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# **Carbon Capture and Storage Laws in Australia: project facilitation or a precautionary approach?**

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Carbon capture and storage (CCS) is considered to be an integral transitional measure in the mitigation of the global greenhouse gas emissions from our continued use of fossil fuels.<sup>1</sup> Regulatory frameworks have been developed around the world and pilot projects have been commenced. However, CCS processes are largely untested at commercial scales and there are many unknowns associated with the long term risks from these storage projects. Governments, including Australia, are struggling to develop appropriate, yet commercially viable, regulatory approaches to manage the uncertain long term risks of CCS activities. There have been numerous CCS regimes passed at the Federal, State and Territory levels in Australia. All adopt a different approach to the delicate balance facilitating projects and managing risk. This paper will examine the relatively new onshore and offshore regimes for CCS in Australia and the legal issues arising in relation to the implementation of CCS projects. Comparisons will be made with the EU CCS Directive where appropriate.

## **1. Outline of Paper**

This paper will begin with a brief discussion of the drivers behind the deployment of CCS and consider the principles of environmental impact assessment, including the precautionary principle, which may be applied to the novel risks of CCS. This paper will then examine the criteria to be applied in the selection of suitable geological sites and the commencement of injection and storage in Australia. The powers of the regulatory body to supervise the injection process, including the range of discretionary tools for responding to risks of harm, will also be presented. Finally,

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<sup>1</sup> International Energy Agency, 'Technology Roadmap: Carbon Capture and Storage' (IEA, 2009) at 4 (IEA Report). Australian Government, 'Australia's Low Pollution Future: The Economics of Climate Change Mitigation' (Commonwealth of Australia, 2008) (ALP Report) at xiv.

this paper will examine the Australian approaches to the management of risk, post-injection, and the allocation of legal responsibility for any harm caused.

## **2. Drivers for CCS Deployment**

The world's atmospheric greenhouse gases are rising and this is primarily driven by increasing emissions from human activities, including fossil-fuel combustion for energy purposes, in the power, transport, buildings and industry sectors, energy generation and land-use change.<sup>2</sup> It appears that society will continue to be dependant on fossil fuels for some years to come. As noted by the Stern Review:

the shift to a low-carbon global economy will take place against the background of an abundant supply of fossil fuels. Even with very strong expansion of the use of renewable energy and other low carbon energy sources, hydrocarbons may still make over half of global energy supply in 2050.<sup>3</sup>

Accordingly, if we are to stabilise atmospheric concentrations of greenhouse gas emissions new technological approaches are required including the large-scale decarbonisation of the power sector.<sup>4</sup> The Stern Review acknowledged the only way to continue such continued use of fossil fuels, without exacerbating adverse climate change, was to deploy 'extensive carbon capture and storage'.<sup>5</sup> Carbon Capture and Storage (CCS) involves the capture of greenhouse gas emissions at their point of source at fossil-fuel based industrial plants.<sup>6</sup> Those captured gases are then processed and transported to suitable storage sites before being injected and stored for an indefinite period of time in geological foundations such as onshore subterranean formations and offshore sea beds.

There are many different methods by which technological modifications to coal-fired power plants could be made to capture emissions at their source including the

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<sup>2</sup> Stern N, 'The Economics of Climate Change: The Stern Review' (Cabinet Office, HM Treasury 2006) 169-170.

<sup>3</sup> Ibid, xiv.

<sup>4</sup> Ibid, xiii.

<sup>5</sup> Ibid, xiv.

<sup>6</sup> Ibid, 4.

use of oxy-fuel combustion, post-combustion and pre-combustion.<sup>7</sup> These forms of coal combustion could be potentially required in all new coal-fired electricity generation plants and retrofits could be undertaken on some existing plants. Retrofits will be dependent on the allocation of sufficient space on site for the new technology. The costs of these retrofits are significant including the cost of capture, compression and drying, transportation by pipeline, and sequestration of the greenhouse gas stream amounting in the hundreds of millions of Australian dollars.<sup>8</sup> These costs will increase where the plant is not proximate to a suitable geological sequestration site and significant transport costs may be involved in transporting the greenhouse gas stream. It is estimated that the addition of CCS to an existing plant could increase capital costs by as much as 50 per cent.<sup>9</sup> The operation of the capture technology at the plant would also increase fossil fuel use by between 30 and 40 per cent with reduced plant efficiencies.<sup>10</sup> It is these cost implications which present the most significant barriers to CCS deployment worldwide. Given the additional capital and operation costs involved, Australian reports have concluded that voluntary CCS deployment will occur *only* when investment is profitable, that is, when the price of emissions via carbon trading or a carbon tax are higher than the costs of implementing and operating with CCS technology.<sup>11</sup>

Despite the cost implications of large-scale CCS deployment, CCS could be legally required as a mandatory addition to the combustion of fossil fuels. Under existing environmental approval legislation, the Australian Federal and State Governments are empowered to require, as a condition of approval, that electricity generators install carbon capture technology to minimise greenhouse gas emissions

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<sup>7</sup> McKinsey & Company, 'Carbon Capture and Storage: Assessing the Economics' (McKinsey Climate Change Special Initiative, 2008)(McKinsey Report) at 9. Massachusetts Institute of Technology, 'The Future of Coal: Options for a Carbon Constrained World' (MIT, 2007) (MIT Report) <[http://web.mit.edu/coal/The\\_Future\\_of\\_Coal.pdf](http://web.mit.edu/coal/The_Future_of_Coal.pdf)> at 24.

<sup>8</sup> The cost of drilling and testing for a suitable storage site is also likely to be in the millions of Australian dollars. Environment Protection and Heritage Council, Ministerial Council on Mineral and Petroleum Resources, 'Environmental Guidelines for Carbon Dioxide Capture and Geological Storage 2009'(Canberra, 2009)(Environment Guidelines), 8. Ibid, 24.

<sup>9</sup> McKinsey Report, n7, 10. Environment Guidelines, *ibid*.

<sup>10</sup> Environment Guidelines, n8 , 10.

<sup>11</sup> ALP Report, n1,179.

from the use of the coal. However, this discretion has not yet been exercised.<sup>12</sup> What we have seen instead is an increasing move towards State government policy statements to the effect that no new coal-fired power plants will be approved unless their design and location is such to render them ‘carbon capture ready’. In the State of Queensland, for example, a new coal fired power station will not be approved unless it uses world’s best practice low emissions technology to achieve the lowest possible levels of emissions, is CCS ready, and will retrofit that technology within five years of CCS being proven on a commercial scale.<sup>13</sup>

The individual components for carbon capture are all currently commercially available. However, there are some uncertainties in applying this combined technology to the particular circumstances of CCS to achieve *safe and permanent storage*.<sup>14</sup> These uncertainties are aggravated by the lack of global consensus regarding the best approaches for suitable storage site selection, monitoring and verification of the injected substances, and risk assessment.<sup>15</sup> Even without the uncertainties of locating suitable storage sites and modelling the predicted behaviour of stored substances, there are enormous legal and financial barriers to the commercial uptake of these activities. There are only four commercial-scale integrated CCS projects in operation around the world.<sup>16</sup> In 2009, the Rudd Government established the *Global Carbon Storage Institute* to promote pilot projects with the aim of achieving broad commercial deployment of CCS, on a global basis, by 2020.<sup>17</sup> The Council of Australian Governments (COAG) agreed that *nationally-*

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<sup>12</sup> See Durrant N, *Legal Responses to Climate Change* (Federation Press, Sydney, forthcoming (to be published late November 2010)).

<sup>13</sup> Queensland Government, ‘ClimateQ: toward a greener Queensland: Fact Sheet Conditions for new coal-fired electricity generation’ (August 2009). In 2009 the UK Government confirmed that any new combustion power station at or over 300 MWe would have to be built Carbon Capture Ready (CCR), that is, designed so there are *no foreseeable barriers* to retrofitting CCS *once it is proven*.

<sup>14</sup> IEA Report, n1,6-7.

<sup>15</sup> IEA Report, n1,4.

<sup>16</sup> These include the Sleipner Project in Norway (commenced in 1996); the Salah Project in Algeria (commenced in 2004); the Snøhvit Project in Norway and the Weyburn-Midale Project in Canada. These are all associated with oil and gas production. See [http://www.globalccsinstitute.com/about\\_ccs/ccs\\_in\\_operation.html](http://www.globalccsinstitute.com/about_ccs/ccs_in_operation.html).

<sup>17</sup> It should be noted that the Australian Coalition Party does not approve of the Global CCS Institute and has proposed the redirection of funding from this initiative to research into clean coal and other low emissions technologies.

*consistent* CCS regulation should be expedited in Australia.<sup>18</sup> Since then, most jurisdictions across Australia have introduced legislation dealing with CCS.<sup>19</sup> Those legislative schemes were passed relatively swiftly at Commonwealth, State and Territory levels raising concerns regarding the level of risk assessment which has been taken in relation to these approval regimes.<sup>20</sup> Furthermore, despite the aspirations of COAG, the Australian Commonwealth, States and Territories have all adopted very different approaches to the regulation of CCS in Australia.

### 3 Principles for the Environmental Assessment of CCS Projects

The achievement of more sustainable energy resource use will require the assessment and management, within an effective legal framework, of the political, social, cultural and economic dimensions of human uses of the Earth's natural resources.<sup>21</sup> At an international level, Australia is a party to many key international environmental agreements, including the United Nations Framework Convention on Climate Change (UNFCCC)<sup>22</sup> and the Kyoto Protocol.<sup>23</sup> As a party to the UNFCCC, Australia is required to promote sustainable management, and promote and cooperate in the conservation and enhancement of sinks and reservoirs of all greenhouse gases.<sup>24</sup> Australia also agreed to take climate change considerations into account in relevant social, economic and environmental policies and actions and to employ appropriate methods, including impact assessments, formulated and determined nationally, with a

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<sup>17</sup> COAG, 'Meeting Outcomes' (2 October 2008)

<[http://www.coag.gov.au/coag\\_meeting\\_outcomes/2008-10-02/index.cfm#climate](http://www.coag.gov.au/coag_meeting_outcomes/2008-10-02/index.cfm#climate)>.

<sup>19</sup> No CCS schemes currently exist in the jurisdictions of New South Wales, Tasmania, the Australian Capital Territory or the Northern Territory.

<sup>20</sup> CCS laws commenced in Queensland in February 2009, the Commonwealth offshore CCS legislation commenced in July 2009, the South Australian CCS amendments commenced in October 2009 and the Victorian onshore CCS legislation in December 2009. The new Victorian offshore CCS legislation commenced in March 2010.

<sup>21</sup> For example, the World Summit on Sustainable Development, 'Johannesburg Declaration on Sustainable Development' (2002) at [11].

<sup>22</sup> *United Nations Framework Convention on Climate Change*, opened for signature on 4 June 1992, 31 ILM 849 (entered into force on 21 March 1994) (the UNFCCC).

<sup>23</sup> *Kyoto Protocol to the United Nations Framework Convention on Climate Change*, opened for signature 16 March 1998 (entered into force on 16 February 2005) (the Kyoto Protocol).

<sup>24</sup> UNFCCC, Article 4(1)(d).

view to minimising the adverse effects of measures undertaken to mitigate or adapt to climate change.<sup>25</sup>

Entrenched in the principles of sustainable development is the obligation to adopt a precautionary approach to risks in environmental management and decision-making processes. This precautionary principle was first expressed in the *Rio Declaration*.<sup>26</sup> It was also adopted in the UNFCCC in the following terms:

[the parties will] take precautionary measures to anticipate, prevent or minimize the causes of climate change and mitigate its adverse effects. Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing such measures, taking into account that policies and measures to deal with climate change should be cost-effective so as to ensure global benefits at the lowest possible cost.<sup>27</sup>

Most environmental protection legislation in Australia has adopted the principles of environmental sustainability and the precautionary principle in some form.<sup>28</sup> In Australia, the precautionary principle is not designed to ensure that the environment is protected from harm against all the odds nor is it designed to be used to avoid all risks.<sup>29</sup> It is concerned with the identification and management of risks of environmental and social harm through a process of ‘institutionalised caution’.<sup>30</sup> Accordingly, it permits the taking of preventative measures without having to wait until the reality and seriousness of the threats become fully known.<sup>31</sup> According to the Australian Courts, the application of the precautionary principle must be triggered by the satisfaction of two conditions, first, a threat of serious or irreversible environmental damage and, second, scientific uncertainty as to the reality and extent

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<sup>25</sup> UNFCCC, Article 4(1)(f).

<sup>26</sup> UNCED, 'United Nations Conference on Environment and Development: The Rio Declaration' ((1992) 31 *ILM* 874), Principle 15.

<sup>27</sup> UNFCCC, Principle 3.

<sup>28</sup> Peel J, *The Precautionary Principle in Practice: Environmental Decision-Making and Scientific Uncertainty* (The Federation Press, Place, 2005) pp 19-20. The principles of sustainable development, known as ESD, have been adopted into many Australian national and state environmental policies and statutes. References to the precautionary principle range from the express to the oblique including direct obligations ‘to take into account’, general obligations to ‘have regard to’ and statutory objectives of acting ‘in accordance with’ a precautionary approach.

<sup>29</sup> *Telstra v Hornsby Shire Council* [2006] NSWLEC 133 at [157].

<sup>30</sup> Barrow CJ, *Environmental Management for Sustainable Development* (Routledge, 2 ed, 2006) p33.

<sup>31</sup> *Telstra v Hornsby Shire Council* [2006] NSWLEC 133 at [156].

of that environmental damage.<sup>32</sup> Once both of those conditions are met, a precautionary measure may be taken to avert the anticipated threat of environmental damage. However, the type and level of those required measures must be proportional to the seriousness and irreversibility of the potential threat.<sup>33</sup>

Most Australian jurisdictions require CCS project operators to obtain specific environmental approval prior to carrying out activities which may cause serious or significant environmental harm.<sup>34</sup> Indeed in the absence of approvals, those project operators, owners and occupiers of the land could be held liable for *unlawfully* causing environmental harm through the statutory offences of causing serious or material environmental harm or environmental nuisance.<sup>35</sup> The environmental assessment for those projects should include proper consideration of the benefits and potential risks of these novel projects. This includes consideration of both the potential benefits of emissions abatement from allowing CCS activities to proceed along with considerations of the risks of potential harm arising from leakage of the stored substances and appropriate measures to mitigate those risks.

#### 4 Facilitating Projects or Minimising the Risk of Harm?

Facilitation of CCS projects raises an interesting regulatory dilemma in terms of achieving the necessary balance between a regime to efficiently and effectively *promote* CCS, and a precautionary regime to *protect* the environment and the community from the risk of harm. Too many legal barriers may stifle technological innovation and delay the commercial deployment of CCS. However, too little

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<sup>32</sup> *Telstra v Hornsby Shire Council* [2006] NSWLEC 133 at [128] per Preston CJ and Brown C.

<sup>33</sup> *Ibid*, [167].

<sup>34</sup> The Environmental Guidelines, n8, are intended to demonstrate best practice and promote a ‘comprehensive and nationally consistent approach’ to environmental assessment of CCS. The guidelines note that all CCS projects will be subject to environmental assessment and approval in the relevant jurisdiction, p 4.

<sup>35</sup> For example under the *Environmental Protection Act 1994* (Qld) ss 436, 437, 438, and 440 and negligently causing harmful substances to leak, for example under of the *Protection of the Environment Operations Act 1997* (NSW) ss 116 and 126. See also the *Environment Protection Act 1986* (WA), *Environment Protection Act 1993* (SA), *Environment Protection Act 1970* (Vic) and the *Environmental Management and Pollution Control Act 1994* (Tas). Furthermore, CCS projects are not exempt from the need for approval under the Federal requirements of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth).



regulation could leave the Australian community vulnerable to the long term risks from these novel experiments.

Many States and Territories in Australia have passed legislation for the regulation and implementation of carbon-based products in *onshore underground storage* areas. The Commonwealth has also established a regime for *offshore storage*<sup>36</sup> while the State of Victoria recently implemented its own CCS offshore regime.<sup>37</sup> All of these regimes make it an offence to explore for potential storage areas or store greenhouse gas substances without a CCS authorisation.<sup>38</sup> The key objectives of these schemes are generally to *facilitate, promote* and *encourage* the storage of greenhouse gas substances in geological formations.<sup>39</sup> By way of contrast, the EU CCS Directive states as its purpose the establishment of a legal framework for the *environmentally safe* geological storage of carbon dioxide to contribute to the fight against climate change.<sup>40</sup>

The Territory of South Australia (SA) elected to incorporate a *de facto* CCS scheme within the existing petroleum legislation despite the apparent differences between the regulation of petroleum products and the ‘unique issues’ associated with CCS, including the potential migration of injected gas and long-term liabilities.<sup>41</sup> The Commonwealth regime has taken a similar approach where petroleum operations and carbon dioxide storage are regulated together. South Australia has implemented the

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<sup>36</sup> In the area between the three nautical mile mark from the coastline to the outer limits of the continental shelf. *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (Cth)(Cth CCS Act), section 4.

<sup>37</sup> Up to the three nautical mile mark. *Offshore Petroleum and Greenhouse Gas Storage Act 2010* (Vic)(Vic Offshore Act).

<sup>38</sup> Cth CCS Act, s 289. See also Vic Offshore Act section 285. Similar prohibitions apply to storage activities, Cth CCS Act, section 386; Vic CCS Act, section 17; Qld CCS Act, Chapter 3; Barrow Island Act 2003, section 13, Vic Offshore Act, section 471.

<sup>39</sup> *Greenhouse Gas Geological Sequestration Act 2008* (Vic)(Vic CCS Act) section 1; *Greenhouse Gas Storage Act 2009* (Qld)(Qld CCS Act) section 3; *Petroleum and Geothermal Energy Act 2000* (SA)(SA CCS Act) section 3(a); *Barrow Island Act 2003* (WA)(Barrow Island Act); Cth CCS Act section 3.

<sup>40</sup> EU Commission, ‘Directive 2009/31/EC of the European Parliament and of the Council of 23 April 2009 on the geological storage of carbon dioxide and amending Council Directive 85/337/EEC, European Parliament and Council Directives 2000/60/EC, 2001/80/EC, 2004/35/EC, 2006/12/EC, 2008/1/EC and Regulation (EC) No 1013/2006’ (5 June 2009, Official Journal of the European Union L140/114) (EU CCS Directive).

<sup>41</sup> Department of Primary Industries, ‘A Regulatory Framework for the Long-Term Underground Geological Storage of Carbon Dioxide in Victoria’ (Discussion Paper, January 2009) at 11.

most industry focused with its legislative objectives referring to the need to create an *effective, efficient and flexible* regulatory system for industries.<sup>42</sup> Legislation in the State of Queensland deals *intently* with the operation of concurrent mining and petroleum lease interests.<sup>43</sup> Meanwhile, the Territory of Western Australia (WA) has taken the approach of enacting project specific legislation, for a large geological sequestration project proposed for the Gorgon area gas fields, rather than adopting a more generalised CCS approval framework.<sup>44</sup> By way of contrast, legislation in the State of Victoria clearly includes in its objectives the goal of ensuring that onshore and offshore sequestration operations are conducted in accordance with the stated principles of *sustainable development* and requires that regard be had to those principles, including the *precautionary principle*, in the administration of the Act.<sup>45</sup> As a result, the minimisation of risks to public health and the environment is more prominent throughout the Victorian regime.

## 5 Approval Processes for CCS Exploration and Injection

### 5.1 Exploration

Most regimes in Australia contain some mechanism for proponents to obtain approval to undertake an activity for the purposes of locating suitable greenhouse gas storage sites and conducting feasibility studies in relation to the injection of greenhouse gas substances into those greenhouse gas storage formations.<sup>46</sup>

The State of Victoria has imposed a precautionary approach to the approval of activities to test the suitability of a geological formation for permanent storage.<sup>47</sup> The injection testing plan must include details of the substance to be injected, including information about the volume and rate of

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<sup>42</sup> SA CCS Act, section 3.

<sup>43</sup> Qld CCS Act, Chapter 4.

<sup>44</sup> Barrow Island Act, the relevant object is to ‘provide for conveyance and underground disposal of carbon dioxide recovered during gas processing on Barrow Island.’

<sup>45</sup> Vic CCS Act, ss 7, 8. See also Vic Offshore Act section 61.

<sup>46</sup> For example, Vic CCS Act, section 22; Qld CCS Act, Part 2, Division 2; SA CCS Act, section 22. Cth CCS Act, ss 296 or 303. A similar approach has been adopted under the Vic Offshore Act, Ch 3, Part 3.2, divs 2 and 3.

<sup>47</sup> Vic CCS Act, Part 3, Division 4.

injection.<sup>48</sup> A monitoring and verification plan must also be included detailing how the behaviour of any stored substance will be monitored and the potential leakage and migration path of an injected substance.<sup>49</sup> The plan must also detail how any risks to public health or the environment will be *prevented*.<sup>50</sup> This plan is placed on exhibition for public comment.<sup>51</sup> Significantly, the Minister may only approve an injection testing plan if he or she is satisfied that the proposed injection testing *will not present a risk* to public health or the environment.<sup>52</sup>

## 5.2 Site Selection

The Commonwealth offshore CCS legislation contains the most specific approach in Australia to those matters which will be considered in *declaring* a site suitable for storage. Under the offshore Commonwealth scheme, once a suitable site has been located, the applicant may apply for a declaration of an eligible formation.<sup>53</sup>

The application must contain the fundamental suitability determinants of the eligible storage formation and an estimate of the spatial extent of the formation.<sup>54</sup> The fundamental suitability determinants refer to a part of a formation, where that part is suitable:

- with or without engineering enhancements;
- for the *permanent storage* - through an effective sealing feature, attribute or mechanism;
- of a particular amount - of at least 100,000 tonnes;
- of a particular greenhouse gas substance;
- injected at a particular point or points; and
- over a particular period.<sup>55</sup>

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<sup>48</sup> Vic CCS Act, section 38.

<sup>49</sup> Ibid.

<sup>50</sup> Ibid.

<sup>51</sup> Vic CCS Act, ss40, 41, 44, 46.

<sup>52</sup> Vic CCS Act, section 40.

<sup>53</sup> Cth CCS Act, section 312.

<sup>54</sup> Ibid.

<sup>55</sup> Cth CCS Act, section 21. A similar approach is taken under the Vic Offshore Act, section 23.

If satisfied that those fundamental suitability determinants have been met, the Minister may declare the area to be an eligible storage formation.<sup>56</sup>

The EU CCS Directive states that the suitability of a geological formation for use as a storage site shall be determined through a characterisation and assessment of the potential storage complex pursuant to the criteria specified in Annex I of the Directive including data collection, 3D geological earth modelling, characterisation of the storage dynamic behaviour, sensitivity characterization and risk assessment.<sup>57</sup> The site can only be declared suitable if there is no significant risk of leakage, and if no significant environmental or health risks exist.<sup>58</sup> Unlike the Australian regulatory approach, ‘significant risk’ is defined in the directive although it is questionable to what extent this definition clarifies the situation stating that it is, ‘a combination of a probability of occurrence of damage and a magnitude of damage that cannot be disregarded without calling into question the purpose of this Directive for the storage site concerned’.<sup>59</sup>

### 5.3 Commencement of Injection

In the State of Victoria, the *application* for an injection and storage licence must contain an assessment of the suitability of the site for the permanent storage of substances.<sup>60</sup> In other jurisdictions the requirement for suitability is less explicit although the application documents or site plans must outline the structure and integrity of the storage area.<sup>61</sup> In all jurisdictions, the substance or stream to be stored must comprise ‘predominantly’ or ‘overwhelmingly’ of carbon dioxide.<sup>62</sup> Indeed, operators may find themselves liable for the unlawful dumping of waste,

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<sup>56</sup> Cth CCS Act, section 312.

<sup>57</sup> EU CCS Directive, Annex I.

<sup>58</sup> EU CCS Directive, Article 4.

<sup>59</sup> EU CCS Directive, Article 3.

<sup>60</sup> Vic CCS Act, section 73.

<sup>61</sup> Qld CCS Act, ss 141, 142; SA CCS Act, section 35(1)(a); Cth CCS Act section 361(10); Barrow Island Act, section 13.

<sup>62</sup> Qld CCS Act, section 12; Vic CCS Act, section 3; Cth CCS Act, section 7; the SA CCS Act refers only to carbon dioxide, section 4. Under the Barrow Island Act, only carbon dioxide recovered during gas processing on Barrow Island may be stored.

as well as unlawful trespass and unlawful nuisance, if they inject or store substances which do not comply with those definitions.<sup>63</sup>

In terms of the commencement of injection, the Australian CCS regimes appear to have been designed to push forward to the commencement of CCS projects rather than providing a more precautionary approach. In most jurisdictions, injection and storage activities must commence within a relatively short timeframe up around 5 years.<sup>64</sup> Failure to do so may result in the licence being revoked.<sup>65</sup> The effect of this appears to emphasise the deployment of projects rather than enabling project operators to adopt a more moderate risk management approach to the commencement of these new activities.

## **6 Powers of Regulatory Authorities in the Supervision of CCS Projects**

### **6.1 Treatment of Pilot Projects**

Pilot CCS projects in Australia include the *Otway Basin Pilot Project*, involving the injection of carbon dioxide into depleted oil and gas reservoirs in the State of Victoria,<sup>66</sup> and the proposed Zerogen *integrated asification combined cycle with CCS* project in the State of Queensland.<sup>67</sup> The Australian State governments are already moving to divert pilot projects from the primary requirements of their CCS legislation. In Victoria, for example, with its precautionary approach to risks to public health and the environment, the Ottway Basin CCS project has been exempted from the operation of the majority of the legislative requirements.<sup>68</sup> The Queensland Zerogen project is also treated as a scientific investigation under the

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<sup>63</sup> See, for example, the offence provision in section 488 of the Vic Offshore Act for the unlawful disposal of waste.

<sup>64</sup> Vic Offshore Act, ss 382, 383; Qld CCS Act, section 167; Vic CCS Act ss 66, 67. In contrast, in SA, the operations must be commenced with *due diligence* and in accordance with the conditions of the licence. SA CCS Act, section 39.

<sup>65</sup> Under the Cth CCS Act, section 360, the injection licence will be terminated if no operations to inject a substance into the formation have been carried on during a continuous period of at least 5 years. See also section 378 Vic Offshore Act.

<sup>66</sup> See <<http://www.co2crc.com.au/otway/>>.

<sup>67</sup> See <<http://www.zerogen.com.au/project/overview.aspx>>.

<sup>68</sup> Only sections 12, 14, 15, 303 and 304 of the CCS Act apply to the Otway Basin CCS Project *Greenhouse Gas Geological Sequestration (Exemption) Regulations 2009* (Vic), S.R. No. 150/2009.

Qld CCS Act, with its less onerous statutory prescriptions, even though it has stated that it intends to operate at commercial scales in the future.

## 6.2 Risk and Rates of Injection

Across most regimes in Australia, the technical and operational aspects of injection and storage are regulated by an approved plan or program including an approved rate of injection.<sup>69</sup> In the State of Queensland, for example, that site plan must be approved for the term of the lease.<sup>70</sup> If the operator wishes to apply for a significant change to the plan resulting in a *reduction* in the rates of injection then it is required to provide an *evaluation* of the market opportunities for storage within the lease area.<sup>71</sup> In deciding whether or not to approve the reduction, the Minister will consider both the reasonableness of the reduction and whether the lease holder has taken all reasonable steps to prevent that reduction in the rates of injection.<sup>72</sup> Similarly, in the State of Victoria, the Minister may direct the holder of the licence to take all necessary and practicable steps to change the volume of, or rate at which, the substance is injected if, in the opinion of the Minister, the direction is necessary to enable more effective substance injection or to *maximise the volume* of the substance able to be stored.<sup>73</sup> Such discretionary interventions appear to be designed to increase the scale and intensity of CCS projects rather than focusing on a precautionary approach to the risks associated with the injection of these substances.

## 6.3 Responding to Serious Situations

Leakage of the stored carbon may occur through the abrupt leakage of carbon dioxide to the atmosphere, through the migration of carbon dioxide to the surface from injection well failure, or through gradual leakage from faults and fractures

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<sup>69</sup> Cth CCS Act, ss 361, 362; Qld CCS Act ss 141, 142; Vic CCS Act, ss 94, 95; SA CCS Act section 38.

<sup>70</sup> Qld CCS Act, section 142.

<sup>71</sup> Qld CCS Act, section 151.

<sup>72</sup> Qld CCS Act, section 154.

<sup>73</sup> Vic CCS Act, ss 89, 90, 91.

with migration of the carbon dioxide into surrounding geological formations or groundwater sources.<sup>74</sup> The IPCC estimates that 99 per cent of the stored substance will remain within the storage area over a 1000 year period.<sup>75</sup> The IPCC report considers that it is ‘very likely’ that 99 per cent of the stored carbon would remain over a 100 year period and it is ‘likely’ that 99 per cent would remain over a 1000 year period.<sup>76</sup> However, more significant quantities of leakage may result in risks to human life and health, particularly if those quantities leak into a confined area.<sup>77</sup> The IPCC considers that concentrations greater than 7 to 10 per cent of carbon dioxide in the air would pose immediate dangers to human life and health.<sup>78</sup> Gradual and diffuse leakage would also pose a risk to local aquifers and soils.<sup>79</sup>

Management of these potential leakages appears to be addressed through the imposition of monitoring and reporting obligations throughout the exploration, injection and storage phases in the Australian regimes.<sup>80</sup> Some regimes also include an obligation to notify the regulator of the existence of a ‘serious situation’.<sup>81</sup> The definition of what constitutes a ‘serious situation’ varies depending on the jurisdiction in which the project is carried out raising interesting questions for those CCS projects where stored substances may cross State and Commonwealth boundaries. In the State of Victoria, for example, a ‘serious situation’ is said to exist where:

- a substance *has leaked or will leak* in the course of being *injected* into a formation;

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<sup>74</sup> McLaren J and Fahey J, "Key Legal and Regulatory Considerations for the Geosequestration of Carbon Dioxide in Australia" (2005) 24(1) *Australian Resources and Energy Law Journal* 45 at 51.

<sup>75</sup> IPCC, 'Special Report on Carbon Dioxide and Storage: Summary for Policy Makers and Technical Summary' (Approved and Accepted by IPCC Working Group III and 24th Session of the IPCC, Montreal, Intergovernmental Panel on Climate Change, 2005) p 31.

<sup>76</sup> Ibid.

<sup>77</sup> Ibid, 31.

<sup>78</sup> Ibid.

<sup>79</sup> Ibid.

<sup>80</sup> For example, Vic CCS Act, ss 55,306,308; Qld CCS Act, section 254; SA CCS Act section 97; Cth CCS Act, section 464.

<sup>81</sup> Cth CCS Act, section 379; Vic CCS, section 181; SA CCS Act, section 85.

- a substance that *has been injected* into a formation *has leaked or will leak*; or
- a substance injected into a formation *has behaved or will behave otherwise than as predicted* in the approved injecting testing plan or injection and monitoring plan;<sup>82</sup>
- the injection or storage of a substance into a formation has had or will have a *significant impact on the geotechnical integrity* of the whole or a part of a formation or structure; or
- the formation is *not suitable for the permanent storage* of a substance.<sup>83</sup>

Legislation in the State of Queensland refers to the more limited concepts of leakage, ‘risk’ of leakage and the substance behaving ‘other than as predicted’.<sup>84</sup> The Territory of South Australia relies on the provisions drafted for the purposes of petroleum operations to address the occurrence of ‘serious incidents’. These have been defined in the context of petroleum operations and include where a person is seriously injured or killed; an imminent risk to public health or safety; or an imminent risk or occurrence of serious environmental damage.<sup>85</sup>

A different approach is taken under the EU CCS Directive where operators must notify the authority of leakages or *significant irregularities* and take the necessary corrective measures.<sup>86</sup> ‘Significant irregularity’ is defined to include ‘any irregularity in the injection or storage operations or in the condition of the storage complex itself, which implies the risk of a leakage or risk to the environment or human health’.<sup>87</sup>

The use of risk as a regulatory trigger is particularly problematic where varying levels of risk and uncertainty will be prevalent in all aspects of CCS operations. There are a wide range of possible triggers for a ‘serious situation’

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<sup>82</sup> See also Cth CCS Act, section 379; Vic Offshore Act section 405.

<sup>83</sup> Vic CCS Act, section 6. The Commonwealth has adopted similar definitions in the Offshore CCS Act.

<sup>84</sup> Qld CCS Act, section 363.

<sup>85</sup> SA CCS Act, section 85.

<sup>86</sup> EU CCS Directive, Article 16.

<sup>87</sup> EU CCS Directive, Article 3.



ranging from a ‘mere’ risk of substances not behaving as predicted to circumstances in which leakage is occurring. Where a ‘serious situation’ is triggered, the relevant Australian Ministers are provided with broad powers of response and may issue directions requiring the permit holder to take any action including a direction to *cease or suspend* the injection of substances or to inject the substance into *another site*.<sup>88</sup>

Furthermore, legislation in the State of Victoria grants the Minister vast discretionary powers to immediately *cancel* an authority where, in the opinion of the Minister:

- it is in the *public interest* to cancel the authority;
- any activity has caused a *risk to public health or the environment* or caused a *serious situation*; or
- the holder of the authority:
  - has not complied with the work program or any conditions of the authority;
  - has failed to maintain any insurance policy or to lodge any bond;
  - no longer has the funds to carry out its work program; or
  - has not paid any amount payable within 90 days after it was due.<sup>89</sup>

This ad hoc response to ‘serious situations’ appears to act as a counterbalance to the more facilitative approval processes with their emphasis on the promotion of CCS projects. However, the adoption of a more preventative risk management approach at the approval stage would be preferable to assuming that all risk can be addressed through reactive regulation. Moreover, the grounds for reaction are exceedingly broad. It seems preferable for these Ministers to be required to apply a more proportional range of interventional responses with cessation and closure as a last resort.

The EU CCS Directive acknowledges this need for a *staged approach* and states that the authority shall review and where necessary update or, *as a last*

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<sup>88</sup> It is an offence not to comply with these directions. Cth CCS Act, ss 380, 382; Qld CCS Act, ss 364, 366; Vic CCS Act, ss 182, 183, SA CCS Act, section 88.

<sup>89</sup> Vic CCS Act, section 175.

*resort*, withdraw the storage permit.<sup>90</sup> In contrast to the Australian schemes, the EU CCS Directive also specifies what would happen in the event that the storage permit is withdrawn; the authority may either issue a new storage permit or close the storage site.<sup>91</sup> The EU authority may temporarily take over all legal obligations relating to site where the authority decides to continue injections, monitoring and corrective measures and may recover any costs incurred from the former operator, including by drawing down on the financial security.<sup>92</sup>

## **7 Licence Surrender and Management of Risk**

Once injection activities have been completed, the Australian CCS regimes differ in their procedures for decommissioning, surrender of licences and handover of responsibility for monitoring and verification. In the State of Queensland, for example, the lease holder must make a surrender application containing the applicant's assessment of the behaviour of substances injected under the lease; the expected migration pathways; and the short-term and long-term consequences of the migration.<sup>93</sup> It must also include the applicant's suggestions for the approach to be taken by the State to monitor and verify the behaviour of the injected substances.<sup>94</sup> The applicant may be required to report on whether the risks have been reduced as much as is reasonably practicable and the Minister may direct the applicant to carry out additional stated work to reduce those risks.<sup>95</sup> Interestingly, the Minister may *only* approve the surrender of the licence if the Minister considers the risks to have been reduced as much as is *reasonably practicable*.<sup>96</sup>

In the State of Victoria, on the completion of injection activities, the holder must surrender the right to inject a greenhouse gas substance under the injection

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<sup>90</sup> EU CCS Directive, Article 11.

<sup>91</sup> Ibid.

<sup>92</sup> Ibid.

<sup>93</sup> Qld CCS Act, section 177.

<sup>94</sup> Ibid.

<sup>95</sup> Qld CCS Act, section 178.

<sup>96</sup> Qld CCS Act, section 179.

and monitoring licence.<sup>97</sup> In surrendering the right to inject, the holder is not taken to have surrendered the licence itself.<sup>98</sup> The Minister may *only* consent to the surrender of an injection and monitoring licence if, in the opinion of the Minister:

- the substance is *behaving*, and will continue to behave, in a *predictable manner*;
- the licence holder has *reduced the risks* associated with the permanent storage of the substance to *as low as is reasonably practicable*;
- the stored substance *will not present a risk* to public health or the environment;<sup>99</sup> and
- the licence holder has provided, among other matters:
  - an *assessment of the pathways* for potential migration and leakage and the effects that any potential leakage might have;
  - a *risk management plan* in the event of leakage; and
  - a *long-term monitoring and verification plan* including an estimate of the cost of carrying out the activities in that plan.<sup>100</sup>

These critical threshold issues are not further defined in the legislation.

Different thresholds and terminology are adopted at the Commonwealth level. Under the Commonwealth Offshore CCS regime, the applicant must apply for a *site closing* certificates following cessation of injection operations and the Minister may issue a *pre-certificate notice*.<sup>101</sup> The Minister may *refuse* to give the pre-certificate notice if the Minister is *not* satisfied that:

- the substance is *behaving as predicted* in the approved site plan; or
- there is a *significant risk* that a substance will have a *significant adverse impact* on the conservation or exploitation of natural resources; the

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<sup>97</sup> Vic CCS Act, section 92.

<sup>98</sup> Ibid.

<sup>99</sup> Vic CCS Act, section 171.

<sup>100</sup> Vic CCS Act, section 170.

<sup>101</sup> Cth CCS Act, ss 386, 388. A similar approach is taken under ss 414, 420 of the Vic Offshore Act.

geotechnical integrity of the formation or structure; the environment; or human health or safety.<sup>102</sup>

The Commonwealth Minister must make a decision on these matters within 5 years.<sup>103</sup> If issued, a pre-certificate notice must specify a program of operations to be carried out by the Commonwealth for the purposes of monitoring the behaviour of the substance and set out an estimate of the total costs and expenses of carrying out the program.<sup>104</sup> The lease holder must lodge security equal to the estimate of costs.<sup>105</sup> Once lodged, the Minister *must issue* the site closing certificate which will remain in force indefinitely.<sup>106</sup>

Fifteen years after the issue of the site closing certificate the Commonwealth Minister may declare the *closure assurance period* to be completed. Prior to making such a declaration, the Minister must be satisfied that the following conditions have been met:

- the substance injected into the formation is *behaving as predicted* in the approved site plan for the formation; and
- there is *no significant risk* that a substance injected into the formation will have a *significant adverse impact* on the geotechnical integrity of the formation or structure; the environment; and human health or safety.<sup>107</sup>

A similar approach is taken to post closure in the EU CCS Directive although a period of at least *twenty years* must have passed before the applicant applies for the transfer.<sup>108</sup> Once again, different thresholds and terminology are adopted under the EU regime to those under the Australian jurisdictions. Under the EU CCS Directive, in applying for the transfer of responsibility, the applicant must

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<sup>102</sup> Ibid. See also section 422 Vic Offshore Act.

<sup>103</sup> Ibid.

<sup>104</sup> Cth CCS Act, section 391. See also section 426 Vic Offshore Act.

<sup>105</sup> Ibid. If the Commonwealth incurs reasonable costs or expenses in carrying out the program specified in the pre-certificate notice then these are a debt due and recoverable but the amount may not exceed the estimated amount included in the pre-certificate notice, section 398. See also ss 429, 433 Vic Offshore Act.

<sup>106</sup> Cth CCS Act, ss 392, 394, 395. Under certain circumstances the injection licence and site closing certificate may be transferred to a third party.

<sup>107</sup> Cth CCS Act, section 399.

<sup>108</sup> EU CCS Directive, Article 18.

demonstrate the *conformity of the actual behaviour* of the injected substance with the modelled behaviour; the *absence of any detectable leakage*; and that the storage site is evolving towards a situation of long-term stability.<sup>109</sup> The transfer of responsibility is deemed to take place if, and when, *all available evidence* indicates that the stored substance will be *completely and permanently contained*.<sup>110</sup>

The EU CCS Directive notes that there will be no recovery of costs from the operator after the transfer of responsibility unless there has been fault on the part of the operator, including cases of deficient data, concealment of relevant information, negligence, wilful deceit or a failure to exercise due diligence.<sup>111</sup> However, the operator must provide a financial instrument to cover the estimated costs of the authority following transfer.<sup>112</sup> That mechanism must cover at least the anticipated cost of monitoring for a period of 30 years.<sup>113</sup> Moreover, the EU CCS Directive transfers responsibility only for compliance with EU requirements regarding monitoring and corrective measures, remedial action and surrender of allowances for emissions.<sup>114</sup> It does not transfer responsibility or liability in respect of common law liability which may apply within the relevant Member State.

These threshold requirements for transfer based on ‘absence of any detectable leakage’, ‘all evidence’, ‘behaving as predicted’ and ‘no significant risk of adverse impact’ have caused concerns for potential operators who are cognizant of the type of monitoring reports and data which will be available to them for these purposes and doubts have been raised about whether these thresholds could ever truly be met.<sup>115</sup> It is important to note that, until such time as the authority deems the requirements to be satisfied, responsibility will remain

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<sup>109</sup> EU CCS Directive, Article 18.

<sup>110</sup> EU CCS Directive, Article 19.

<sup>111</sup> Ibid.

<sup>112</sup> EU CCS Directive, Article 20.

<sup>113</sup> Ibid.

<sup>114</sup> EU CCS Directive, Article 18.

<sup>115</sup> Hughes C, ‘CCS: Legislating to Quantify Risk and Increase the Financial Viability of CCS Projects’ (UCL Faculty of Law: Think Piece, January 2009) <[https://www.ucl.ac.uk/cclp/pdf/Calum\\_thinkpiece\\_final.pdf](https://www.ucl.ac.uk/cclp/pdf/Calum_thinkpiece_final.pdf)>.

with the operator. Therefore, under both the Commonwealth and EU Schemes, proposed operators must make provision for the possibility, in the absence of any other temporal or quantum limits, of almost indeterminate liability arising from these CCS projects.

## 8 Legal Responsibility for Harm and Long-Term Liabilities

There are very different approaches to the treatment of liability from CCS projects across the Australian jurisdictions.

Under the Commonwealth offshore regime, the Commonwealth Government must indemnify a person against liability where:

- a site closing certificate is in force in respect of a formation specified in an injection licence, and the closure assurance period is complete; and
- the liability is in relation to an existing person who has been the *registered holder of the licence*; and the liability is:
  - for *damages*;
  - *attributable* to an act done or omitted to be done in the carrying out of *operations authorised* by the licence; and
  - incurred or accrued *after* the end of the *closure assurance* period.<sup>116</sup>

Accordingly, this Commonwealth indemnity is limited and extends to only the holder of the licence and to acts or omissions post-closure which can be attributed to operations authorised under that licence.

Very different approaches are taken at the State and Territory levels in Australia. Under the project specific *Barrow Island Act*, the Gorgon Project was initially required to indemnify the State.<sup>117</sup> However, the project operator has since negotiated with the State and Commonwealth Government to be indemnified for all common law liability arising from independent third party claims for loss or damage, suffered post-closure, as a result of the long-term

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<sup>116</sup> Cth CCS Act, ss 400, 401.

<sup>117</sup> Barrow Island Act, section 14, Schedule 1 Agreement cl 27.

storage of substances.<sup>118</sup> A closure assurance period of at least 15 years will apply prior to closure of the project and the operator will be liable for all costs up to that point.<sup>119</sup> The Commonwealth has agreed to cover 80 per cent of the liability with the Western Australia Government covering the remaining 20 per cent.<sup>120</sup>

Indemnities are not specifically addressed in the Victorian and Queensland CCS regimes. The Victorian onshore and offshore legislation notes that the Crown owns all underground storage formations below the surface of any land in Victoria.<sup>121</sup> The Act further notes that if an injection and monitoring licence is cancelled or surrendered, the Crown becomes the owner of any substance that has been injected into an underground geological formation under that licence.<sup>122</sup> The legislation in the State of Queensland takes a similar approach but notes that on the surrender of a lease, any substance injected into a storage reservoir in the former lease area becomes the property of the State.<sup>123</sup> The Act states that this applies despite the greenhouse gas stream being on or part of land owned by someone else; or the sale or other disposal of the land.<sup>124</sup> Although not explicit on the face of the legislation, it appears that, within the Victorian and Queensland jurisdictions, responsibility post-surrender would rest with the government whereas responsibility for harm done, or liability incurred, pre-surrender would stay with the operator without limit. The key differences between these approaches will be particularly significant where stored substances migrate between the offshore Commonwealth and offshore Victorian areas.

It should be noted that operators may also face additional statutory liabilities for the emission of stored carbon streams into the atmosphere under any future Australian carbon trading scheme. The Australian Government has indicated that

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<sup>118</sup> WA Department of Mines and Petroleum, 'Gorgon Project (Barrow Island)' <<http://www.dsd.wa.gov.au/7599.aspx>>.

<sup>119</sup> Ibid.

<sup>120</sup> Ibid.

<sup>121</sup> Unless it is within 15-24 metres of the surface of the land, Vic CCS Act, section 14. A similar provision is contained in section 65 of the Vic Offshore Act. There is no similar provision in the Cth Offshore CCS Act.

<sup>122</sup> Vic CCS Act, section 16. A similar provision is contained in section 67 of the Vic Offshore Act.

<sup>123</sup> Qld CCS Act, section 181.

<sup>124</sup> Ibid.

emissions captured and stored through CCS would not be counted towards an entity's gross emissions while fugitive emissions from the storage site would result in liabilities under any future carbon trading scheme.<sup>125</sup> A similar approach has been adopted in the European Union.<sup>126</sup> By contrast, proposed legislation in the United States of America intended to initially allocate free allowances to CCS facilities and hold operators liable for their net emissions from the project.<sup>127</sup>

## **9 The Need for A More Consistent Risk Management Approach**

The current regulatory approach in Australia is clearly fragmented, and inconsistent in its approach to the promotion of CCS projects and management of possible risks of harm. All of the Australian CCS regimes adopt different thresholds, criteria, and definitions including in relation to suitable site selection, serious situations, responses to risk, and whether the stored substance is behaving as predicted. These regimes also have very different approaches to the treatment of the long-term liabilities of project operators with some jurisdictions providing differing levels of indemnities and others electing to leave the loss where it falls. Given the goal of moving towards broad commercial scale CCS deployment, Australia appears in dire need of a more consistent and legally coherent national regulatory framework. Such a framework should balance the need for relatively swift deployment of CCS against the need to adopt a precautionary approach to the potential adverse risks from these novel and largely untested projects. It should also have sufficient embedded flexibility to promote practices of continuous learning and improvement throughout the CCS life cycle. If such a regime were achieved then the government could move into the relatively uncharted waters of commercial scale CCS supported by an appropriate set of legal mechanisms to manage the uncertainties and risks from these projects.

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<sup>125</sup> Australian Government, *'Carbon Pollution Reduction Scheme White Paper (2008) Policy position 6.13.*

<sup>126</sup> European Union, Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC (entry into force 25.10.2003) published in OJL of the 25.10.2003., Article 12, Annex I.

<sup>127</sup> *American Clean Energy and Security Act of 2009 (H.R. 2454)* proposed ss 722, 782, 786 to the US Clean Air Act.