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A pragmatist approach to audit practices: two cases of technical dialog from nuclear risk governance in France

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Abstract:

Audits are increasingly used by risk governance as a mode of risk management (Power, 1997). They are known to be successful when auditors are both independent and competent, and to be influenced by the effects of valuations, formalization, informal interactions and vocabularies employed in the field. However, very little research clarifies how audits occur in practice from start to finish.

This paper aims at contributing to the analysis of audit practices through a study of nuclear risk governance in France. Audit dialog, here called "technical dialog", are based on "safety demonstrations". We propose a pragmatist approach based on Dewey's Theory of Valuation (1939) in order to investigate methods that are used by field actors to demonstrate or assess safety.

We draw from two cases, the preparation of a safety demonstration by a nuclear operator and the production of a safety assessment by the IRSN (the nuclear technical support organization in France). For each case, we carried out a document collection (e-mails, work documents, meeting reports…, 404 doc, around 10.000p. total) that we complemented with 11 interviews (18h. total). We analyzed each corpus through their intertextuality and then made a narrative analysis of the production of each official document.

The overall value of our results is that they shed light on the "technical dialog", a little-known risk governance device, through a detailed description of field actors conducts. Surprisingly, they show that the technical dialog is not a place for exchanges of certainties and justifications, but of doubts and beliefs. In this context, we identify several features of the technical dialog. First, auditor and auditee manage beliefs and doubts differently depending on their own situations and interests. But secondly, both apply the same work categories, related to (1) managing attention paid to document reading (2) use of the document to solve a problem and (3) collection of written resources. Finally, we identify the role of this work in the (different) management of beliefs and doubts.

These results invite to understand the classical factors of audit practices from their practical consequences, getting activity as a starting point and aiming at understanding how both auditor and auditee experience the dialog. The paper calls more broadly for a renewal of risk governance, paying attention to how actors manage doubts and beliefs. Suggestion is made to practitioners to highlight the importance of dialog, of doubt production, and of sizing of bureaucratic work.

Keywords: Audit, Risk, Case Study, Processual Approach, Interactionist Approach

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INTRODUCTION

The existing literature on audit shows that in finance, veterinary services, chemistry or oil and gas industries, actors construct risks and evaluate them through audit practices. We identify that very few papers describe concrete audit processes in detail. And yet this is the key to revealing the crafts of internal and external auditors. Thus, this paper aims at renewing the understanding of audit practices (i.e. their characteristics, performance criteria, and valuation practices) and more broadly the understanding of risk governance. Through audit practices, this paper also aims at returning its theory to other field practices. We thus chose to write a mainly empirical paper, placing our theoretical considerations somewhat in the background to bring our interpretations of audit practices to the fore.

We shed light on a very particular audit practice: the "technical dialog" that is currently used in France to govern nuclear risks (Rolina, 2010). Our paper shows that nuclear safety is a founding value, not only for cultural reasons (i.e. the existing "safety culture") but also due to very concrete audit practices that prioritize safety over any other competing industrial objectives. In order to obtain authorization for creating, operating, or dismantling a nuclear installation, each nuclear operator must demonstrate to the Nuclear Safety Authority (ASN), and the technical support body, the Nuclear Safety and Radioprotection Institute (IRSN), that there will be no problems in the field. This technical dialog reflects the rise of audit practices as a mode of managerial control of risks, as identified by Power (1997).

We studied two dismantling projects. This type of project is associated with a high level of uncertainty (IAEA, 2016). It forces nuclear operators and regulators to adapt their safety demonstration and safety assessment practices accordingly, prompting them to dialog more than usual. Obviously, interorganizational dialog is always a necessity for audits. First because what is to be controlled is never fully defined, second because the frame of reference is never perfectly clear nor fully given in advance.

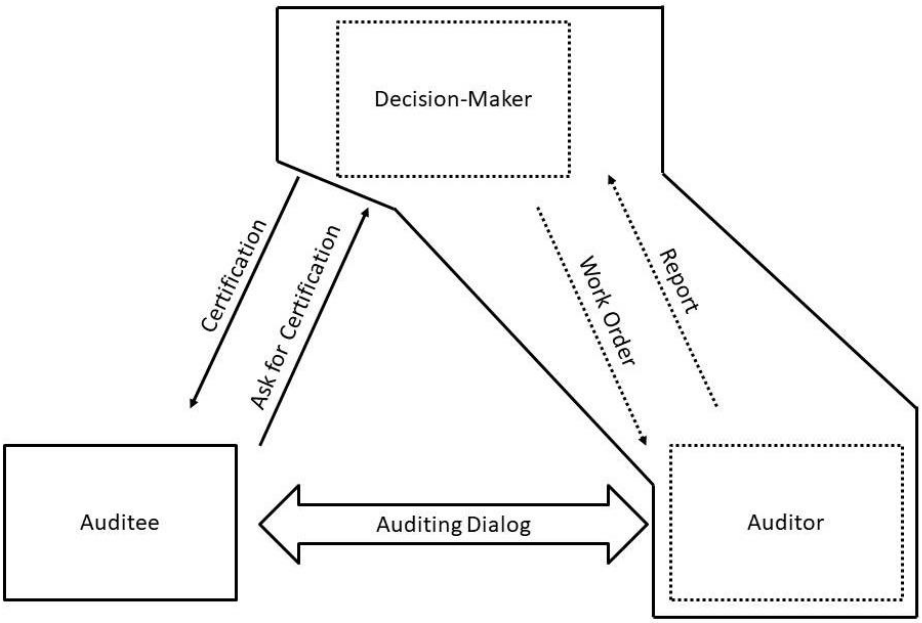
We draw on Dewey's Theory of Valuation (1939), which provides elements for understanding a situated elaboration of values. The originality of our approach is that our analysis is not developed from a pre-existing set of values, enacted by actors in situations or inscribed in written traces. Instead, we are looking at methods by which actors value and appraise issues and challenges related to the risks they manage through audit practices. We thus show that sense of mission is not crowded out by paperwork, but is continuously enacted through paperwork done "for a good cause": nuclear safety.

1. THEORETICAL BACKGROUND

1.1. AUDIT PRACTICES IN RISKY INDUSTRIES

Our theoretical gap is found in risk management and audit practices literature. While these practices are related to very distinct dangers, they share a common structure and process, illustrated in figure 1, which tend to spread in contemporary societies (Power, 1997).

Figure 1: Auditor-Auditee Relationship



Two performance criteria for audit dialog can be found in the literature, the first being the auditor's independence. In financial audits, Herda and Lavelle (2015) show that the objectivity of auditors can be affected by a lack of independence from their client. The second criterion is the auditor's competence. Works by Bonnaud (2005, 2011) on classified installations inspectors show how their professional skills evolved from technical to bureaucratic skills. These two performance criteria of how actors lead the audit dialog are the

determinants of audit quality at the organizational level and appear to be contradicting each other (Richard, 2006).

The literature also examines three characteristics of these relationships. Firstly, it looks at the formalization of the auditing dialog in texts. In the Norwegian petroleum sector, Jordan et al. (2013) show that risk maps are useful for articulating distributed actors and thus for supporting risk management. The second characteristic is the informal communicational dynamics that overflow the text content. Through safety audits of seven petrochemical plants, Grote and Künzler (2000) show that safety culture audits are useful to measure safety perception, but that deeper enquiries would be needed to obtain information on behaviours and attitudes. Finally, the literature shows the importance of the vocabulary used. Erb and Pelger (2015) show that "reliability" is difficult to define, and even more so in financial audit contexts where "fair value" has to be assessed.

The literature also highlights sociological factors impacting valuation processes in audit practices. Power (2015) underlines that accountability activities are embedded to social infrastructures. Hardy and Maguire (2016) show how risks are discursively elaborated, which is important as financial audits are retrospective and the technical dialog is prospective. The work of Mennicken and Power (2015) on plasticity of valuation is also important, as dismantling projects are associated with high uncertainties to be managed through valuation adjustments. Boholm and Corvellec (2015) can also help in analyzing how actors may overemphasize some types of risks.

Yet, the literature places little emphasis on the methods used by field actors to demonstrate or assess what has to be evaluated, depending on the risks to be managed. Therefore, in order to do that, we propose a pragmatist approach to audit practices in risky industries.

1.2. A PRAGMATIST APPROACH BASED ON DEWEY'S THEORY OF VALUATION

To fill this gap, we propose a pragmatist approach to audit practices based of Dewey's Theory of Valuation. We are thus following on from the interactionist sociology approaches (Becker, 2007; Tillement et al., 2009) inspired from pragmatist philosophy. Belief is one of the cornerstone notions of pragmatist philosophy. It thinks of them not at a strong religious level (Friedland, 2014; Kouabenan, 2009), but more popularly as a prerequisite for action, as a *habit of action* (Lorino, 2014, 2018).

We propose to consider "valuation" processes as an analytical means to get to the way actors move from one belief to another. Dewey (1939) defines valuation as *an action elaborating a value judgment on a past action and a rule determining a future action*. This notion helps to think of values aside from cultural explanations, and to focus on practices and how they (re)define values.

The Theory of Valuation is useful for the study of audit practices, as it benefits from the fact that Dewey's pragmatism delves into the collective justification of beliefs. Like other pragmatists, Dewey disregards ontology in order to focus on method, i.e. the *conduct of human action*. Focusing in the same way on transitions between beliefs let us unfold the way mediations are more or less dialogical (Lorino, 2018). Dialogism outcomes in action and meaning less trapped into rules and more coherent with concrete situations, which is important in audits and even more regarding decommissioning projects.

By intersecting Dewey (1939) and Peirce (1877), we identify three modes of valuation distinguishable in a context of demonstrations and assessments, and summarized in table 1.

Table 1: Modes of valuation

	Valuation by authority	**Valuation by theories**	**Valuation by inquiry**
Fixation of beliefs (Peirce, 1877)	Morally superior entities decide on the appropriate beliefs and suppress any others	Beliefs are fixed from what pleases the individual's reason	Beliefs are elaborated by processes made controllable by other individuals

For the sake of clarity, let us give a fictional example by imagining a group of experts having to assess the reliability of a set of technical solutions. If they just refer to an authoritative reference to tell what solutions are reliable and what solutions are not, they apply *valuation by authority*. If they delve into each solution but limit themselves to their preexisting ideas about the technology at hand, they apply *valuation by theories*. If they unfold their assessment process so that other groups can criticize and complement their way of thinking, they apply *valuation by inquiry*.

2. METHODOLOGY

Our research process is inductive and designed from the grounded theory of Corbin and Strauss (2015). To be coherent with our vision of auditing dialog as a relationship, we investigated both sides of the dialog. An originality of our research is to combine two cases in one study, looking at both the auditor's and auditee's side. Furthermore, we collected data on both sides in each case in order to grasp the back-and-forth communication dynamics.

2.1. RESEARCH SETTINGS

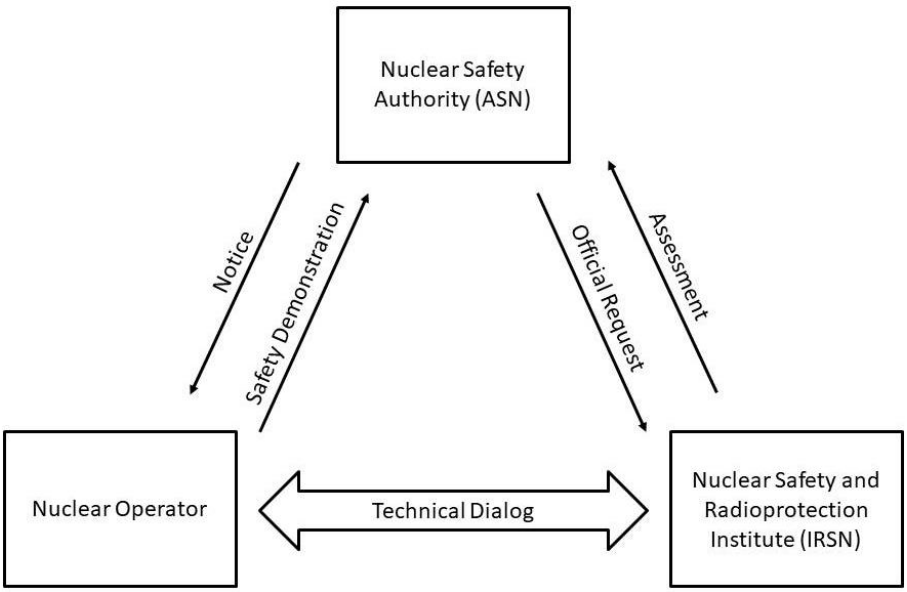
We studied two cases of technical dialog. They are justified by regulations, as any nuclear operator wanting to construct, operate or dismantle a nuclear installation in France must ask for authorization from the Nuclear Safety Authority (ASN) under the law on transparency and nuclear safety (TSN) of June 13 2006. In order to obtain this authorization, the operator must demonstrate its capacity to maintain operations within an acceptable level of nuclear safety, through a "safety demonstration". The safety demonstration is defined by reglementation in this way:

> "Set of elements contained or used by the preliminary safety report and the safety reports […] and contributing to the demonstration […], which justify that accident risk, radiological or not, and the magnitude of their consequences are, considering current knowledge and practices, and facility environment vulnerability, as low as possible within acceptable economic conditions." (February 7, 2012, decree, article 1.3, translated by us)

As we see, the legal definition of "safety demonstration" implies "economically acceptable conditions", for which the nuclear operators are the most authoritative.

In addition, the ASN does not have the technical skills necessary to assess elements of the demonstration. Thus, it asks for an assessment from the Nuclear Safety and Radioprotection Institute (IRSN), which is the national public expert for radioprotection and nuclear safety. This places the IRSN and nuclear operators into what actors call the "technical dialog", illustrated in figure 2.

Figure 2: The Technical Dialog



Each case is related to the dismantling of a nuclear installation involved in nuclear fuel production. The first one is called 'Demonstration case' because it occurs within a nuclear operator's organization, and is about the elaboration of a safety demonstration. For the operator, there are uncertainties related to the dismantling project, which the auditing dialog helps to solve. Installation dismantling will require specific and unusual technical solutions, namely the continuous mobilization of 80 rope-access technicians, and in January 2013 the operator is afraid that regulators may stop its industrialization once started. Thus, in June 2013 it initiates an auditing dialog with IRSN (technical dialog in fig.2) while preparing a dossier summarizing its safety options (which is not a mandatory document for dismantling projects, safety demonstration in fig.2, sent in Novembre 2013).

The second case is called 'Assessment case' because it occurs within IRSN's organization, and is about the elaboration of a safety assessment. For ASN (official request in fig.2, February 2010), and then IRSN (internal request, May 2010), there are uncertainties about the nuclear operator's management of its relationships with its subcontractors. The nuclear operator plans to massively hire subcontractors, but it delegates to them some of its responsibilities related to safety (for example management of safety documentation and safety skills). Thus, human and organizational factor experts enquire about these issues from May to December 2010 (technical dialog in fig.2) in order to make recommendations to ASN (assessment in fig.2, March 2011).

2.2. DATA COLLECTION METHODAND ANALYSIS

Our data collection methods were mainly based on the collection of material traces of past audit practices. This is different from a neutral document collection (Bowen 2009) as we sought to reconstruct actors' activity from archives. Interviews, used to complement this approach, were organized from the results of document analysis. Such a non-reactive approach (Brewer and Hunter 1989) was suitable for our setting. Field actors were willing to help us understand the technical dialog, while valuing an approach with a minimum of interference between our inquiry and theirs. We thus adopted a "transactional relationship" (Cunliffe and Alcadipani, 2016).

For the Demonstration case, the writing process of the nuclear operator was informal and related to the early stages of the project. Thus, we used interviews in order to complement the gaps in the documentary corpus. We collected 47 documents (e-mails, slide shows, reports... around 750 pp. total) and conducted 8 interviews (1 non-structured and 7 semi-structured, 12:45 hours, 192p.). For the Assessment case, we had access to a greater number of documents from IRSN. Interviews were used to confirm/troubleshoot our understanding of the documents. We collected 357 documents (e-mails, work documents, nuclear operator documents... around 9000 pp. total) and conducted 3 interviews (1 non-structured and 2 semi-structured, 5:05 hours, 102p.). For both cases, a table summarizing document types is provided in appendices.

2.3. DATA ANALYSIS TECHNIQUES

Our data analysis techniques are based on document analysis and narrative analysis. First, we carefully read the documents and classified them by categories depending on their format, author, addressee and purpose. We then analyzed the intertextuality of each corpus, in categories relevant for the field and consistent with the academic literature. We used Cytoscape software to systematically analyze our two documentary corpora. As it associates a database with a dynamic visualization of the resulting network, it keeps our categorizations of documents and of intertextuality in memory while giving us a bigger picture of the whole corpus. For this article, intertextuality analysis is merely an entry point for us into the bodies of documents. It is worth mentioning for transparency, but our results are not based on this data analysis technique.

In order to make explicit actions that occurred in the field, we performed a narrative analysis of (1) the final demonstration and assessment documents and (2) their elaboration processes. De Loo et al. (2015) recommend basing narrative analyses on one or two frameworks, so that one can understand how the tale told by the researcher was produced. Our narrative analysis is based on two frameworks. Greimas' actantial model decomposes narration into four phases: manipulation (a character is committed to act); competence (it gets a capacity to act); performance (it acts); sanction (its action is validated). Burke's pentad decomposes narration into five ingredients: agent (who acts); action (what the agent does); purpose (aim of action); scene (space and time of action); agency (tool used to act). We did not make systematic use of this 4x5 analytical grid; but we used it to reveal interesting elements of the tale we were making.

3. MAIN FINDINGS

Our findings can be summarized into two categories: in each case, we find different practices for managing beliefs and doubts because risks are not the same; in both cases regarding the production of a text, we find the same eight work categories.

3.1. RISK MANAGEMENT AND AUDIT PRACTICES: DIFFERENT BEILEFS AND DOUBTS MANAGEMENT

In both case studies, the organization (operator or IRSN) makes valuation by theories in order to produce a text, while the resulting texts make valuation by authority. The two cases present a different management of beliefs and doubts.

In the Demonstration case, the nuclear operator is afraid regulators may stop its project because it will involve very specialized technicians:

2011 - Jan. 2013: Theorizing of solutions occurs. The nuclear operator identifies some doubts that, if pursued by ASN and IRSN, could require them to stop the industrialization of the dismantling project. As box 1 shows, the risk of having to abandon rope-access technicians for the scaffolding at the last minute, following an assessment by the authorities', comes under the category of industrial disaster.

Box 1: Interest of the dossier for the dismantling project risk management, by one of the contracting authority's engineers

For me, the aim of such a document is to have technical or organizational safety options that are shared with IRSN. And about which we could get an opinion, even if this is not an opinion in the regulatory sense of the term. But to get their opinion, particularly on rope-access technicians. In the sense that it was still something quite new, and that there should normally be relatively large teams. Here too we had to get it right, because, we can't afford to change our minds, a few months or a few years before operations begin, by saying well *OK, we heard you're against rope access technicians, or at least that you don't agree with us on this subject, so we'll use scaffolding everywhere*. That is not possible. [...] On the one hand, in terms of timing, it would mean we are not OK. And in terms of costs we would not be OK either. Thus, it would mean that even the budget we had made for the dismantling project would not tie in with what is really in the till.

Jul. - Oct. 2013: The nuclear operator organizes meetings with IRSN in order to continue its theorizing of these doubts, particularly by learning the relevant vocabulary to express them. The next box shows that the nuclear operator had initially planned to use direct language, in order to be clear in terms of technical obligations.

Box 2: Nuclear operator's initial writing strategy, by the project manager's engineer in charge of drafting the written document

As I was telling you, [Contracting authority's safety manager] said *we provoke*; from the outset we write this is not possible. *You bug us with your criticality; we would never be able to measure up. We cannot, this is not adapted to our context. Besides, we need to dismantle within ten years. But, if you take two days to measure each diffuser, and there are 1400 diffusers, then dismantling will take 40 years.* That is not in their interest. It's in nobodies' interest. But well, the thing is that this is not robust, that is we don't provide any guarantees. We are not working in the way of the fundamental rule of safety that says we should always avoid any safety accident. Functional redundancy, and all that. It's absolutely not our mindset at all.

Jan. - Nov. 2013: Writing of the dossier, in which the nuclear operator gathers its beliefs and doubts in order to take an authoritative position. As box 3 shows, content of the dossier has

been substantially reworked thanks to the technical dialog. The document gains in legitimacy, while losing some of its clarity.

Box 3: Modification of nuclear operator's writing strategy, by the project manager's engineer in charge of drafting the written document

Which means that in the end [sic]. The initial wording was *we are frank, we tell things as they are* and we say well you see, *we won't be able to do it any other way, we'll invent a process that would free us from risks*. In fact, it has become something. Honestly when I look at it almost a year later even I can't tell what it is we wanted to say. Well, I'm exaggerating, I know it very well. But, you know what I mean, we said something but. (Researcher: You have been forced to go back to the conventional form so that it fits.) Yes, that's it, we went back to the conventional form of criticality analysis. And we tried to put out, to spread almost everywhere messages saying, *this is too big, this would never fit, material balance is impossible, uncertainties are much too important for the material balance to be viable*. In fact, we wrote that, but in the end we lost a lot although, we gained in legitimacy if you know what I mean.

April 2014: A notice is served by ASN to the nuclear operator, ruling on doubts that had not been pursued and for which subsequent justification will not be needed. From the nuclear operator's point of view, the document helped to inform IRSN and ASN on safety options judged uncertain in the operator's organization, and thus to avoid unpleasant surprises.

Box 4: Reception of ASN notice by nuclear operator, by the project manager's engineer in charge of drafting the written document

It has been useful for us with the preparation for the production of the next demonstration document. And mainly it gave us [sic]. In fact, the most important was that they knew, you see. It was clear that we made some progress, but the most important thing, if you like, when we received the notice was to say *that's it, we have a text, we sent the document at this date, they made some comments on some points* that I've just presented to you, however, *on the safety options we retained, including rope-access technicians, including mechanical diggers, including the big shear press and all of that, there was only minor criticality, not like as usual, so they have judged it acceptable*. They didn't make a [sic], they haven't brought it into question. So, we told ourselves, *they won't be surprised when they open the next safety report in a year's time*.

In the Demonstration case, *valuation by theories* helped to elicit doubts that IRSN and ASN may use to stop industrialization, and *valuation by authority* makes the two texts statutory (dossier and notice).

In the Assessment case, IRSN expresses its disagreement with the nuclear operator delegating its nuclear safety responsibilities to its subcontractors:

2008 - Feb. 2010: Theorizing of ASN and IRSN's initial doubts, based on the safety demonstration transmitted by the nuclear operator. In its official request for information sent to IRSN, ASN asks for an assessment of two topics: (1) the overall dismantling strategy of the nuclear installation, and (2) the consideration of interfaces (operations organization, coactivity risks...), with regards to safety, especially between operating installations and installations undergoing dismantling activities. In the IRSN, the non-specialized engineer leading the safety assessment asked for a contribution from the department specialized in Human and Organizational Factors (HOF). He wanted the experts to investigate: (1) the proposed evolution of the organization (2) the interfaces between staff management (3) the consideration of HOF in design processes (4) the application of this consideration in several cases and (5) how the operator manages its multiple subcontractors.

Feb. 2010 - Oct. 2010: Discussions between IRSN, the operator and ASN, where IRSN theorizes its doubts concerning the dismantling project. The HOF expert prepared a questionnaire raising several questions from the safety demonstration, and calling for argumented and documented answers. These questions addressed eight themes: (1) operator organization (2) HOF consideration in the design processes (3) experience feedback (4) sensitive operations in dismantling operations from a HOF point of view (5) safety analysis and safety managers (6) subcontracted activities management (7) document management and (8) skills and competence management. While the nuclear operator gathered additional documents, the expert carried out fieldwork relating to those same themes. She mainly used interviews, complemented by observations of work practices. The non-specialized engineer made his own assessment, related to cases for which there were similar previous examples that had undergone an assessment by a specialist department. For example, he assessed drop load risks in heavy handling by applying the "determinist approach" whereby the drop load is presumed and consequences ought to be contained.

Oct. 2010 - Feb. 2011: Writing of the assessment report, in which IRSN gathered doubts that it believed were relevant in order to make the report authoritative regarding its very own expertise. Two and a half months before the HOF department communicated its contribution, the non-specialized engineer sent a summary draft to all the experts involved in the assessment. Then, the HOF expert and the non-specialized engineer exchanged a series of e-mails related to the position of the HOF contribution in the final report. At first, the engineer had not planned to give a distinct place for the HOF. The expert did not agree, as she considered that HOF are a cross-cutting thematic. The non-specialized engineer responded indicating that he would make a cross-reference where needed, and the HOF expert started to collect elements to convince him of her opinion. She produced writing on the HOF aspects of the dismantling project, structured in six parts: (1) organizational structure managing the project and interfaces with other entities (2) HOF consideration approach for the dismantling project (3) experience feedback (4) subcontractor follow-up during their operations (5) documentation management and (6) skills and competence management. This became the proposition of the department following a review by the department's manager and was proposed as the contribution of the HOF expert department. After the proposal, the non-specialized engineer continued more or less with his original approach. He introduced part of the HOF contribution in the analysis of dismantling strategy, and he located the most original elements in a sub-sub-sub-section (5.1.3.9) of the safety analysis (section 5).

Feb. 2011 - March 2011: A preliminary meeting was organised with the operator, then a meeting of ASN's experts group, which rules on which of IRSN's doubts should be investigated by the operator and ASN. Before the preliminary meeting, the nuclear operator made commitments related to the recommendations included in the IRSN report. These were examined carefully by IRSN's experts and the non-specialized engineer. The preliminary meeting was about these commitments and how they satisfy recommendations. After the preliminary meeting, a few contributions from the HOF were modified in the margins, adding a word to one of them and deleting an expression in another. At the meeting of the ASN experts group, the nuclear operator made satisfactory commitments to all the HOF recommendations. ASN did not make any comment on HOF management by the nuclear operator. As the experts group meets a few times a year, engagements taken by the nuclear operator are thus considered mandatory for any similar projects in the future.

In the Assessment case, *valuation by theories* helped to clarify doubts consistent with IRSN expertise, and *valuation by authority* made assessment authoritative regarding this expertise and made the two meetings statutory regarding their consequences on risk governance.

3.2. AUDITING PRACTICES INVOLVING THE SAME EIGHT WORK CATEGORIES

Because audit practices imply organization of the auditing dialog and the production of a text, whether for the nuclear operator or IRSN, we found that in each case actors do similar work categories, summarized in table 2. Each work category is differentiated by the ingredients of document elaboration involved and by its position in the global process of document writing.

Table 2: Work categories for document elaboration and their managerial stakes

Work category	Managerial stake	Meta-category
(1) Take the addressee into consideration	Preparation of the interorganizational articulation produced by the document	Attention paid to the document reading
(2) Measure what it can understand	Adjustment of the articulation to the addressee organization	
(3) Read addressee reactions	Appraisal of articulation's profitability	
(4) Identify the problem to solve	Clarification of the subject for which organization needs stabilization	Use of the document to solve a problem
(5) Clarify the context for writing the document	Control of the relation between this subject and empirical reality	
(6) Size the text in order to meet expected outcomes	Wording design from the subject and its empirical reality	
(7) Collect material for writing	Robustness of organization's wording facing facts	Collection of written resources
(8) Establish author legitimacy	Coherence between organization's wording and identity	

In our analysis of the Demonstration case, the addressee was taken into account during design phases, through the identification of ASN as an organization to speak with (alongside safety at work regulators), as it has the power to stop the project during its industrialization, and through discussion with ASN and IRSN preliminary to the technical dialog. This work helped the nuclear operator to prepare its interorganizational articulation with ASN and IRSN, produced by the dossier. Measuring what the addressee can understand meant involving the non-specialized engineer of the IRSN in the meetings where the nuclear operator presented the safety options. Those meetings helped the operator to avoid basing its design on an

unacceptable solution for ASN. Thus, this work helped to adapt the content of the dossier to what was understandable for ASN and IRSN. The reading of the addressee's reactions involved observing the behaviour of IRSN, and especially involving its HOF experts during the meeting dedicated to rope-access technicians, and by reading the notice from IRSN. This work enabled the nuclear operator to assess the profitability of the technical dialog and of the document elaboration. In fact, the document had fulfilled its role by testing its chosen safety options with the safety authorities.

The problem to solve was identified through design activities and first discussions with ASN where the strategic role of the dossier was clarified. This work helped to pinpoint the subject to be stabilized by the document, thus avoiding the risk of investing in safety options that were unacceptable for ASN and IRSN. The writing context is clarified through the decision to get in touch with ASN to present the safety options, through design follow-up and the design of HOF analysis. These activities help to control the relationship between the subject to stabilize and empirical reality. Sizing of the text in order to meet expected outcomes was achieved through interactions with IRSN, which helped to modify the nuclear operator's writing strategy, and through the operator's choices in his dossier. This work contributed to adapting the wording in the document, depending on the specific problem to solve with the document and the empirical reality of the dismantling project.

Material was collected during design activities, especially interactions between project managers and the contracting authority, noticeable in the design review meetings, and through the interactions between the contracting authority and the sub-contractor supplying the rope-access technicians. Elements collected at this time helped to ensure the robustness of the nuclear operator's words in light of the facts. The nuclear operator's legitimacy as the author of the dossier was established through design processes engaged by the operator, which involved advanced technical and bureaucratic competences and skills (design of the work site and the activity of the rope-access technicians, writing phases management...). These processes ensured coherence between the words of the nuclear operator in his document and the identity he built himself through dismantling design.

In our analysis of the Assessment case, we identified that the addressee of the assessment report is essentially taken into consideration via ASN's official request for information (preceded by discussion between IRSN and ASN). The official request prepares the interaction produced by the assessment report between ASN, IRSN and nuclear operator

organizations, by defining the subjects requiring a decision from ASN. Measuring what the addressee can understand is done through a mid-term meeting with ASN, a presentation of IRSN's HOF inquiry to operators' actors, and through interactions aiming at articulating IRSN's demand to nuclear operator's opportunities. As a result of these activities, during the writing process the document content can be adjusted to ASN and the nuclear operator. Interpreting the addressee's reactions is achieved by having IRSN's actors review the nuclear operator's proposed commitments (which correspond to IRSN's recommendations). This reading activity, and the preliminary meeting that accompanies it, help IRSN's actors to assess the profitability of the process of preparing the assessment report, and of the inquiries it required, through its effects on the nuclear operator's safety.

The problem was identified during an engagement meeting between IRSN and the nuclear operator, and was clarified further in the texts provided by the non-specialized engineer to the HOF department. These activities illustrate the multiple subjects IRSN needs to address and stabilize regarding the system proposed by the nuclear operator, in order to assess the safety of the dismantling project. The context for writing the document was clarified through the non-specialist engineer's own analysis and his interactions with the nuclear operator, through the HOF questionnaire and the HOF department's contribution, and through the specialist analyses collected by the non-specialist engineer. All of this produced a collective control of coherence between the subject to be stabilized with the assessment report and its empirical reality. The text was adapted to meet expected outcomes during interactions between the non-specialized engineer and the HOF expert and relating to the HOF position in the assessment report, as much as through recommendations made by IRSN in their report. These elements show how the wording was designed, based on the subject to be stabilized by the IRSN and its empirical reality as observed by the actors.

Written material to be used as a resource came from demonstration elements from the nuclear operator, answer sheets and the assistance provided during the HOF experts' fieldwork, from this fieldwork itself and through the internal meeting of IRSN's team. Elements collected here help to generate the content of the assessment report, particularly its recommendations, which must be robust when facing facts. IRSN's legitimacy is established through the clarification of the worst-case scenario for a fall during handling, or the extent of contamination affecting infants in the population, through the organization of the HOF fieldwork by the expert herself, and through the modification of two recommendations at the margins. These elements ensure

coherence between the content of the assessment report and IRSN's identity as the national expert on radiological and nuclear risks.

4. CONCLUDING DISCUSSION: TOWARDS A PRAGMATIST APPROACH TO AUDIT PRACTICES

Pragmatist works have always developed a "pragmatism of something", for example with Dewey (1939) developing a "pragmatism of values". This article is no exception, it relies on Dewey, Peirce, and our own investigation of the technical dialog to provide a "pragmatism of audit practices". The eight work categories that we have identified led us to define two methods used by field actors to collect, select, analyze and test their data. These grounded definitions are coherent with pragmatist philosophy that encourages us to disregard ontology and focus on the methods used to conduct human action. They fall within the suggestion of Gimmler (2016) to not only ground theories in field practices, but also to shape them in order to bring them to more general practices. With them, we seek to achieve a double objective: to renew the understanding of audit practices (their characteristics, performance criteria and valuation practices) and more broadly to understand risk governance, and to return our theory to other field practices. Our first method, "to elaborate a demonstration/assessment", involves the use of the document to solve a problem (categories 4 to 6) and the collection of material for writing (category 7). The second method, "to intersect proofs and objections", involves the attention paid to the document reading (categories 1 to 3) and the establishing of the author's legitimacy (category 8). We propose a definition of each method below.

To elaborate a demonstration/assessment: In a written document addressed to a decision-maker, organizing elements that support the facts that an auditee has to establish in order to obtain certification, or elements that cast doubt upon them by emphasising facts that could be important for the decision-maker. *For example, in France, in order to obtain an authorization for dismantling a nuclear facility from ASN, every nuclear operator uses a safety demonstration to prove the correspondence between its project and governmental requirements.*

This method describes how each organization is actually conducting an elaboration of its own contribution to risk governance (Becker, 2007): safety demonstrations for the nuclear operator and safety assessments for IRSN. In other words, it helps to describe how each organization

elicits, collects, assembles, and formalizes its own beliefs (for the auditee) or doubts (for the auditor) related to what has to be evaluated (Peirce, 1877).

To intersect proofs and objections: Confronting the beliefs and doubts of an auditor and an auditee, related to the facts that an auditee has to establish to obtain certification from a decision-maker. *For example, the way a financial auditor, during their audit and in order to build a detailed and informative report for decision-makers, makes good use of their informal interactions with managers of the audited organization to detect potential fraud that is not apparent from the documents.*

This method describes how each organization adjusts its contribution to risk governance by challenging its own stance towards risks against those of the organizations it is speaking to (Maier, 2015). As risk governance is distributed among multiple organizations, each one has to engage in some sort of inter-organizational inquiry (Lorino and Mourey, 2013) if only to avoid writing an irrelevant document.

Our two definitions deepen our understanding of the characteristics and performance criteria of audit practices, of valuation practices occurring in auditing practices, and lead us to propose a new way of thinking about risk governance based on the pragmatist notion of doubt. As they overcome the representationalism underlying a great part of the audit literature, they help in considering audits as mediation processes (Lorino, 2018).

4.1. CHARACTERISTICS AND PERFORMANCE CRITERIA OF AUDIT PRACTICES

Analyzing audit practices through the prism of these two methods enables us to develop a better understanding of their characteristics (formalization of the auditing dialog, informal communicational dynamics and vocabulary used) as well as their performance criteria (auditor's independence and competence). Concerning audit practices' characteristics, we have tended to go beyond the classical descriptive understanding of them and adopt a more pragmatist stance. Formalization of the dialog in texts is often viewed as a way to coordinate distributed actors in auditor and auditee organizations (Jordan et al., 2013). We say that formalization is something actors use in order to establish milestones in the history of the audit dialog. When elaborating their safety demonstration, actors take responsibility for the formalization of the auditing dialog while collecting material for their writing and estimate the empirical reality surrounding the subject to be stabilized with the demonstration. It is also when the nuclear operator intersects their own doubts with those of IRSN and ASN in order to

gain legitimacy that it successfully formalizes the auditing dialog. More globally, text production is a means to establish milestones in the history of risk governance. Work categories identified in section 3.2 are the same in both cases because each organization has to produce a text to contribute to risk governance.

Informal communicational dynamics are often considered as complementary to formalization, helping auditors to delve deeper in the organizational reality they are assessing (Grote and Künzler, 2000), including for example the rationality of the demonstration (Eydieux, Tillement and Journé, 2018). In our perspective, informal aspects of communication are something to be prudently managed by actors as they could become awkward in the future. They are mainly managed at the beginning and end of the implementation of each method. When elaborating their safety demonstration, actors manage informal communicational dynamics by carefully identifying and defining the exact problem to be solved by the document. The intersection of proofs and objections begins with taking the addressee into consideration. In the two case studies, actors manage the informal dynamics that emerge by getting to know to whom exactly they are speaking. In the assessment case, actors manage these dynamics when reading the addressee's reaction; by identifying how and to what extent the nuclear operator takes into consideration the implications of IRSN's assessment.

The literature considers the vocabulary used as a basis for risk assessment (Erb and Pelger, 2015). Our two methods lead us to view the vocabulary as something that actors gradually stabilize through the audit dialog. As we see in the Assessment case, stabilization of the vocabulary is done throughout the process of auditing dialog. In the elaboration of the assessment document, actors define the relevant vocabulary while they adapt the writing in order to meet the outcomes expected from the document. In their intersection of objections and proofs, actors determine the vocabulary to be used to express risk thanks to their assessment of what the addressee can understand (mainly the nuclear operator).

Concerning the performance criteria of audit practices, our pragmatist approach views independence and competence as a way to proceed rather than as a status that is attributable to an auditor. The first criterion is auditor independence, which questions how all the actors deal with the risk of auditor objectivity being influenced by their auditee (Herda and Lavelle, 2015). In our view, independence is continuously maintained. While elaborating their demonstration/assessment, auditor and auditee manage independence differently. In the

Assessment case, IRSN improves its own independence by collecting resources used for writing its assessment report. The nuclear operator contributes to IRSN's independence by appraising and formalizing the core problems facing the dismantling project. When they intersect proofs and objections, auditors and auditee manage independence in a similar way. In the Demonstration case, the nuclear operator contributes to IRSN's independence by measuring what IRSN and ASN can understand, and in the Assessment case IRSN manages its own independence by measuring what the nuclear operator can understand.

The literature primarily addresses competence as the set of technical and bureaucratic skills (Bonnaud, 2005, 2011) that are constructed and tested throughout the audit dialog. Our two definitions incite us to see competence as the tendency of an auditor to engage autonomously in its own understanding of what is evaluated. IRSN establishes its own competence while elaborating its assessment. It identifies by itself the exact problem to be solved by the document and clarifies on its own the writing context of the report. In the Demonstration case, the nuclear operator manages IRSN's competence by intersecting proofs and objections. It recognizes IRSN's competence through the reading of its reactions, which indicate a different understanding to how the nuclear operator understands its own demonstration.

4.2. VALUATION PRACTICES IN AUDITS

The two methods that we have defined also lead us to discuss the classical approaches of valuation practices in audit settings. Following the analysis of Power (1997), who sees in audits a sign of a generalized loss of trust in society, many current works on valuation practices in audits are observing that good values are lost in formalization. Our work calls for a more nuanced stance, as in our case studies actors implement a range of formalized valuation activities, which are materialized in the production of texts in order to ensure nuclear safety (a founding value of French nuclear risks governance). Formalization in audits can thus contribute to good values (in our cases, safety). It calls for an understanding of how this is achieved. One way to do that would be to look at which methods generate risk management discourses and infrastructures (Hardy and Maguire, 2016; Power, 2015) and valuation practices of risks (Boholm and Corvellec, 2015; Mennicken and Power, 2015).

The focus on methods renews rather than abandons classical criticism directed towards formalization. Methods we have identified can be applied through the three modes of valuation we defined in the literature: by authority, by theories or by inquiry. Despite the fact

that nuclear risk governance in France is claimed to be science-based, we find that valuation by inquiry is surprisingly absent from the technical dialog. The fact that elaboration processes of demonstrations and assessments are not made controllable is a serious threat for audits. Using a pragmatist stance, we would say that power stakes are favoured over a distributed understanding of actual circumstances, which is a questionable approach.

4.3. GOVERNING RISKS THROUGH DOUBTS

More broadly, our pragmatist approach calls for a renewal of risk governance. The case of audit practices shows that sharing of and attention to behaviours is required, as a result of which beliefs and doubts can be identified (habits of action and absence of such habits). A really reflective audit dialog requires such identification. It is the only way to know what is hard to believe or question for actors' conversation partners, and thus to develop and maintain conversations with them (Maier, 2015). However, free communication is risky, as it requires everyone to reveal their habits. It seems safer to fall back on theories or statuses of authority, and not reveal too much information (for the auditee) or the theoretical framework (for the auditor). However, complete sharing of information and theoretical frameworks is required to produce a real intersection of beliefs and doubts.

It also requires the ability of auditor and auditee to perceive the problems of whom they are speaking to. An intersection made through *valuation by inquiry* fully unveils the concrete problems experienced by each organization. Making new problems explicit implies a production of new doubts, resulting in beliefs for auditee and doubts for auditor that together will produce a subtler understanding of concrete circumstances. Our work suggests a new way to describe the auditor's competence (Bonnaud, 2005, 2011): being able to see auditee's problems and to make visible its own problems to the auditee. It is not easy. Disclosure of the auditor's assessment criteria can weaken its position and requires adaptation from auditee, and disclosure of raw data from the auditee can weaken its position and requires the auditor to address the elements being presented to it.

In its document, each organization has to gather its habits of action. For the auditee, these are its determined habits (its beliefs), and for the auditor these are its undetermined habits (its doubts). The decision-maker then bases its own beliefs and doubts on the dialog between these prior habits. The auditor contributes to a reflective decision not by bringing doubts that would resist auditee beliefs, but by bringing contradictory facts that would have been

otherwise ignored. Competence is not the ability of the auditor to examine the real technical problems (Bonnaud, 2005, 2011), but rather its ability to produce objections that force the auditee into a discussion, letting the decision-maker better understand the situation. For independence, the challenge is not so much to avoid conflict of interest (Herda and Lavelle, 2015) rather to produce a situation of disparity between doubts from the auditor and auditee. It implies that the auditee writes down beliefs for which it has no remaining doubt, and that auditor dares producing very original doubts.

In order to produce a real dialog between beliefs and doubts, the auditor and auditee must truly involve themselves in doubting. As Peirce (1877) shows, doubting is costly as it "is an uneasy and dissatisfied state". Instead of doubting, each organization can arrange beliefs and doubts by relying on theories or on authority. Demonstrations then contain descriptions in very general terms where day-to-day realities are barely visible and assessments contain criticism as a principled position or based on a state of the art. This results in a head-on disagreement, which is not a demonstration of reflexivity. It shows a lack of inter-organizational inquiry, in the sense of Lorino and Mourey (2013), underlines the theoretical position each opponent wants to defend and hides the actual situation behind rhetorical constructions. If there is real interorganizational cooperation, the beliefs and doubts of the auditee are clarified, the auditor is able to produce new doubts, and the dialog between them helps the decision-maker to better understand the situation.

Our pragmatist approach changes what we should expect from a demonstration and an assessment. Demonstrations do not have to demonstrate the facts the auditee has to establish, but rather require the auditee to present its final beliefs, those for which it has no remaining doubt. We are not in a positivist epistemology, where reality is independent and could not be discussed, but in a pragmatist one where things that are not discussed do not have any reality (Martela, 2015). Assessment is not a source of enlightened opinion, but of new doubts that trigger discussions. We are neither in a constructivist epistemology, where contradictory opinions automatically improve collective action, but in a pragmatist one where they do so if the confrontation changes the "warranted guidance" (ibid., p.548).

4.4. MANAGERIAL GUIDANCE

Our focus on methods underlines that auditing dialog is not enough *in itself*, but instead is something that has to be directed. We thus propose three ways to improve the conduct of audits. The first is to lead auditing practices with a willingness to dialog, whether on the auditor or auditee side. In audits, it is easier if there are only exchanges of proofs and objections, but this is not really helpful for the decision-maker. It is more useful when every organization engages in a dialog through which the initial beliefs and doubts of everyone are changed. Practitioners can do that by monitoring the behavior of their interlocutor and their own behavior, following if their tendencies change over time. The second is to carefully dimension the amount of bureaucratic work to be done. In a pragmatist approach, one would recognize the cost of doubting and thinking so that one needs to stop demonstrating or assessing safety where there is no return on investment. Practitioners can manage this by making coordinating experts, such as the non-specialized engineer in the Assessment case, accountable for real-time informing specialist experts of the needed amount of doubt. Finally, we would recommend managing audits by aiming at a sufficient production of doubt rather than an exhaustive or precise picture of what is audited. As audit practices are implemented in order to inform a decision-maker, what matters is to produce sufficient doubts in order to get subtler beliefs than those initially obtained from the auditee. To do this, practitioners have to look less at the frames of reference and more at the auditee's behavior, aiming at changing its tendencies to something more coherent with the auditor and the decision maker beliefs.

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APPENDIX 1: DOCUMENTS COLLECTED FOR THE DEMONSTRATION CASE

The following table synthesizes the collected documents concerning the Demonstration case. For more details about the aims/authors/addressees which justifies types and categories, please refer to Eydieux (2017, p.148).

Table 3: Documents collected for the Demonstration case

Category	Type	Quantity
Official document resources		
Sources of rope access technician companies	Regulatory texts	3
	Rope access work regulation	5
Deliverables by rope access technician companies and design departments	Design documents by rope access technician companies	4
	Slides of design conclusions from design departments	15
Track of human and organizational factors experts' work		
Work documents HOF	Slides second HOF expert	2
Documents for communication		
Internal communication of the decommissioning project	Emails	10
	Meeting minute	3
	Organization document	2
Officialization of work and its outcomes		
Nuclear operator's official document	Safety options dossier	2
Loopback from nuclear authorities	IRSN's assessment	1

APPENDIX 2: DOCUMENTS COLLECTED FOR THE ASSESSMENT CASE

The following table synthesizes the collected documents concerning the Assessment case. For more details about the aims/authors/addressees which justifies types and categories, please refer to Eydieux (2017, p.149).

Table 4: Documents collected for the Demonstration case

Category	Type	Quantity
Official document resources		
Resources transmitted by the nuclear operator	Operator document	185
	Operator slides	10
	Photo	4
Texts produced during the subcontracting relationship between HOF experts	Loitlet report	3
	Angohan contract	2
	Interview minute	3
	Angohan report	3
Track of human and organizational factors experts' work		
Material collection	IRSN demand	5
Documents for working on the text	HOF writing	18
	HOF department contribution	4
Communication of the assessment	IRSN slides	9
	Scientific article	2
Documents for communication		
IRSN internal communication	Internal mail	10
	Meeting minute	15
	IRSN organization document	10
Institutional communication	Email	39
	Mail	16
Officialization of work and its outcomes		
IRSN official documents	IRSN assessment advice	2
	IRSN assessment report	11
Loopback with the general public	Agenda	1
	ASN advice	1
	ASN web article	4