



UNIVERSITY OF CALGARY

University of Calgary

PRISM: University of Calgary's Digital Repository

Graduate Studies

Master of Public Policy Capstone Projects

2016-08

Alberta's end-of-life Oil and Gas Liabilities

de Beer, Helene M. E.

de Beer, Helene M. E. (2016). Alberta's end-of-life Oil and Gas Liabilities (Unpublished master's thesis). University of Calgary, Calgary, AB.

<http://hdl.handle.net/1880/51698>

report

Downloaded from PRISM: <https://prism.ucalgary.ca>



THE SCHOOL OF PUBLIC POLICY

MASTER OF PUBLIC POLICY CAPSTONE PROJECT

Alberta's end-of-life oil and gas liabilities

Policy Recommendations

Submitted by:

Hélène M.E. de Beer

Approved by Supervisor:

Michal C. Moore

Submitted in fulfillment of the requirements of PPOL 623 and completion of the requirements for the Master of Public Policy degree



THE SCHOOL OF PUBLIC POLICY

Acknowledgements

Thank you to my friend Margaret Messier, you were here at the beginning with inspiration and energy to start this journey.

Thank you to Michal Moore, my capstone supervisor, you were here at the end, with questions and feedback to get me to the finish line.

Thank you to my husband Danny and my children Sophie and Benjamin, you were here all along, with unwavering support and encouragement.



THE SCHOOL OF PUBLIC POLICY

Table of Contents

1. Introduction.....	1
2. Methodology.....	3
3. History.....	5
3.1 Alberta's oil & gas industry.....	5
3.2 Alberta's oil & gas legislation and regulation.....	6
4. Risk Analysis of oil & gas liabilities.....	17
4.1 Current and future state.....	17
4.2 Regulatory response to date.....	21
4.3 Emerging Issues and Trends.....	25
5. Policy Options and Evaluation.....	33
5.1 Policy evaluation criteria.....	33
5.2 Evaluation of status quo.....	35
5.3 Alternative policy options.....	38
5.4 Evaluation of alternative policy options.....	40
5.4.1 Improving timeliness.....	41
5.4.2 Collecting upfront security.....	44
5.4.3 Creating a legacy fund.....	46
6. Recommendations.....	49
7. Conclusion.....	51
8. Bibliography.....	53



THE SCHOOL OF PUBLIC POLICY

Table of Figures and Tables

Figure 1: Map of Alberta.....	6
Figure 2: Alberta oil & gas well inventory in 2016	17
Figure 3: Alberta growth in inactive and abandoned wells 1963-2012	21
Figure 4: Ballooning Corporate Debt.....	27
Figure 5: The top ten companies with the biggest cash hoards.....	30
Table 1: Timeline of regulatory responsibilities for energy resources.....	8
Table 2: Increase in insolvency rates	28
Table 3: Orphan Well Association inventory	28
Table 4: Summary of emerging issues and trends	32
Table 5: Policy evaluation.....	49



THE SCHOOL OF PUBLIC POLICY

Capstone Executive Summary

Oil & gas end-of-life liabilities exist in different forms in Alberta. There are real liabilities that we can see, touch and count, in the form of rusting wellheads and pump jacks left in farmers' fields. There are future liabilities that we can anticipate; these exist largely in the form of currently producing wells that one day need to be abandoned and reclaimed once they stop being profitable. Last but not least there are the invisible liabilities, typically unpredictable, in the form of already abandoned and reclaimed well sites (also known as legacy sites). These could start leaking years after abandonment resulting in contamination of soil or groundwater.

Irrespective of their form, oil & gas liabilities have the same three risks: financial risks (is there enough money for closure?), environmental risks (what is the impact on soil, water and wildlife?) and social-economic risks (what are the lost opportunities for our natural resources?).

Over the last 30 years, the government of Alberta and Alberta's energy regulator have implemented legislation and associated regulatory programs to manage these liabilities. Unfortunately, success of these interventions can be debated when we look at the

data: financial funds that can be dedicated to abandonment and reclamation are scarce and inventories of inactive wells and not reclaimed sites continue to grow.

This may already sound like a good enough reason to revisit legislative and regulatory programs. However, when we look at the potential impact of the recent economic downturn (2014 onward) and the resulting decrease in oil & gas prices in Alberta, there may be additional reasons why to take action sooner than later. The dramatic increase in insolvencies and the recent Redwater court decision (May 2016) have shaken the foundation of Alberta's oil and gas liability management programs. Landowners are becoming more and more vocal in expressing their displeasure with oil & gas development on their land. Capital investment in the Alberta oil & gas industry is used to pay down debts rather than to drill new wells. The number of industry insolvencies and exits, resulting in so-called legacy issues that are fully unfunded at this moment, are expected to rise. Finally, there is increasing urbanization in Alberta encroaching on inactive and abandoned well sites. It's a perfect storm simply waiting to happen.

This paper evaluates existing policy and proposes a combination of three policy options that will address the shortcomings in management of oil & gas liabilities in Alberta. These options are: implementation of timeliness for abandonment and reclamation; upfront security collection for new energy developments and the establishment of a legacy fund, jointly funded by the Government of Alberta and the oil & gas industry.

The Alberta Energy Regulator (AER) is charged with implementing a "timeliness policy" using a performance based regulatory framework. This performance-based approach allows flexibility for industry to determine the most cost effective, fit for purpose implementation of timeliness outcomes.

Upfront security collection requires a combination of approaches to assess deemed liabilities and security collection, based on best practices in other Regulatory programs and jurisdictions.

In order to be efficient, the funding for the legacy fund should be combined with royalty collection and needs to replace the current orphan levy but remain managed by the Orphan Well Association, in which the Government of Alberta will play a more active role.

Stakeholder engagement as well as in depth economic analysis of the proposed policy options must be a top priority in the coming period to ensure the high level assumptions in this paper are validated and confirmed.

Once these policies are implemented, the new regulatory framework in Alberta will incent industry to address its existing and future liabilities in a timely manner. This will uphold the polluter pay principle and will ensure sufficient funds are put aside for unfunded liabilities associated with legacy issues while continuing to ensure competitiveness of the oil & gas industry in Alberta.

1. Introduction

In this paper I explore new policy options to address Alberta's growing oil and gas end-of-life liabilities. I use the following framework to describe and evaluate the issues and offer alternative approaches for future policy actions.

The study commences with a review of the history of oil and gas development in Alberta as well as the legislative and regulatory events leading to the current system.

This is followed by a risk analysis section, where I review the risks associated with oil & gas liabilities in Alberta as well as the regulatory response to date. At the end of this section I discuss emerging issues and trends that provide urgency to the need to review Alberta's current policy.

The policy section begins with an overview of the evaluation criteria I use to evaluate policy options. I evaluate the status quo, followed by the introduction of three alternative policy options. For consistency, these three policy options are evaluated against the same criteria as the status quo.

The final section combines the evaluation and analysis and offers recommendations for the future.

2. Methodology

In this paper I rely on both quantitative and qualitative information including reports and data from the AER, comparative literature from journal articles and other jurisdictions facing similar issues. The Alberta Energy Regulator (AER) and the former department of Environment and Sustainable Resource Development (ESRD) have been tracking the status of wells in the province through its lifecycle but unfortunately not a lot of this data is readily available for analysis. Therefore, I am relying on analysis of data published already rather than my own data analysis. I have also utilized anecdotal evidence from news media, reports published by NGO's and discussions with agency and industry representatives.

As a fundamental tenet of my paper I have compared the nature of the regulatory policy prescriptions in Alberta over the past two decades, analyzed them over time to show their intent and effectiveness in achieving their objectives, and use that analysis to recommend future policy changes.

I have utilized readily available data on well closure activities and plans from the AER and former ESRD. In addition, I have used Alberta Provincial legislative and regulatory documents as the basis for comparison of intentions and public oversight.

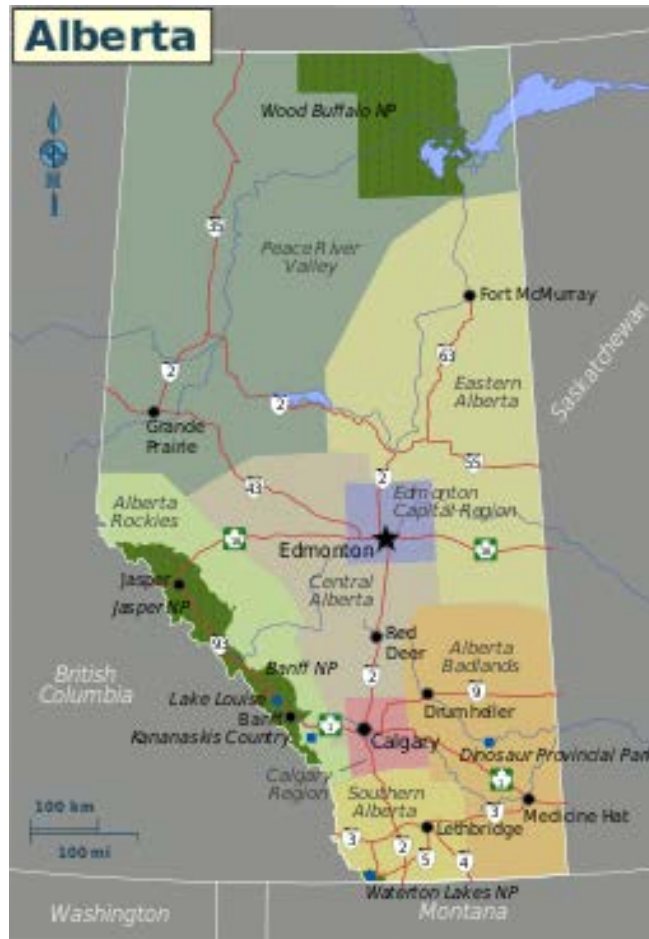
3. History

3.1 Alberta's oil & gas industry

The first natural gas resources in Alberta were accidentally discovered in 1883 when a Canadian Pacific Railway crew drilled for water near Medicine Hat. A year later a second well was drilled in the same area and produced enough gas to light and heat several buildings. More wells were drilled in the Medicine Hat area in the 1890s to take advantage of this emerging resource.

In 1908 the Bow Island Gas field was discovered southwest of Medicine Hat. This was the first *major* discovery and initiated the start of Alberta's commercial oil and gas production, warranting a 16-inch pipeline to Calgary and Lethbridge. In 1914, Arthur W. Dingman discovered gas in Turner Valley. In the same year the Viking-Kinsella gas field near Edmonton was discovered and started to deliver gas by pipeline to Edmonton in 1923. When the Leduc oil field was discovered by Imperial in 1947, Alberta's oil & gas industry was firmly established as a significant player in the national and international energy landscape ("Alberta Energy History Prior to 1950" 2016). By 2016 the well and pipeline inventory in Alberta had increased to over 178,000 operating wells and 421,000 km of pipelines ("What We Do" 2016).

Figure 1: Map of Alberta



Source: "Map of Alberta" 2016

3.2 Alberta's oil & gas legislation and regulation

In 1930, 25 years after Alberta became a province, the Canadian federal government passed legislation that transferred control of natural gas and other natural resources to the provincial Government of Alberta. This was followed in 1938 with an amendment that allowed the province to regulate wells that were leased before 1930. This meant that Alberta had full jurisdiction over the mineral rights, associated royalties and the regulation of oil and gas production.

In 1915 the Public Utilities Board became Alberta’s first regulatory agency followed by a key milestone in 1938, when the Oil and Gas Resources Conservation Act became law and the Petroleum and Natural Gas Conservation Board was formed. The jurisdiction over closure activities changed over time. Initially it was included in the duties of the energy regulator. After the first minister of environment was appointed in 1971, the Government of Alberta became more involved with remediation and reclamation of energy sites and the regulator’s closure activities focused mainly on suspension and abandonment of energy infrastructure. The Alberta Energy Regulator (AER), established through the Responsible Energy Development Act (REDA) (*Responsible Energy Development Act 2014*) in 2013, was given jurisdiction over all aspects of energy development in the province of Alberta. Today the AER is responsible for balancing the social and economic priorities with environmentally responsible energy development across the well lifecycle.

The table on the next page shows the how energy resource responsibilities have shifted between ministries and the regulator over the last 80 years.

Table 1: Timeline of regulatory responsibilities for energy resources

	Alberta Energy Regulator	Alberta Environment	Alberta Energy
1930	1938-1957 Petroleum & Natural Gas Conservation Board	1930-1992 Minister of Forestry, Lands & Wildlife	
1940			1945-1975 Minister of Mines & Minerals
1950	1957-1971 Oil & Gas Conservation Board		
1970	1971-1995 Energy Resources Conservation Board	1971 –now Minister of Environment	1975 –now Minister of Energy
1990	1995-2007 Alberta Energy & Utilities Board		
2000	2008-2013 Energy Resources Conservation Board	2001-2012 Minister of Sustainable Resource Development	
2010	2013 – now Alberta Energy Regulator:		
Energy Resource Responsibilities	Oil & Gas Development Approvals & Compliance	Surface Rights Board; Land Use Framework; Climate Change	Mineral Rights
	Policy Management Office		
	Public Lands and Environmental Approvals & Compliance		

Color Legend	
Alberta Energy Regulator	Alberta Energy
Alberta Environment	Previous Ministries

Sources: (Jaremko 2013) (AER 2016) (“Regulatory History of Alberta’s Industrial Land Conservation and Reclamation Program” 2012) (“The Evolution of Alberta’s Energy Regulator” 2014) (“Separation Anxiety - Is a Divided Alberta Energy Regulator around the Corner?” 2016) (“Alberta Environment and Parks” 2016) (“Alberta Environment and Sustainable Resource Development” 2013) (“Environment and Sustainable Resource Development. Annual Report 2012-2013” 2013) (“List of Alberta Provincial Ministries” 2016).

In Alberta, there are a range of different acts and rules that govern oil and gas development and deal with specific end-of-life provisions.

The principal instruments for the regulatory process are the **Energy Resource Enactments** that deal with oil and gas development only (“Acts, Regulations & Rules” 2016). The main acts that are relevant for this paper are: the *Oil and Gas Conservation Act (OGCA)*, the *Oil and Gas Conservation Rules (OGCR)* and the *Orphan Fund Delegated Administration Regulation (OFDAR)*. In contrast there are the so-called **Specified**

Enactments (“Acts, Regulations & Rules” 2016), that deal with impacts to the environment of all activities on the province. The *Environmental Protection and Enhancement Act (EPEA)* and the *Conservation and Reclamation Regulation (CRR)* provide operational details that are particularly relevant for this paper. In the following pages I summarize the key legislation pertaining to oil & gas closure activities and management of liabilities from these acts.

The purpose of the **Energy Resource Enactments** is to ensure any oil and gas development is completed in an economic manner (by preventing waste and optimizing production) and in the public interest (by ensuring safe and efficient work practices and controlling pollution). The Oil & Gas Conservation Act (OGCA) (*Oil & Gas Conservation Act 2014*) and the Oil & Gas Conservation Rules (OGCR) (*Oil & Gas Conservation Rules 2016*) state that a licensee is responsible for the cost associated with end-of-life issues: "Abandonment of a well or facility does not relieve the licensee, approval holder or working interest participant from responsibility for the control or further abandonment of the well or facility or from the responsibility for the cost of doing that work" (*Oil & Gas Conservation Act 2014 s29*). Notably, the licensee is not alone in its duty to pay: "the well or facility suspension costs, abandonment costs and reclamation costs must be paid by the working interest participant in accordance with their proportionate share in the well or facility" (*Oil & Gas Conservation Act 2014 s30*). The OGCR explicitly states a licensee must comply with the AER's Liability Management directives in: "A licensee must comply with the requirements set out in directives 001, 006, 011, 024, 068 and 075 published by the regulator, as applicable" (*Oil & Gas Conservation Rules 2016 s1.200*). These directives explain how the AER administers end-of-life liabilities. The Oil & Gas Conservation Act also introduces the Orphan Fund and describes the following purposes for the Orphan Fund:

(a) to pay for suspension costs, abandonment costs and related reclamation costs in respect to orphan wells, facilities, facility sites and well sites where the work is carried out

i) by the regulator

ii) by a person authorized by the regulator

iii) by a director or a person authorized by a director in accordance with the EPEA

(b) to pay for costs incurred in pursuing reimbursement for the costs referred to in clause

(a) from the person responsible for paying them ...

(d) to pay for any other costs directly related to the operations of the regulator in respect of the orphan fund (*Oil & Gas Conservation Act 2014 s70(1)*).

The Orphan Fund Delegated Administration Regulation describes the relation between the AER and the Orphan Well Association (OWA) as follows:

The following powers, duties and functions of the Regulator are delegated to the Association:

- a) all of the powers, duties and functions of the Regulator for the purpose of administering the payment of money for the purposes set out in section 70(1) of the Act
- b) (b) the powers, duties and functions of the Regulator under sections 28(b)¹, 102² and 104(1)(b) and (2)(b)³ of the Act (*Orphan Fund Delegated Administration Regulation 2016 s3(1)*).

In summary, this means that if a licensee cannot perform and pay for its closure activities, and/or working interest partners are not able to fulfill and pay for their share of the abandonment and reclamation duties and cost, the OWA will perform and finance the cost

¹ Suspension and Abandonment

² Sale of Equipment, etc.

³ Containment, clean-up and disposal of escaped substances

of closure. In order to pay for the costs borne by the OWA, the AER collects an “orphan levy” on an annual basis.

This orphan levy is based on the revenue requirements identified in the OWA budget (“Orphan Levy” 2016). For each licensee operating in Alberta, the levy is calculated based on an estimate of each licensee’s *proportional share* of the sector liability and is intended to pay for end-of-life activities if licensees become insolvent or defunct. The AERs liability management programs augment this orphan levy. Under certain conditions and in certain circumstances, securities are collected from licensees that are used by the OWA when those licensees go defunct. For oilfield waste management facilities the OGCR requires security to be provided “before construction or operation of the facility commences” (*Oil & Gas Conservation Rules 2016 s16.640(1)*).

The purpose of the **Specified Enactments** is to support and promote protection and wise use of the environment across the spectrum of all industrial development. EPEA states that it is: “the responsibility of polluters to pay for the costs of their actions” (*Environmental Protection and Enhancement Act 2014 s2.0(i)*). The CRR is more specific when stating:

Without limitation to sections 140⁴, 141⁵, 142⁶ and 241⁷ of the Act, an environmental protection order regarding conservation and reclamation may contain terms and conditions requiring the person to whom the order is directed to

- (a) prevent, contain, control, remove or remedy any degradation or deterioration of the surface of the land,

⁴ Environmental protection order regarding conservation and reclamation

⁵ Environmental protection order regarding off-site damage

⁶ Environmental protection order after reclamation certificate

⁷ Environmental protection orders including any other requirements

(b) conserve or replace soil, and

(c) apply for and obtain a reclamation certificate within the time prescribed by the Director (*Conservation and Reclamation Regulation 2014 s9*).

The CRR describes operator liability after obtaining a reclamation certificate to be:

(1) Where a reclamation certificate is issued under the Act to an operator in respect of an activity referred to in section 1(t)(ii) to (viii)⁸, no environmental protection order regarding conservation or reclamation may be issued under section 142(2)⁹ of the Act

(a) more than 5 years after the date of issuance of the reclamation certificate, in a case where no approval in respect of the activity was held on the date of issuance of the reclamation certificate, or

(b) after the date of issuance of the reclamation certificate, in the case of an activity listed in Division 3 of Schedule 1¹⁰ of the Activities Designation Regulation, where an approval was held in respect of the activity on the date of issuance of the reclamation certificate.

(2) Where a reclamation certificate is issued under the Act in respect of an activity referred to in section 1(t)(i)¹¹

(a) on or before October 1, 2003, no environmental protection order regarding conservation or reclamation may be made under section 142(2) of the Act more than 5 years after the date of issuance of the reclamation certificate, or

⁸ Construction and/or operation and/or reclamation of: an oil production site; municipal pipeline; telecommunication system or transmission line; mine; pit; borrow excavation; quarry; peat operations; roadway; exploration operations; railway

⁹ No environmental protection order regarding conservation and reclamation may be issued under this section (a) in any case where the reclamation certificate in respect of the specified land was issued under the Land Surface Conservation and Reclamation Act, RSA 1980 cL-3, or (b) in any other case, after the date prescribed or determined in accordance with the regulations for the purposes of this section with respect to different classes of specified land set out in the regulation.

¹⁰ Construction and/or operation and/or reclamation of: an oil production site; municipal pipeline; telecommunication system or transmission line; mine; pit; borrow excavation; quarry; peat operations; roadway; exploration operations; railway

¹¹ Construction, operation or reclamation of a well, an industrial pipeline or a battery

(b) after October 1, 2003, no environmental protection order regarding conservation or reclamation may be made under section 142(2) of the Act more than 25 years after the date of issuance of the reclamation certificate.

(3) Where a reclamation certificate is issued under the Act in respect of an activity referred to in section 1(t)(ix)¹², no environmental protection order regarding conservation or reclamation may be made under section 142(2) of the Act more than 25 years after the date of issuance of the reclamation certificate (*Conservation and Reclamation Regulation 2014* s15).

In summary, this means that since 2003, oil & gas licensees and operators in Alberta carry responsibility for their reclaimed sites for 25 years after the reclaimed site has been certified.

The **Alberta Energy Regulator** (AER) is responsible for the enforcement of these acts where energy development is occurring. The policy underlying the mandate of the AER is best discerned from the report "Enhancing Assurance, Report and Recommendations of the Regulatory Enhancement Task Force to the Minister of Energy" ("Enhancing Assurance" 2011). The main policy recommendation of this document, as implemented in the REDA, was the creation of a *single regulator* for energy development. The AER brought together the economic and social responsibilities (from the former Energy Resource Conservation Board) with the environmental responsibilities and oversight (from the former Environment and Sustainable Resource Development Ministry). This created an agency that combined all end-of-life liabilities under jurisdiction of the AER. Further change embedded in this policy was to move policy *development* from the regulators into a centralized Policy Management Office (PMO) while leaving policy *assurance* with the

¹² the construction, operation or reclamation of a plant

regulators. Although the REDA does not explicitly mention the PMO, it does describe the limited rule making authority for the AER, placing significant authority with the Minister and Cabinet: "Unless the Minister directs otherwise, the Regulator shall give the Minister at least 120 days' written notice before making a rule under this Act or any other enactment" (*Responsible Energy Development Act 2014, s22*). This dictates that the Minister must decide on changes in policy or regulations to more effectively manage end-of-life liabilities. The policy also contained a recommendation for risk management, not explicitly implemented in REDA but adopted by the AER in day-to-day decision-making. This recommendation allows for innovation, continuous improvement and use of a broader suite of policy assurance tools, such as outcomes based regulations, market based instruments and industry standards and codes of conduct.

Regulatory context. In a Supreme Court of Canada decision (*Imperial Oil Ltd. v. Quebec (Minister of the Environment)* 2003), the Court dismissed Imperial Oil's appeal setting aside the Minister's order to conduct a study on contamination at a former Imperial Oil site. The Court used the fact that the Minister was representing public interest in protecting the environment, as one of the reasons to dismiss the appeal stating that: the Minister saved public money by applying the polluter-pay principle. The OGCA and EPEA are supported by this case, which confirms in part the 'polluter pays' principle¹³. The Imperial Oil case also supports the policy issue that requires that polluters pay *before* they are at the end of their economic life is in the public interest. Current law and policy both enable and constrain the regulator from getting companies to "clean as you go".

¹³ The 'polluter pays' principle is established by environmental law in a number of countries and makes the party responsible for producing pollution responsible for paying for the damage done to the natural environment ("The Polluter Pays Principle" 2008)

The two principal acts (OGCA and EPEA) provide clear direction to licensees and operators with respect to end-of-life liabilities. However, they omit many of the details as to how this will actually be administered. Ultimately, the acts keep the door open to the development of alternative approaches.

The rules and regulations within the acts contain regulatory details that tend to constrain the ability to manage end-of-life liabilities. This is because:

1. The OGCR and AER directives (001, 006, 011, 024, 068, 075) (“Acts, Regulations & Rules” 2016) mainly focus on the 'insurance' part of the licensees liabilities. For example the orphan fund is a short-term provision regarding unfunded liabilities; the asset/liability related security deposits provide potential funds, assuming licensees are still able to pay the required security deposit.

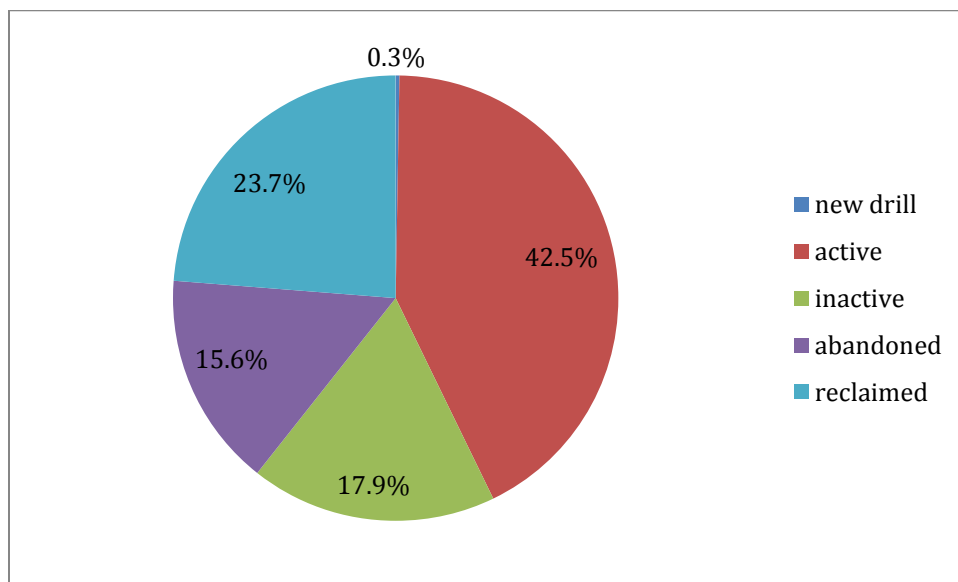
2. Limits and timeliness requirements that could encourage a "clean as you go" approach *do not exist* in the rules and regulations. A licensee only typically abandons a well if ordered to do so by the regulator, a rare event. Additionally, the regulator can order an environmental protection order with a time limit for reclamation, which also rarely happens. There are no general timelines for abandonment, reclamation or remediation in any of the acts, rules or regulations.

4. Risk Analysis of oil & gas liabilities






4.1 Current and future state

Statistics show that the province of Alberta has over 440,000 oil & gas wells (“Multi Stakeholder Engagement Advisory Committee Closure & Liability Presentation” 2016). Of these, approximately 79,000 are inactive – meaning they have not produced oil or gas over the last 6-12 months (6 months for sour gas wells; 12 months for all other wells) (“Draft Directive 013” 2016). 69,000 Wells have been abandoned but not yet reclaimed; 105,000 wells have been reclaimed. This leaves the province with approximately 188,000 active wells or 42% of the total well inventory. This inventory is represented in the graph below:

Figure 2: Alberta oil & gas well inventory in 2016



Derived from: “Multi Stakeholder Engagement Advisory Committee Closure & Liability Presentation” 2016

Legend (“Frequently Asked Questions Directive 013 and Inactive Well Compliance Program (IWCP, Bulletin 2014-19)” 2016)	
New Drill: Wells that were drilled and cased but are without reported volumetric activity	
Active Well: A well that has reported volumetric activity	
Inactive Well: a well that has no volumetric activity for 6 or 12 consecutive months (based on the risk category of the well); within 12 months inactive wells needs to be suspended (which includes regular inspections) in accordance with directive 13 and reported to the AER	
Abandoned Well: a well which is abandoned in accordance to directive 20 (both surface and down hole) and the abandonment is reported to the AER	
Reclaimed Well: a well which well site has been reclamation certified	

Public health and safety interests require well monitoring and management. This means well sites need to be subject to risk assessment and mitigation. Three main risk areas can be identified when observing risks associated with oil and gas well sites: financial risks, environmental risks and social economic risks. Below I explore these three risk categories in more detail.

1. Financial Risk. Abandonment and reclamation of well sites present a potential financial liability for the operator and licensee. As per June 2016, the AER estimates that across the province of Alberta the total oil & gas liabilities are approximately CDN \$36 billion. In simple terms this implies that the oil & gas industry must spend \$36 billion before it decides to pack-up and leave the province of Alberta. This would not be of concern to the general public but for the fact that Alberta is a mature basin where production outpaces reserve additions. This means that more oil and gas is produced in Alberta than is discovered for replacement.

Remaining conventional marketable gas reserves are approximately 32 Trillion Cubic Feet (TCF) and operate at current production rates of approximately 3.4 TCF per year and 2.4 TCF reserves additions per year. The upshot is that Alberta has approximately 32 years of natural gas production remaining. For conventional oil the outcome is worse: here, production outpaces reserve additions by 86%. Alberta currently has $288 \times 10^6 \text{ m}^3$ of conventional oil reserves remaining, produces $34 \times 10^6 \text{ m}^3$ annually but only adds $4.8 \times 10^6 \text{ m}^3$ to its annual reserves (derived from “ST98-2015 Alberta’s Energy Reserves 2014 and Supply/Demand Outlook 2014-2024” 2016). Thus, at current production rates Alberta could run out of conventional oil in 10 years.

Industry currently puts what appears to be significant effort into abandonment and reclamation through the Orphan Well Association (OWA) as well as through its own licensee driven end-of-life programs.¹⁴ In total, industry spends an average yearly sum of just over \$200 million on abandonment and reclamation (assuming the average abandonment and reclamation cost from directive 006) (“Directive 006” 2016). If industry keeps up this yearly rate of spending, it would take approximately 177 years to pay for the deemed provincial liabilities of \$36 billion.

Based on the simplified numbers above, it is clear that the financial burden of these liabilities is significant, and is not being addressed by industry in a manner timely enough to mitigate the risk for the province.

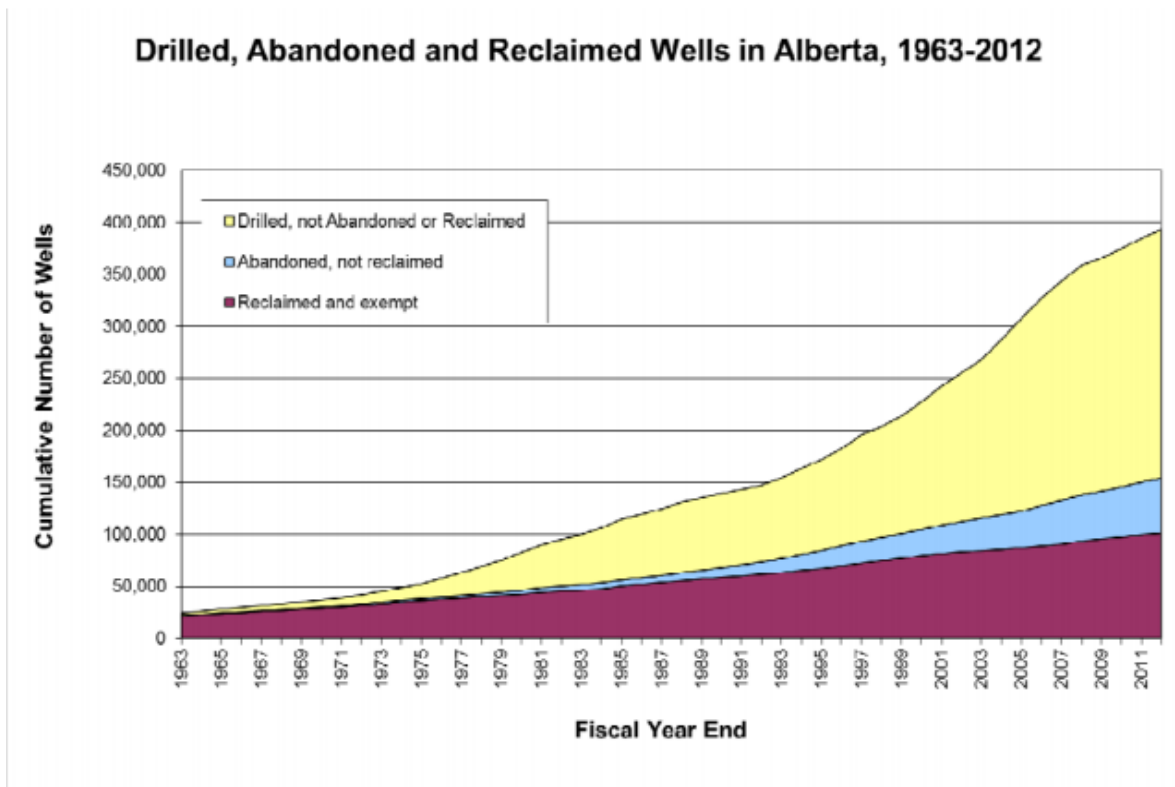
2. Environmental Risk. There are environmental risks associated with inactive and abandoned well sites. Jason Unger highlights a long list of “environmental impacts from well sites and related infrastructure like roads ... are continued when abandonment and reclamation are delayed” (Unger 2013, 9). His list includes impacts on biodiversity and species-at-risk like Woodland Caribou, grizzly bears and the Great Sage-grouse. Future environmental impacts recognized by him are impacts to hydrology, surface water, soil and groundwater. Soil and groundwater impacts occur primarily where there is contamination and risks of contamination increase when abandonment and reclamation are delayed. Not only does contamination affect flora and fauna but it also poses a risk for public health and safety through possible explosions and contamination of drinking water.

¹⁴ For example, the OWA abandoned 156 wells and reclaimed 50 wells for the total cost of \$30 million last year. This is over and above the abandonment and reclamation activities individual licensees do. According to Jason Unger in his report on Alberta's state of Reclamation (Unger 2013) between 2001 and 2011 operators on average abandoned 4,111 wells per year and 1682 well sites were reclamation certified.

The longer remediation is delayed, the more cost increase along with potential risk of migration of the contamination. It is also important to take note of Unger's remark on cumulative effect management. There is a growing collective recognition that impacts from small disturbances such as well sites are magnified when viewed at a landscape-scale. By contrast, current regulatory oversight of abandonment and reclamation is currently focused on a site-by-site basis. Cumulative environmental effect management addresses this "fragmentation and incrementalism in decision making by ensuring that the full range of activities on the landscape are regulated in a manner that is consistent with a single set of principles, objectives and limits" (Kennett and Woynillowicz 2007, 2).

3. Social-Economic Risk. The delayed abandonment and reclamation of well sites also results in social and economic risks such as reduced land use. According to Ecojustice (Robinson 2016), over 10,000 wells have been inactive for 10 years or more and 17,000 have been abandoned for more than 10 years awaiting a reclamation certificate. The sites that remain dormant for decades represent lost opportunities and associated economic losses (Robinson 2016). This also includes ancillary potential economic losses as companies hold on to mineral rights tied up in inactive wells that do not produce and do not generate royalties for the province. The graph on the next page illustrated the growth in inactive and abandoned not reclaimed well sites in the period from 1963 - 2012.

Figure 3: Alberta growth in inactive and abandoned wells 1963-2012



Source: "Update Report on Alberta Environment and Sustainable Resource Development's Upstream Oil & Gas Reclamation Certificate Program" 2013

4.2 Regulatory response to date

During the past 25 years, the Energy Regulator in Alberta has initiated a number of regulatory responses in a variety of areas in attempts to address the financial, environmental and economic risks associated with oil & gas liabilities. These responses can be grouped in 3 categories: mitigating the financial risk, mitigating the inactive well risk and mitigating the lack of reclamation risk.

1. Mitigating the financial risk. In 1986 the Energy Resources Conservation Board (ERCB) instituted “a special well fund to be directed to abandoning ‘orphan’ wells” (Robinson 2010, 1). In May 1994, this fund was replaced by the Abandonment Fund and succeeded by the Orphan Fund aka Orphan Well Association (OWA) in 2000 through an amendment of the Oil & Gas Conservation Act. The amendment “expanded the scope of the Orphan Fund to include suspension of wells, discontinuance of pipelines and the reclamation of the associated surface lands in addition to abandonment” (Robinson 2010, 2).

An orphan levy was to be collected every year to fund the OWA. In addition to the establishment of the Orphan Fund in 2000, the regulator (called AEUB at that stage) introduced the Licensee Liability Rating (LLR) program. The purpose of the LLR program was, and still is, to manage the risk of licensees building up too many liabilities by collecting security once their deemed liabilities outweigh their deemed assets. The LLR program bases the calculation of assets on reported production by the licensee and the calculation of liabilities on total number and characteristics of wells and facilities licensed by the licensee. The security was to be handed over to the OWA if and when the licensee’s assets were orphaned. In the following years the AEUB implemented separate liability programs for oilfield waste management facilities (the OWL program) and large facilities (the LFP). While these programs are not directly relevant in the context of well sites, they are mentioned here because the Liability Management Rating (LMR) is “the ratio of a licensee’s eligible deemed assets in the LFP, LLR, and OWL programs to its deemed liabilities in those programs” (“Directive 075” 2016).

2. Mitigation of inactive well risk. According to Barry Robinson, “as early as 1989, the ERCB recommended that suspended wells be reviewed every five years and that suspended wells be abandoned after five years unless the operator could justify the continued suspension of the well beyond five years” (Robinson 2016, 3). By 1989 there were over 25,000 inactive wells in Alberta and this number continued to grow. Wells were also left inactive for longer periods of time.

In response to the increase in amount and age of inactive wells the Alberta Energy and Utilities Board (AEUB) (which replaced the ERCB from 1995 till 2008), issued a letter in 1995 to all oil & gas producers expressing concerns about the risks posed by the inactive wells.

To mitigate the risk, the AEUB implemented the Long term Inactive Well Program (LTIWP) in 1997. This program included a 5-year time limit on inactive well status and forced operators to either abandon or re-activate the wells or pay a security deposit¹⁵. The program was deemed successful and the number of inactive wells started to decline. However, industry objected strongly to the program, claiming it should be allowed to leave inactive wells in that state for a *reasonable* period in order to keep options open for re-activation in the case of new technology and/or higher prices.

In 2000, with the introduction of the LLR program, the LTIWP was terminated. The number of inactive wells grew again and "by 2004 there were 42,000 inactive wells, many of which had been inactive for more than 25 year" (Robinson 2010, 4). To address this issue the AEUB introduced Directive 013, which required licensees to suspend an inactive well. The main requirement for well suspension obliges licensees to perform regular safety

¹⁵ The objective of the security deposit was to make it more expensive for operators to leave their wells inactive

inspections. The frequency of the required inspections, and other mandatory suspension requirements like testing, repair and reporting, increase pending the risk of the well. By 2005 the amount of inactive wells increased to 44,820 and by 2009 it was 61,945 (Robinson 2010). In 2015 the AER implemented its inactive Well Compliance Program (IWCP) to address the approximately 30,000 non-compliant inactive wells. The IWCP requires all licensees to come into compliance with directive 013 in 5 years by achieving 20% compliance each year. After the first year, 71% of the licensees exceeded this target (“Multi Stakeholder Engagement Advisory Committee Closure & Liability Presentation” 2016). Progress towards abandonment now remains as elusive as before.

3. Mitigation of reclamation risk. During the period post 1990, timely reclamation of well sites was not achieved either. By 1992, there were 29,580 abandoned but not reclamation certified well sites in Alberta. By 2009 Alberta Environment reported that there were 45,248 abandoned, not reclamation certified sites and 11,505 of these had been abandoned for more than 10 years¹⁶. Alberta Environment and Parks issued updated Reclamation criteria in 2010 (“Reclamation” 2016) but these did not include requirements for timeliness.

Given these numbers, it appears that the legislative and regulatory framework is failing to effectively manage the timely movement of oil & gas sites through the lifecycle of abandonment and reclamation. The Annual Report of the Auditor General of 2004-2005 states that: “without a requirement for timely abandonment... and subsequent monitoring and enforcement, industry may defer their abandonment and reclamation activities and

¹⁶ The standard time required for reclamation work and re-growth is approximately 5 years.

costs. If certain licensees do not meet their responsibilities for abandonment and reclamation activities in the future, other licensees or the government may have to cover the liabilities” (Robinson 2010, 6).

4.3 Emerging Issues and Trends

During all of 2015, as oil & gas prices plummeted, a new sense of urgency about controlling the end-of-life oil & gas liabilities, began to appear among all stakeholders in the oil & gas sector. Industry associations like the Canadian Association of Petroleum Producers (CAPP) and the Explorers and Producers Association of Canada (EPAC) formed special committees and published position papers around the liability problem. The provincial and national media increased its attention to the case of abandoned wells in Alberta and one of the NGO's re-ignited the public debate by sending a public letter to the Ministers of Energy and Environment. Stakeholders highlighted concerns about the risks associated with liabilities in the oil & gas sector for a number of reasons including: increase in insolvencies; impacts on surface rights, decrease in capital investment, increase in legacy issues and increase in urbanization. Below I discuss these five emerging issues in more detail.

1. Insolvencies. Due to the low oil and gas prices and limited pipeline capacity, many companies are defaulting on their debt and filing for bankruptcy as a result (Loder, Church, and Klein 2016). In Alberta, many companies have been shutting in production, banks are now refusing to offer financial lifelines and the number of new orphan wells as a result of insolvencies has increased more than sevenfold from 80 in 2013/14 to 591 in 2014/15.

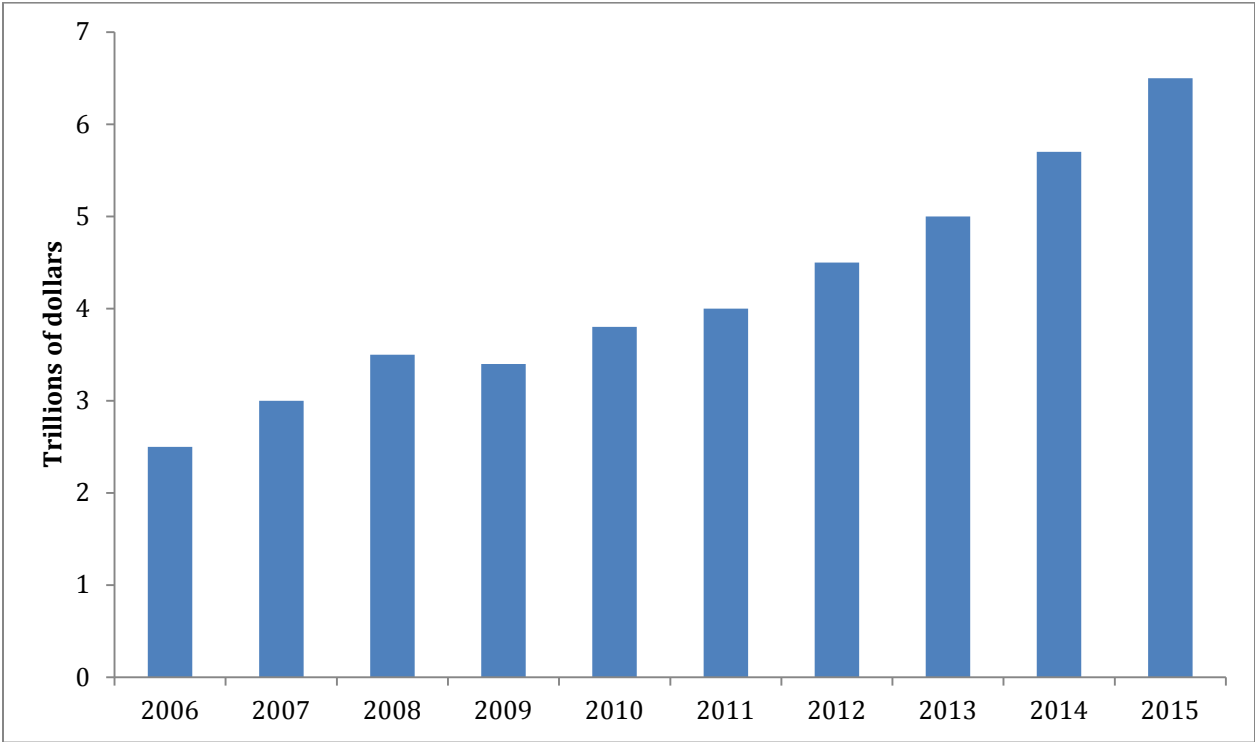
The practical process of insolvency is described below. Usually a trustee is appointed in the case of a bankrupt oil and gas company. The OGCA states that the trustee is responsible for care and custody of all the licenses held which includes ensuring public safety, protecting the environment and if directed to do so, abandonment of wells. The trustee's objective is to maximize the value of the debtor's estate for the creditors through a process to sell the debtor's assets. As part of the sale of oil & gas assets, the trustee must verify the approval from the AER to transfer licenses. However the AER does not always approve these license transfers. For example, the sellers Liability Management Rating must not decrease as a result of the sale, unless the transfer is submitted with a sufficient security deposit.

Clearly the incentives of the trustee are not fully aligned with the public interest. As a result, there have been a number of recent cases where trustees either disclaim all assets, for example in the case of Shoreline, or where the trustee denounces certain licensed assets. The most well known example of the latter is the Redwater Energy Corp case. In this case, which was recently ruled in favor of the trustee (Grant Thornton) by the Alberta Court of Queen's Bench, the AER, OWA and the trustee were contesting a number of key principles that are part of the insolvency practice including: Is the trustee entitled to renounce assets? Is the trustee obliged to fulfill its statutory obligations under the OGCA? Can the AER refuse to approve license transfers? (Redwater Energy Corporation (Re) 2016 ABQB 278 2016).

The judge concluded that there is an operational conflict between the abandonment and reclamation provisions of the province's Oil and Gas Conservation Act (*Oil & Gas Conservation Act* 2014) and the federal Bankruptcy and Insolvency Act (*Bankruptcy and*

Insolvency Act 2015). As a result, a trustee in bankruptcy can now disclaim unproductive oil and gas assets and the value of the productive assets is preserved for the benefit of secured creditors. The effect of this outcome is that the AER can no longer enforce the closure activity at the cost of the licensee (by issuing abandonment orders) and can no longer guarantee that the licensee has assets to cover its liabilities (by stopping transfers of assets that deteriorate the licensee's Liability Management Rating). "Thus, the entire provincial scheme for protecting Albertans from the abandonment costs in relation to non-productive wells is seriously compromised, and, as a result, in the case of a bankrupt licensee the costs of abandonment will necessarily be assumed by the Orphan Well Fund or the province" (Banks 2016).

Figure 4: Ballooning Corporate Debt



Derived from: Miller 2016

As a result of ballooning debt (Figure 5 above illustrates the situation in the U.S.), banks are withdrawing or limiting credit to oil & gas companies and a large number of companies file for bankruptcy before their Liability Management Rating dips below one, i.e. before they need to pay security to the AER. In cases like this, and following dismissal of the trustee, the AER will orphan any oil and gas assets that are not sold as a result of the trustee’s sales process. Consequently, with no security to hand over to the OWA, the abandonment and reclamation of these orphans must be fully funded by the Orphan Levy. As more oil & gas companies in Alberta become insolvent, there are fewer companies left to pay for the orphan fund. Consequently, with increased insolvencies, the program requires more and more funding each year. Table 2 on the following page shows the relative corporate insolvency rate of various provinces in Canada.

Table 2: Increase in insolvency rates

	Alberta	Newfoundland and Labrador	Saskatchewan	Manitoba
Increase in rate of insolvencies in 2015	43.5%	37.7%	30.2%	22.9%

Source: “Insolvency Rate Jumps 43.5% in Alberta” 2016.

This influx of orphans creates an unsustainable situation. Once the OWA is not able to fund its operations, it is not able to protect the province of Alberta from unfunded liabilities. Table 3 below shows the work done by the OWA and its growing inventory.

Table 3: Orphan Well Association inventory

	Prior years	2004 - 2010	2010-2015	Total	New wells received in 2012/13	New wells received in 2013/14	New wells received in 2014/15	Inventory as of 2014/15
Well abandonment	405	152	145	702	50	80	591	705
Site Reclamation	130	195	201	562				

Sources: “Orphan Well Association Annual Report 2014-15” 2015; “Orphan Well Association Annual Report 2012-13” 2013; “Orphan Well Association Annual Report 2013-14” 2014

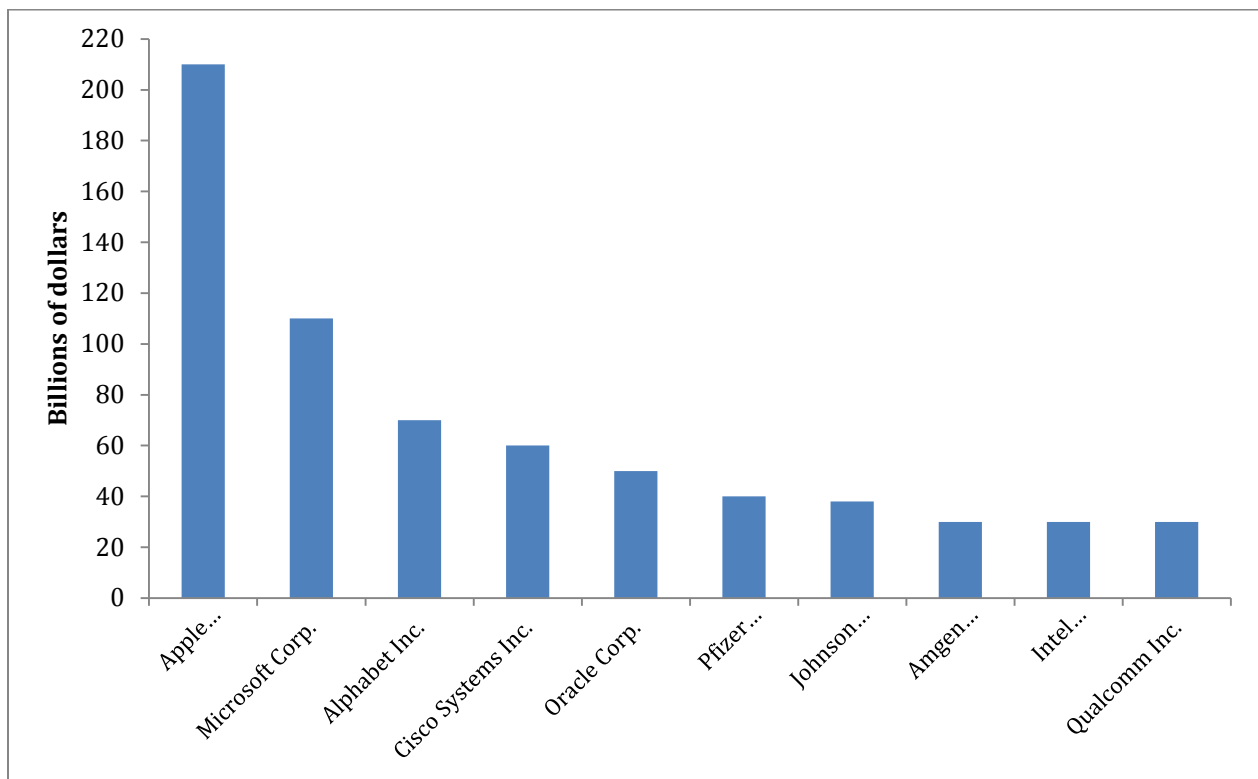
2. Surface rights. To obtain the rights to the surface land their wells are located on, licensees must have a lease agreement with the landowner (for private land) or the crown (for public land) and need to pay annual lease payments. Recently, oil & gas companies have begun to default on surface lease payments. That has resulted in a sharp increase in payments requested by landowners from the Surface Rights Board (SRB). For instance, in 2015, the SRB received 750 new applications for compensation from landowners due to operators and licensees who had not paid their surface rental fees. By comparison, in 2014, the SRB made 38 decisions on recovery of rentals (“Surface Rights Board Decisions” 2016)¹⁷. In another trend, oil & gas companies have recently started asking landowners to drop their lease payments in light of the economic situation (Blair 2016).

3. Capital Investment. A recent report from the Canadian Association of Petroleum Producers (CAPP) claimed capital spending between 2014 and 2016 would show a decline of 62 percent (Hames 2016). In the same report CAPP predicted “the total number of wells drilled in Western Canada... to decline to 3500 wells in 2016, a 66% drop from the 10,400 wells drilled in 2014” (“Capital Investment in Canada’s Oil and Gas Industry down 62% in 2 Years” 2016). If true, this reduction in spending is likely to result in a reduction of abandonments and reclamation activities. As a result of this delay, risks posed by the inactive and abandoned wells and the cost to address them is expected to continue to increase.

¹⁷ The payments made by the Surface Rights Board are fully funded by Alberta’s taxpayers.

Figure 5 on the following page illustrates that cash and liquid investments is concentrated among a small number of companies in the technology sector. Bloomberg reported at the end of May that "For the most part, companies aren't pouring all that money into capital expenditures to increase the efficiency and capacity of their operations. Instead, much of it has been used to finance share buybacks, dividend boosts and acquisitions ... 'There is newly intensified, broad-based pressure on business to cut capital spending and inventories,' David Levy, chairman of consultant Jerome Levy Forecasting Center LLC in Mount Kisco, New York, wrote in a report to clients this month"(Miller 2016).

Figure 5: The top ten companies with the biggest cash hoards



Derived from: Miller 2016

This sentiment is reflected in a recent article in the Calgary Herald stating "nearly \$2 billion has been raised by Canadian non-oilsands producers on equity markets, but most of

it has been geared to paying down debt or funding acquisitions, not for drilling new wells" (Healing 2016).

4. Legacy Issues. As the pressure on the OWA continues to increase, the association will face important choices on expenditure policy. Currently the OWA looks after legacy infrastructure¹⁸ only when the AER requires it to do so - that is when there is an imminent risk to the environment or public health & safety. In its recent submission to the Alberta Royalty Review Panel, CAPP highlighted this issue by pointing out: "it is critical for the government, regulators, and industry to be pro-active in developing a funding model to finance the potential liabilities" (CAPP 2015).

5. Urbanization. With increasing population, urbanization is expanding throughout Alberta. Well sites that were formerly in remote areas suddenly can or are claimed to 'interfere' with new roads, housing developments, shopping mall extensions or additional airport runways. As a result, dealing with these well sites can cause economic delays as well as new public health and safety risks. A good example is the new school in Red Deer proposed on a site that has a number of abandoned wells that have resulted in contamination ("Northeast High Schools and Play Fields" 2014). In a further complication of this case, the licensee responsible for the remediation, Canadian Oil & Gas International Inc. (COGI) is in receivership, which leaves the City of Red Deer with a more complex

¹⁸ Legacy infrastructure is best explained by an example. Take the case of a well that was abandoned and reclaimed according to the standards of the day by a company that no longer exists, there is no responsible party any longer. This well now creates a legacy issue when the well starts to leak or exhibits other adverse effects. Since the company in this example has received regulatory approval for closure and has exited the business, the polluter pay principle no longer applies. As more and more companies exit the oil and gas industry, legacy issues are likely to occur more frequently. At the same time there will be a decreasing number of industry players available to fund overall cost.

situation than anticipated initially. And in a cruel twist, the trustee of COGI recently disclaimed one of the contaminated sites, citing the Redwater decision as its driver for this action, meaning that the new case law creates ever more complications and there will be more to follow.

Table 4 below summarizes the risks discussed above.

Table 4: Summary of emerging issues and trends

Root cause	Risk	Regulatory response	Effectiveness of regulatory response
Debt, low oil & gas price, limited pipeline capacity	Insolvencies	OWA takes on liabilities	Low
Companies defaulting on surface lease payments	Surface Rights	Surface Rights Board revokes the surface lease; AER forces abandonment	Low
Debt, pressure to cut capital spending	Capital Investment	None	n/a
More and more companies exit, decreasing number of licensees	Legacy Issues	OWA takes on liabilities where there is high risk	Low
Increasing population	Urbanization	High Risk Wells in Urban Area's (AER Project) Developer funded, OWA operated, cut and cap (AER Operations)	Medium

5. Policy Options and Evaluation

In order to recommend the optimum policy going forward, new policy options must be evaluated against the current policies and each other. In this section, I establish the context for this evaluation by introducing commonly used performance evaluation criteria (Bardach 2012). These criteria guide my evaluation of the current and alternative policies.

5.1 Policy evaluation criteria

The four criteria and associated measurements I employ for this evaluation, follow the questions of efficiency, effectiveness, equitability and feasibility. They are explained in more detail below.

As a matter of principle, *any* new policy must be **economically efficient**. This policy goal and evaluation criteria is typically defined using common economic terms like "maximizing the public interest" or "maximizing net benefits" (Bardach 2012). The last 15 years of policy application and change in Alberta reveal the impact and cyclical nature of the oil & gas sector. They highlight the need to reflect on the characteristics of the oil & gas sector and the economy and the need to avoid unintended consequences, such as an alarming increase in number of licensees that are unable to fund their liabilities.

A good anchor for this reflection is the regulatory framework under which the single regulator was designed. This framework requires "goals, performance measures and targets for the effectiveness and efficiency of the operation of the regulatory system" ("Enhancing Assurance" 2016, p5). Therefore, to be efficient, the policy must be held against two commendable and measurable outcomes: it must to be easy to enforce (i.e.

industry performance can be measured) and it must be flexible so it can adapt to changes in the environment (Weimer and Vining 2011).

Second, any new policy must be successful in stopping an increase and achieving a **decrease in liability risk**, and offer a clear path to reduced liability. There are two aspects of growing liabilities that may warrant separate approaches in order for these criteria to be successful. First, there are the currently existing liabilities. These result from 100 years of oil & gas industry operating without stringent regulatory oversight of timely and complete closure and present a difficult funding and administrative challenge. Second, there will be future liabilities, generated by new licensees and/or yet to be approved activities.

Therefore, to be effective, the policy must meet two measurable outcomes: it must avoid creating new unfunded liabilities going forward, without stifling economic growth, and, it must address currently existing liabilities in such a way that existing licensees are able to successfully implement the new rules. All this must be done while preserving competitiveness and encouraging innovation in the oil and gas industry.

Third, the new policy must meet **equity expectations**. The policy must to be fair to industry, which has made large investments in the province of Alberta and relies on current and predictable policy and as a result sees changes as potentially harmful to its future. The policy also must be fair to landowners, who make their private property available for energy development and expect to be duly compensated and demand land returned to its original state after operations are finished . As well, the policy must be fair to taxpayers, who expect the polluter to pay for the pollution.

Finally, the policy must be politically **feasible**. Radical policies are often more difficult to achieve than gradual policy changes (Weimer and Vining 2011). Given the

circumstances: the still relatively new NDP government (recently elected after 40-plus years of Progressive Conservative governments) and a significant economic crisis facing the province, political feasibility may prove to be difficult to assess and predict but nevertheless warrants attention and thought.

5.2 Evaluation of status quo

In this section, I evaluate the status quo using the policy evaluation criteria introduced above.

1. Efficiency. The current Liability Management Programs and the Inactive Well Compliance Program (IWCP) are relatively easy to enforce: the programs have clear requirements and are straightforward to measure. Unfortunately, neither of the programs is functionally flexible. For example, under the LMR, licensees are forced to continue to produce at a loss for fear of their Liability Management Rating (LMR) to go under one¹⁹, which makes little economic sense in a time of low energy prices and pipeline capacity limitations. Also, under IWCP, it could happen that a company who was planning for life cycle closure (from abandonment through to reclamation), e.g. for a gathering system or field, is forced to divert closure budget to suspension activities in order to catch-up on compliance requirements enforced under IWCP, which makes little sense if the preferred outcome is lifecycle closure. The prescriptive requirements oriented nature of the LMR

¹⁹ The LMR is calculated as follows: $LMR = \frac{\text{deemed assets}}{\text{deemed liabilities}}$: When a licensee has more liabilities than assets, the LMR will be less than one

and IWCP programs do not meet the characteristics of outcomes based regulation²⁰.

Therefore the status quo may be easy to enforce but lacks in flexibility.

2. Liability risk reduction. Liability risk has continued to grow significantly under the current programs. The IWCP only requires suspension of wells, which does not have an impact on financial liability and only addresses environmental and public safety risks in a rather limited manner. The LMR did not result in an increase in abandonment and reclamation when oil was over \$100/barrel and is not incenting industry to perform abandonment and reclamation activities in the current down turn. Therefore, it is unlikely the status quo can achieve the desired liability risk reduction in the future.²¹

3. Equity expectations. The current programs benefit industry, landowners and the tax payer in the short term, as long as cash flows support profitable operations. While property rights of landowners are rather limited in the context of energy development in Alberta²² and there have been landowners complaining about inactive well sites on their land for a while (Sheldon, Fionda, and Kapelos 2015); most landowners tolerate this as long as yearly cheques continue to arrive. The recent economic downturn illustrates that landowners immediately feel the impact when lease payments suddenly stop and have turned to the Surface Rights Board for compensation. As a result, the taxpayers are the big losers under

²⁰ Outcome based, also known as performance-based regulation refers to "a suite of related regulatory instruments that provide regulated entities with greater flexibility in achieving regulatory outcomes, directing businesses to achieve desired ends while allowing them to choose on their own the means to achieve those ends." (Coglianese 2015)

²¹ To really make this point I must resort to an overused cliché: the definition of insanity is doing the same thing over and over and expecting different results

²² If an operator fails to reach an agreement with a landowner, the Surface Rights Board may grant a Right of Entry Order ("Surface Rights Board: Right of Entry" 2016)

the current regime: they are on the hook for landowner compensation as well as industry's unfunded liabilities. Industry continues to be allowed to delay moving its inventory through the life cycle and especially the larger players can offset aging fields and marginal producing wells with other assets like in-situ operations or oil sand mines. Even though the orphan levy has doubled in 2015, the amount industry pays is insignificant compared to the increasing liability risk.

4. Political feasibility: The current Alberta NDP government ran on a platform that stated in part: "The PCs have also refused to implement realistic oil royalties that the people who own the resources — all of us — deserve. The reason for this refusal is clear: Jim Prentice and the PCs are too close, much too close, to a small minority of Albertans who benefit from the status quo under the PCs, while the people of Alberta as a whole are deprived of much of the benefit of our own resources" (NDP Alberta 2015, 6). Nevertheless, the recent, much anticipated Royalty Review maintained status quo to a large extent ("Alberta at a Crossroads. Royalty Review Advisory Panel Report" 2016). Also, the government's review of 136 agencies, boards and committees that was concluded in March 2016 resulted in no changes for the Alberta Energy Regulator. I conclude this provides evidence that changing policy to better address oil & gas liabilities may simply not be on the priority list of the current government yet. Hence the feasibility of maintaining status quo is high.²³

²³ One can also not underestimate the Staying Power of the Status Quo (Flanagan 1998)

5.3 Alternative policy options

As I have pointed out in previous sections, existing policies and regulations are *not effective and efficient*, especially not in the current economy. In this section, I explore three alternative policy options that can provide solutions for Alberta's oil & gas liability challenges: improving timeliness, collecting security and creating a legacy fund.

1. Improving timeliness. This policy option builds upon the established and successful implementation of *timeliness for abandonment*, which was implemented as part of the Long Term Inactive Well Program (LTIWP). This policy option complements the LTIWP with timeliness for reclamation. There is a precedent for this policy. Several other jurisdictions have implemented timeliness for abandonment and reclamation. For example, Colorado has a 6 month timeline for abandonment (*Drilling, Development, Producing and Abandonment 2014*, section 319(b)3) and 3-12 months for reclamation (*Reclamation Regulations, 2009*, section 1004(a)).

While it is attractive to make prescriptive timeliness part of this policy, the imperative of performance based regulation and risk informed decision making, as stated in the REDA, forces us to modify the approach slightly in order to have a higher chance of success. Consequently, this policy needs to pursue the principle outcome of timeliness to incent closure activities but leave it up to a flexible regulatory framework to implement this in a way that allows for cost effectiveness and innovation.

The introduction and implementation of timeliness requirements in Alberta will ensure industry will move their inventory through the lifecycle in a timely manner and thus

will ensure future insolvent companies have less liabilities and the overall liability risk for the province of Alberta is reduced.

2. Collecting upfront security. The current policy fails to collect sufficient security (just under 1% of the total liabilities) and collects that security at a point where it might be irrelevant (when companies liabilities outweigh their assets). Under this proposed policy, licensees would be required to post full security for abandonment and reclamation at the moment of well licensing. The security deposit would be refunded in thirds: one- third once abandonment and remediation is completed, one- third when reclamation is completed and one-third once the reclamation certificate has been issued. An additional advantage is that this policy may work well in a changing energy price scenario: "more wells are drilled and more funds will flow into the security program when oil and gas prices are high. When prices are low and skilled labour and equipment is readily available, licensees may draw down on their posted security to complete abandonment and reclamation work" (Robinson 2016, 6). There are different securities mechanisms that can be useful when implementing this policy:

- parent guarantee (the parent company will honor the liability obligations of its affiliates);
- third party guarantee (a bank or other financial institution will issue a guarantee);
- insurance (insurance against unforeseen costs or earlier than anticipated end-of-life obligations);
- trust funds (based on a ratio of present production to anticipated future production, licensees pay an amount of cash into a trust fund) (Testa 2013).

The introduction and implementation of upfront security will ensure industry will take closure costs into account before deciding on investment and as a result unfunded liabilities will greatly reduce.

3. Creating a legacy fund. Unfunded liabilities continue to pose a public risk. The legacy fund would fund unforeseen liabilities that cannot be mitigated by other existing policies. There are a number of different components to this policy option, all of which have been adopted elsewhere in the world:

- The first component is the establishment of a fund, funded by taxes paid by oil & gas licensees and used to partly pay for closure activities. For example Norway pays a share of the decommissioning costs of licensees proportionate to the tax rate the licensee faced on net incomes from the field (Testa 2013).
- A second component follows from the Canadian Association of Petroleum Producers (CAPP) recommendation to establish a jointly funded model to finance potential legacy liabilities (CAPP 2015). Both the UK and Norway have addressed this challenge in the past. In Norway "the government can accept maintenance and future responsibility in return for a financial settlement" (Ayoade 2002, p125).

The introduction and implementation of a legacy fund will ensure any future liability risks are funded by those currently gaining the economic benefit rather than future generations.

5.4 Evaluation of alternative policy options

In the following section I review my suggested policy options (improving timeliness, collecting upfront security and creating a legacy fund) using the same criteria for

comparison (efficiency, effectiveness, equitability and feasibility) as used to evaluate status quo.

5.4.1 Improving timeliness

Below I evaluate the first policy option of Improving timeliness against the four policy evaluation criteria.

1. Efficiency. The biggest challenge of this policy option is an implementation approach that is efficient. Four different approaches can be considered that can incent industry to implement timeliness. The approaches are: 1. Making it cheaper to perform closure activities (e.g. through tax incentives); 2. Making it more expensive to leave inactive infrastructure unattended (e.g through collecting full security for well sites that are not in compliance); 3. Designing a cap and trade/off-set framework, which enables operators and licensees to balance inactive inventory with active inventory or 4. Simply prescribing timeliness requirements without any alternatives. The following timelines are considered appropriate for Alberta;

- Suspension timelines: 6 months for sour gas wells; 12 months for all other wells (“Draft Directive 013” 2016).
- Abandonment timelines: within 5 years of 6-12 months of inactivity or suspension; unless an extension is approved before the end of the five-year period.
- Reclamation timelines: reclamation needs to commence within 1 year of abandonment and an approved remediation or reclamation plan needs to be renewed every 5 years until a reclamation certificate is issued.

A recent publication examined the decisions operators and licensees face when deciding how to allocate money for abandoning wells versus leaving them inactive for a period of time (Muehlenbachs 2015). In this article, the author indicates that a possible unintended consequence of making it cheaper to perform closure activities could be that the number of active wells will decrease and as a result production will decrease. A 25 % reduction in cost results in 46% to 48% more decommissioned wells but also in 20% fewer active wells and 2% to 5% less production. As an alternative, Muehlenbachs (2016) proposes the option to make it more than 25% more expensive to leave wells inactive, which results in 3% to 5% more decommissioned wells in combination with an increase of active wells of 5% to 6% and production increase by 2%. Whether to choose option 1 or 2 depends on the appetite of the policy makers and regulator to not fully deplete the resource in exchange for timely clean up. The choice between option 3 and 4 is driven by a choice between outcomes based regulation and prescriptive regulation. The availability of these options makes this a flexible policy option. Moreover, the policy is easy to enforce due to clearly measurable outcome of closure happening in a timely fashion, while giving licensees the flexibility to choose implementation strategies.

2. Liability risk reduction. The Long Term Inactive Well Program that the ERCB implemented for just over two years in 1997, proved to be a rather effective tool in addressing the existing liability risks. The requirements made it more difficult for operators and licensees to keep wells inactive and made them choose between either abandoning wells, reactivating wells or paying security. The fact that industry was so keen to cancel the LTIWP may be an indication of its effectiveness.

Timeliness requirements can be implemented going forward as part of any newly approved activity and will be very effective in addressing the future liability risk. Applying timelines on the current inventory of liabilities will be more challenging. Moreover, they will require a careful selection of approaches listed above to ensure oil & gas licensees and operators are able to comply with requirements while continuing to be profitable. The implementation of the Inactive Well Compliance Program gives industry 5 years to come into compliance with timeliness requirements regarding suspension and to date 71% of companies have complied with the 20% target for the first year. The degree of success of the IWCP in the current economic climate will provide good insight in how feasible aggressive implementation of timeliness is for existing inventory of liabilities.

3. Equity expectations. For both landowners and tax payers, the implementation of timeliness would result in reaching desirable outcomes: a predictable timeline of the return of the land to reclaimed state and certainty that industry is either paying security or executing closure and hence the oil & gas liability risk for the tax payer is greatly reduced. For industry, timeliness is a more challenging concept, especially when it is applied to all current liabilities. Newly approved activities must take closure cost into account in upfront economic analysis. Estimating the anticipated costs of closure upfront can be seen as a more realistic and economically sound approach when compared to the current policy that mostly recognizes these costs as an afterthought at the end of life. The need to address current liabilities will need to be phased in carefully using any of the different implementation approaches mentioned above.

4. Political feasibility. The political feasibility of this option is likely to be low. Industry will protest strongly against this policy option, Industry can be expected to claim the consequence of abandoning potentially profitable wells as a major unintended consequence. In the current economic climate this will require strategic understanding and vision underpinned by significant economic analysis of oil & gas sector to make this policy option acceptable to industry. While the current government has proven it's capability to formulate policy and achieve consensus in a previously unpopular policy area of climate change, it is not clear if they wish to repeat that achievement in the area of oil & gas liabilities.

5.4.2 Collecting upfront security

Below I evaluate the second policy option of Collecting upfront security against the four policy evaluation criteria.

1. Efficiency. Collecting upfront security means making every approval of an oil & gas activity conditional on payment of upfront security sufficient to offset liabilities associated with the approved activity. This is an easily enforceable policy option since the security payment is at the right moment: when industry is making an investment decision and requires approval before it can continue. This is also a flexible policy option since the number and type of approvals that will be conditional for payment can grow over time as the policy is introduced. An upfront security program is also efficient in the context of boom and bust of the oil & gas industry.

2. Liability risk reduction. Upfront security will only address future liabilities. The biggest challenge with this policy option is the assessment of the liability risk and the amount of security. There are three different approaches to solve this.

1. The first approach is currently used by the AER in assessing the Licensee Liability for the LLR and is based on a set of tables with estimates for abandonment and reclamation taking into account different well completion scenario's, additional risk elements such as wells with vent flows or multiple completions as well as the location of the well in the province ("Directive 006" 2016). The drawback of this approach is that it is challenging to take all the different scenarios and situations into account to ensure the deemed liabilities represent the closure costs that will be incurred by the licensee sometime in the future.

2. The second approach was suggested by Robinson who stated: "the amount of security should be set at the Orphan Well Program's average cost of abandonment and reclamation per well over the previous three years" (Robinson 2016, 6). This will make the estimation of liability significantly more effective. The drawback of this approach is that the sites ending up with the OWA may be considered worse case scenarios and as a result security deposits may be higher than required in most cases.

3. The third approach is used in the Mine Financial Security Program in which the licensees can estimate their own liabilities ("MFSP Guide" 2014). The MFSP program has a comprehensive audit component to ensure consistency and reliability of the licensee's estimates, which are often already reported as part of financial reporting requirements.

All three scenario's above have pro's and con's and a combination of the three may be desirable for an optimal solution which ensures the policy is effective in mitigating the unfunded liabilities while remaining efficient in its administration and enforcement.

3. Equity expectations. Upfront security is a policy option that provides advantages for all stakeholders in this sector. Unfortunately it is only applicable for future liabilities. This policy option works well for industry, since it only requires them to deposit security for newly approved activities. Taxpayers and landowners are still faced with the burden of present liabilities and are not much better off in this scenario.

4. Political feasibility. This is a policy option that is attractive to both government and industry. It provides a safe guard against future liabilities and sends a signal to the public that government and industry are working together to address oil & gas liabilities.

5.4.3 Creating a legacy fund

Below I evaluate the third policy option of creating a legacy fund against the four policy evaluation criteria.

1. Efficiency. The implementation and enforcement of shared responsibility for the oil & gas liabilities can be relatively easy to achieve. Collection of funds for legacy liabilities can be combined with the current royalty program. The simplest way is to dedicate a portion of royalty revenues for liabilities incurred by future generations (legacy issues). If the amount of funds collected in this scenario is based on royalty revenues, it will fluctuate with ups and downs of the oil and gas sector and will increase during boom times and decrease during bad times. This is a desirable scenario for industry and will meet the requirements of flexibility in that the burden will adjust to circumstances. While the *polluter pay principle* will allow the regulator to go back in time to hold previous licensees accountable for

closure work, it must be recognized that this is may not always result in funds to be available in a timely manner. Therefore the Legacy Fund should be applied to assets of insolvent licensees as well. Last but not least, the Legacy fund may need to be used in cases where the collected security is not sufficient and the current and previous licensees are not able to provide sufficient funds. For these reasons the percentage of royalty revenues dedicated to the legacy fund will need to be matched by industry to ensure the Polluter Pay principle is upheld through the fund.

2. Liability risk reduction. The funds collected can in theory be used to address the present and future risk. The biggest question is whether it is sufficient since 100 years of oil and gas production and associated royalty collection has gone by without saving a percentage to address the future liabilities. We may therefore assume that dollars collected going forward should be put aside to address future risk but not the already existing legacy risk.

3. Equity expectations. From an industry point of view this is an equitable solution. A company will be able to rely on a predictable and certain outcome: once it has abandoned, cleaned-up and reclaimed sites and closed its office it is off the hook for future liabilities. For landowners this will provide certainty that someone will look after any future liabilities in case the company responsible does not exist any longer. And even from a taxpayer point of view this can be seen as an equitable solution given that regulations are enforced while companies are around to do the clean-up and previous licensees are recognized as responsible parties in case the current licensee cannot pay for closure.

4. Political feasibility. The political feasibility of this option is poor. The NDP government ran on a Platform which condemned the previous government for failing to build up the Heritage Fund and planning for a downturn in oil prices (NDP Alberta 2015). It is though highly unlikely that the NDP aims to spend the revamped Heritage fund on legacy liabilities. There are positive examples of this approach in other jurisdictions (for example Norway) but these are all governed at a federal level and have been in place for many years. The “level of foresight, budgetary planning and careful fiscal management on the part of the government that it require” (Testa 2013, 29) has not been demonstrated by Alberta's governments to date with respect to the Heritage Fund and one should therefore be realistic in deeming this option unfeasible. Nevertheless, from an industry and public point of view this could be seen as a desirable policy option.

6. Recommendations

In the table below I summarize the evaluation of the status quo and the three proposed policy options.

Table 5: Policy evaluation

Policy Goals→ Policy Options ²⁴ ↓	Efficiency		Liability Risk Reduction		Equity			Political Feasibility
	Enforceable	Flexible	Present	Future	Industry	Landowners	Taxpayer	
1. Status quo	Good - strict requirements	Poor - comes with a number of unintended consequences	Poor - liabilities have continued to grow	Poor - no incentives to change behavior	Good - allowed to delay closure indefinitely	Poor - immediately feel the impact of economic downturn and lack of closure	Poor - inevitable that tax payer will be paying for closure sooner or later	Good - royalty review and ABC review of AER indicate little appetite for change
2. Timeliness	Good - conditional approvals (closure requirements) are an efficient regulatory instrument	Good - different approaches available to mitigate unintended consequences	Good - although balance between speed and profitability may be challenging	Good - proven to be very effective during LTIWP	Poor - challenging to implement timelines for present liabilities	Good - predictable timeline for reclamation	Good - Companies do closure or pay security	Poor - requires strategic vision and in depth understanding
3. Upfront security	Good - conditional approvals (security deposit) are an efficient regulatory instrument	Good - scope and type of approvals can be changed overtime as can the amount collected	Poor - not applicable	Good - different options available to assess liabilities correctly	Good - security deposit is only required for new activities	Poor - present liabilities are not addressed	Poor - present liabilities are not addressed	Good
4. Legacy fund	Good - incorporate in royalty collection	Good - fluctuates with industry cycles	Poor - insufficient funds to address current liabilities	Good - funds put aside to address liabilities for future generations	Good - predictable and certain	Good - certainty of a party to address future risk	Good - as long as current companies held responsible	Poor - requires disciplined fiscal management

²⁴ This approach to policy evaluation is inspired by the Canadian Salmon Fishery case study (Weimer and Vining 2011)

My recommendation is to pursue a combination of policy option two, three and four as outlined below.

From option 2: the implementation of timeliness will be implemented retrospectively to ensure that existing liabilities will be addressed while licensees are still capable of either performing the closure work, re-activating wells or putting up a security. Timeliness will also apply to any newly approved infrastructure to ensure that closure activities progress and industry continues to move its new inactive inventory through the lifecycle.

From option 3: upfront security should be applied on a going forward basis: every new energy activity should be conditional upon the payment of appropriate security by the licensee. This security will be held by the regulator and refunded to the licensee when closure activities reach certain milestones. The security will be based on 3-year averages of Orphan Well Association costs for abandonment and reclamation.

From option 4: the province will start putting aside a percentage of royalties collected for the legacy fund which will be matched by industry and replace the current Orphan Levy. The legacy fund will be spent on future liabilities incurred on wells of companies that have left the province and cannot be tracked down or for companies that have gone insolvent before security collection happened and for which no previous licensees can be found (in a timely manner). This fund and the activities will be managed by the OWA. The OWA will be jointly managed by industry, the AER and GoA.

7. Conclusion

I began this paper by examining the history of oil & gas development in Alberta, which started with the promising discoveries by colorful oilmen like Arthur Dingman and skilful regulation by respected leaders such as George Govier.

Toward the end of the twentieth century, inventories of inactive and abandoned wells were ever increasing and in response, at the turn of the century, the Alberta Energy Regulator commenced implementation of its liability management programs with the aim to protect the province of Alberta from unfunded liabilities. Sixteen years later and in the midst of an economic downturn and low oil and gas prices we can conclude that the regulatory intervention has not had the desired effect and the risk to the province of unfunded liabilities is rather alarming.

This paper recommends three policy options to be implemented using a performance based, risk-informed regulatory framework. This implementation approach will allow the province to mitigate the risk of unfunded liabilities while continuing to promote a competitive and innovative oil & gas sector. The three policies are as follows.

- First, implementation of timeliness that will ensure future liabilities are addressed in a timely fashion and existing liabilities can be tackled by current licensees in the most cost effective way possible.
- Second, implementation of upfront security that will ensure the province has secured funding for future liabilities and licensees have an incentive to perform closure activities to get security refunded.

- Third, the establishment of a legacy fund to make sure any unforeseen liabilities will not go unfunded. The legacy fund will be funded by industry and the province and administered by the Orphan Well Association. It will replace the Orphan levy.

Stakeholder engagement as well as in depth economic analysis of the proposed policy options must be a top priority in the coming period to ensure the high level assumptions in this paper are validated and confirmed.

Once these policies are implemented, the new regulatory framework in Alberta will incent industry to address its existing and future liabilities in a timely manner, will uphold the polluter pay principle, and will ensure sufficient funds are put aside for unfunded liabilities associated with legacy issues while continuing to ensure competitiveness of oil & gas industry in Alberta.

8. Bibliography

- "Acts, Regulations & Rules." 2016. Accessed January 3.
<http://www.aer.ca/rules-and-regulations/acts-and-rules>
- "Alberta at a Crossroads. Royalty Review Advisory Panel Report." 2016. Calgary.
<http://www.energy.alberta.ca/Org/pdfs/RoyaltyReportJan2016.pdf>
- "Alberta Energy History Prior to 1950." 2016. Accessed May 1.
http://www.energy.alberta.ca/About_Us/3997.asp
- "Alberta Environment and Parks." 2016. Accessed May 28.
<http://aep.alberta.ca/Default.aspx>
- "Alberta Environment and Sustainable Resource Development." 2013.
https://en.wikipedia.org/wiki/Alberta_Environment_and_Sustainable_Resource_Development
- Ayoade, Morakinyo Adedayo. 2002. *Disused Offshore Installations and Pipelines. Towards "Sustainable Decommissioning"*. Kluwer Law International.
- Bankruptcy and Insolvency Act*. 2015.
CanLII. <http://canlii.ca/t/52f1z>
- Banks, Nigel. 2016. "The Power of a Trustee in Bankruptcy to Disclaim Uproductive Oil and Ga Properties and the Implications for the AER's Liability Management Program."
http://ablawg.ca/wp-content/uploads/2016/06/Blog_NB_Redwater_June2016.pdf
- Bardach, Eugene. 2012. *A Practical Guide for Policy Analysis. The Eightfold Path to More Effective Problem Solving*. SAGE Publications Ltd. CQ Press.
- Blair, Jennifer. 2016. "Oil Companies Bucking Their Commitments."
<http://actionsurfacerights.ca>
- "BC Oil & Gas Commission." 2015. Accessed December 30.
<https://www.bcogc.ca/>
- "Capital Investment in Canada's Oil and Gas Industry down 62% in 2 Years." 2016.
<http://www.capp.ca/media/news-releases/capital-investment-in-canada-oil-and-gas-industry-down-62-per-cent-in-2-years>
- Coglianesse, Cary. 2015. "Listening - Learning - Leading. A Framework for Regualtory Excellence." http://www.aer.ca/documents/about-us/UPenn_Final_Report_Regulatory_Excclence.pdf
- Conservation and Reclamation Regulation*. 2014.
CanLII. <http://canlii.ca/t/52b51>
- Davis, Anthony A. 2014. "Separating Fact from Fiction in the Claim That Oil and Gas Companies Are over-Subsidized." *Alberta Oil*, July 31.
<http://www.albertaoilmagazine.com/2014/07/giver-taker/>
- "Directive 006." 2016. Accessed May 1.
<https://www.aer.ca/rules-and-regulations/directives/directive-006>
- "Directive 075." 2016. Accessed June 18.
<http://www.aer.ca/documents/directives/Directive075.pdf>
- "Draft Directive 013." 2016. Accessed May 1.
<http://www.aer.ca/documents/directives/DraftDirective013.pdf>
- "Drilling, Development, Producing and Abandonment." 2014. Colorado Oil & Gas Conservation Commission.
<http://cogcc.state.co.us/documents/reg/Rules/LATEST/300Series.pdf>

- “Enhancing Assurance.” 2011.
http://www.energy.alberta.ca/Org/pdfs/REPEnhancingAssuranceIntegratedRegulator.pdf&usg=AFQjCNHMhmi1lOmd_YbXhttp://www.energy.alberta.ca/Org/pdfs/REPEnhancingAssuranceIntegratedRegulator.pdf
- “Environment and Sustainable Resource Development. Annual Report 2012-2013.” 2013.
<http://esrd.alberta.ca/about-us/corporate-documents/documents/ESRD-AnnualReport-2012-13.pdf>
- Environmental Protection and Enhancement Act*. 2014.
CanLII. <http://canlii.ca/t/52d7f>
- Flanagan, Thomas. 1998. *Game Theory and Canadian Politics*. University of Toronto Press.
- “Frequently Asked Questions Directive 013 and Inactive Well Compliance Program (IWCP, Bulletin 2014-19).” 2016.
<http://www.aer.ca/documents/directives/Directive013andIWCP-FAQs.pdf>
- Funk, Wesley Alan. 1999. “Estimating and Managing Environmental Liability in the Upstream Oil and Gas Industry.” University of Calgary.
http://www.collectionscanada.gc.ca/obj/s4/f2/dsk1/tape8/PQDD_0015/MQ47662.pdf
- Hall, Charles A.S. and Kent A. Klitgaard. 2012. *Energy and the Wealth of Nations. Understanding the Biophysical Economy*. Springer
- Hames, Elizabeth. 2016. “Competitive Pricing Leads to ‘Dire’ Outlook for Oilfield Services Sector: PSAC CEO.” *Alberta Oil*.
<http://www.albertaoilmagazine.com/2016/04/dire-outlook-for-oilfield-services-sector-as-competition-for-jobs-heats-up/>
- Healing, Dan. 2016. “Farmers Accuse Oil and Gas Companies of Cutting Corners on Rent Payments.” *Calgary Herald*, April 7.
<http://calgaryherald.com/business/energy/farmers-accuse-oil-and-gas-companies-of-cutting-corners-on-rent-payments>
- Healing, Dan. 2016. “Oilfield Hopes Thin despite \$2B Producer Financing.” *Calgary Herald*, June 18.
- Hill, Peter J, and Roger E Meinders, eds. 1998. *Who Owns the Environment*. Rowman & Littlefield Publishers, Inc.
- Igarashi, Y. 2010. “Optimal Bonding System for Land Reclamation in Oil and Gas Development.” University of Wyoming.
<http://ezproxy.lib.ucalgary.ca/login?url=http://search.proquest.com/docview/761377177?accountid=9838>
- Imperial Oil Ltd. v. Quebec (Minister of the Environment)*. 2003.
CanLII. <http://canlii.ca/t/1g3lw>
- “Insolvency Rate Jumps 43.5% in Alberta.” 2016. *CBC News*. Accessed June 10.
<http://www.cbc.ca/news/canada/calgary/insolvency-rates-bankruptcies-proposals-1.3609351?cmp=rss>
- Jaremko, Gordon. 2013. *Steward. 75 Years of Alberta Energy Regulation*. Alberta Energy Resources Conservation Board.
- Johnson, Tracy. 2015. “Alberta Sees Huge Spike in Abandoned Oil and Gas Wells.” *CBC News*.
<http://www.cbc.ca/news/canada/calgary/alberta-sees-huge-spike-in-abandoned-oil-and-gas-wells-1.3032434>
- Kennett, Steve, and Dan Woynilowicz. 2007. “A Review of Alberta’s Proposed Regulatory

- Framework for Managing Environmental Cumulative Effects.”
<https://www.pembina.org/reports/Pembina-review-AB-Env-ce.pdf>
- “Liability Management.” 2015. CAPP Letter to the Alberta Royalty Review Panel.
- “List of Alberta Provincial Ministeries.” 2016.
https://en.wikipedia.org/wiki/List_of_Alberta_provincial_ministers#Minister_of_Forestry.2C_Lands_and_Wildlife
- Loder, Asjylyn, Steven Church, and Jodi Xu Klein. 2016. “\$19 Billion Default Wave Poised to Come Crashing down as Debt Catches up to Oil Boom.” *Financial Post*.
http://business.financialpost.com/news/energy/19-billion-default-wave-poised-to-come-crashing-down-as-debt-catches-up-to-oil-boom?_lsa=58c6-ad9c
- “Map of Alberta.” 2016. Accessed July 4
https://commons.wikimedia.org/wiki/File%3AAlberta_map.svg
- McMillan, Tim. 2016. “Municipalities and Oil Companies Should Work Together.” Accessed May 20. <http://www.capp.ca/media/commentary/municipalities-and-oil-companies-should-work-together>
- McNeill, J.R. 2000. *Something New Under the Sun. An Environmental History of the Twentieth-Century World*. W.W. Norton & Company
- “MFSP Guide.” 2014. Calgary. https://www.aer.ca/documents/liability/MFSP_Guide.pdf
- Miller, Rich. 2016. “Risky Reprise of Debt Binge Stars U.S. Companies Not Consumers.” *Bloomberg*. <http://www.bloomberg.com/news/articles/2016-05-31/risky-reprise-of-debt-binge-stars-u-s-companies-not-consumers>
- Muehlenbachs, Lucija. 2015. “A Dynamic Model of Cleanup: Estimating Sunk Costs in Oil and Gas Production.” *International Economic Review* 56 (1): 155–85
- “Multi Stakeholder Engagement Advisory Committee Closure & Liability Presentation.” 2016
- NDP Alberta. 2015. “Leadership for What Matters.”
http://d3n8a8pro7vbm.cloudfront.net/themes/5538f80701925b5033000001/attachments/original/1431112969/Alberta_NDP_Platform_2015.pdf?1431112969
- “Northeast High Schools and Play Fields.” 2014.
<http://www.reddeer.ca/media/reddeerca/business-in-red-deer/planning-and-development-of-property/planning/%28Sept-2-2014%29-Northeast-High-Schools-and-Play-Fields-ASP.pdf>
- Oil & Gas Conservation Act*. 2014. CanLII. <http://canlii.ca/t/5277x>
- Oil & Gas Conservation Rules*. 2016. CanLII. <http://canlii.ca/t/52kfk>
- Orphan Fund Delegated Administration Regulation*. 2016. <http://canlii.ca/t/52nw0>.
- “Orphan Levy.” 2016. Accessed May 7. <http://www.aer.ca/abandonment-and-reclamation/liability-management/orphan-levy>
- “Orphan Well Association Annual Report 2012-13.” 2013. http://www.orphanwell.ca/OWA_2012-13_Ann_Rpt_Final.pdf
- “Orphan Well Association Annual Report 2013-14.” 2014. http://www.orphanwell.ca/OWA_2013-14_Ann_Rpt_Final.pdf
- “Orphan Well Association Annual Report 2014-15.” 2015. http://www.orphanwell.ca/OWA_2014-15_Ann_Rpt_Final.pdf
- Posner, Richard A. 2011. *Economic Analysis of Law*. Eight Edit. Wolters Kluwer Law & Business.
- “Reclamation.” 2016. *AER*. Accessed May 1. <https://www.aer.ca/abandonment-and-reclamation>

reclamation/reclamation

Reclamation Regulations. 2009. Colorado Oil & Gas Conservation Commission.
<http://cogcc.state.co.us/documents/reg/Rules/LATEST/1000Series.pdf>

Redwater Energy Corporation (Re) 2016 ABQB 278. 2016.

“Regulatory History of Alberta’s Industrial Land Conservation and Reclamation Program.”
 2012. *Canadian Journal of Soil Science* 92: 39–51. doi:10.4141/CJSS2010-033.

Responsible Energy Development Act. 2014. <http://canlii.ca/t/52ddq>.

Robinson, Barry. 2010. “Well Abandonment and Reclamation in Alberta: The Failure of the Licensee Liability Rating Program.”

Robinson, Barry. 2016. “Long Term Inactive and Unreclaimed Oil and Gas Well Sites.” Letter to the Alberta Minister of Energy and the Minister of Environment and Parks

“Separation Anxiety - Is a Divided Alberta Energy Regulator around the Corner?” 2016.
Lexicology. Accessed May 28.
<http://www.lexology.com/library/detail.aspx?g=4da092c2-137f-4694-9426-99311a55735f>

Sheldon, Mia, Francesca Fionda, and Vassy Kapelos. 2015. “When the Oil Stops.” 16/9.
<http://globalnews.ca/news/2301676/when-the-oil-stops-16x9-takes-a-closer-look-at-old-wells-in-canada/>

Simmons, Randy T. 2011. *Beyond Politics. The Roots of Government Failure*. The Independent Institute

Siu, Bobby. 2014. *Developing Public Policy. A Practical Guide*. Canadian Scholars’ Press Toronto

Smith, Catherine F. 2013. *Writing Public Policy. A Practical Guide to Communicating in the Policy Making Process*. Third edit. Oxford University Press

“ST98-2015 Alberta’s Energy Reserves 2014 and Supply/Demand Outlook 2014-2024.”
 2016 Accessed May 1. <http://www.aer.ca/documents/sts/ST98/ST98-2015.pdf>

“Surface Rights Board: Decisions.” 2016. Accessed May 1
<http://surfacerights.alberta.ca/Decisions/SearchforBoardDecisions.aspx>

“Surface Rights Board: Right of Entry.” 2016. Accessed June 19
<http://surfacerights.alberta.ca/ApplicationTypes/RightofEntry.aspx>.

Testa, David. 2013. “Dealing with Decommissioning Costs of Offshore Oil and Gas Installations: an Appraisal of Existing Regimes.” IMO International Maritime Law Institute.

“The Evolution of Alberta’s Energy Regulator.” 2014. *Alberta Oil*
<http://www.albertaoilmagazine.com/2014/06/the-evolution-of-albertas-energy-regulator/>

“The Polluter Pays Principle.” 2008. OECD Publishing, Paris. Accessed July 4.
<http://dx.doi.org.ezproxy.lib.ucalgary.ca/10.1787/9789264044845-en>

Unger, Jason. 2013. “Reclaiming Tomorrow Today.”
http://www.elc.ab.ca/Content_Files/Files/Reclaiming_Tomorrow_Today.pdf

“Update Report on Alberta Environment and Sustainable Resource Development’s Upstream Oil & Gas Reclamation Certificate Program.” 2013.
<http://esrd.alberta.ca/lands-forests/land-industrial/programs-and-services/reclamation-and-remediation/upstream-oil-and-gas-reclamation-and-remediation-program/documents/UpstreamOG-RR-PrgmUpdate-Mar31-2013.pdf>

Vlavianos, Nickie. 2000. “Liability for Well Abandonment, Reclamation, Release of

Substances and Contaminated Sites in Alberta: Does the Polluter or Beneficiary Pay?”
University of Calgary.

<http://www.collectionscanada.gc.ca/obj/s4/f2/dsk2/ftp01/MQ55188.pdf>.

“What We Do.” 2016. Accessed May 7. <http://www.aer.ca/about-aer/what-we-do>

Weimer, David L., and Aidan R. Vining. 2011. *Policy Analysis*. Fifth Edit. Longman