste management and the beneficial uses of the land environment, and decline those that are not. This work requires a broad range of expertise, some of which is outside EPA's traditional skill base such as agronomy. Working with the universities ensures we have access to the right experts who are working together utilising their individual strengths. This is a fantastic opportunity and has the potential for really powerful outcomes in dealing with these traditionally complex assessments."

How this supports our 5 Year Plan priorities



Integration of EPA's research and development

The vision for EPA's research and development is:

> *Research and development will be a driver of strategic direction and connect EPA with the right knowledge to confidently make decisions and challenge assumptions.*

EPA has created a set of nine principles that reflect the intent of the research and development vision and guide our research and development investment decisions. These ensure that our research and development is:

Strategic	Research and development prepares EPA for the future and drives step changes aligned with corporate priorities, objectives and purpose.
Relevant	Research and development substantially influences organisational decisions and has enduring outcomes.
Collaborative	Research and development is done with others who share the need and the best partners that create opportunities for EPA and its staff.
Excellent	Research and development is high quality and managed well.
Adaptive	Research and development is flexible and responsive to new information and understanding.
Inter-disciplinary	Research and development is as inter-disciplinary as possible. With the broad nature of our environmental opportunities and problems, no single discipline will provide the answers we need.
Transparent	Research and development is visible to our staff, stakeholders and the community.
Applied	Research and development covers priority knowledge needs in EPA, meets client needs and is fit-for-purpose.
Accessible	Research and development is available and communicated to those who need it.

Our Research and Development Program addresses our shorter-term tactical knowledge needs as well as our longer-term strategic needs. This includes projects and programs of work across different timescales and focus:

- short-term (1 year) – immediate tactical needs and exploration / review to establish if there is a need for longer-term research
- medium-term (2 to 4 years) – delivery of the current 5 Year Plan and development of future plans
- long-term (more than 4 years) – long-term environmental outcomes (10 to 20 years).

Our medium to longer-term research uses a staged approach, whereby knowledge and tools are developed throughout the life of projects, which can be taken up and used by the business in the shorter term.

EPA's research and development priorities are identified with input from all areas across the business and it is those areas of the business that use the results, who are working with our research partners to scope and manage the projects. This ensures that outcomes of our Research and Development Program meet EPA's needs and are fit-for-purpose.

Although our Research and Development Program is organised into five program areas (see page 9), it is managed as a single integrated organisational program. The outcomes of projects in any single program area often also inform the research and EPA's activities in other areas. For example, our research into odour health burdens in the Environmental Citizenship Research area will also inform our work in the Environmental Outcomes Research area.

Finally, our governance and annual planning processes (see page 4) are crucial in ensuring integration and uptake of the outputs of the EPA Research and Development Program.

Summary of Research and Development Projects

Compliance and Enforcement – current research and development priorities

Current research and development priorities	Projects	Research partners	Project status
Understanding business behaviour to drive compliance outcomes The development of knowledge and tools to support EPA in understanding our industry and business stakeholders, providing information and education, and utilising behaviour change tools for better outcomes.	**Building on current understanding of EPA and business compliance interactions (stage 1)** This project will develop a foundational understanding of what behaviour change approaches are currently being used, how effective these are and areas where there are opportunities to reinforce good practice and fill gaps. This will include ensuring a good understanding of our business audiences.	Monash University, RMIT University	Active Due 2012/13
	Development of behaviour change tools that will support EPA and businesses for improved compliance (stage 2) This project will use the baseline information from the above project to build an effective behaviour change approach and tools within this for EPA field staff. The aim of these tools is to support the use of compliance approaches in a way that is targeted to its audience and promotes effective behaviour change.	Monash University, RMIT University	TBD after stage 1

Compliance and Enforcement – current research and development priorities continued

Current research and development priorities	Projects	Research partners	Project status
Technologies and methods for pollution detection and source tracking Technologies and analysis techniques that support EPA in making timely and informed decisions about pollution.	**Technologies for pollution detection and source tracking – surface water environments** Stage 1 of the project will identify available technologies and approaches for detection and tracking of aquatic pollution for EPA adoption. Stage 2 of the project will be the development of new technologies for priority gaps.	Centre for Aquatic Pollution Identification and Management (CAPIM) – The University of Melbourne	Active Due 2015/16
	Advanced polymeric membranes in the passive sampling of herbicides in aquatic systems A subset of the larger project (above), this project will develop inexpensive herbicide passive samplers with significantly improved selectivity and sensitivity. These will allow for easier and more rapid identification of herbicide pollution events and their sources.	Centre for Aquatic Pollution Identification and Management (CAPIM) – The University of Melbourne, The University of Kitakyushu, Institute of Technology, Narashino ARC linkage proposal	Pending ARC approval to commence in 2013/14
	The smart sensor project This project is proof of concept for attaching a device to smart meters to allow communication with householders in situations such as emergency warning / prevention or energy appliance usage. This will also support environmental hazard and quality monitoring, and chemical detection and measurement.	Department of Environment and Primary Industries (DEPI), and Dius Computing Funded through the Department of Business and Innovation (DBI) Market Validation Program (MVP)	Active Due 2012/13
	Using high capacity broadband to enable pervasive environmental sensing – air quality applications The project will develop and trial air quality sensors within regional Victoria to augment EPA's current air quality monitoring network.	Department of Environment and Primary Industries (DEPI), Dius Computing and Grey Innovation Funded through the DBI Broadband-Enabled Innovation Program (BEIP)	Active Due 2014/15
	Molecular biosignatures for isolating pollution problems in aquatic ecosystems using macroinvertebrate bioindicators This project aims to develop new molecular tools for assessing pollution in aquatic ecosystems, which provide faster identification of pollution and the impacts to the environment.	The University of Melbourne ARC Linkage funding	Active Due 2014/15
Risk based approaches to tackling pollution Knowledge that supports EPA's risk-based regulatory approach.	**Towards a holistic impact assessment - merging life cycle assessment and quantitative risk assessment** This project will increase the robustness of our regulatory development decision-making. Quantitative risk assessment is the most accurate way to analyse direct human health risks, and by combining it with life cycle assessment we will expand the scope of our assessments. The project will produce guidance on a methodologically consistent way to combine both approaches in the same analysis.	University of New South Wales, Chalmers University of Technology (Sweden) and the University of Cincinnati (USA)	Active 2014/15

Improving Environmental Outcomes – current research and development priorities

Current research and development priorities	Projects	Research partners	Project status
Future air quality in Victoria An understanding of the future scenarios for Victorian air quality. This includes the main issues and opportunities, and effectiveness of different approaches in responding to these.	**Future air projections** This project investigates the likely trends in Victoria's air quality over the next few decades. It examines factors affecting future air quality (including climate change, technology change and population growth), and evaluates air quality impacts under three future scenarios for the year 2030. The primary focus is on the Port Phillip region, with a secondary focus on smoke from fires and wind-blown dust across the state. This information will be used to develop effective strategies for control of air pollution into the future.	CSIRO	Active Due 2012/13
Current air quality and impacts in Victoria Understanding and predicting current air quality and impacts in Victoria.	**Smoke impacts on community health and social perceptions** This project will study the Individual and population level health responses to smoke exposure and the value of potential mitigation and communication strategies directed at reducing human health impact from smoke exposure. This will be used by EPA to support working other government agencies to reduce health impacts from smoke.	Monash University, University of Tasmania, CSIRO Industry partners – DEPI, Department of Health (DH)	Active Due 2014/15
	Smoke transportation modelling and smoke emissions modelling The project aims to improve our capability to model and predict the spread and accumulation or dissipation of smoke from planned and unplanned fire events, by improved smoke trajectory and accumulation or dissipation modelling. This will assist EPA in predicting smoke impacts, undertaking air quality impact forecasting and providing smoke alerts.	CSIRO, The University of Melbourne, University of Wollongong Industry partners – DEPI	Active Due 2014/15
Health burden from noise to Victorians Quantify the health burden from noise to Victorians.	**Quantify the health burden from environmental noise** Through this project, EPA and its research partners will quantify the health burden from exposure to environmental noise sources. Focusing on Melbourne, the study will look at how many people are exposed to noise from road traffic, trains and industry and how this impacts upon the community's health. This information will be used to develop or influence future national, state and local measures to address environmental noise.	Monash University, RMIT University, The University of Melbourne, WSP Buildings Pty Ltd	Active Due 2013/14

Improving Environmental Outcomes – current research and development priorities continued

Current research and development priorities	Projects	Research partners	Project status
Future water quality in Victoria An understanding of the future scenarios for Victorian water quality. This includes the main issues and opportunities, and effectiveness of different approaches in responding to these.	**Future water scenarios** This project will provide quantitative evidence on future water quality and pollution in Victoria, the priority drivers and threats, and how this may change under different likely future scenarios. This information will be used in determining the future priorities that need to be addressed, and the most effective interventions in managing these.	The University of Melbourne, Monash University	Active Due 2015/16
	Functional links between estuaries and their catchments This project will address a key knowledge gap on the role temperate Australian estuaries play in the connectivity of catchment management and impact to coastal waters. The research will be focused on the Western Port area.	Monash University, Deakin University, University of Southern Denmark, University of Western Australia Industry partners – Melbourne Water, Parks Victoria, DEPI, NSW Department of Environment and Heritage ARC Linkage funding	Active Due 2014/15
	Either side of the big wet: the future resilience of south eastern Australia's biota This project will provide information on the response of a range of floodplain and plains landscapes plants and animals to the 2010–11 break in the recent drought. It will then use this information to evaluate the relative resilience of these biota over the next century.	Monash University, Parks Victoria, Charles Darwin University Industry partners – DEPI, Goulburn Broken CMA, North Central CMA ARC Linkage funding	Active Due 2015/16
	Carbon farming This project will assess interactions between carbon farming, water (quality and quantity) and biodiversity. It will also assess how a range of future climate and carbon pricing scenarios might influence carbon farming uptake.	Monash University Industry partners – DEPI, Goulburn Broken CMA, North Central CMA, Kilter Pty Ltd ARC Linkage funding	Active Due 2012/13
	Seagrass resilience This project will investigate the important factors that contribute to seagrass resilience. This information will inform water quality standards.	The University of Melbourne, Deakin University, James Cook University, DEPI Funded by DEPI	Active Due 2014/15
	The recovery of seagrass beds: The role of catchments and options for management responses This project will further our understanding of the processes that cause losses of seagrass beds, the factors that prevent their reestablishment and provide a framework for evaluating alternative management options. This information will inform nutrient and sediment loading, water quality targets and threshold criteria for Western Port that will be linked directly to measured ecosystem health.	Monash University, Southern Cross University, The University of Melbourne, University of Tasmania Industry partners – Melbourne Water, Parks Victoria ARC Linkage proposal	Pending ARC approval to commence in 2013/14
	Quantitative metric for determining aquifer ecosystem state This project will develop quantitative metrics for aquifer ecosystem function. This will improve understanding, management and assessment capability of Australian aquifer ecosystems.	Flinders University, Macquarie University, University of Technology Sydney, South Australian Museum, The University of Adelaide, University of Southern California Industry partners – Environment Protection Authority South Australia, South Australian Museum, Western Australian Museum ARC Linkage proposal	Pending ARC approval to commence in 2013/14

Environmental Citizenship – current research and development priorities

Current research and development priorities	Projects	Research partners	Project status
Environmental equity – state of the environment and transforming disempowered communities The knowledge EPA needs to ensure a consistent and evidence-based view of environmental equity, and how this may be applied to our regulatory decisions and inform our role as an influential authority.	**Environmental Equity – Building policy & practice for the EPA** This project aims to develop a flexible conceptual model of community vulnerability and resilience. A model that when applied with environmental, planning and land use datasets can indicate the potential for environmental or social impact to occur and allow EPA to adapt or develop new strategies when engaging with these communities.	RMIT University, Monash University, The University of Melbourne	Active Due 2014/15
	Health risk assessment of odour-related impacts This project is an input to the above Environmental Equity project. It will provide an evidence base for the health and wellbeing burden from odour. This will inform policy, support regulatory activities and provide community information on the likely impact of odour.	RMIT University, Monash University, The University of Melbourne	Active Due 2014/15
Driving lasting behaviour change and promoting joint responsibility with community, business and other stakeholders	**Spill over from private to public sphere behaviours** Using private sphere pro-environmental behaviours as leverage, this project will assess interventions promoting citizenship behaviours (public process participation, monitoring and reporting of pollution) with the aim of fostering communities with greater environmental awareness and behaviour.	Monash University, Aarhus University, Denmark, The Shannon Company Pty Ltd ARC Linkage proposal	Pending ARC approval to commence in 2013/14
	Beyond business as usual: A study of continuities and discontinuities in SMEs' environmental sustainability practices This project will provide interview and survey evidence on when small to medium enterprises (SMEs) adopt and resist environmentally sustainable practices. By increasing understanding of how to change business as usual it will assist in reducing negative environmental impacts of SMEs and, ultimately, in promoting an environmentally sustainable Australia.	Monash University, Edith Cowan University, The Shannon Company Pty Ltd ARC Linkage proposal	Pending ARC approval to commence in 2013/14

Contaminated Land and Groundwater – current research and development projects

Current research and development priorities	Projects	Research partners	Project status
Technologies for cleaning up contaminated sites Developing and trialling cost effective technologies for remediating contaminated sites.	**Phytoextraction approaches for mitigating heavy metal release from unlined and loosely capped rural landfills** The project aims to develop novel approaches to substantially improve the long-term environmental safety of rural landfills. These approaches involve the use of high-value tree crops and plants capable of extracting toxic metals. Utilization of these plants will create a valuable resource on an otherwise derelict area.	The University of Melbourne, University of the Balearic Islands, La Trobe University Industry partners – Pyrenees Shire Council ARC Linkage funding	Active Due 2013/14
Regulatory frameworks Reviewing, developing and implementing improved regulatory frameworks.	**National remediation framework** This project aims to develop a nationally consistent approach to the remediation and management of site contamination. The components of the framework will provide practical guidance to practitioners and to regulatory personnel.	CRC CARE Industry partners – state and territory environmental regulators	Active Due 2016/17

Regulating Waste – current research and development priorities

Current research and development priorities	Projects	Research partners	Project status
An integrated assessment model for land application of waste The information and knowledge for development of a risk based framework for decision making on application of waste to land.	**Assessment – understanding waste streams and land characteristics** This project will provide information on the: types and volume of waste streams from industry sectors; the chemical, physical and microbiological characteristics of these wastes; land characteristics and land uses that are important to assessing benefits and risks of applying waste to land. It will then prioritise and categorise the waste streams, waste constituents and soil characteristics for further research.	RMIT University, The University of Melbourne, Monash University	Active due 2012/13
	Beneficial values – understanding beneficial values of applying waste to land This project will provide an understanding of the waste and land characteristics and processes that provide benefits to soil health and productivity, and the best practice in the application of waste to land. It will then develop criteria for assessing the environmental benefit associated with applying wastes to land.	RMIT University, The University of Melbourne, Monash University	Proposed commencing 2013/14
	Risk – understanding risks of applying wastes to land This project will provide an understanding of the: short and long-term environmental impacts of applying the wastes from the above two projects to land; such as dust impacts, pollution of surface and groundwater; and best practice in the application of waste to land. It will use this to develop criteria for applying waste to land that optimises benefits and minimises risks that is based on general waste and soil characteristics.	RMIT University, The University of Melbourne, Monash University	Proposed commencing 2016/17
	The pollution potential of mercury in legacy biosolids and possibilities for its minimisation by phytoremediation and phytostabilization approaches This project will develop new analysis techniques to study the fate of mercury in legacy biosolids. It will also assess phytoremediation approaches using native plants to reduce mercury release so the biosolids can be safely used for land applications.	The University of Melbourne, Southern Illinois University, University of the Balearic Islands Industry partners – Melbourne Water ARC Linkage funding	Active Due 2017/18

How to get more information

Annual updates on EPA research and development projects underway in our Research and Development Program as well as access to related publications is provided on the EPA website at www.epa.vic.gov.au

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