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COMPARATIVE DIMENSIONS OF 'WATER' AS "SHARED COMPETENCE" IN COOPERATIVE FEDERALIST STRUCTURES OF THE US, INDIA, AND AUSTRALIA: A CASE STUDY OF REGULATING FRACKING-SPECIFIC WATER RISKS

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Table of Contents

Thesis Overview

This research identifies and comparatively analyses different components of the United States (US), Australian and Indian cooperative federalist systems that influence the nature and application of the precautionary regulations on water-related risks posed by hydraulic fracturing (fracking). This research, under the comparative method approach, will test the hypothesis that differences in the systemic distribution of legislative and regulatory powers between national and subnational units, in a cooperative federalist system, affect the implementation the precautionary measures on regulating fracking-specific water risk regulation. In this context the three comparators (the US, Australia, and India) have (1) different level of shared competence over environmental matters in their multilevel governing system, (2) implemented fracking and triggered different precautionary actions against similar fracking-specific environmental risks, (3) regulated water risks with different precautionary approaches. The case study of fracking is relevant as it is still considered as an "emerging technology" since there are 'scientific uncertainties' over the cause and effect relationship between environmental degradation and fracking.

Since this research analyses two concepts, namely risk regulations and cooperative federalism, through the case study of fracking-water nexus, it is important to highlight how these two key concepts synergise with each other and why the case study of fracking squarely fits in this synergy.

To that effect, chapter one of the research discusses how risk regulations (through precautionary measures) and the contemporary understanding of 'cooperative federalism' interact with each other to regulate emerging technologies. Chapter two, in detail, unwraps the theoretical underpinnings of cooperative federalism, from its narrow and wider perspectives. While doing so, chapter two analyses various components of the 'American', Australian, and Indian cooperative federalism and how each of these comparators establish interactions

between their national and subnational units, to regulate water risks. Subsequently, chapter three analyses water regulations in the three comparators from a generic perspective and map those regulations with the theoretical context of cooperative federalism, namely broad (subdivided into three categories) and narrow (subdivided into two categories) conception. This chapter brings out an imperative discussion on how broad and narrow conceptions of cooperative federalism affect decision making while regulating risk in emerging technologies through peculiar examples.

Chapter four, then, brings in the case study of fracking while analysing the impact of cooperative federalism in regulating fracking-specific water risks. While doing so, this chapter highlights the common fracking-specific water risks faced by the three comparators and analyses the precautionary measures (stemming from the different versions of 'the Precautionary Principle') adopted by each of the comparators. At this stage, it is important to understand how the regulations analysed in chapter four are implemented in various types of cooperative federalist structures, especially how broad and narrow conceptions of cooperative federalism affect implementations of the precautionary regulations. Chapter five maps these precautionary regulations with the five subcategories (two in narrow and three in broad) of cooperative federalism. Such mapping exercise is conducted by tracing how subnational and national units of the comparators interacted with each other, through policy and legal instruments, to adopt precautionary measures and regulate fracking specific water risk. In its conclusion, this research tests the hypothesis, while determining that "differences in the systemic distribution of legislative and regulatory powers between national and subnational units, in a cooperative federalist system, affect the implementation the precautionary measures on regulating fracking-specific water risk regulation". This, overarchingly, concludes that different types of cooperative federalist structures have a direct impact on environmental risk regulation.

Chapter 1. Introduction

The US, within the past one decade, entered the "golden age of natural gas"[1] by commercially scaling its shale (natural) gas production through fracking, an unconventional technique that allows extraction of natural gas by creating fissures in non-porous (shale) rocks through injection of pressurised water, tapping the otherwise locked natural (shale) gas[2]. The water-specific risks posed by fracking are acutely different from the conventional drilling processes. Such risks include (but not limited to): (1) water-induced seismic activities (the level of risk is more in the EU)[3]; (2) methane migration into aquifers[4]; (3) flowback (produced) water management[5]; (4) sourcing of 5-9 million gallons of water per activity[6] (5-10 times more than conventional drilling), among others. These fracking-specific water risks are widely contested within scientific communities and new research findings keep on changing the dynamics between the *cause and effect* relationship between the environmental degradation and fracking (for instance, the study on airborne radioactive spread through fracking was first published in October 2020[7]). Under international environmental law, such *scientific uncertainties* can not be used as an excuse to rule out the possibilities of imposing environmental regulations, as precautionary actions, on such contested risks[8]. However, it is important to find a balance between overregulation and underregulating of such uncertain environmental (water) risks in

[1] Hu, D., & Xu, S. (2013). Opportunity, challenges and policy choices for China on the development of shale gas. Energy Policy, 60, 21-26.
[2] Sovacool, B. K. (2014). Cornucopia or curse? Reviewing the costs and benefits of shale gas hydraulic fracturing (fracking). Renewable and Sustainable Energy Reviews, 37, 249-264.
[3] Boersma, T., & Johnson, C. (2012). The shale gas revolution: US and EU policy and research agendas. Review of Policy Research, 29(4), 570-576.
[4] Huang, B., Cheng, Q., & Chen, S. (2016). Phenomenon of methane driven caused by hydraulic fracturing in methane-bearing coal seams. International Journal of Mining Science and Technology, 26(5), 919-927.
[5] Gregory, K. B., Vidic, R. D., & Dzombak, D. A. (2011). Water management challenges associated with the production of shale gas by hydraulic fracturing. Elements, 7(3), 181-186.
[6] ibid
[7] Li, L., Blomberg, A. J., Spengler, J. D., Coull, B. A., Schwartz, J. D., & Koutrakis, P. (2020). Unconventional oil and gas development and ambient particle radioactivity. Nature communications, 11(1), 1-8.
[8] Zander, J. (2010). The application of the precautionary principle in practice: comparative dimensions. Cambridge University Press.

wake of an emerging technology. A pro-innovation, light-touch regulatory approach may interfere with the citizens' constitutional right to a clean environment, access to water, among others. On the contrary, triggering the precautionary measures on low-level uncertain risks may discourage scientific innovation eventually halting innovation and market growth. In any case, it is important to identify the 'safe levels' of exploitation[9]. These safe levels are 'minimum plausible threshold' that enables only genuinely hazardous impacts of a technology to trigger precautionary actions[10]. Although, the current literature highlights the various components of a legal system that influence regulation of environmental risks through such precautionary actions, it does not comparatively analyse these components. A comparative analysis of how different cooperative federalist systems trigger precautionary measures is important to ensure that "safe levels" are determined in a scientific, rational (or proportional[11]), and decentralised (bottom-up) manner.

JB Weiner (in 2001[12], 2002[13], and 2018[14]) asserted that the application of the precautionary principle in a legal system, is affected by its various components, including legal mobilization at national and subnational level[15], nature of fundamental environmental rights [16], complexity of a constitutional designs[17]. These specific components of a cooperative federalist structure

[9] ibid
[10] Lempert, R. J., & Collins, M. T. (2007). Managing the risk of uncertain threshold responses: comparison of robust, optimum, and precautionary approaches. Risk Analysis: An International Journal, 27(4), 1009-1026.
[11] Fischman, R. L. (2005). Cooperative federalism and natural resources law. NYU Envtl. LJ, 14, 179.
[12] Wiener, J. B. (2001). Precaution in a multi-risk world. *The Risk Assessment of Environmental And Human Health Hazards, Dennis D. Paustenbach, ed.,*.
[13] Wiener, J. B., & Rogers, M. D. (2002). Comparing precaution in the United States and Europe. *Journal of risk research*, *5*(4), 317-349.
[14] Wiener, J. B. (2018). Precautionary principle. In *Elgar Encyclopedia of Environmental Law* (pp. 174-185). Edward Elgar Publishing Limited.
[15]The US resisted to adopt a strong version of the precautionary principle through international treaty or national orders as it is more likely to get implemented it through judicial review, citizens suit, legislative acts, and/or executive orders.
[16] A jurisdiction that recognise fundamental right to access to clean water, access to environmental data, and clean air etc. as judicially enforceable rights are more cautious in deploying emerging technologies with uncertain risk—eventually adopting a stricter version of the Precautionary Principle. However, this right may clash with the basic principles of scientific innovation and economic welfare.
[17] It is important to analyse how an environmental decision making happens in a multilevel legal system, categorically from stringency and timeliness perspective, to understand the checks and balance on the

can facilitate or hinder rational and consistent implementation of the risk regulation related precautionary measures. This was further highlighted in a study conducted by Hansen *et al*[18] (2002) that analysed "what" triggered precautionary measures on 88 selected "risks" and found that apart from the four risks, all others were a false call to trigger precautionary regulations. The research highlighted the importance of studying different "legal systems" to ensure that "risks" are regulated rationally, predictability, and proportionally and not merely for political and economic interest. In an attempt to rationalise the risk regulation, Crawford-Brown[19] (2011) argued that "when there is a wide range of scientific uncertainties over a particular risk (as in the case of fracking-related risks), evidence over that risk should reach an *epistemic threshold* to trigger the precautionary actions." Such epistemic threshold (through environmental regulations) must be determined with rationality and consistency to avoid politicization of precautionary decision making.

However, the concrete meaning of abstract concepts like 'rationality' and 'consistency' in risk regulation is hotly debated especially when regulatory power is shared between national and subnational units. Risk regulations in a cooperative federalist system are not linear and such decision making usually falls between the extreme scales of the 'exclusive national powers' and 'exclusive subnational level powers'[20]. This establishes a cooperative system in which national and subnational units interact with each other, at different levels, to legislate and regulate over environmental matters[21]. This shared competence plays an important role in

discretionary power applied to make a risk regulation. Moreover, if the environmental decision-making power is top-down or bottom-up.

[18] Hansen, S. F., & Tickner, J. A. (2013). The precautionary principle and false alarms-lessons learned. European Environment Agency. Rosendahls-Schultz Grafisk: Copenhagen.

[19] Crawford-Brown, D., & Crawford-Brown, S. (2011). The precautionary principle in environmental regulations for drinking water. Environmental science & policy, 14(4), 379-387.

[20] ibid

[21] It is important to separate dual federalism from cooperative federalism, at this stage. In dual federalism national and sub national units act independently; in cooperative federalism different level of governing structures have shared competence

determining the application of the precautionary measures on risk posed by emerging technologies.

The US, Australia, and India have different levels of overlapping authorities over natural resources and a comparative analysis on how they trigger precautionary regulations (procedurally and substantially) on fracking-specific water risks will highlight the different components of these cooperative legal systems that influence the environmental regulatory regime. Such findings will ensure that the regulations of risks is done in consistently in larger public interest and not in discretionary manner to suit specific political and/or economic interests. However, it is premature to assume that only the structures within a legal system are influential factors in determining the threshold level of precautionary regulations. The precautionary principle, as construed under the international environmental law, itself is a widely contested principle with no uniformly acceptable definition. There are 19 different definitions of the precautionary principle and the present literature[22] crystallises these versions into three versions:

Version 1 : "uncertainty does not justify inaction"

Version 2: "uncertainty justify action"

Version 3: "shifting the burden of proof"

While the version 1 liberalises the precautionary approaches as it "permits" regulators to take action in case of scientific uncertainties, version 2 is more precautionary as regulators are "required" to actions in case of uncertainties. Version 3 is considered the strictest as it "forbids"

[22] Wiener, J. B. (2001). Precaution in a multi-risk world. The risk assessment of environmental and human health hazards, Dennis D. Paustenbach, ed.,.

risky activity until the operator of the proposed activity establishes that it poses no potential threat[23].

How subnational and national governments interact with each other is dependent on which version of the precautionary principle they adopt. The adoption of different versions of the precautionary principle can be traced through the environmental legal culture of a country and judicial precedence. This nature is also dependent on the federalist specificities of a particular jurisdictions and on what parameters national and subnational units, in their shared competence, implement environmental related risk regulations.

While using the term 'precautionary', the research subscribes to wider connotation of the precautionary principle covering all the three versions of the precautionary principle, namely (1) regulations that recognise scientific uncertainty over the impact of fracking on water resources, leaving it to the discretion of the regulators to set a threshold up to which such risk is allowed- this approach rests on the principle that "uncertainty does not justify inaction"- implying that if an uncertainty exists, regulators are permitted to take an action but such action may be subject to cost and benefit analysis, legal culture of a jurisdiction, and other consideration such as the nature and scope of delegation of power; (2) scientific 'uncertainty' over the cause and effect relationship between an emerging technology (fracking) and its effect (water pollution) warrants regulators to take an action—in this case, the regulator is under the obligation to take an action in case there is an uncertainty, such obligation is either established at national level through a legal instrument or at sub-national level catering to the location-specific need of a subnational unit. In any case, the regulator is under an obligation to create a threshold that substantially cater to the nature and scope of the risk at issue; and (3) regulations

[23] Yadav, S., Sarangi, G. K., & Ram Mohan, M. P. (2020). Hydraulic fracturing and groundwater contamination in India: evaluating the need for precautionary action. Journal of Energy & Natural Resources Law, 38(1), 47-63.

that shifts the burden on the project proponents to prove that their activity is within the 'acceptable level' of risk as set in by the pre-existing rules and regulations. The burden is borne by the corporation and discharged to the regulator. Generally, the 'acceptable risks' are duly noted in the Environmental Impact Assessment (EIA) guidelines of a jurisdiction at national or their subnational level. In a case where the EIA guidelines are silent on a risk posed by a new technology, the project proponent is under the legal obligation to reveal the emerging risk and scientific uncertainty associated with it.

It is not that a jurisdiction neatly adopts one or the other precautionary approaches and tracing 'rationality' and 'reasons' for cherry-picking a precautionary approach can highlight the legal components that facilitates or hinder adoption of a precautionary approach over the other. In this scenario, a jurisdiction may have all the three versions of the precautionary principle spread across its regulatory regime, however, it is important to analyse the precautionary regulatory approach of such a jurisdiction through distribution of powers between national and subnational units to understand how a legal system adopts a particular set of precautionary principle and does the decision making process, between the national and subnational units, affect the version of the precautionary principle it adopts. A through enquiry of how cooperative federalism evolve and function is essential to fathom such precautionary decision making process and contemporary literature analyses the cooperative federalism and its impact on environmental regulation from two perspectives: broad and narrow conception. As opposed to narrower approach in which national units must impose some minimum standard on subnational units, the broader conception of the corporative federalism includes all programs, including incentive from state, tribal, and local jurisdiction to help advance federal policies. The broader framework includes the narrower approach of minimum statutory federal requirements. Hence, categorising regulations related to fracking-specific water risks into broad and narrow cooperative federalism will highlight how national and subnational units

interact with each other in a legal setting—this, in turn, will highlight the specific components of a legal system that influence precautionary regulations.

To comparatively analyse the cooperative federalist structures of the United States, Australia, and India, it is important to take into account the and cooperative federalism and understand how they both impact each other while determining the "minimum threshold" or "safe levels" of resource exploitation by applying precautionary measure. To that effect, this research focuses on the risks posed by fracking on water resources. These risks are common fracking-specific risk as identified by the 2016 the US Environment Protection Agency (EPA)[24] report, namely (1) risk of methane migration, (2) risk posed by excessive flowback (produced) water, and (3) risk related to rationing of five to 10 times more water as required by the fracking activities in comparison with the conventional extraction processes.

[24] Meng, Q. (2017). The impacts of fracking on the environment: A total environmental study paradigm. Science of the Total Environment, 580, 953-957.

Chapter 2. Theoretical Conception of Cooperative Federalism

Water resources , in a multilevel governing system, is usually governed through a cooperative framework between national and subnational units[25]. While governance of water resources, during the energy production cycle, is deeply impacted by its geographical location and usage pattern in a particular area, countries still establish a broad-based policy frameworks at national levels to ensure a uniform access of energy-water resources across the territory of a nation[26]. Moreover, these broad-based policies are useful while determining the regulations of energy-water nexus. There are primarily two reasons for having a broad-based national-level policy on water resources, especially from a water-energy nexus perspective: first, the government must ensure uniform access of energy to all its citizens, however, geographically, natural resources are not uniformly distributed among all the subnational units of a governing system—thus, if a few subnational units have excessive natural resources than the national average, it is important to have a national-level policy in place precluding energy-rich subnational units from monopolising those resources[27]. Second, energy extraction and generation process require active involvement with water resources, while energy resources and water react differently in different geographical settings, a standard policy on governing this energy-water interaction helps the national level government in establishing a standard base-level of risk assessment, precluding subnational levels from underregulating energy-water interaction—as such underregulating may lead to violation of citizens' fundamental right to clean environment[28].

[25] Zimmerman, J. F. (2001). National-state relations: Cooperative federalism in the twentieth century. Publius: The Journal of Federalism, 31(2), 15-30.
[26] Scott, C. A., Pierce, S. A., Pasqualetti, M. J., Jones, A. L., Montz, B. E., & Hoover, J. H. (2011). Policy and institutional dimensions of the water–energy nexus. Energy Policy, 39(10), 6622-6630.
[27] Rehman, I. H., Kar, A., Banerjee, M., Kumar, P., Shardul, M., Mohanty, J., & Hossain, I. (2012). Understanding the political economy and key drivers of energy access in addressing national energy access priorities and policies. Energy Policy, 47, 27-37.
[28] Goldthau, A. (2014). Rethinking the governance of energy infrastructure: Scale, decentralization and polycentrism. Energy Research & Social Science, 1, 134-140.

However, subnational and national units establish these broad-based policies and regulations specific to their legal (and constitutional) cultures. For instance, a governing regime with a predominant dualistic federalist character may not impose strict national-level regulations on subnational units, eventually resulting in sporadic access to energy and water resources among all the subnational units; whereas a regime with centralising tendencies, would avoid giving subnational units enough room to regulate water-energy nexus as per their geographical needs and their water-related socio-economic specificities[29]. Thus, it is important to strike a balance between overarching centralising tendencies and a predominantly dualistic model. This 'balance' is difficult to champion, but a multilevel governing system adopts and assimilates this 'balance' within their constitutional contours, establishing a cooperative 'environmental' federalism. This cooperative relationship between national and subnational units takes different shapes and forms and affect the regulation of natural resources, therefore, to understand how risks are regulated before deploying new technology like fracking, it important to understand how such risks regulations powers are balanced between national and subnational units in a multilevel legal system.

While federalism in its extreme sense is perceived as a system in which national and subnational units have predominant exclusive powers, natural resources governance rarely hit such exclusivity at national and subnational units[30]. A few common exceptions, that indeed has hit exclusive national level regulatory powers, in natural resources management, are nuclear waster disposal, especially at defence level and pesticide labelling to ensure uniform food quality assurances at national level[31]. On the other hand a near-exclusive subunit level exceptions are commonly seen in land-related rights as mostly subnational units level have

[29] Craig, R. K. (2010). Adapting water federalism to climate change impacts: Energy policy, food security, and the allocation of water resources. Envtl. & Energy L. & Pol'y J., 5, 183.
[30] Dapice, D., & Thanh, N. X. (2013). Creating a Future: Using Natural Resources for New Federalism and Unity (No. 0795). Department of Economics, Tufts University.
[31] Supra 11 at 182

right to allocate property and determine its land-usage pattern as per their local laws and regulations[32]. However, most of the natural resource regulations fall between the scale of national and subnational level exclusivity. And this is the area on the scale where both the units establish a relationship – a regulation may be closer to the extreme federal exclusivity of the scale and another may be at the other extreme end

Historically, cooperative federalism in environmental matters was significantly discussed in 1938, in the US states Iowa Law Review and described the US cooperative environmental federalism as an "entirely new field of experiment characterised by the participation of several governments in cooperative legislative and administrative action"[33]. In India, the constitutional assembly debates on the distribution of legislative powers on environmental matters, specifically water, reveal that the framers intended to give subnational units autonomy over their water resources; however the central government effectively retains powers on water resources that are shared among two or more subnational units[34]. In Australia, the subnational units structurally had "near-exclusive" power on their natural resources, including water with an "emergency-like" power to the national government through which they may trigger legislative and administrative actions[35]. To understand the scope and lasting effect of these cooperative environmental settings, it is important to contextualise these underpinning within the contemporary literature on federalism and environmental law.

[32] ibid
[33] Glicksman, R. L. (2006). From cooperative to inoperative federalism: the perverse mutation of environmental law and policy. Wake Forest L. Rev., 41, 719.
[34] Cullet, P. (2009). Water law, poverty, and development: Water sector reforms in India. Oxford University Press.
[35] Murchison, K. M. (1994). Environmental Law in Australia and the United States: A Comparative Overview. BC Envtl. Aff. L. Rev., 22, 503.

2.1. Forms of Cooperative Federalism in Environmental Law

Interactions between national and subnational units, on natural resources management, can be broadly categorised into two approaches[36]: In the first approach the national unit lays down a minimum threshold of environmental regulation that each subnational level must adopt, although these subnational units are allowed to impose a stringent measure beyond the threshold level[37]; in the second approach, the national units adopts a "carrot-and stick-approach", incentivising subunit levels to adopt federally-administered programs at subunit level. Both approaches involve fiscal federalism at some level[38]. In the first approach, the national government may impose fine, budgetary cuts, et cetera if subnational units fail to meet the national level threshold (for instance the US EPA lays down such a minimum threshold for the states), whereas in the second approach subunit levels that meet the federally-administrative programs are incentivised through budgetary support and financial allocations (for instance, Australia has a specific green program in which states are allocated extra budget if they decide to implement federal policy in their territorial jurisdictions). The first approach is seen as a sanction based mechanism and is usually referred to as "narrow" cooperative federalism. The second approach has a wider breadth and can encompass a variety of federally administrative programs, this is referred to as "broad" cooperative federalism.

2.2.1 Narrow Cooperative Federalism

As discussed, a narrow approach to cooperative federalism establishes a federal level minimum standard that subnational units must adopt, although the subnational units are generally allowed to increase the regulatory threshold catering to their geographical and socio-economic conditions[39]. These minimum standards are rolled out by the national units, at the subnational

[36] Supra 11 at 183
[37] Doremus, H., & Hanemann, W. M. (2008). Of Babies and Bathwater: Why the Clean Air Act's Cooperative Federalism Framework Is Useful for Addressing Global Warming. Ariz. L. Rev., 50, 799.
[38] Supra 11 at 188
[39] Kaswan, A. (2007). A Cooperative Federalism Proposal for Climate Change Legislation: The Value of State Autonomy in a Federal System. Denv. UL Rev., 85, 791.

levels, either by defining regulatory parameters at the national level and leave it to subnational units to decide how they meet such regulatory parameters, a *compliance based method* (for instance, at the national level a government may list down threshold of acceptable levels of methane while fracking and leave it to subnational units level to achieve those thresholds, without administrating any procedural aspects of such compliance) or by establishing federal-level programs, with details on "how and what to achieve", that state must adopt, *a program based method* (for instance, several national units adopt a detailed step by step process for granting subnational level environmental clearances, each subnational unit must adhere to these steps -- like conducting public participation -- before granting environmental clearance to a project proponent)[40].

In a *compliance based method*, subnational units have a greater discretion on determining procedural aspects of the regulatory threshold. Such a method is adopted by the US, under its Clean Water Act (CWA)[41], as the US EPA specifies the minimum level of pollutants that are allowed under the US water — and each state must achieve that minimum level of pollutant. However, the US EPA does not prescribe any procedural aspects for the States on achieving those minimum levels. Each State may customize its administrative regulations and legislative instruments as per its requirement. The US EPA pollutant levels standards are scientifically determined through labs and experiments, hence any deviations from those standards would require a scientific explanation. As in the case of the US, usually subnational level units are required to make an implementation plan to adhere to the national level standards and are required to submit compliance reports after a pre-determined period. In India, a similar trend is observed, the Ministry of Water Resources and the Central Pollution Control Board, at the national level, release an annual level list on acceptable pollutant level in the water and the

[40] Supra 11 at 190

[41] Hough, P., & Robertson, M. (2009). Mitigation under Section 404 of the Clean Water Act: where it comes from, what it means. Wetlands Ecology and Management, 17(1), 15-33.

subnational units are required to follow those level[42]. In Australia, such levels are not decided at the national level; however, in exceptional cases—usually, in 'matter of national environmental significance [MNES]'[43], such as Coal Seam Gas, national-level governance determines pollutant levels that subnational units must follow.

The subnational unit level tailoring of federal incentives is widely restricted in the *program based method,* in which the national unit forms a broad-based policy that subnational units must follow with predetermined levels of deviations. Usually this method contains three basic steps[44]: (1) the national unit underwrites framework policy to be implemented at the subnational unit level with a clear implementation strategy such as financial sanctions (for instance, the US federal government, in absence of a clear constitutional power to regulate environmental matters at national level, invoked its constitutionally guaranteed *spending powers* against States that fails to follow their framework policies)[45]; (2) a conditionality that subunit level governments must adopt federal level program with the same level of (or stricter) stringency (it is different from the compliance based method as stringency level is one of the parts of the *program based method* and these stringency are not restricted to pollutant levels only—for instance subnational units may be asked to conduct public participation while granting environmental clearance in a site that is within 5 km of the proposed project site, followed with a circulation of objections raised in the participation meeting—here the national government lays down specific guideline on "when and how" to conduct the public participation but subnational units may impose stricter criteria—for instance many subnational

[42] Chakrabarty, P. D., & Srivastava, N. (2011). Green Federalism: Experiences and Practices. Nanotechnology.
[43] The national level Environment Protection and Biodiversity Conservation Act, 1999 (chapter 2) lays down the definition of "Significant Impact" as "*a significant impact is an impact which is important, notable, or of consequence, having regard to its context or intensity. Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts. You should consider all of these factors when determining whether an action is likely to have a significant impact on the environment*".
[44] Supra 11 at 192
[45] Binder, D. (2001). The Spending Clause as a Positive Source of Environmental Protection: A Primer. Chap. L. Rev., 4, 147.

units in India require project proponents to circulate information on the proposed project to the public in vernacular language); (3) a compliance mechanism in which national level agency require subnational units levels to submit 'enforcement reports'—these enforcement reports covers a report enforcement of the procedural aspects of the federal programs, such as giving citizens a right to information on the objection raised during public participation (as opposed to the compliance report in which the subunit level is only require to submit its report on the sampling of pollutant levels as per federally determined scientific standards).

Compliance Based Method	**Program-Based Method**
• Minimum pollutant levels determined at national level; subnational units must adhere to federally determined minimum level but can go federal-plus.	• Federal government makes broad policy framework that states must adopt; states are allowed to define their own substantive parameters, though.
• Does not require a federal level procedural guideline	• Usually require a federal level procedural guidance but generally federal government do not impose a substantive restriction (meeting a threshold) until and unless state governments adhere to the procedural requirements.

Both the compliance-based and program-based methods have financial or other such sanctions in common. While the narrow conception of cooperative federalism has some sort of *sanctions* in place, the broader conception has *incentives* instead of sanctions..

2.2.2 Broad Cooperative Federalism

The traditional understanding of cooperative federalism has underpinned a system in which the national unit oversights at subnational units, under enabling legislation. However, on a broader perspective, cooperative federalism moves beyond the national-subnational level interactions (federal-state interactions) but also includes direct coordination of national unit with local bodies, tribal communities et cetera. While the federal-state interaction in a narrow conception is based on a constitutionally drawn 'sanction' mechanism, at the broader level, federal government incentivises state governments to adopt their programs or to coordinate with their

agencies[46]. For instance, in Australia, the national unit has established a "harmonized framework" for regulating communities concerns on environmental impact on natural gas extraction[47]. These harmonized frameworks are non-binding but subnational units, that have the power to regulate natural gas in their respective jurisdictions, usually refer to the framework as a 'best practice guideline' while regulation the natural gas sector. The framework effectively serves as a yardstick for measuring how well subnational units are protecting citizens' environmental rights and thus compliance with the framework has underlying incentives. Similarly, in the US, federal governments actively coordinate with States having federally managed lands to regulate land use patterns as per EPA regulations[48]. Similarly in India, although groundwater is a State subject, subnational units model their groundwater regulations around the national level groundwater policies, this enables subnational units to gain financial incentives from the national-level water management programs[49]. Here, it is important to mention that decarbonisation plans announced in Australia, India, and the US incentivise subnational units to use low carbon technology and national units incentivise such usages by providing budgetary support and specialized financial allocations to high performing subnational units[50].

To understand how such coordination between federal-state and local bodies develop through cooperative federalism, the current literature divides broad cooperative federalism into three types[51]: (1) *location based cooperation* in which the federal and State (in coordination with local bodies) collaborate to regulate 'unique' ecological issues of a particular location. This

[46] Supra 11 at 205
[47] See "The Harmonized Regulatory Framework of natural Gas From Coal Seams" available at https://energyministers.gov.au/sites/prod.energycouncil/files/publications/documents/CSG%20Framework%20annual%20update.pdf <last accessed on May 24, 2021>.
[48] Hudson, B. (2011). Reconstituting land-use federalism to address transitory and perpetual disasters: The bimodal federalism framework. BYU L. Rev., 1991.
[49] Vani, M. S. (2009). Groundwater Law in India: A New Approach. Water and the Laws in India, 447.
[50] Fiorino, D., & Weted, C. A. (2020). Environmental Federalism in a Polarized Era. State and Local Government Review, 52(2), 138-151.
[51] Supra 11 at 193

approach allows stakeholders to holistically regulate environmental issues in ecologically sensitive areas. This collaboration is noticed in the Mangroves forest of India where environmental clearance guidelines are specific to the region and both the state and central agencies collaborate to implement these regulations[52]. Similarly the federal, State, and local bodies collaborate to manage the US Sacramento River Delta, catering to the specific need of the region related to water quality and habitat—necessary for supporting fisheries[53]. However, these cooperation models are subject to the concurrent power of a constitutional structure and are often weighed down by excessive administrative delegations. (2) *Procedural favouritism* is the most common framework allowing national and subnations governments to share procedural regulations of natural resources law, this type of broad cooperative federalism setting allows the federal government to regulate on environmental matters but with a responsibility to take into consideration the written views of respective states, where the natural resources are located, while implementing these laws. Although adherence to state views is not a requirement but federal agencies are required to scientifically justify non-adherence to the respective states' view[54]. Unlike location-based cooperation, procedural favouritism does not place state and federal government on equal footing but creates a regulatory framework in which States enjoy a right to express their concerns on federal policies. Whereas the federal government is obliged to justify when not considering the state's view. For instance, in the US Federal Land Policy Management Act, through its agency Bureau of land Management, is required to make land-use plans after taking into consideration the states' viewpoints as long as they are "consistent" with the federal law[55]. While in Australia, the environmental matter

[52] DasGupta, R., & Shaw, R. (2013). Changing perspectives of mangrove management in India–an analytical overview. Ocean & coastal management, 80, 107-118.
[53] Pitt, J., Luecke, D. F., Cohen, M. J., Glenn, E. P., & Valdes-Casillas, C. (2000). Two nations, one river: Managing ecosystem conservation in the Colorado River Delta. Natural Resources Journal, 819-864.
[54] Supra 11 at 200
[55] Glicksman, R. L. (2006). From cooperative to inoperative federalism: the perverse mutation of environmental law and policy. Wake Forest L. Rev., 41, 719.

related to trade and commerce fall within the central government regime[56], states view are taken into consideration while developing interstate trade policies on natural resources management[57]. In India, the environmental clearance of projects that fall under the central government's domain requires consultation with state governments before granting a clearance certificate[58]. (3) *federal deference to state process*, while in procedural favouritism, state governments' viewpoints are taken into consideration through a systematic review process, in federal deference system, the federal government is required to implement states' interest if the state government has successfully adopted a state-level plan following the criteria established by the federal government[59]. For instance, the US Coastal Zone Management Act (CZMA) provide guidelines for the states to create their coastal zone management plans and once these plans are approved by the CZMA, federal agencies are required to implement the state plans while granting a lease, licenses, and permits in their coastal zones[60]. Similarly, in India, Integrated Coastal Management Act 2008, requires the central government to manage coastal zones and require each state to make their plans—to be approved by the federal agency—and once approved the federal agency is required to take into consideration the state plans while granting permits and leases in respective territorial areas[61].

[56] See Australian Constitution Article 51 (xx), 52 (xxix), and 51 (xxix)
[57] This position is reaffirmed in *work choices case* (NSW v. Commonwealth [2006] HCA 52) by the High Court
[58] See Indian Environmental Impact Assessment Notification 2020
[59] Supra 11 at 201
[60] Duff, J. A. (2001). The Coastal Zone Management Act: Reverse Pre-Emption or Contractual Federalism. Ocean & Coastal LJ, 6, 109.
[61] Panigrahi, J. K., & Mohanty, P. K. (2012). Effectiveness of the Indian coastal regulation zones provisions for coastal zone management and its evaluation using SWOT analysis. Ocean & coastal management, 65, 34-50.

Location-Based Cooperation	Procedural Favouritism	Federal Deference
• Federal and state (including local bodies) enter into a specific location based legal instrument and share regulatory powers. • Basis of cooperation is eco sensitivity and uniqueness of the area • Usually, local bodies are prominently involved owning to the location-specific issues.	• States' viewpoints are recorded on federally regulated subject areas, federal government, if does not take into consideration States' viewpoints must justify their regulatory actions on scientific grounds. • Usually, federal government enjoys wider powers	• Federal government lays down guidelines for formulation of States' level plans. Once States' plans are approved by the federal regulators, the federal agency must implement the respective states' plan. • Usually, state government enjoys wider power.

It is important to note here that in narrow cooperative federalism the carrot and stick relationship between the national unit and subnational unit is kept intact under subject to constitutional scheming of a country. In broad cooperative federalism, innovative regulatory systems are tried and tested—be it involving multiple stakeholders while regulating Eco-sensitive areas (location-based), integrating states' viewpoints in a federally governed subject matter (procedural favouritism), or federal adherence to approved states' plans on natural resources. However, these various types of cooperative federalist structures are not spelt out in a constitutional governing system and are often hidden within the layers of administrative regulations. Thus, it is important to contextualise the theory of cooperative federalism with the constitutional status of "water" in the three comparators of this research. Such contextualisation will highlight the role of a constitutional framework in allowing (or blocking) a specific type of cooperative regulation of water resources.

Chapter 3. Water Regulations and Cooperative Federalism in India, the US, and Australia

Since constitutional frameworks are continually adapting to societal needs, environmental matters take various shapes and forms while travelling through the regulatory routes established by Centre-State interactions in a multilevel governing system. Thus, to understand how this interaction between Centre-State affect regulations of water risks, it is important to keep track of how such interactions developed and from where they gain their legitimacy. This section traces such centre-state interaction of central and state governments in the three comparators and categorises such interactions into broad and narrow conceptions of cooperative federalism. This section maps the constitutional status of water resources in the three comparators and traces their regulatory framework to understand the nature and scope of cooperative federalism the comparators. While doing so, this section begins with analyses of how the constitution of the comparators distribute powers among national and subnational units on water regulations. It is important to note here, that although a constitutional framework may not directly distribute such powers, administrative culture in a comparator establishes such regulatory power distributions through innovative interpretation and uncontested practices.

3.1 "Water" and Narrow Cooperative Federalism in the US, India, and Australia

As federal-led sanctions and compliance requirements are two basic attributes of narrow federalism, this section analysis how 'narrow' cooperation between national and subnational units is facilitated through the constitutional structure of the comparators. Both Australia[62] and India, expressively distribute the regulatory powers over water resources in their constitution; however, it is the US that takes the innovative approach to regulate water resources through

[62] See Article 100 of Australian Constitution "*The Commonwealth shall not, by any law or regulation of trade or commerce, abridge the right of a State or of the residents therein to the reasonable use of the waters of rivers for conservation or irrigation.*"

active interpretation of its *spending clause*[63]. The US constitution is silent on the distribution of powers between the federal and state governments and under Article 1 section 8, historically, the central government is subject to enumerated powers, "*the powers not delegated to the United States by the Constitution, nor prohibited by it to the States, are reserved to the States respectively, or to the people.*"[64] Since the constitution is silent on the "environmental regulations", the federal agencies could only act if they derive such regulatory powers through other sources. The search to find an alternative concluded with the *spending power clause*. By invoking the spending clause, Congress established a system through which States that adhere to the federal guidelines on environmental management become eligible to accept 'delegations', in the form of grant funds. However, this system left scope for state governments, especially the ones with rich natural resources and are not in want of federal grants, to ignore the federal guidelines. Subsequently, federal regulations on water (and other natural resources) was tied with the *Commerce Power of the Congress*[65], where "*Congress authorises pre-emption under the Commerce power in the absence of cooperation with the federal guidelines and the Congress may enforce the federal statute directly in a state*".[66] This interaction between federal and state government, on environmental matters, became clearer post-1970, when US EPA established itself as an 'oversight' authority through federally enacted law, especially the Clean Air Act and Clean Water Act (CWA). Under CWA the US EPA established federal level standards, including maximum pollutant standards and compliance strategies, leaving room for subnational authorities to tailor those standards as per their regulatory requirement. For instance, CWA requires each state to have a state pollutant discharge elimination system,

[63] See Article I Section A Clause 1 of the US Constitution "*Congress may lay and collect Taxes, Duties, Imposts, and Excises, to pay the Debts and provide for the common defense and the general welfare of the United States*".
[64] Primus, R. (2018). The Essential Characteristic: Enumerated Powers and the Bank of the United States. Mich. L. Rev., 117, 415.
[65] Article I Section 8 "… to regulate commerce with foreign nations and among the several states"
[66] Supra 11 at 201

however, the regulatory aspects of how the system functions and at what stage of a project such system is required to be administered is left to the states to decide[67]. As a sanction, the US EPA assumes 'veto power' under CWA which allows the federal agencies to regulate water resources in case subnational units are in defiance of the federal standards[68]. However, the veto power enjoyed by US EPA is used to deregulate the energy-water nexus as well. For instance, in 2018, under the veto power, the States were not allowed to hold the fossil-fuel project, permitted by the federal government, by invoking subnational-level authorities granted under CWA[69]. This was a stark deviation from the US Supreme Court position, allowed subnational units to impose stricter than federally levied conditions while regulating energy-water nexus, especially in fossil fuels related projects[70]. This US EPA and subnational unit relationship are broadly based on compliance and veto-driven sanction based mechanism and, thus, this neatly falls into the 'narrow cooperative federalism'. While the Constitution is silent on the distribution of water related regulatory powers between national and subnational unit, Indian constitution, in detail, establishes a 'shared competence' relationship between Centre and States.

Under Indian Constitution, legislative powers over various subject matter are distributed through three list systems- Union list (List I: subject matter on which Parliament can make law), State List (List II: subject matter on which state legislature makes law), and Concurrent List (List III: subject matter on which both Parliament and State can make law). Entry 53, List I gives exclusive power to make laws related to "*Regulation and development of oilfields and*

[67] Malloy, B. A. (2011). Testing cooperative federalism: Water quality standards under the Clean Water Act. Envtl. & Energy L. & Pol'y J., 6, 63.
[68] Glicksman, R. L., & Batzel, M. R. (2010). Science, politics, law, and the arc of the Clean Water Act: The role of assumptions in the adoption of a pollution control landmark. Wash. UJL & Pol'y, 32, 99.
[69] Louvin, R. (2021). President Trump's Environmental Policy. DPCE Online, 46(1).
[70] The US Supreme Court in a series of decision affirmed the States' powers to levy stronger than US EPA regulations. See "Evolution of the Meaning of "Waters of the United States" in the Clean Water Act" available at https://fas.org/sgp/crs/misc/R44585.pdf <accessed on May 24, 2021>

mineral oil resources; petroleum and petroleum products"[71]. Therefore, natural gases, including shale gas, falls under the Union List. Accordingly, regulation and development of shale gas in the hand of the central government . However, legislative power over 'water' and mostly vests with the State government (Entry 17 and 23 List II) or falls under the concurrent list where union shares its legislative power with the respective states under which the specific natural resources fall. Also, law-making powers of centre and state are under continuous judicial scrutiny over public policy matters[72].

Since respective States enjoy legislative power over water resources within their territories, they may make legislation, policies, and regulation to manage water resources; however environmental impact assessment guidelines on hydrocarbon related projects are set in at the national level[73]. The Central government can not only lay down maximum allowable pollutant levels but may also make a framework legislations guiding state governments on how to conduct a water-related impact assessment of energy project and while doing so, central agencies keep 'regulatory oversight' over state regulations[74]. The Supreme Court of India, in several matters, has held that in case of a conflict between Central and State competence on a subject matter, that seemingly has shared competence, it is the Central government that gain predominance[75]. In the case of the water-energy nexus, hydrocarbon resources are under the central government domain, while territorial water resources are under the state government, while regulation of the environment falls in list-III, concurrent list. The EIA process in India is also divided into two categories, where certain large projects require central-government level clearance (including hydrocarbon projects) and some medium to small level projects can

[71] Ram Mohan, M. P., & Kant Yadav, S. (2021). The Oil and Gas Sector in India: Balancing Business Policies and Public Interest by the Supreme Court of India. Global Energy Law and Sustainability, 2(1), 1-21.
[72] ibid
[73] Yadav, S. (2020). Fracking in India. Ecologist: The Journal for the Post Industrial Age.
[74] Bhat, S. (2015). The paradox of environmental federalism in India. In The Law and Policy of Environmental Federalism. Edward Elgar Publishing.
[75] The series of Supreme Court decision is discussed in Supra 72 at 5.

operate with a state-level environmental clearance (small scale hydrocarbon plants)[76]. This shared competence was formalised after India became a signatory of the United Nation Convention on Human Environment (UNCHE) and passed a series of central legislation, in the 1970s, erecting frameworks on regulating air and water resources[77]. The Water (Pollution Prevention and Control) Act, 1972 (water act), a federally enacted law in India, lays down the administrative structure at the Central and State level, granting oversight regulatory power to central level administration over state regulations. Although the Water Act does not provide the central government with veto power, the Environment Protection Act 1976 (environment) allows the central government to determine environmental regulations and environmental clearance process applicable to a variety of projects, both at the central and state level. Hence, there is little room left for the state government to tailor-made their constitutionally guaranteed regulatory power on water resources[78].

Quite contrary to India, Australia's cooperative federalist structures give the widest power, out of the three comparators, to its States. However, similar to the US, the Australian constitution does not grant explicit power to the federal government on regulating environmental matters and so, the federal government invoked its trade and commerce powers to regulate the export and import of certain items on environmental grounds (this position of the federal government was later upheld by the High Court of Australia, see the previous section for more details). Further, Australian Constitution grants the federal government "power to make laws for the peace, order, and good governance" facilitating the central government to make law on environmental matters essential to maintain "peace, order, and good governance"[79]. In 1999, Australia, at the federal level enacted Environmental Protection and Biodiversity Conservation

[76] Parikh, M. (2019). Critique of Environmental Impact Assessment Process in India. Environmental Policy and Law, 49(4/5), 252-259.
[77] Suhag, R. (2019). Overview of ground water in India. PRS.
[78] ibid
[79] See Article 51 of Australian Constitution

Act (EPBCA), which require subnational units to refer 'certain activities' to the federal government before granting them environmental clearance. Under EPBCA, all activities related to environmental matters fall under the ambit of State-level regulations; however, if an activity has a "significant impact" on the environment then the central government can assume an oversight regulatory approach. In 2013, such a significant impact was 'triggered' to regulate the water cycle in Coal Seam Gas projects in one of the six sub-national units, Queensland, in Australia[80]. However, it is important to note, that such trigger to determine if a matter falls under the "significant impact" is initiated at a subunit level by a private party or subnational units themselves refer to some matter at the national level to determine its impact. Thus, the federal level government is actively precluded in initiating such triggers to centralise regulatory power through unilateral decision making.

Narrow CF[81]	**The US**	**India**	**Australia**
Compliance-based Method	US EPA, under spending clause and CWA, can determine maximum level of pollutants allowed at federal level and can establish regulatory oversight.	The Environment Act allows Centre to attain regulatory power on determining pollutant levels at federal level. Such power is supported by judicial precedence.	Such compliance can only be implemented when such activities have "significant impact" on environment. The federal government can not unilaterally determine that an activity falls under the "significant impact" category.
Program-based Method	Federal government can use Veto Power under CWA to lay down broad policy framework on state-level activities; such veto power should be invoked on scientific basis and through a proved non-compliance record of a State.	The Water Act read with Environment Act allows federal government to set broad guidelines that States must follow.	Under Australian Constitution, federal government can set in broad policies on environmental aspects of commerce and trade. Moreover such broad policies are allowed under EPBCA regime and federal government can make policy framework of matters with "significant impact".

[80] See "Implementation of the Water Trigger under the Environment Protection and Biodiversity Conservation Amendment Act 2013" available at https://ris.pmc.gov.au/sites/default/files/posts/2017/09/implementation_of_the_water_trigger_post_implementation_review.pdf <last accessed on May 24, 2021>

[81] Here and henceforth 'CF' is an abbreviation of 'Cooperative Federalism'

Narrow cooperative federalism, in the US water governance regime, is the norm rather than an exception. Since the US EPA has invoked its veto powers, guaranteed under CWA, 13 times between 1972 and 2018[82]—it is important to highlight that such judicially-affirmed veto power has emerged as a sanctioning tool that US EPA at the federal-level may use to implement the narrowly construed concept of cooperative federalism in the US. Although such sanctions are not common in India, the Central government precludes state governments from regulating energy-water nexus by setting in a trend in which it regulates its energy sector (primarily, hydrocarbons) comprehensively (including granting environmental clearance to defining pollutant levels) at the federal level[83]. Hence energy-water nexus in India is predominantly governed at the federal level and States may impose tailored-made regulations to an extent they a harmonized with the federal regulations. In Australia, such a narrow conception of cooperative federalism is restricted allowing states to have a say on when the federal government can overtake their regulatory powers (refer to referral scheme under "significant impact" provisions), however, federally water-related regulations are imposed on trade and inter-state movement commercial goods. Hydrocarbon projects, in Australia, with a significant impact on the water resources, also have federally imposed regulation, but if a project is of "significant impact" is determined by a two-way consultative process[84] between state and centre rather than a sanction based mechanism.

[82] Kelso, M. (2019, January). The President as Legislative Leader: The Use of Veto Power in Environmental Policy Making. In Congress & the Presidency (Vol. 46, No. 1, pp. 135-158). Routledge.
[83] Yadav, S., Sarangi, G. K., & Ram Mohan, M. P. (2018). Challenges in Shale Gas Production Cannot Be Resolved by Generic Environment Clearance Processes. Economic & Political Weekly, 53.
[84] Hunter, S. (2017). Independent review of the water trigger legislation. Department of the Environment and Energy.

3.2 Water and Broad Cooperative Federalism in the US, India, and Australia

While it is easy to identify 'sanctions' and 'compliance' mechanism inherited in multilevel governing systems that rely on cooperative federalism (as these sanctions and compliance derive their legitimacy through constitutionally-derived powers), it is difficult to highlight and assess how broad conceptions of cooperative federalism is inherited and practised in a governing system (as the broad conception of cooperative federalism is usually practised in a specific location, or a specific project, or as an exception to a norm). So, this section highlights a few case studies as broad aspects of cooperative federalism and water resources.

Geographical conditions of a location influence how water resource interact with energy projects and society at large; therefore local bodies play an important role in regulating water resources, especially in eco-sensitive areas[85]. Hence, a well-nuanced federally implemented regulation may not be able to tackle water-related risks throughout the territorial limits of jurisdictions and federal governments must leave sufficient room for its state governments and local bodies to innovate and tailor-made location-specific water regulations.

In the US, the federal government usually facilitate coordination among local bodies and state government to come up with location-specific risk regulation plans. Constitutionally, the federal government justify such leadership role through its spending power, through which it incentivise such coordination with grants and budgetary allocations. For instance, the US federal government, in 1994, created the CELFED Bay-Delta program[86] in which the US EPA coordinates with the California water board, local fishery bodies, civil societies to manage risks related to the expansive California delta. The CALFED led Water Operations Management Team "*comprised of representatives from the United States Bureau of Reclamation, California*

[85] Supra 11 at 202

[86] Innes, J. E., Connick, S., & Booher, D. (2007). Informality as a planning strategy: Collaborative water management in the CALFED Bay-Delta Program. Journal of the American Planning Association, 73(2), 195-210.

Department of Water Resources, Fish and Wildlife Service, National Marine Fisheries Service, California Department of Fish and Wildlife, and the California State Water Resource Control Board"[87] to manage risks through collaborative policy and regulatory framework with an aim to mitigate risks related to water-energy nexus and climate change. Such a location-based program is established through an active federal-led negotiation between various interest groups and finding common grounds of water risk regulation. Instead of sanctions, the main push here is finances and the common good. The legitimacy of the collaborative regulations policy is found in federally and state affirmed policy and regulatory framework. However, there is a limitation to such collaboration—local bodies may not collaborate and create rules against the will of respective state regulations and federal statute. The US federal court, in 1999, in this regard noted that while such cooperation is encouraged under the relevant statute, these statutes did not delegate administrative powers to the local bodies[88].

In India, such location-based collaboration is rare but not redundant. Under Central government's Environment Act, States with declared 'eco-sensitive' areas are given wider powers to collaborate with local bodies and determine their own rules and regulations- as an exception to prevailing water regulations[89]. Such collaborations is seen while regulating Mangroves forest that hosts several rare species due to its unique water distribution patterns and soil salinity. The environmental clearance processes, for projects that require federal-assent, also have a higher regulatory threshold that caters to the location-specific need and require additional clearance from local bodies before it can reach to the federal level environmental clearance[90]. Such location-based collaborations also come into play when federally approved project is subject to additional water regulations at State level and

[87] Lee, C. T. (2020). Federalism and Water: The California Experience. *Golden Gate U. Envtl. LJ*, *12*, 23.
[88] See National Parks & Conservation Associations v Stanton, 54 F. Supp. 2d7, 18-19.
[89] Kathiresan, K. (2018). Mangrove forests of India. Curr Sci, 114(5), 976-981.
[90] See Environmental Impact Assessment Manuals available at http://www.indiaenvironmentportal.org.in <last accessed May 24, 2021>

compliance with such state-level water regulations are set in as a condition to sustain the approval (environmental clearance) granted by the Centre. Such arrangements are common in the northeast states of India that have myriad structures of rives flowing through different subunit levels having perforated borders[91].

In Australia, location-based collaboration a common strategy for governing water resources in catchment areas. While until the early 1980s, Australian catchment area management was at the fragmented grass root level where local bodies collaborate with various stakeholders to manage water resources under vague and perforated state-level policies. over the past two decades, the federal government in Australia has increasingly implemented "collaborative catchment management" establishing a Natural Heritage Trust, 1996 (NHT) that provided "provided support for local community natural resource management programmes and landholder initiatives"[92]. However, NHT met only limited success due to its "over-ambitious" consultative process led by the federal government. In 2002, the central government launched NHT-2 in which it created a bilateral agreement with States creating policies specific to the location-based requirement of catchment areas and disbursing funds to States, under the bilateral agreement.[93] An exception to NHT-2 based catchment are management in Australia is the Murray-Darling Basin, which is governed by a federal agency due to its eco-sensitivity and widespread among several States[94]. This federal dominant arrangement is sustained since 1914 through an intergovernmental agreement among the Australian States and federal government[95].

[91] Poffenberger, M., Barik, S. K., Choudhury, D., Darlong, V., Gupta, V., Palit, S., ... & Upadhyay, S. (2006). Communities and forest management in northeast India. Background Paper, 12.
[92] Dale, A. P., Pressey, B., Adams, V. M., Álvarez-Romero, J. G., Digby, M., Dobbs, R., ... & Gobius, N. (2014). Catchment-scale governance in Northern Australia: a preliminary evaluation. Journal of Economic and Social Policy, 16, 1-27.
[93] Ibid at 23
[94] Ibid at 25
[95] Ibid at 4

Apart from location-based collaborations, all the three comparators show *federal deference*, a wide conception of cooperative federalism, as one of the strategies while managing water resources. For instance, in the US CWA section 401 provides States with an indirect power to deny federal discharge permits. While the federal government lays down rules and regulations on how to obtain federal water discharge permits, it establishes a framework in which corporations must obtain a clearance at the State level, effectively allowing states to add conditions in order to obtain State-level clearances[96]. This is a classic example where a procedure established by national level government empowers subunits to go "federal-plus" while setting their regulatory threshold. Although, in the US such federal-plus regulatory threshold is placed while seeking environmental clearance, in India, projects that require federal-level environmental clearances are required to obtain a 'consent to establish' and 'consent to operate' certificate, under the Water Act, from the respective State government, allowing States to impose "federal plus" measures after obtaining environmental clearance at the federal level[97]. In Australia, federal deference, for managing water resources, in a norm rather than an exception. For instance, "The Australian National Water Quality Management Strategy" sets a "*framework of non-regulatory, non-mandatory water quality objectives and values for multiple water uses, which states, communities and practitioners can adapt if they want to local conditions*"[98]. It is a common practice in Australia, where the federal government sets in a policy structure framework giving nearly absolute power to States on how they want to govern their water resources (the only exception is 'water trigger' under significant impact as discussed in narrow federalism)[99]. The role of the federal government in this situation remains that of a negotiator and a facilitator.

[96] Duncan, D., & Ellis, C. (2019). Clean Water Act Section 401: Balancing States' Rights and the Nation's Need for Energy Infrastructure. Hastings Envt'l LJ, 25, 235.
[97] See Chapter V of The Water (Prevention and Control of Pollution) Act 1974
[98] Benson, D., & Jordan, A. (2010). The scaling of water governance tasks: a comparative federal analysis of the European Union and Australia. Environmental Management, 46(1), 7-16.
[99] Ibid at 15

As discussed in the previous chapter, the US has also, although occasionally, used *procedural favouritism*, as a tool of wide cooperative federalism reserving "special roles for States in the federal decision". In India, management of groundwater and land (both falls under the States' regulatory domain) in hydrocarbon projects (falls under the exclusive domain of Central government) is primarily done through a weak implementation of procedural favouritism. While laying down Standard Operating Procedures (SoPs) for extracting hydrocarbon resources, the State government are given room to propose regulatory changes in governing (ground) water risks, however, if the central government can defend non-adherence of States proposal based on scientific finding, them may ignore States suggestions on the wider policy framework. However, States are free to impose additional conditions under federal deference as discussed above, once the central government grants clearance at their end[100]. Usually, States are discouraged from taking federal deference routes and are encouraged to have harmonized policy frameworks. The source of discouragement stems from financial implication, especially after the implementation of the Goods and Services Taxes Act, which allows States to centrally collect (and in certain conditions) hold a large chunk States funds earned through taxes[101]. In Australia, procedural favouritism is common in matters of "significant impact" related to water resources that led to "water trigger"—effectively allowing the federal government to manage water resources but in consultation with States governments, the State governments' referrals are essential for federal to assume power in case a project has 'significant impact' on water resources.

[100] Supra 23
[101] Chaturvedi, I. (2016). The Carbon Tax Package: An Appraisal of Its Efficiency in India's Clean Energy Future. CCLR, 194.

Broad CF	The US	India	Australia
Location-based	Limited application- An exception to the norm of US EPA-led narrow cooperative federalism Water resources management in inter-state rivers are governed location-based cooperative federalism	Limited application- An exception to the norm of constitutionally laid down narrow federalism Water sensitive areas such as Mangroves forest falls under this category	Wide application- emerging policy norm for managing water resources Formalised Catchment area regulations with location-specific rules
Federal deference	Wide application- CWA provides scope for additional conditionalities to States while regulating water discharges.	Limited application— States may add additional conditionalities after Centre grants clearance; conditions must be 'harmonized'.	A norm rather than exception
Procedural favouritism	Limited application- States are allowed to give viewpoints in federal decisions, such as land management patterns; non-adherence to States' suggestion needs scientific justification	Limited Applications— SoPs set in by Centre rarely meet opposition from States due to foreseeable economic consequences.	Limited Application— Since federal government only manage water resources that falls under 'significant impact' category through State referrals.

The broad conception of cooperative federalism concerning water governance is prominently seen in Australia, where States have wider regulatory powers than the Centre, whose constitutional job is to establish a framework for policy negotiations and ensures interstate management of resources. In India, broad cooperative federalism has a limited role to play in regulating water resources, this is due to two primary reasons: (1) while territorial water resources are under the legislative and regulatory control of States, the hydrocarbons (energy sources) and related environmental matters squarely fall within the Central government's domain—this allows Centre to regulated water-energy nexus leaving limited regulatory independence at the state level; (2) the Environment Act in India empowers the central government to lay down procedural rules and regulations for granting environmental clearances and States get delegated environmental regulatory powers, leaving no space for the States to have independent regulatory framework without the constant pressure of harmonization between Centre-State regulatory regime. On the contrary, in the US, although EPA inherited wide powers, the State level regulators have wide powers to govern water

resources, especially CWA that allows States to impose additional conditionalities catering to State-specific requirements.

In this scenario, it is important to analyse how national and subnational units interact with each other to determine and assess risk related to an emerging technology, especially in wake of scientific uncertainties. A system with broad conceptions of cooperative federalism may have various approaches towards risk regulations within a jurisdiction, whereas a legal system that has controlled delegation of powers to States will have uniform risk regulation approach. Thus, a single risk in a broad cooperative federalist setting may have several different regulations with various outcomes (for instance, seven States in the US have banned fracking due to water-related risks, while States like Texas are scaling up their fracking operations and regulating water related risk with lesser threshold; similarly in Australia, while Queensland has banned fracking, other states have varying level of fracking-specific water regulations). While in narrow federalist structure, a single risk will be regulated from more or less a harmonized approach (in India, risks related to conventional and unconventional hydrocarbon—including fracking--extraction processes are not regulated differently at central level, strategically, precluding States from regulating fracking and its water-related risks). In this regard, it is important to analyse how fracking-specific water risks are determined and regulated in the three comparators. It is impractical to list down and analyse the implementation of all the fracking-specific water regulation in a cooperative federalist setting and thus it is important to limit the scope of regulations for the purpose of this study. Thus, this thesis analyses precautionary regulations applicable to fracking-specific water risks. Since precautionary regulations are set in at the stage when an *cause and effect* relationships between the technology and its impact are uncertain, regulators (at various levels of a governing system) are at an uphill task to fathom the risk associated with a technology and to find an appropriate regulatory threshold.

Chapter 4. Precautionary Approach in Regulation Fracking Related Water Risks

Over the last decade, the US revolutionized its energy sector by combining the well stimulation technique of fracking with horizontal drilling to extract natural (shale) gas from non-porous rocks[102]. The US entered the "golden age of natural gas" by commercially scaling its shale (natural) gas production to an extent that it has become a gas-secure nation and has started exporting shale gas to other countries (in 2019 the US alone produced 34 trillion cubic feet of shale gas)[103]. This triggered interest of several countries in exploring and exploiting shale gas reserves within their own territories.

Conventionally, hydrocarbons are extracted from porous rocks, that allowed movement of gases without any external force. However, most of the natural gas remain trapped in the non-porous dense rocks that require external pressure to create cracks in the rock to let the natural gas release in the collection well[104]. In fracking this pressure is created by injecting up to 13,200 m3 pressurised water (up to 10 times more than the conventional extraction process) mixed with chemicals and sand particulate. Once the pressure eases out, up to 40 percent of the injected water flows back upward carrying shale gas (predominantly methane) to the surface.[105] Without any precautionary measures, such flowback water can migrate into nearby aquifers contamination groundwater supply (in 2010, several families living near fracking sites complained that their water supply is "catching fire" asserting methane, an inflammable gas, contamination of their water supplies)[106]. Since 2010, fracking remained controversial due to

[102] Ladd, A. E. (Ed.). (2019). Fractured communities: Risk, impacts, and protest against hydraulic fracking in US shale regions. Rutgers University Press.
[103] Solarin, S. A., Gil-Alana, L. A., & Lafuente, C. (2020). An investigation of long range reliance on shale oil and shale gas production in the US market. Energy, 195, 116933.
[104] Supra 23
[105] Hammond, P. A., Wen, T., Brantley, S. L., & Engelder, T. (2020). Gas well integrity and methane migration: evaluation of published evidence during shale-gas development in the USA. Hydrogeology Journal, 28(4), 1481-1502.
[106] Chailleux, S. (2020). Strategic ignorance and politics of time: how expert knowledge framed shale gas policies. Critical Policy Studies, 14(2), 174-192.

its potential impact on water resources. Several studies empirically linked fracking activities with water-related risks such as: (1) increases greenhouse gas emission into water resources[107]; (2) asphyxiation of wildlife[108]; (3) up to 770% increase in freshwater requirement over the lifetime of a fracking well[109]; (4) up to 1440% of increase in flowback (produced) water; (5) groundwater contamination[110]; (6) seismic activities triggered by reinjection of the flow backwater into the grounds[111]. However, several contrasting studies delinked the cause-and-effect relationship between fracking and these water-related risks.

The 2016 US EPA report highlighted this conundrum asserting that: (1) during fracking activities freshwater requirements may rise exponentially over a period of time; (2) fracking may contaminate groundwater if the shale well is not properly cased; and (3) there is scientific uncertainty over methane contamination of groundwater during shale gas fracking[112]. Subsequently, the US federal government released Centre-level fracking regulations that Sates adopted in different degree of implementation[113]. While the New York State completely banned fracking, Texas scaled it to the commercial level asserting that uncertain risks should not hamper economic development[114]. Arguably, the delinking studies created a wider range of scientific uncertainties allowing the authorities to set in "minimum plausible threshold" for triggering precautionary actions at a higher level. Here it is important to note that the US did not adopt the precautionary principle officially, however, several of its regulations, including its constitutional court judgments, consider the precautionary principle as an approach toward

[107] Meng, Q. (2017). The impacts of fracking on the environment: A total environmental study paradigm. Science of the Total Environment, 580, 953-957.
[108] Anderson, S. E., Shane, H., Long, C., Marrocco, A., Lukomska, E., Roberts, J. R., ... & Fedan, J. S. (2020). Biological effects of inhaled hydraulic fracturing sand dust. VIII. Immunotoxicity. Toxicology and applied pharmacology, 408, 115256.
[109] Kondash, A. J., Lauer, N. E., & Vengosh, A. (2018). The intensification of the water footprint of hydraulic fracturing. Science advances, 4(8), eaar5982.
[110] ibid
[111] Das, I., & Zoback, M. D. (2011). Long-period, long-duration seismic events during hydraulic fracture stimulation of a shale gas reservoir. The Leading Edge, 30(7), 778-786.
[112] Supra 23
[113] Burger, M. (2012). Fracking and federalism choice. U. Pa. L. Rev. PENNumbra, 161, 150.
[114] Supra 23

regulating risk, however, this approach integrates cost and benefit analysis as one of the major components[115]. Different US states react differently to emerging technologies and their risks—these reactions a streamlined by the central regulator EPA by setting in minimum standards for environmental protection which state must meet through federal-level programs or state-specific initiatives. Moreover, EPA can veto environmental permits granted by the States in case of violation. This structure of interaction between federal regulator and States established a corporative federalist regime in the US[116].

Like the US, Indian states can not impose stricter regulations unilaterally. Law making and regulatory power on hydrocarbon vests with central government and states can only regulate water resources to an extent it harmonizes its regulations with the central policies. In 2020, the central government of India allowed exploratory fracking without any EIA process[117]. After the exploration, fracking in India can be scaled up to a commercial level without any fracking-specific regulations[118]. In 2019, the central government included the "Shale gas" within the generic definition of petroleum—implying that fracking and the standard drilling process would be subject to the same regulations[119]. In 2018, the hydrocarbon regulatory authority issued a guideline on managing environmental risks during fracking—acknowledging that the current legal regime in India does not regulate fracking-specific environmental issues such as

[115] Tickner, J. A., & Wright, S. (2003). The precautionary principle and democratizing expertise: a US perspective. Science and Public Policy, 30(3), 213-218.
[116] Leske, K. O. (2018). VETO-ING THE VETO?. Environmental Law, 48(4), 797-833.
[117] See Government of India Notification"Govt of India categorizes onshore and offshore oil and gas exploration activities as Category B2 for green clearance" available at http://dghindia.gov.in/index.php/story_details?story=182&heading=Govt%20of%20India%20categorizes%20onshore%20and%20offshore%20oil%20and%20gas%20exploration%20activities%20as%20Category%20B2%20for%20green%20clearance <last accessed May 27, 2021>
[118] Supra at 23
[119] See Government of India Notification on "Amendment to Petroleum and Natural Gas Rule 2018" available at http://petroleum.nic.in/sites/default/files/amendment_in_definition.pdf <last accessed May 27, 2021> (English translation on page no. 2)

flow back water, methane migration, a casing of fracking wells[120]. However, the same guideline did not impose any regulation at the central level.

Contrary to India, in Australia, the state governments have primary powers in regulating and legislating on fracking and its related water risks. Onshore petroleum activities are regulated by state governments since the Australian commonwealth has no specific power on regulating petroleum and mineral under the constitution (although the commonwealth can invoke regulatory power under 51 (i) and 51 (xx) of the Australian constitution). It is important to note that after fracking was considered in Australia, the federal government included a "water trigger" related to coal seam gas or large coal mining activities in its national environmental significance list—requiring state government to submit environmental data on the impact of the mining activities on water resources. However, scientific communities remained divided on the effect of fracking on water resources and the fracking-water nexus is governed by state governments. In this case, the scientific community establishes a higher epistemic level of water-related risks, the federal government may consider including "water trigger" from fracking activities as "significant impact" into the federal list invoking uniform precautionary actions. As of today, the federal government established "The Harmonized Regulatory Framework for Natural Gas from Coal Seams" (framework) that covers fracking-water related risks, but the framework is non-binding but mere recommendatory. Nevertheless, the state government enjoys primary powers in regulating fracking-specific water risks. The US, India, and Australia: all the comparators have cooperative legal systems in which national and subnational unites share powers on regulating natural resources and potential risks.

However, internal hierarchy, separation of power and the nature of constitutional rights in these jurisdictions have triggered different precautionary actions on same or similar risks.

[120]See "Guidelines for Environmental Management during Shale Gas/Oil Exploration and Production" available at http://www.dghindia.gov.in/assets/downloads/59645efa09b1cGuidelines_for_Environmental_Management_during_Shale_Gas_Oil_Exploration_and_Production.pdf <last accessed May 27, 2021>

4.1. Precautionary Regulations and Mapping of Water Risks

Extracting shale gas through fracking is a water-intensive process and since early 2010, the US, as a pioneer in commercial fracking is monitoring water risks related to fracking. The US findings on water risks posed by fracking are widely considered as a template by countries around the world that are implementing fracking as a viable technology[121]. World Resource Institute in its 2014 report estimated that roughly 38% of the area where shale resources are located is arid or under significant water stress; plus, 386 million people live above these areas[122]. Thus, assessing water-related risks associated with fracking is an important consideration for regulators before commercially scaling up the technology. After a series of studies that involved data analysis from all the US fracking sites, the US EPA released a report in 2016 on water-related risks posed by fracking and the report summarizes that regulators around the world must assess fracking-specific water risks as scientific uncertainty prevails over 'fracking-water nexus'[123]. The report clarifies that the fracking-water nexus should be regulated keeping in mind the risks that:

"(1) water requirement may rise exponentially while conducting shale gas fracking; (2) fracking may contaminate groundwater if shale well is not properly cased with cement; (3) there is a probability of methane contamination of groundwater during shale gas fracking."

A series of 41 peer-reviewed papers published by Duke University[124] echoed the same concerns but with greater magnitude. The Duke Study established a clear link between fracking

[121] Bomberg, E. (2017). Fracking and framing in transatlantic perspective: a comparison of shale politics in the US and European Union. Journal of Transatlantic Studies, 15(2), 101-120.
[122] International Renewable Energy Agency (IRENA). Renewable energy in the water, energy and food nexus. IRENA; 2015. Available at http://www.irena.org/documentdownloads/publications/irena_water_energy_food_nexus_2015.pdf <last accessed May 26, 2021>
[123] The US EPA Report on "Hydraulic Fracturing for Oil and Gas: Impacts from the Hydraulic Fracturing Water Cycle on Drinking Water Resources in the United States" available at https://cfpub.epa.gov/ncea/hfstudy/recordisplay.cfm?deid=332990 <last accessed May 27, 2021>
[124] See "Duke Study on Shale Gas and Fracking and Impact on Water Resources" available at https://sites.nicholas.duke.edu/avnervengosh/duke-study-on-shale-gas-and-fracking/ <last accessed May 27, 2021 >

and methane migration, that Texas-based environmental consultancy firms denied in a subsequent paper arguing that such methane migration is a natural process. This created a wide scientific uncertainty over the cause and effect relationship between fracking and methane migration, leaving regulators around the world puzzled about the methane risk regulations[125]. The US fracking and water-related risks are officially cited by the regulators of India and Australia while laying down fracking regulations in their jurisdictions. However, approaches to these risks vary among the three comparators. To understand how fracking-specific water risks and their uncertainties are assimilated in the cooperative federalist structures of the comparators, this section traces precautionary regulations applicable to fracking-specific water risks (namely, groundwater contamination, including methane migration; management of flowback water, and other ancillary water issues) and categorise them as per the three versions of the precautionary measures.

4.2. Tracing 'precautions' in fracking-specific water risks related to 'leakages'

One of the major concerns while extracting natural gas through fracking is 'leakages' of methane-rich shale gas into neighbouring aquifers[126]. Typically, a constructor drills the earth surface to form a tunnel till the non-porous shale rock. Later, through this tunnel, pressurised freshwater (mixed with sand and chemicals) is injected into the rock to release the shale gas. The released gas travel upwards through the tunnel along with the 'flowback' water. While the gas travels through the tunnel, it may seep into the nearby aquifers, rocks with groundwater- a major source of household supply of water[127]. Since methane is inflammable, many households near Marcellus shale reserves in the US complained that their tap water is "catching fire"[128].

[125] Supra 23
[126] Supra 123
[127] Ibid
[128] Jaspal, R., Turner, A., & Nerlich, B. (2014). Fracking on YouTube: Exploring risks, benefits and human values. Environmental Values, 23(5), 501-527.

Corporations and regulators assert that such contamination of groundwater can be easily prevented by 'casing' the tunnel through steel lining so that the inflow of the gas through the tunnel does not contaminate the water resources[129]. Moreover, in case, a corporation forms multiple tunnels in a fracking site, all the tunnels (or wells) must be integrated so that the gas does not escape from the fracking wells/tunnels[130].

Hence, there are two basic precautionary steps to regulated groundwater contamination: casing and well integrity. A look into how the three comparators apply these two precautionary measures will animate the cooperative federalism at play while highlighting how the peculiar nature of the comparators' legal systems affects the application of these precautionary measures.

In the US, although the federal government, under its commerce clause, can lay down minimum standards for regulating casing related precautionary measures at the central level, it not only leaves such regulatory decision to the States but also exempt fracking from several federal regulations such as "several major federal water statutes, including the Safe Drinking Water Act and the Clean Water Act"[131]. Such exemptions are derived from the Energy Policy Act, 2005 that envisions liberalising the energy extraction process in the US by giving regulatory autonomy to the States. For instance, the federal Safe Drinking Water Act requires States to implement federally laid down procedural "Underground Injection Control (UIC)" programs[132]. The UIC programs "contain minimum requirements for effective programs to prevent underground injection which endangers drinking water sources," however, the US EPA construed fracking outside the purview of UIC asserting that 'underground injection' does

[129] Supra 123
[130] ibid
[131] Warner, B., & Shapiro, J. (2013). Fractured, fragmented federalism: A study in fracking regulatory policy. Publius: The Journal of Federalism, 43(3), 474-496.
[132] See US EPA "Protecting Underground Sources of Drinking Water from Underground Injection (UIC)" available at https://www.epa.gov/uic <last accessed May 26, 2021>

not cover the fracking process. Subsequently, the U.S. Court of Appeals for the 11th Circuit determined that "hydraulic fracturing activities constitute 'underground injection' and must be regulated under UIC programs.[133]" However, the Congress amended the 'underground injection' definition to keep fracking outside the purview of UIC programs[134]. This, among many federally imposed, minimum requirement measures are waived off to let fracking regulated at the State level. Hence, there is no minimum basic requirement at the federal level in the US, to install 'casing' or to ensure 'well integrity'. However, the US EPA in its 2016 report, recommends the States to ensure proper casing and well integrity as precautionary measures[135]. The 2016 EPA guidelines are merely recommendatory in nature, while the few US States, including New York, Maryland, and Vermont, assessed water risks posed by fracking as sufficient to meet the threshold for triggering precautionary measures, to an extent that fracking activities were banned others, namely gas-rich Texas, triggered the precautionary measures to amend their environmental impact assessment process to include 'casing' and 'well integrity as one of the requirements to obtain environmental clearance[136].

The US "federal-level guidance but no minimum compliance" sort of approach is also prevalent in Australia. In Australia, all 18 fracking sites are commercially operative in Queensland[137]. There are no federal-level regulations specific to 'fracking or hydraulic fracturing; however, Australia's "National Harmonized Framework for Natural Gas from Coal Seams", which was initially conceptualised by the federal government keeping coal bed

[133] Legal Environmental Assistance Foundation, Inc., Petitioner, v. United States Environmental Protection Agency, Respondent, 276 F.3d 1253 (11th Cir. 2001)
[134] See The US EPA "Underground Injection Control Regulations and Safe Drinking Water Act Provisions" available at https://www.epa.gov/uic/underground-injection-control-regulations-and-safe-drinking-water-act-provisions <last accessed May 26, 2021>
[135] Supra 123
[136] Russo, T. N. (2020). A US Ban on Fracking: Implications for US and Global Energy Security. Natural Gas & Electricity, 36(6), 24-32.
[137] Hunter, T. S., & Campin, D. (2020). Regulating the Disposal of Produced Waters from Unconventional Oil and Gas Activities in Australia. In Regulating Water Security in Unconventional Oil and Gas (pp. 243-266). Springer, Cham.

methane extraction process in mind, is considered a 'best practice guideline' for conducting fracking[138]. The guideline is non-binding and does not carry any explicit incentive as such if subnational units follow these guidelines. Subnational units are 'expected' to submit reports on compliance with the guideline, hence, the national level government maintains oversight responsibility for fracking activities. Like the US States, the reactions to the fracking-specific water risks at the subnational unit level varied greatly; while New South Wales and Victoria have issued several moratoriums, over time, against fracking activities, Queensland has commercially escalated fracking activities[139].

In India, risks related to fracking are regulated through the environmental impact assessment process, effectively at the central level (state-level environmental clearance may be sufficient for small projects but none of the fracking projects yet fall under this category)[140]. Oil and gas and comprehensively 'hydrocarbon' regulations by the purview of the Indian constitution fall under the domain of central government. Since 2012, the central government, through a series of legislative and policy framework changes, has deregulated fracking-specific risks by erecting a policy framework that does not differentiate between conventional and unconventional extraction process[141]. Hence, subnational units, too, can regulate fracking categorically as it may stand directly in conflict with the central level regulations. To understand, this conundrum in a nuanced manner, it is important to see risk regulations from two perspectives: (1) regulating risks before allowing any activity to escalate at the commercial level, namely taking precautionary measure and (2) managing risks once the activity is allowed. The subnational units in India may impose stricter water regulations to 'manage' the risks but not as a precautionary measure—since fracking-related environmental clearance is granted at

[138] See the policy at https://energyministers.gov.au/publications/national-harmonised-regulatory-framework-natural-gas-coal-seams-review-and-name-change <last accessed May 27, 2021>
[139] Supra 137
[140] See EIA Notification 2020 at http://environmentclearance.nic.in/writereaddata/Draft_EIA_2020.pdf <last accessed May 27, 2021>
[141] Supra 123

the federal level. The deregulation of fracking-specific risks is done through a series of policy and legislative changes, under the federal government-led under its 'ease of doing business policy'[142], that has reinterpreted its oil and gas regulations by (1) amending the generic definition of 'petroleum' to include shale gas, (2) allowing the extraction of unconventional natural gases under the licensing regime that was primarily given for conventional gases extraction, and (3) clarifying that 'hydraulic fracturing does not require a sector-specific environment clearance process[143]. As of today, fracking is regulated through the same set of regulation as any drilling process in India and thus fracking-specific water challenges in India remain unaddressed at the national and subnational level. The federal-level government assert that precautionary measures related to fracking-specific water risks are taken into consideration on a case by case basis while granting such projects environmental clearance. However, there is no fracking specific environmental clearance manual at the federal level and the common yardstick (referred to as general 'terms of references' in an EIA process) that apply to conventional process (not requiring casing and well integrity) are also applicable to fracking[144].

There are no explicit regulations to implement casing and well integrity as a precautionary measure to avoid fracking-specific water risks in India at the central level, which also preclude subnational units to impose any such precautionary measure. Subnational units in India are required to harmonize their policies with the federal government and can only impose stricter regulating while 'managing' the water-related risks (since water falls under the State domain) and not while ascertaining the threshold levels. Interestingly, the federal government of India released the 'Environmental Management During Shale Gas/Oil Exploration and Production'

[142] See Government of India, Ease of Doing Business Policy at https://www.makeinindia.com/eodb <last accessed May 27, 2021>
[143] Supra 123
[144] ibid

guidelines[145], that recognise the fracking-specific water risks and states that before granting environmental clearance to fracking projects, the national government must ensure 'casing' and 'well integrity on a case by case basis. The guideline while highlighting that "implementation of the fracking process, being a water-intensive process, may change India's water dynamics, primarily due to (1) rate of water consumption throughout the process, and (2) contamination of groundwater (aquifer) due to insufficient fracking well construction and design," concludes that the government does not propose a sector-specific environmental clearance process for fracking or a comprehensive risk assessment of the fracking sites in India.

4.3. Tracing 'Precautions' in Fracking-Specific Water Risks Related to 'Flowback Water'

Although the basic nature of regulations applicable to leakages, in the three comparators, also applies to flowback water, it is important to highlight a few exceptions that are specific to the flowback water regulations.

In the US, the methane and chemical-rich flowback water (around 10-40 % of 5-10 million gallons of water per fracking activity), is disposed of through reinjection, attracting special attention for the need of regulations under UIC programs. Hence while casing and well integrity is left to subnational units regulations, (re)injection of flowback water produced from fracking that used diesel fuels, requires States to adhere to the federal-led UIC programs. Moreover, although US EPA does not ban reinjection of flowback water, States have either banned reinjection or regulated it to a higher threshold than other fracking-related water risks as scientific literature links such reinjection with seismic activities.

An important exception to the US federal deference approach while regulating fracking-water risks is disclosure requirements in federal land, a location-based approach,—corporations are

[145] See the guidelines at http://www.dghindia.gov.in/assets/downloads/59645efa09b1cGuidelines_for_Environmental_Management_during_Shale_Gas_Oil_Exploration_and_Production.pdf <last accessed May 27, 2021>

required, under federal law, to disclose the composition of the shale gas fluid before injecting it in the surface while doing fracking[146]. This disclosure is although not regulated by the US EPA and is a part of the requirement under land regulations laid down by the US Department of the Interior's Bureau of Land Management.

In Australia, flowback water is regulated with the same process of 'federal deference' where States' may make their regulations with 'desirable' compliance with the federal guidelines. However, here it is important to mention the National Water Initiative (NWI), a multiparty agreement between the Australian national level government and (among) subnational level government to share their water resources[147]. The NWI provides an exclusion in which parties facing specific needs related to petroleum and natural gas-related water requirement can go beyond the NWI frameworks and States may enter into specific arrangements among themselves. This may allow subunits to procure a high amount of fresh water requirement for fracking purposes. It is also important to reiterate here that in exceptional circumstances, national units, through the reference of subunits, may regulate water-related matters with "significant importance"[148]. To date, flowback water is largely regulated by the State-specific regulations and the federal government has only laid down recommendatory guidelines.

In India, while the national government lays down case by case requirements to manage flowback water while granting environmental clearance, States may impose extra conditionalities, post clearance, while granting consent to operate or managing water pollution levels. There are no fracking-specific flowback water regulations at the national level and the generic regulations under the Water Act as discussed in chapter 3 apply to fracking as well. In this situation, the States may invoke their constitutional power to go "federal-plus" while

[146] See the US Congressional Research Service (2015) "Hydraulic Fracturing and Safe Drinking Water Act Regulatory Issues" available at https://fas.org/sgp/crs/misc/R41760.pdf <last accessed May 27, 2021>
[147] Supra 137
[148] ibid

managing the water pollution in their territory. It is important to note here, that the States' federal-plus prerogative is dependent upon the fact that the Centre has chosen not to regulate that particular matter. Since flowback water is a hydrocarbon-extraction related issue, the Centre may lay down binding rules and States must comply with them or harmonize their provision to avoid any conflict[149]. The judicial precedence of Centre dominance over Centre-State conflict in oil and gas-related matters is clear on this position[150]. Under the federal-led environmental clearance process, the only explicit fracking-related guideline is that fracking corporation must reveal their shale fluid chemical composition, irrespective of the State in which such project is executed.

Tracing regulation of casing, well integrity, and flowback water, in the comparators, reveal how national and subnational units interacted with each other to regulate the water risk. However, these interactions were predominantly guided by the precautionary approach of the comparators. In version 1 of the precautionary principle, in case of scientific uncertainties, the regulators may impose a threshold level of risk regulations. In the US and Australia federal government leaves it to the States to impose precautionary regulations on fracking-specific water risks and thus federal-State interactions in both the comparators roughly follow the liberal version of the precautionary principle. In the US, version 2 where regulators must regulate risk in case of scientific uncertainty is applicable in a location-based approach where disclosure of shale fluid is essential in federal lands. Moreover, minimum compliance is laid down through version 2 in the US at the federal level while disposing of flowback water through (re)injection in case of using diesel propellent. In Australia, the fracking-specific water risk is ascertained through the national level guideline as casing, well integrity, and flowback

[149] Supra 123
[150] Ram Mohan, M. P., & Kant Yadav, S. (2021). The Oil and Gas Sector in India: Balancing Business Policies and Public Interest by the Supreme Court of India. Global Energy Law and Sustainability, 2(1), 1-21.

water is regulated in all the subunits and a best practice recommendatory guideline exists at the federal level.

In India, the Central government's fracking-related risk regulation met an obscure approach where it deregulates any fracking-specific water issue but equating fracking with conventional extraction methods. Although the central government in 2018, list the prevailing scientific uncertainties in its guideline, it concludes by stating that it will regulate any water-related risk on a case by case basis. Hence indicating that uncertainties do not warrant regulations. State governments in India may impose minimum thresholds while regulating water risk but such threshold should not overlap with any regulations laid down by the federal government. Currently, neither casing nor well integrity is regulated in India, either at the national or subnational level. Also, the Centre does not regulate flowback water-related risks despite acknowledging the risks in its 2018 guidance[151]. State governments are also excluded from regulating these risks as a precaution (as a part of granting environmental clearance, since EIA is granted through a national level process in which States are stakeholders but not regulators) but may 'manage' these risks once the clearance is granted. In this situation, it is safe to assume that India's approach falls under version 1 of the precautionary principle, where regulators may regulate risks in wake of scientific uncertainties. It is noteworthy here that the apex court of India, though, have expressively adopted version 3 of the precautionary principle in which the regulator must shift the burden to the operator on establishing that the technology at issue is environmentally benign. One may argue that such burden is shifted through the EIA process in which the operator must obtain the clearance; however, by deregulating fracking and equating it with conventional oil and gas extraction process, the Centre has categorically determined not

[151] Yadav, S., Sarangi, G. K., & Ram Mohan, M. P. (2018). Challenges in Shale Gas Production Cannot Be Resolved by Generic Environment Clearance Processes. Economic & Political Weekly, 53.

to regulate fracking-specific water risks in wake of scientific uncertainty – squarely falling into the version 1 category where regulators do not inherit a responsibility to regulate risk.

At this stage, it is important to understand how these regulations can be contextualised within the theoretical context of cooperative federalism and to ascertain if a certain type of 'cooperative federalism' affect the implementation of these precautionary measures. To this effect, the next chapter briefly maps the finding of this chapter with the various types of cooperative federalism.

Chapter 5. Mapping Precautionary Regulations and Cooperative Federalism

This chapter maps the previously discussed precautionary measures with theoretical context of the cooperative federalism and understand how different approaches to cooperative federalism affect risk regulations in the case study of fracking-specific water risks.

5.1. Narrow Cooperative Federalism

While India regulates fracking-specific water risks by vesting almost an exclusive power to the national unit, the US and Australia reserve narrow cooperative federalism for exceptional circumstances (for instance use of diesel prepollent while fracking is regulated at the national level, matters with 'significant impact' falls under the national domain in Australia). This section discusses regulations of fracking-specific water risks through the narrow conception of cooperative federalism and assesses the specific characteristics of the comparators that facilitated such a narrow approach.

In India regulations of fracking, specific water risks are done through a national level environmental clearance process on a case by case basis. Although the States under whose jurisdictions that project falls remains a stakeholder, the regulations are imposed and the risk threshold is determined at the national level[152]. States may impose water-related regulations once the project is passed, to 'manage' the risks. Regulators may impose risk regulations measures during the EIA process but it is not mandatory as a precautionary measure at the national level. Since oil and gas are exclusively regulated at the national level and national government gain predominance over any conflict between Centre and State over subject matter[153], subnational level government can only regulate fracking-specific water risks in two

[152] See EIA Notification 2020
[153] Supra 151

situations: (1) as a stakeholder giving a recommendation, when national-level government grants environmental clearance to a fracking process in the respective territory of the State; or (2) once the clearance is granted, subunits may exercise its constitutional power to impose strict regulations in disposing of flowback water to 'manage' risk. This establishes a narrow approach to cooperative federalism in India where the national government predominantly lay down a detailed framework, as in this case an environmental clearance process, leaving only water risk management related power (rather than precautionary powers) at the subnational level. This arrangement is not merely compliance-based narrow federalism as the national government not only lay down minimum pollutant levels but also lay down (and also implement in consultation with subunits) procedural aspects of risk regulation through the EIA process. Thus, in India, no subunit can unilaterally ban fracking based on location-based water risks (in India several States have hit groundwater zero and groundwater depletion rate in India remains highest in the world—more than the combined rate of China and the US[154]). Since the minimum standards are set on a case by case basis at the national level and the procedure is also set in by the Environment Act at the national level, subnational units are reduced as a stakeholder 'without any teeth'. Hence, India's water-tight compartment of constitutionally served distribution of powers between Centre and State and Centre's dominance in case of any conflict severely affect the application of the precautionary measure to regulate fracking-specific water risk. Currently, there is no national-level standard guideline on the casing, well integrity, or management of flowback water.

The US approach towards environmental regulations, through EPA minimum compliance-based regulatory approach, majorly falls under the narrow conception of cooperative federalism, thus having almost a uniform basic standard of environmental regulations.

[154] See Water Aid 2020 report available at https://www.wateraidindia.in/media/ground-water-our-most-precious-buffer-to-climate-change-requires-our-action-and-attention <last accessed May 27, 2021>

However, fracking like most energy projects is exempted from such a federal-led compliance mechanism. However, in two specific case, the US retains compliance-based narrow federalism: (1) while allowing fracking activities in federal land, the national level government lays down detailed rules on the regulation on flowback water and casing requirements; (2) due to high-risk thresholds, shale fluid using diesel proponents are regulated through national-level regulations. Apart from these two measures, the national level government, on the casing, well integrity, disposal of flowback water, precludes itself from making any binding regulations. Although the US EPA issues guidelines and scientific finding, they remain merely recommendatory in nature. One may argue that limited application of narrow cooperative federalism in the US fracking-water regulations is since the national government does not attain a direct constitutionally driven power over oil and gas resources, rather it invokes a commerce clause to impose financial implications on States that do not adhere to minimum environmental standards. This allows US EPA and the subunits level agencies to establish a flexible relationship in which the US EPA may defer itself from regulating a specific aspect of water risk regulation by assuming a role of a guide, rather than a regulator.

Similarly, in Australia, the national level government gains power over water risk regulation through the trade and commerce clause and hence refrains itself from regulating any aspects of natural resources management at the subnational level. A well-laid down mechanism of 'significant impact', in which through a referral from subnational units, the national government can impose regulations on certain matters as discussed in the previous section. Such a 'significant impact' mechanism is yet not triggered for the fracking-related water risks and hence there are no instances for narrow cooperative federalism in Australia. It is important to note that the national level government releases a harmonized framework on managing coal seam gas (including fracking) related risks—the framework remains non-binding in nature and often serve as a minimum compliance guideline. Like the US, the fact that oil and gas,

constitutionally, do not fall under the exclusive domain of either the national and subnational helps Australia to adopt a flexible approach towards managing water risks.

Narrow CF	**The US**	**India**	**Australia**
Compliance-based	National level specific disclosure agreements for fracking risks in federal lands	National level establish minimum pollutant levels at risk regulation level	National level compliance only trigger once the activity has "significant impact"
Program-based	Fracking-exempt from program based compliance	All sub units must comply with the environmental clearance framework set at national level.	No Program-based compliance is required.
Structure	US EPA assumes role of a 'minimum compliance authority' as an extended interpretation of 'commerce clause'. No direct constitutional provision empowers national level to establish sanctions for non compliance.	Oil and Gas is under Centre's domain as per the Constitution. Moreover, in Centre-State conflict; Centre's role is given priority.	No constitutional power at national level to regulate oil and gas sector. On contrary, States empowered to regulate natural resource. Inter-state commerce is regulated at national level.
Impact	No national level fracking-water regulatory regime.	National level deregulation of fracking-water risks. States may regulate to manage risk but no to prevent the risks as clearance is granted at national level.	No national level fracking-water regulatory regime.

5.2. Broad Cooperative Federalism

Both Australia and the US do not have a constitutionally defined competence over hydrocarbon and water resources. Both these comparators derives national level competence over water risk regulation through commerce clause (interstate) and reserves national-level power to regulate risks in case of exception scenario. This arrangement has been possible since the legal system sees national units as a negotiator/ guardian rather than a regulator. In India, the Constitution leaves little space for national and subnational units to broadly coordinate with each other without any sanctions or financial implications. This majorly affects the risk regulation at the

local level. For instance, both in the US and Australia eco-sensitive areas have unilaterally banned fracking by raising the federally-prescribed threshold levels. In India, however, none of the subunits, despite having several water-stringent areas could ban fracking or impose stricter precautionary regulations. The constitutionally-derived subunit level regulatory power over water resources only allows the subunit level regulators to manage the risk after the national level regulator had granted the permission to operate based on a uniform guideline. This severely undermines the risk regulation in two glaringly visible manners: (1) this approach ignores location-based water requirement- although States are consulted while granting clearances, their role at precautionary level is merely reduced as a consulting stakeholder; (2) this approach fails to harmonize the regulatory thresholds set in by national and subnational units as it precludes State level government to impose stricter threshold while assessing the risks of emerging technology. For instance, in August 2020, the national level government unilaterally exempted all hydrocarbon exploration techniques, including fracking, from obtaining environmental clearance. Exploration level environmental clearance significantly help regulators in determining location-specific risks of technology. Thus, at present, no subnational unit may impose an environmental clearance mandate, let alone issuing a moratorium.

Both Australia and the US significantly used federal deference, as explained earlier, by explicitly precluding itself from regulating fracking-specific water risks at the national level. While, at the same time both the comparators called for a harmonized approach by laying down best practice non-binding guidelines that subnational units are advised to follow, to better manage the risk. The risk regulations rules on the casing, well integrity, and flow back water at a subnational unit level were derived from such scientifically assessed in the national level guideline.

A major difference in the US and Australian approach to regulating fracking-specific water risks is how they perceive location-based cooperative federalism. The US regulate federal lands, as they fall under their competence but expressively preclude itself from regulating fracking-specific water risks through the national level Water Act, leaving aside a chance of location-based regulation. Australia, on the other hand, keeps the "significant impact" provision intact, keeping the option of triggering water risk regulation at the national level. The procedural framework on how national-level risk regulation can be triggered is sufficiently laid down at a national level statute and subnational unit level governments are actively involved in triggering the "significant impact" provision. Here it is important to mention that certain north-eastern States in India have special powers to regulate their land resources but the Supreme Court of India has expressively excluded hydrocarbon resources from such 'special powers of the States, leaving out any scope of broad cooperative federalism.

Broad CF	**The US**	**India**	**Australia**
Location-based	Federal lands are regulated through national level land laws—reinjection of flow back water is regulated	No specific regulation	Location-based national level regulations can be trigged through a consultative process. No instance on record
Federal-deference	Federal government expressively exempt itself from regulation fracking-specific wate regulation; state specific regulations	Federal level government involves subnational units for consultative process but does not defer its powers.	Federal deference is the norm.
Procedural favouritism	National level guidance on regulating fracking-specific risks exists; States are expected to follow them but no explicit incentives are mentioned.	No specific regulation	A harmonized policy on hydraulic fracturing risk regulation exist; no specific incentives but national level government may trigger "significant impact" provisions.
Impact	Contrasting regulation on similar risks. regulatory requirement	Uniform (de) regulation, precluding states from regulating fracking-specific risk as precautionary measures	Contrasting regulation on similar risks.

Chapter 6. Conclusion

This research applies the theoretical framework of cooperative federalism to the fracking-specific water regulations in the US, Australia, and India. While doing so, the research highlighted specific characteristics of the comparators that impact the risk regulation. These specific characteristics are highlighted by analysing various legal instruments that implement precautionary measures while regulating fracking-specific water risks.

The research finds that a constitution that exclusively lists down national and subnational level powers limits the scope of interaction between and among the various level of its governing system. Such limited interaction may hinder subunits to adopt localised precautionary measures, and can also move natural resources regulation closer to the 'exclusive' control rather than a 'cooperative' control. This finding is amplified through the Indian case study where oil and gas is constitutionally a subject matter of national-level government; although water resources fall under the State Subject—the national government effectively (de)regulate fracking-water nexus precluding States from having subunit level or location-specific precautionary risk regulations. The judicial affirmation of the Centre's dominance in case of a conflict decreases the Centre-State cooperation to develop a harmonized precautionary framework allowing the Centre to unilaterally take decisions on risk regulations.

On the other hand, in case of the absence of such listing of subject matter specific competence in the constitution, the national level government may implement minimum regulatory standards across all the subnational units by imposing financial sanctions derived through constitutional provisions that give federal government competence over commerce and trade. However, national-level legislation that lay down such sanctions ensure procedural freedom to the States and also empowers States to go beyond the federally prescribed minimum standards. Since such financial sanctions are subject to greater scrutiny as they are derived powers at the national level from an expansive interpretation of "commerce clauses" rather than a

constitutionally-prescribed power, national units focus more on harmonization and less on command-control measures. Judicial precedence in such an arrangement also avoids granting exclusive regulatory control as it may travel beyond the constitutional contours of a jurisdiction.

Usually, after attaining risk regulatory powers through commerce clauses, national-level governments lay down minimum basic requirement and defer their powers allowing sub-national units to adopt location-specific localised risk regulations. In such systems, a single risk may have various level of precautionary regulations and thus all three versions of the precautionary principle may see an implementation within one legal system. For instance, in the US Texas regulators may regulate methane migration into groundwater while regulating fracking operations; whereas in New York State, since fracking operators can not rule out the possibility of methane migration into groundwater, fracking operations are banned. Similarly in Australia, Queensland regulators may impose precautionary measures on fracking-related groundwater contamination following the federal level harmonized guidelines, where Western Australia regulators imposed stronger than federally-guided regulations to avoid fracking-triggered groundwater contamination.

These findings are supported through mapping of the fracking-specific water risk regulations with five categories of the cooperative federalism; reflecting that narrow cooperative federalism, that works on sanctions, may allow adoption of a uniform (or restricted) version of the precautionary measure; while broad cooperative federalism allows adoption of various versions of the precautionary measures within one legal system. This is amplified, in the thesis, through extensive case studies and a detailed enquiry of how each subtype of cooperative federalism interact with risk regulation measures.

A comparative analysis of the cooperative federalist structure of the US, India, and Australia, in the thesis, overarchingly reflected that precautionary risk regulations of natural resources are impacted by the structure and manner in which a constitutional scheme lay down the interaction between its national and subnational units.