CARL THEMATIC REPORT

The Framing of Radioactive Waste Risk: a Comparative Analysis

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April 2008

Contents

1 Introduction: Radioactivity, Society and Trust

In the paper we analyse radioactive waste framing in Belgium, Slovenia, Sweden and UK. The problem of risk and social trust connected to resolution of a particular environmental problem – selecting the location of the radioactive waste repository is examined. Even repositories for low and intermediate level (LILW) radioactive waste, present a great problem in almost every country that produces such waste. Attempts to locate a disposal facility have often proved unsuccessful. The main problem was not a technical one, but socio-psychological, namely the acceptability of this kind of repository. In general people are strongly opposed to any kind of such a facility in their vicinity (NIMBY) even if they are aware of its necessity. We shall try to comparatively analyse framing of this problem. This introduces the problem of misunderstanding between the general public, experts and the state administration, caused not only by differences in perception of risk[1] between the involved parties, but also by distrust on the side of the general public and stigmatization of nuclear technology (NT). Both issues are strongly connected as trust, values, equity and the notion of social justice interact with risk perception (Kasperson and Dow, 1993).

In a number of domains, mainly those connected to any kind of possible – real or imaginary – risk, distrust of official actors is increasing. This is demonstrated through public opinion polls and the concrete behaviours of people. Reactions to risky technologies and connected issues are increasingly influenced by the distrust in responsible institutions providing the information (Cvetkovich and Löfstedt, 1999). In fact, the solutions to many urgent problems that are perceived as risky or annoying are nowadays – at least in democratic societies - more dependent on public acceptance than on technical possibilities. The need to open up the decision-making process to public participation and not simply "to educate" people, is increasingly evident. Technical approaches are giving way to socially based approaches. Radioactive waste management (RWM) is a typical case of such a problem, but there are also many others, subsumed under new, dread, involuntary or uncontrolled risks (Slovic, 1993; Morgan et al., 2002).

Public and scientific knowledge and consequently their attitudes have changed over time. Before the hazards of high-energy radiation were fully recognized, radioactive substances were advertised and X-ray pictures were freely taken (see Fig. 1). There were even X-ray apparatus in shoe-shops, for customers to check the adequacy of the shoe size. What was earlier perceived as a nice prospect and advancement of technology, later became a dreaded threat. Up until the seventies civil use of nuclear energy presented a sign of prosperity and development, during the later years its popularity decreased. Threats of earlier times were replaced by the new ones, especially after a number of disasters e.g. TMI, Chernobyl. Eventually the atomic bomb became the prototype mental model of nuclear energy. Problems that were earlier perceived only or mainly as technological, e.g. energy problems, construction of the radioactive waste facility have become increasingly social due to the increase in public concern and development of environmental movements. The route of evolution was similar for many of them: enthusiasm, scepticism and finally rejection. This stance also revealed itself in the prevailing type of socio-psychological research in certain domains. The story of radioactive waste is a typical example of this kind of development and will be presented here.

[1] Lay public use more complex »multiatribute« definitions of risk, including additional considerations beyond the expected numbers of deaths (Morgan et al., 2002).

FIGURE 1. Hand with ring - one of the first X-ray pictures made by Roentgen in 1898, and advertisement for "Aqua Radium" sold to public during the 1920s and 1930s (after Goldstein and Goldstein, 2002).

Following Cvetkovich and Löfstedt (1999, p. 3) and reflecting changes in public attitude we could trace the characteristic evolution in the research related to risk assessment and management from: (1) initial issue of determination of the levels of acceptable risk; (2) risk perception with concern about differences between lay people and experts; (3) resolution of existing conflicts and application of concepts about risk perception and risk communication; and (4) current stage of focusing on trust which broadened the concern from assessment of only physical processes to understanding of social systems and their actors. Social trust can be defined as "assured reliance on the character, ability, strength, or truth of someone or something" (after Cvetkovich and Löfstedt, 1999). The Merriam-Webster Dictionary definition has some additional characteristics), which are similar to those in Kasperson and Dow (1993). These are for example: the implications of power and control differences, risk involvement, relationship expectations regarding a person's interests, choice when and who to trust, impersonality aspects, etc. In their studies Earle and Cvetkovich (1999) found support for the cultural-values hypothesis, namely that social trust is based on value similarity. They identified *pluralistic* social trust, rooted in the pasts of existing groups, and *cosmopolitan* social trust, that is multiple and based on a new set of values. Both are considered more suitable for successful risk management. For Löfstedt and Frewer (1998) risk perception is socially constructed. According to the theory of *cultural biases* (Adams, 1995; Löfstedt and Frewer, 1998) risk assessments are consistent with and reflect predominant worldviews (hierarchic, fatalists, individualists, egalitarians and environmentalists). These ideas also apply to RWM problem framing.

In general, nowadays, people are strongly oppose to any kind of facility in connection to radioactivity in their vicinity and exhibit an extremly strong 'Not in my Backyard' (NIMBY)

attitude even if they are perhaps aware of the need for the facility in the Country. These attitudes have all the characteristics of technological stigma, '*as a mark placed on a person, place, technology, or product, associated with a particular attribute that identifies it as different and deviant, flawed, or undesirable*' (Kasperson, Jhaveri, Kasperson, 2004). In this case nuclear technology (NT), places with nuclear facilities, or radioactive waste are perceived to be unduly dangerous.

2 Framing process and chronology of the nuclear technology development

Public understanding of an issue depends on its framing. The concept of framing stems from the work of Erving Goffman (1974; p.21), namely his definition of frames as '*schemata of interpretation*' which enables its user (individuals or groups) '*to locate, perceive, identify, and label*' events and occurrences, thus rendering meaning, organizing experiences, and guiding actions. Of both, the natural and the social frameworks, that he distinguishes, the latter are of interest to us, as they provide '*background understanding for events that incorporate the will, aim, and controlling effort of an intelligence'*. For Kosicki (2002; p. 66) framing is a perspective from which to approach the study of public deliberation, the process of collective and open reasoning and discussion about the merits of public policy. Framing includes '*the discursive process of strategic actors utilizing symbolic resources to participate in collective sense-making about public issues*' (Kosicki, 2002; p. 66).

Framing is part of broader processes of selecting and structuring of social problems. Actually framings are the changeable results of perplexed and continuing "social construction" of the social reality - nuclear technology perception for instance. The one who structures and selects a framing is the one who has the power to determine what is more and what is less important, safe, dangerous, etc. In this respect framing processes are an attempt to "invoke a particular image of an idea" about un/safety of nuclear waste disposal for instance. It is quite obvious that these processes are open to a variety of interventions and therefore so complex and multileveled that precise management of the framing procedures is not possible. Empirical evidence of nuclear technology framing demonstrates that it is very difficult to control. What is frustrating to Radioactive Waste Management Organisations (RWMO) is that the process is not deterministic at all and that it can escape from the control of rational expert procedures. As a consequence the illusive framing procedures are a persistent problem in the technocratic style of nuclear technology management.

Although nuclear technology is not a new discovery any more, it still constantly provokes a range of reactions among different social groups. In a way it is a paradigmatic, modernist technology that has various levels of fear and fascination. Among the general public its schizophrenic image was efficiently established at the end of WWII with the dropping of nuclear weapons in Hiroshima and Nagasaki. But according to Weart Spencer (1988) it is possible to trace a much longer history of fearful, affectionate images which are associated with this tremendously powerful technology.

In a social context the power of nuclear technology therefore generates simultaneous reactions ranging from enthusiastic worship fascinations to strong skepticism and criticism and even fearful absolute denial. The effects are further strengthened as a consequence of extreme time dimensions of radioactive isotopes. The fact that spent fuel remains dangerous for an

unconceivable long period, far beyond any common sense experiences, adds strong additional incentives to the fascination and fear effects of NT. In common sense perspective this seems an "other space phenomenon". In this respect it is also important that full understanding of these extraordinary powerful and sustained characteristic are limited to rather narrow expert groups. Further it has to be considered that these elite groups, in fact the entire nuclear field, were and still are closely linked to classified military endeavors[2]. In fact conspiracy, secrecy, elitism, and exclusion of the public are essential characteristics of the nuclear industry just because of their military connections and exclusive comprehension. On the basis of these observations it sounds reasonable to suppose that the fascination fear (Fa- Fe) syndrome[3] forms the initial and basic framing pattern of nuclear discourse. Of course in the background of NT framing we should always consider its utility/dependability as an energy supplier in society. While a nuclear power plant (NPP) is active but useful, radioactive waste (repository) is passive but not useful. In this sense the dimension of dependability will not be relevant for discussions on the radioactive waste repository as it is isolated away from people, and fear and fascination remain as the main dimensions of the framing pattern.

It must also be understood that multiple frames exist in society, and particular frames could prevail within different groups. Frames change over time and between groups. In the context of radioactive waste we could distinguish local/general (lay) public and administrative/technical public frames. It is particularly interesting to analyze the dynamics between different framing clusters. In this discussion only local/general public framing will be considered as the most important issue in siting procedures. At the beginning this frame was close to or overlapping with the technical one, while later on in the process they diverged. We could say that while the technical framing is still dominated by fascination, the general public framing is increasingly dominated by fear and stigma.

It is possible to imagine four different ideal types of relations between enthusiastic supporters and skeptical critics of nuclear technology. In the model we suppose that fascination and fear attitudes are the extreme values of those two opposing attitudes, corresponding to four "ideal types" of social groups. Therefore different relations between fascination and fear are possible:

1. High fascination (FA) – low fear (fe): technology worshipper;
2. Low fascination (fa) – high fear (FE): critical anti-technologist;
3. High fascination (FA) – high fear (FE): interested hesitant;
4. Low fascination (fa) – low fear (fe): disinterested public.

These four types are of course very rough generalizations, there exist many subgroups in between them. But it is important to stress surprising or at least unusual counter evolutionary development of the acceptability of nuclear technology. At the beginning the technology worshipers prevailed, but with the passing of time critical and ambiguous second and third types gained more support. In most cases the developmental pattern of technology introduction and dissemination is just the opposite – hesitation and caution at the beginning is followed by broader acceptability or tolerability at least. To understand these changes the general chronology of nuclear technology (NT) development should be considered in detail. To begin with it seems sensible to differentiate six chronological phases of nuclear technology perception:

[2] The first energy producing reactors were developed as a side product of military programs (Spence, 1986: 30), e.g. the Manhattan project

[3] This syndrome corresponds to classical »approach – avoidance« situations in psychology.

"Prehistory" - time before the first military use of nuclear power in 1945 when the capacities of nuclear technology were not widely known, but there existed vague, mythological perception of possible options (Weart Spencer, 1988).
"Military demonstration" of nuclear technology efficacy in mass destruction (from 1945 onwards) when the extraordinary power of nuclear energy was efficiently confirmed in Hiroshima and Nagasaki;
"Peaceful use of the atoms"- endeavors in civil use of nuclear energy, electricity production and some other civil applications of nuclear technology (from 1951 to 1978);
"Global nuclear accidents" efficiently reconfirm the dangerous, fearful side of nuclear technology and gave strong incentives to anti nuclear movements (from 1979 to 1988),
"The end of the cold war, terrorism and global warming" temporary relief from global nuclear war, but new ambiguities affecting nuclear technology perception and framing (from 1989 to 2001 and onwards).

Considering the mysterious military connections of nuclear technology the initial technocratic approach to management seems somehow reasonable. But the absurdity[4] of nuclear weapon proliferation during the cold war gave strong incentives to anti nuclear movements and critics. These developments influence attitudes on use of nuclear technology for nonmilitary purposes. It is important to stress that in the process of "civilizing" of nuclear technology the technocratic style became more and more inefficient, even counter productive. Actually rigid technocratic approaches start to irritate an increasingly motivated antinuclear public. In addition the TMI accident and particularly the Chernobyl catastrophe fundamentally changed the global perception of nuclear technology.

In this respect radioactive waste materials played a special role in configuring the technocratic credibility. Although at the beginning radioactive waste (RW) was not considered a serious problem, it turned out that this is one of the most persistent ("sustainable") problems not to be solved by a closed, autocratic, technocratic decision-making model. Unfortunately for the image of the nuclear experts, so far in most countries repeated efforts did not produce a legitimate solution for safely disposing of RW. Many failures evidently demonstrate the weak side of the technocratic approaches and what is even more embarrassing, the inability to gain knowledge about the basic causes of the failures. These failures have undermined the general public's confidence in the technical competence of experts. From a common sense perspective it make sense to deduce that if the most competent experts can not find a safe location to construct a safe waste repository, then we must have limited expert competency. This has contributed to the fact that, at least in public perception, the technically "marginal" problem of RW has become one of the crucial even strategic failures of the nuclear industry. Therefore the unsolved waste problem has become an issue for the entire sector and has started to hamper further projects and even the operation of existing nuclear installations. All these developments have influenced the framing process but at the same time the framing of the nuclear waste problem in the public is itself also the origin of the failures.

[4] With the words of Sloterdijk: '*The overkill atmosphere becomes denser by the minute. The (extermination) factor grows monthly and its growth is, in the final analysis, the determining agent of our history. The overkill structures have become the actual subject of current developments*' (Sloterdijk, 1987:128). In order to be able to "defend itself", each part has produced instruments of destruction that suffice for the absolute annihilation of human, animal and even plant life (Sloterdijk, 1987: 129). Nuclear fission is in any case a phenomenon that invites meditation, and even the nuclear bomb gives the philosopher the feeling of here also really touching on the nucleus of what is human (Sloterdijk, 1987:130).

The side effect of these developments was a slow and reluctant transition from technocratic decision-making model to participatory (socio-technical, see other terminology) decision-making model. The recognition that perhaps the only chance to find a legitimate solution is the establishment of a complementary socio-technical decision-making model starts to gain ground. This development was of course very much in line with the general changes in modern societies, where the legitimization crisis is one of the basic structural problems[5]. But it is important to stress that the shift from a technocratic to participatory model in expert circles was essentially an unwilling change. It was somehow imposed as the only way out of a cul-de-sac and not generally accepted as a better and democratically legitimate option for waste management. In fact, one of the most general characteristic of radioactive waste management in all ""nuclear countries", is that the participatory approach was introduced only after a number of technocratic failures. It is therefore understandable why only recently a participatory approach is becoming institutionalized.

The basic framing nuclear technology and in particular RW is therefore developing from a technocratic to participatory model. Behind this shift there is a general change to the "fascination – fear syndrome". At the beginning the fascination prevailed, skepticism or even fear was hidden or at least dominated by the faith in unlimited technocratic competences. This could be marked as "FAfe" framing. But along with somehow surprising and unexpected changes in the legitimization processes on the local, national and global level the unsolved radioactive waste problem started to play a more and more crucial role. Finally it contributed to the substantial shift of the frame from an enthusiastic to a much more skeptical approach. This could be marked as faFE framing.

According to the basic framing dimensions it is possible to construct a general two dimensional system in which the framing process is developing over the course of time and where both dimensions are not orthogonal. With the first dimension we evaluate the changing general public attitudes, opinions about nuclear technology and particularly about the nuclear waste problem. As already mentioned, the extreme values of this dimension are fascination and fear. The other dimension evaluates the style of decision-making in the field. The extreme values here are authoritative, elitist technocracy and democratic, participatory decision-making. It makes sense to suppose that the fascination attitudes support technocratic style management and that fear, concerns and worries support participatory management. The interesting point to investigate is how over the course of time with the development of modern "nuclear societies" the framing has evolved. The basic assumption is that the changes are highly correlated with the general developments to legitimise crisis in modern societies including nuclear technology developments and particularly the development of the RW problem. A number of context and time specific frames could be detected and inserted in this system.

[5] See Habermas (1987/91), Offe (1987) and others.

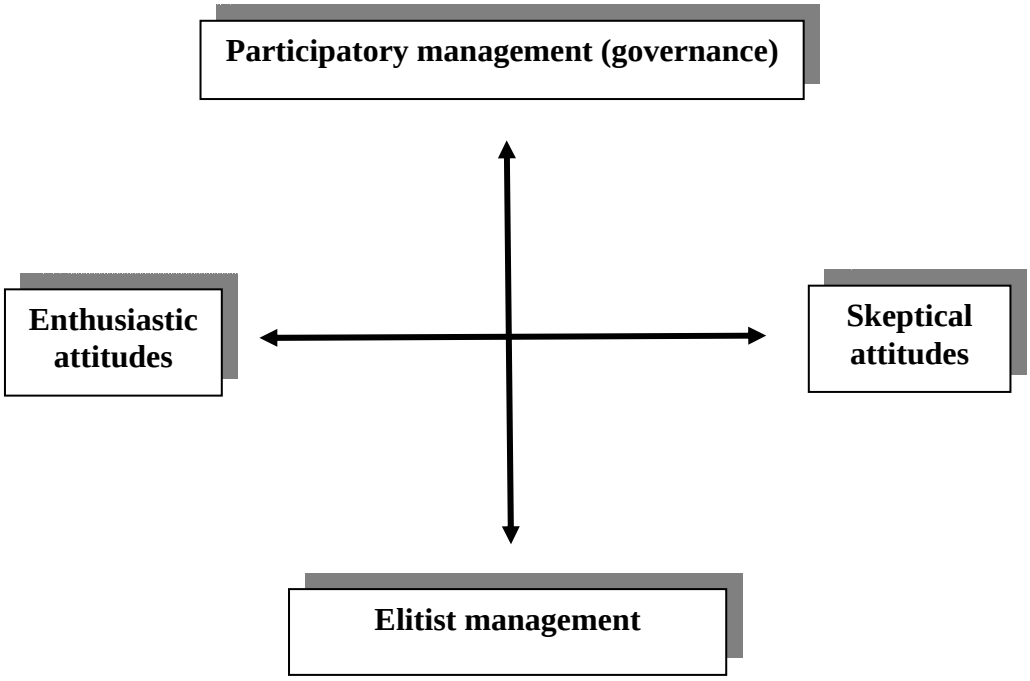

FIGURE 2 Framing dimensions

An even more ambitious objective is to compare the differences in the framing of the nuclear waste problem between different societies. Although the general development is surprisingly similar it is nevertheless possible to trace country specific framing patterns. The angle between the style of management dimension shows the shift of the framing patterns in comparative countries.

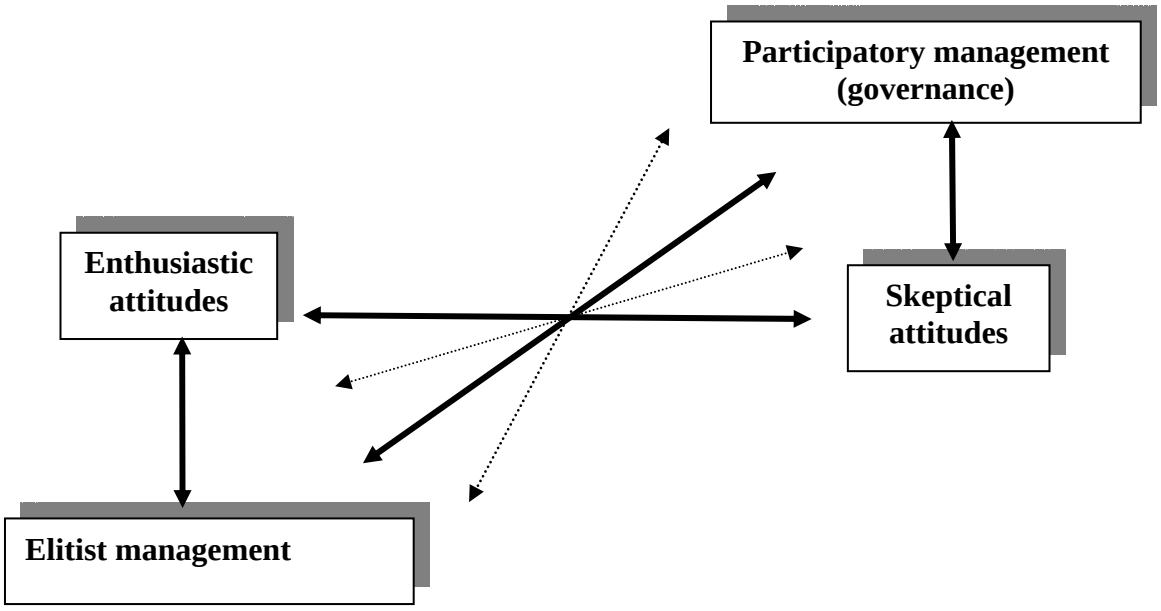

FIGURE 3 Relationship between framing dimensions

3 Comparative analysis of RW framings

This simple, two dimensional model helps us to identify different but coexisting framing patterns and their evolution over the course of time. A comparative analysis of RW framings in countries with different political, social, economic and cultural backgrounds somehow, surprisingly reveals that much of the waste images i.e. framings are quite similar irrespective of rather substantial cultural, economic, political and other differences. Analyzing the Belgian, Slovenian, Swedish, and British framing history[6] it seems that NT and particular RW framings are constructed along universal patterns.

The first step in analysing the similarities and differences was to construct four general clusters of framing types which somehow correspond to the model above. From the history of NT and RWM development presented in the four Country Reports it is possible to identify four basic groups of framings. These general groups are of course further divided in to specific subtypes. What is rather confusing is that these types are not discriminative, it means that they sometimes overlap. This could be explained by the fact that fear and fascination often come together and that the common sense perception of the NT is often puzzled by the consequence of the inhuman dimensions of NT effects. These four general framing types are as follows:

3.1 Optimistic technological framings: basic attitudes: fascination, attraction, trust

The first cluster is evidently developed from belief in "technological omnipotents". In extreme cases, trust in technology and expertise leads to a kind of experts' "priesthood" making them untouchable authorities. The positive contributions of NT are so promising that in the interpretations of heroic experts, the problems of NT are courageously or even arrogantly denied as unimportant and negligible. In this respect of course even the disposal of radioactive waste is not a real technical issue. The problem exists only because there are some (local) people who are not able to understand the technical characteristics of NT, supported by some eco fundamentalists who are against any technological progress.

NT is interpreted as the highest achievement of human mind which leads to further innovations especially in the field of energy supply. Developmental optimism reaches utopian dimensions that lead to the exclusion of local people and the dominance of "unlicensed" experts in the decision-making process. However the exclusion of the stakeholders is not interpreted as a violation of democratic standards. In such political and social circumstances the opposing voices are weak with little effect on public opinion. Further incentives in positive imaging of NT are supported by national aspirations about independence in the military and civil (energy) field. At the same time the promised civil use of atoms successfully camouflages the terrifying military connections of NT.

[6] As exploratory material we use the Coutry reports on RWM in Belgium, Slovenia, Sweden and the UK and some other texts produced by the CARL research group which is an independent, self-supporting consortium of organisations from countries that have experience with stakeholder involvement in radioactive waste management. The project unites four types of partners (**C**itizen stakeholders, **A**gencies responsible for radioactive waste management, social science **R**esearch organizations and **L**icensing and regulatory authorities) in four countries: Belgium, Slovenia, Sweden and the UK). See http://www.carl-research.org/

Short description of "optimistic technological framing characteristics"

- Developmental (utopian) optimism legitimising the exclusion of locals and the dominance of experts in the decision-making process.
- Technological omnipotents, nuclear technology and radioactive waste do not present a problem, trust in technology, expertise, closed exclusiveness, elitism, expert "priesthood", arrogant ignorance of the social aspects of the problems.
- Nation self-sufficiency in military and energy field contribute to experts' exclusivity as national heroes.
- Civil use of NT is a legitimate complement to military use.
- Civil use of NT as a response to the energy crisis (1972 and 2000).

3.2 Pessimistic technological framings: basic attitudes: terrific power, fear, concern,

The original sin of NT is its military connection. Terrifying, globally demonstrated mass destructive effects have dominated any discourse on nuclear technology since 1945. Secrecy, conspiracy, exclusion of the public, classified information etc. are "natural" characteristic of NT regardless of its use. Besides its military legacy, the catastrophic discourse on NT is strongly influenced by various layers of technological fears that have accumulated from the beginning of the modern era. Nuclear technology is seen as a paradigmatic, untamed technology with unpredictable consequences. This is also the reason why the discourse is emotional with multiple hidden dimensions. The cold war and the cross border effects of nuclear accidents contribute to the dramatization of the nuclear question. The public discussion is conflicted, divided, controversial and difficult to cope with. Even the civil use of atoms is problematic because it is not possible to differentiate it from the military sector and because the civil use of NT has potential lethal consequences. In this respect radioactive waste is considered as a paradigmatic failure, since no nuclear country to date has succeeded in finding a final solution for the management of spent fuel. In fact the "inhuman" characteristic of NT and RW constantly produce negative reflections regardless of institutional guaranties.

Short description of "pessimistic technological framing characteristics"

- Military connections, military mass destruction legacy, secrecy, conspiracy, exclusion, classified info, etc.
- Civil use as a result of cold war competition, civil use developed as the side effect of the cold war competition.
- Lethal consequences of civil use, accidents prove that the safe use of NT is not feasible.
- Radioactive waste as paradigmatic failure of the blind faith in technology.

3.3 Technocratic framing characteristics: instrumental, authoritative PR approaches

At the beginning the decision-making process on the NT question was not transparent to the general public. As the public started to protest against plans for NT proliferation the response was authoritative, arrogant ignorance. In the second phase this attitude led to minimalization and later marginalization of the problem. The view was that the public cannot comprehend the

technical characteristics of NT anyway. As this tactic did not work, the flow of information produced by PR specialists started to rise. This resulted in information overload and information fatigue. The aim was to diminish the growing opposition to NT with technocratic PR instruments, by replacing a technical explanation of the open questions (technocratic approach) by a social (engineering) technocratic approach. This included also the penetration (occupation) of the research activities in the filed of public participation. In this respect the radioactive waste problem became the negotiation problem and appropriate institutional framework was needed. The processes abound in constant institutional changes which also substantially contribute to fatigue of many involved actors.

Short description of technocratic framings types:

- NT is an exclusive field, only experts can comprehend the technology.
- Marginalization of negative effects of NT, to hide RW in marginal locations.
- Information overload, information fatigue, permanent institutional reforms.
- PR approaches penetrate the research sector as well.

3.4 Participation framing characteristics: governance, local involvement

Because the negative consequences of NT are evident and it constantly produces conflicts, divisions and controversies it is essential that technical and social approaches to nuclear issues are balanced. The decision-making procedures should be opened to all actors. In fact actors should become stakeholders with a veto option on any substantial decision regarding location of nuclear plants, a radioactive waste repository etc. The nuclear problem also triggers fundamental political questions of participative democracy. It is only possible to reestablish trust in institutions with open participative governance. Antinuclear movements and protests contribute to nonproliferation of military and civil nuclear technology. It is not possible to ignore these issues as no expert has sufficient knowledge about the questions of NT raised by the public. In such social conditions even "NIMBY" reactions are understandable and also somehow legitimate, because the social consequence of NT installations include the symbolic contamination of the location. Although it is not possible to measure this sort of contamination with technical instruments it has empirical consequences affecting the local population and its real estate assets.

Short description of participation framings types

- Participation in decision-making process alleviates negative social consequences of NT which constantly produce conflicts, divisions, controversies.
- Participation of all actors, (stakeholders) to solve NT problems contribute to democratic standards of decision-making.
- Antinuclear movements and protests contribute to nonproliferation of military and civil use of NT and therefore improve safety performances in society.
- "NIMBY" reactions to NT and especially to RW repositories are understandable.

4 Framing chronology[7]

4.1 Prehistory: "mythological" threats (before 1945)

Nuclear technology is an inhuman, devil affair: a very small quantity of radioactive material which is "burning" for a very, very long time, in fact an inconceivable 100 000 years. In common sense terms this is in fact eternal, i.e. hell fire. According to Weart Spencer (1988) NT stimulates opposing images of hopes and fears rooted in the long history of civilizations' hopes and fears. His main point is that NT invokes already existing images and that prehistory explains contemporary public perception of NT. This interpretation corresponds to the idea of "longue durée" structures (Braudell, 1979). According to this understanding of history there are few really new things in the present time. In this respect it is possible to connect NT hopes and fears to middle age alchemy and faustian and frankensteinian mythology.

We did not include such deep rooted fears and fascinations in our analysis; however on the basis of our analysis it is possible to support the idea. This idea is also supported by the fact that the spontaneous public reactions to NT proliferation are quite similar in all the countries analyzed: the initial fascinations and hopes were later replaced by growing skepticism and fears.

4.2 Military demonstration of the power of atoms (from 1945 to 1955)

Although the discovery of nuclear physics is already more than 100 years old (W. Roentgen discovered X rays in 1895), perhaps the most strong and the decisive moment in the framing process is the fact that the extreme power of nuclear energy was introduced to the general public as by far the most efficient weapon of mass destruction in human history. Instant destructions of Hiroshima and Nagasaki in 1945 are probably the most influential events, which after so many years still decisively determine the nuclear technology framing patterns. With these events the multiple layers of hopes and fears were given a strong empirical incentive. In 1949 the Soviet Union detonated its first atomic device. This gave terrifying nuclear acceleration to the cold war tensions but also to the public perception of nuclear technology. All together, since then, any discussions on nuclear technology (discourse, framing processes) has been strongly linked to the "cold" East-West conflict but potentially extremely "hot" nuclear catastrophe.
In 1952, testing of the hydrogen fusion bomb, thousands times more powerful than Hiroshima bomb, gave the ultimate incentives to frankensteinian nuclear fears.

At the time the **UK** was already involved in the investigation and development of a nuclear weapons program. *"Although civil nuclear power had emerged from the military nuclear programme, the 'atoms for peace' frame mobilised by the technocratic pro-nuclear movement represented a counter-framing that attempted to distance nuclear power from the horrors of Hiroshima and Nagasaki with which nuclear technologies were framed by the peace*

[7]The following periodization is of course to some extent arbitrary, it means that for different milestones a different setting is possible, especially from an individual country perspective. However the purpose of differentiating the postwar "nuclear era" is to stress general social context changes and their effects on framing nuclear (RW) issues.

movement" (Simmons, 2007). Uranium mines in Belgian Congo are the reason why the **Belgian** nuclear era began in 1920. The civil nuclear program was developed immediately after WWII. It was strongly connected to the USA and UK development of their nuclear research and military programs. In **Sweden** the investigation of the possibilities to develop nuclear weapons started immediately after WWII, in fact just eleven days after the atomic bomb was dropped over Hiroshima (Elam, Sundqvist, 2006)[8]. In **Slovenia**, at the time part of Yugoslavia (YU), there is no evidence of any nuclear program at the time. But the split from the Soviet Union in 1948 led YU to independent (nonalignment) foreign politics which, as with the neutrality of Sweden, also needed independent military support. According to some unverified information, in fact rumors, this was the reason why also in YU ideas appeared about developing a nuclear bomb. The fact is that the first nuclear research reactors were installed in the middle of 50s.

Although we are not in a position to verify the thesis it is reasonable to believe that due to the strong military connection in all countries with nuclear programs the absolute prevalence of a closed, elitist, technocratic framing existed. Nuclear technology appeared to be dangerous and particularly related to the military (even its civil use) therefore strong state control was exerted over it. The participation of local inhabitants and other potential actors was not possible even to imagine as long as NT was under firm military control. Actually, no discourse of NT other than of a military nature was possible in the period immediately after the WWII. An exclusive military framing, rooted in this period played an important role in later developments since it definitively connected nuclear fascinations with fears. Actually, fascination and fears are the background and starting point of technocratic framings. In this respect later civil use was much more acceptable than development of nuclear weaponry. This contrast perhaps supports the relatively fearless fascination during this period. It is also easier to understand that marginalization i.e. hiding of the unpleasant aspects of nuclear technology and its side effects in remote places was a popular tactic in the UK, Sweden, and Slovenia.

At the time the RW was not really an existing problem (Weart, 1988) and the RW treatment corresponded to that attitude. The existing reports on the safety precautions reveal naive and irresponsible safety management. RW as a problem appeared only 30 years after the first bomb explosion. Such a long reaction time is some of the most persuasive evidence of technocratic, self-confidence which determined the framing patterns and which firstly contributed to the absolutely irresponsible waste treatment at the beginning and secondly strongly influenced difficulties later and is still affecting efforts to find an appropriate final solution to the RW problem.

4.3 Developing "Atoms for Peace" (from 1951 to 1978)

Although in December 1951, an experimental breeder reactor (in Idaho) produced the first usable electric power from atoms and US president Eisenhower's 1953 "Atoms-for-Peace" Program proposed an international agency to develop non military nuclear technologies, civil use of nuclear energy was for a long time in the deep shadow of military use. In 1954 the first NPP in the world started to operate in the Soviet Union. In 1956 in the UK the first commercial NPP and a year after the first full-scale nuclear power plant in the USA began service. Not surprisingly civil use of nuclear power was part of the cold war competition as

[8] See details in Sundqvist Goran (2002) The Bedrock of Opinion and Thomas Jonter (2001) Sweden and the Bomb - The Swedish Plans to Acquire Nuclear Weapons.

well. The side effects of the fascination with nuclear technology, as the "embodiment of a modernist vision of abundance" (Simmons et al. 2007), was developmental optimism and arrogant ignorance. This attitude was perhaps even stronger in the eastern European countries. The "atoms for peace" programs distanced NT from the horrors of Hiroshima and Nagasaki. In this respect it is significant that the Soviet Union launched their first nuclear powered surface ship, the ice-breaker Lenin, in the same year the US built their first nuclear-powered merchant ship. But the use of the Savannah as a cargo ship was in fact delayed until 1964 due to public hearings, safety testing and labor disputes, something which was not likely to happen in the USSR!

The late 50s brought the beginning of the antinuclear movements. This also substantially contributed to the Nonproliferation Treaty (NPT) – which called for halting the spread of nuclear weapons capabilities, and was signed by most of the world states in 1968. The third pillar of the treaty allowed the peaceful use of nuclear power which was perceived as a much better option. But the military use of nuclear energy remained a high threat and became an important political question discussed in society. The year 1968 is widely recognized as an important milestone in critical, social movement development, which influenced the general public attitudes about NT (Manzano, 1986) causing the "trickle down" effect in spreading antinuclear views. In the 70s the first large scale wave of anti nuclear movements appeared openly confronting the technocratic framing versus the participatory framing. These two opposing positions represented two fundamentally different worldviews: an irresponsible utopian threat to the future of society vs. anti-modernist even Luddite irrationalism. To make the conceptual puzzle even worse the first oil shock gave not only a strong incentive to modern environmental movements but also to nuclear electricity production. As a response to the first oil crises in 1972 in the USA 41 nuclear power plants were ordered - a one-year record. The increase in ordering NPP happened in other nuclear countries as well (Canada, France, UK, Germany, Scandinavia, East Europe and Japan).

In the **UK** the civil nuclear program has developed soon after WWII. Despite some localised public opposition, the programme was established with successive phases of construction through the 1950s and 1960s (Simmons et al. 2007). Early nuclear accidents were surrounded by a certain level of secrecy (UK, Slovenia, Belgium) and at the time did not negatively impact enthusiasm for nuclear technology. However later on, the fact that nuclear accidents were officially covered up played an important role in undermining the institutional and expert credibility.

Also in **Sweden** technocratic fascination with nuclear technology capacities were astonishing: *"The early Swedish nuclear era is an amazing example of experts making national policy. Nuclear experts became the bearers of new dreams, a vision of a new society, which made them part of an "expert priesthood" with the power to decide in isolation what they thought to be best for society (Anshelm 2000: 66-67). For more than two decades this dream of an expert driven nuclear society was a consensual political project in Sweden. Nuclear experts were considered the heroes and saviours of their time, possessing the ability to transform a technical power of warfare into social welfare, through the production of clean and cheap energy. The strong military connection was not discussed in public by politicians. It was motivated as a defense project in order to support Swedish autonomy in the Cold War era" (Elam, Sundqvist, 2006).*

Belgium did not visibly join the club of large scale nuclear energy producers before 1975. However, active uranium mining in Katanga (Congo) since the 1920's and its role as uranium

supplier for the Manhattan project gave Belgium an early start in civil nuclear research activity. Important in this respect was the establishment of a national nuclear research centre (now SCK-CEN) in 1952. The centre settled down in Mol on a site bought from the royal family. Recent publications[9] reporting on that period claim that *"technical, psychological and community criteria"* were considered in the siting process (Verwimp, Verledens, 2002 cited in Bergmans e.a., 2006). Rather than this making Belgium the pioneering country in practicing participatory governance in the field, the mentioning of psychological and community criteria is more likely to refer to the relative remoteness and isolation of the area at that time. However, a claim is indeed made that at the time *"the approval of the local population"* was considered one of the criteria to be met for siting the nuclear research centre (Ibid). Such approval in those days was obtained by demonstrating the economic benefits of this operation to the mayor and parish priest-dean of the concerned municipality. The proclaimed benefits of hosting a nuclear research center and developing a civil nuclear program were**:** *"strictly peaceful applications, lots of employment, future industrial development, the residence of scientific personnel with a high social status and many visits of Belgian and foreign figures from the political, social, industrial and scientific world" (Ibid).* Such a proclamation clearly indicates the technocratic fascination framing patterns, this is also demonstrated by the initial plans to build Belgium's first nuclear test reactor in Brussels, to be incorporated into the World Exhibition of 1958. Eventually these plans were abandoned and the reactor was built in Mol, on the site of the nuclear research centre.

The presence of the nuclear research centre over the years attracted other nuclear activities in the area, some of them rather experimental (*e.g.* a prototype reprocessing plant in the 1960's). The legacy of these enthusiastic endeavors in Belgium is now called "historical or legacy waste". *"It thus seems fair to say that up until the beginning of the 1970's, nuclear energy in Belgium was primarily seen as an essential part of the economic growth"* (Bergmans, Van Steenberge 2006). Anti-nuclear activism in the 1950's and 1960's was mainly focused on the consequences of atmospheric nuclear tests, rather than on the risks of nuclear energy production.

The turn to nuclear energy production in the 1970's, however, gave rise to new opposing framings, corresponding to three types of nuclear activists: (1) alarmists, advocating technical improvements, (2) reformists stressing the undemocratic nature of NT, and (3) utopianists, self- proclaimed prophets of counterculture who advocated a radical shift in mentality (Bergmans, Van Steenberge 2006). Opponents' prevailing arguments were (1) the damages nuclear energy causes to the environment; (2) the underestimation of the risk and consequences of a nuclear accident; and (3) the underestimation of the actual costs of nuclear energy production.

In the 70s **Slovenia** (part of Yugoslavia at the time) entered the club of nuclear energy producers. The first NPP was under construction from 1974 to 1981. In the jargon of the time this was interpreted as a big achievement of the "working people of Yugoslavia" although there was hardly any possibility to effectively participate in the decision-making process. What makes the Slovenian story similar to others is the fact that the problem of the final disposal of RW was not part of the NPP project. In fact as in other countries RW was not part of any project.

[9] Celebrating the 50 year anniversary of the centre

At the beginning of this period the image of RW treatment was similar in all CARL countries. It means that the picture was "tabula rasa" i.e. predominantly white, offering almost no information.

The official statement was that RW treatment was not seen to constitute a serious problem. In the UK RW was placed in a number of areas around the British Isles, the same simple method of "high-tech" waste treatment was practiced in Belgium. There were no public comments of RW discharges and no existing RW strategy. Only for the first time in **1976** (UK) was safe waste disposal defined as the essential part of the nuclear energy program. Strong trust in expert opinion and technological programs and military constraints are the reasons that RW only appeared on the agenda in the 70s in Sweden. (See Swedish country report) In Slovenia and Belgium the RW was placed on the agenda even later. The waste problem was officially recognized at the beginning of the 1980s. Who is responsible for safe RW treatment was a question that had to be addressed at the beginning of the RW discussion. Local, national or international responsibilities were discussed. Again there was no question about who is the most competent to deal with RW. The technocratic approach was absolutely dominant in all initial RW waste disposal programs. Geology as a "king expertise" played an absolutely dominant role in the first round of siting endeavors. The social acceptability efforts meant looking for suitable siting locations in remote, less developed and hopefully also less populated areas. These simplified tactics triggered immense local opposition and set "the mood for subsequent conflicts" (Openshaw et al 1989).

In **Belgium and Sweden** the technical solution i.e. reprocessing of spent fuel was considered practical in the first phase, but a few years later the "reprocessing hopes" faded away because opponents of nuclear power protested against the reprocessing technology as it also enabled the production of nuclear bombs. In the UK which had a military nuclear program since the end of the WWII, this argument did not hold sway. In Slovenia reprocessing has never been a realistic option. At this time it was only in Sweden that the nuclear question became one of the most important social and political issues. In the 1970s the technocratic framing strategy, based on a freedom-of-action doctrine and the idea of self-sufficiency, for decades proved to be successful in minimalizing and even hiding the problematic questions on NT and RW. However, this *"dramatically changed into one of the most politically controversial topics in Swedish society. … The obvious change was the growing importance of the public arena (Student's movement and anti Vietnam protests?). Governance was broadened; both experts and politicians became anxious about how to govern the issue of nuclear power"* (Elam, Sundqvist, 2006). The nuclear question was highly problematic, politicized and led to controversial national referendum. Anti-nuclear activists made a "strategic public withdrawal" from the waste problem discussion. As a consequence the nuclear industry took control of the waste issue after 1980. Paradoxically the referendum enabled an undiluted technocratic approach in RW management.

It is possible to conclude that the development of RW framing patterns in all countries follows the same logic. In the first period enthusiasm even fascination with the civil potentials of NT, high developmental aspirations, national pride in developing such advanced (high) technology, national autonomy in energy supply, in short promising economic opportunities were distancing the image of NT from terrifying military application. This positive image legitimised the technocratic management style and suppressed isolated skepticism and attempts to participate in the decision-making process. The civil use of NT alleviated but did not stop the criticism about nuclear technology. In fact it enabled intensification of the public discussion on the nuclear question. The enthusiasm started to fade away being replaced by

much more skeptical attitudes. This shift made it possible to discuss the question of who is responsible for safely managing RW and how they should take care to make it absolutely harmless. At the beginning the answers to these questions were purely technical but "social" difficulties in solving this "marginal" problem started to play a more important role. With the exception of Sweden the problem of RW management started to become a kind of permanent "self expanding problem".

4.4 "Normal" accidents: (1979 to 1988) - shift from safe "determinism" to insecure "probability"

Although smaller nuclear accidents occurred before, there are two milestone accidents which triggered a global change in public perceptions and the political feasibility of the peaceful use of nuclear power. In **1979** a major accident occurred at the Three Mile Island nuclear plant near Harrisburg, Pennsylvania. This was "a system accident, involving four distinct failures whose interaction was catastrophic" (Perrow C., 1984). The range of (framing) influence was wide, but nevertheless limited to expert and ecological activist reference groups. In 1986 the world's worst nuclear power accident happened at the Chernobyl plant in the former USSR (now Ukraine). Since then even the civil use of nuclear energy has become much more questioned. Catastrophic framing of nuclear power started to appear in public discussions. In fact the difference between military and peaceful use became smaller. Chernobyl became the most powerful symbol for anti NT movements and attitudes[10]. The costs to prevent such accidents entered into the calculation of NT productivity, ending the illusion of cheap nuclear energy (Traube, 1986). Both events fit with the interpretations which challenge modern technological progressivism and support the shift from determinism to probability. According to Charles Perrow (1984) there is no secure high technology it is just a question of probability, a question of time, when a more or less terrible accident will occur. The expert credibility dropped and lay interpretations of technology especially technological safety became more and more confused. From this perspective nuclear technology was a paradigmatic case. It is unacceptable since the inevitable accidents will cause inevitable and unpredictable damage. Even worse, the problems of safe RW treatment, (especially spent fuel) made it transparent to the general public that nuclear technology is questionable even if there is no direct threat. In short, for an increasing number of observers safe nuclear technology literally became a "science fiction" concept. This reasoning was in accordance with the general decline of credibility in modern (scientific) institutions[11]. In the same period the civil use, i.e. the nuclear energy program, was at its peak. Already in 1980 nuclear plants generated more electricity than oil in the United States and a lot of new projects elsewhere were under construction.

In the beginning of the 1980s in the **UK** the NT dilemma became bound up with issues surrounding the privatization agenda. As a consequence of failures in RW management NIREX a limited company was founded directly by the nuclear industry. An indicative sign was the 1981 abandoning of a drilling program in favor of desk research, as well as the end of sea dumping in 1983 and discoveries of childhood leukemia interpreted by some as the consequence of a number of accidents that were kept secret at Sellafield. Ironically in the UK the Chernobyl clouds most affected Cumbria. NIREX continued to be "perceived as arrogant

[10] It is no coincidence that Beck's very influential book Risk Society appeared one year after the Chernobyl accident.

[11] The credibility crisis is nevertheless strongly connected to a legitimacy problem of modern systems (Habermas 1976 , Offe, 1990 et al.).

and inconsiderate of local sensibilities and concerns, resulting in hostility from the local population" (Simmons et al. 2007). With the adoption of Special Development Orders which attempted to offer a route to simplify the siting procedure (implying no public inquiry and/or planning permission) "government stated that, this is an area where it has proved particularly difficult to bridge the gap between scientists' assessment of risk and the honestly-held perception of the public" (Simmons et al. 2007). Attempts at site investigation were presented to communities as being a research activity only. The divergent expert and lay public framing of the issues and causes were deepening the divide between RWO and the lay people. Indeed, 1987 is important because it marked the building of the last UK NPP and the first steps towards a more participatory or at least more communicative approach to siting. A National Discussion Program launched consultation exercises to promote public understanding. Progress was made in the transition from a site selection process framed solely in terms of geological suitability to a process framed also in terms of social acceptability. Only the existing nuclear location supported NIREX ideas. Heavy criticism of expertise from other actors appeared also because the Discussion Program was orchestrated by dubious (PR) organizations and because of the previous neglect of local concerns.

Only a few weeks after the TMI accident in March 1979, the **Swedish** political parties agreed that a National Referendum on the future of nuclear power should be held early in 1980. This was in fact the peak of the Swedish discussion on the future of nuclear energy. Strong controversy between two different framings of NT including waste problems developed: a) old narrow technical and b) broader political definition. In this second framing no questions were too technical for laypeople to discuss. Mass demonstration and mass media influenced the battle of this framing divide. In the referendum 58% voted in favor of another six reactors before the nuclear program was phased out. This concluded a seven year period when the nuclear issue was a national trauma. For technocrats the participation of lay people in decision-making on 'technical' issues was humiliating and incorrect because it prevented the best technical sites being found: *"it was irresponsible to let the general public vote on nuclear safety issues and geological questions of waste storage"* (Elam, Sundqvist, 2006). Advocates of the referendum *"did not see nuclear power as a question for experts only but as a political issue, and more so when experts were in disagreement"* (Elam, Sundqvist, 2006).

In Sweden the nuclear question was for the first time reframed from a technical question to political and even moral question. Efforts to create absolutely safe long-term management produced controversies among experts. The fact that something like that is not possible to construct further undermined the expert's reputation in public. With a referendum on the future of NT the question of the safe disposal of RW in Sweden was not closed. Although in theory waste is a collective responsibility in fact the responsibility to solve the existing and future RW remained on the shoulders of people living in nuclear locations. This was framed as the "nuclear oasis siting strategy". There were dramatic confrontations at potential RW management locations. The strategy of not involving people, turned out to be a disaster for the nuclear industry. The industry was forced to change its narrow technocratic siting strategy to become more socially sensitive. A gradual process of re-adjustment was required, where both political as well as physical geology could be taken into consideration. The most important lesson was that "political geology at the surface matters". Although intense discussions could produce information overload and cause a sort of fatigue the siting could not happen without a comprehensive Environmental Impact Assessment process, clarification of the safety criteria, open information flow and dialogue with citizens. The moral of the story is that technocratic management based on expertise alone cannot legitimatize the controversial question of NT including the "marginal RW problem".

In **Belgium** low-level waste was dumped in the sea until 1982. The criticism of sea burial was based on the argument that it is a pure anthropocentric and irreversible approach, which lacked certainty about the exposure mechanisms. But it was the "Transnuklear scandal" – the coming to light of the fraudulent management of nuclear waste following a road accident on Belgian territory with a truck transporting German radioactive waste[12] - in 1986, the same year as Chernobyl, that put the waste problem on the agenda and the whole nuclear sector in a bad light. It is at this point that the RW problem moved up to the forefront. National and international scandals created a public awareness and demonstrated that a long-term solution and "stable management" of RW was needed.

The problem of HLW however remains 'in the closet' for the time being. Reprocessing of spent fuel remained the preferred strategy until 1993 and the research for disposal options remained safely confounded to the underground laboratory (constructed between 1980 and 1985) at the site of the nuclear research centre. The problem is not considered urgent, for it takes at least 50 years for the vitrified waste to cool down enough to start disposing of it. Trust was placed in the experts to come up with a solution by that time.

The end of sea dumping as a legitimate practice, however, turned the low and intermediate level waste (LILW) issue into a siting problem. The word stakeholder was not yet in fashion, technical engineers were convinced they would be able to determine the technically ideal concept and locate the technically ideal site to build it on. Meanwhile interim storage facilities were erected on the existing nuclear site of Belgoprocess (NIRAS/ONDRAF's[13] subsidiary in charge of processing and storing nuclear waste), all within a technical and expert framing of the problem. At that point in time, NIRAS/ONDRAF had never felt a need to engage other parties in setting out its strategy and no "stakeholders" had actively been knocking on the agency's door to claim an interest. For NIRAS/ONDRAF, communication meant informing concerned parties about the activities set up in line with its mission, no less but certainly not more. The technical rationale remained predominant. Communication was interpreted in terms of "public relations", as instrumental image building.

Slovenia (in a joint venture with Croatia both federal units of Yugoslavia) at the beginning of 80s put into operation their first nuclear power plant. As a latecomer in the nuclear energy club this was presented (framed) as an important technological development making Slovenia and Yugoslavia more autonomous in their energy supply and proving the technological competence of the society, state, political system etc. Because of that, but also because of the specific social and political system criticism of NT at the time was marginal. The information about TMI accidents did not reach the general public, as is the case also with the "domestic" nuclear accident[14] which only triggered sporadic and localized rumors. It is very symptomatic that for decades (from 1961 to the middle of 80s) very improvised storage of the RW coming from these early accident did not attract much attention, not even at the locality of this improvised storage. Also the problem of RW treatment produced in NPP was not present in the public discourse at the time. As energy supply in Slovenia in the 70s and even later was unstable any additional energy power plant was framed as extremely welcome. All in all this explains why a positive image of the first (and last) NPP absolutely prevailed at the beginning of the NPP operation. The expert image and the technocratic management style were also not questioned. Criticism from abroad, in the first place from Austria were officially rejected as

[12] For details on the accident in transporting waste, see Bergmans e.a., 2006.
[13] NIRAS/ONDRAF Flemish and French acronym of Belgian RW agency.
[14] The so called Zavratec case, see details in (Polič, Kos, Železnik, 2006)

unacceptable interference on Slovenian (Yugoslav) internal affairs, but on a popular level this criticism was reinterpreted (reframed) as Austrian nationalistic arrogance. The change came with the Chernobyl accident in 1986 (Klemenc, 1986). The wide and intense media coverage started discussions about the safety of the domestic NPP. Seismic safety was especially questioned since it is a widely recognized fact that the location of the NPP was vulnerable in this respect. The most effective contra arguments were framed as technological but also political i.e. an ideological explanation that the domestic NPP is not comparable to soviet technology because it was built according to superior, much safer US (Westinghouse) technology. This was already the time of the political reforms in Slovenia leading to the establishment of political party pluralism and therefore the nuclear question entered the political arena. The nuclear energy program in Slovenia fueled the growing political importance of the emerging green party who entered the first pluralist parliament in 1990 as respectively the strongest green party in Europe of the time. The technocratic response to these changes was astonishment, disbelief, suspicion and arrogant denial of any competence to any common sense concerns, which later on proved to be a totally inappropriate way to solve even the minor problem of low and intermediate RW.

It is possible to generalize that the technocratic responses to the attempts of lay people, local stakeholders and many other concerned groups and individuals were perplexed, confused, even, irrational but first of all missing the point of common sense concerns. This misunderstanding partly reflected the state of the art of the modern systems structure but it also reflected more banal things such as an irrational power play between technical and natural science experts on one side and social science experts on the other. But the crucial and it seems irreversible change was demonopolization of the technocracy in the public framing of NT issues as well as the management of RW . Since the middle of the 80s the narrow technocratic approach was already old-fashioned and so was the image of the ones who did not realize this and accommodate the change.

4.5 The end of the cold war, terrorism and global warming (from 1989 onward)

The end of the cold war not only changed the role of nuclear weaponry but influenced the image of NT in general. The focus on tensions between East and West were replaced by virtual, potential, but also real conflicts between the rich north and the poor south. Although the “clash of civilizations” idea seems an ideological exaggeration it influenced world public opinion and also the perception of the nuclear threat. In fact the “cold” and limited “hot war” over energy sources especially fossil fuel control is already underway. The proliferation of nuclear weapons continues in the countries of the south (China, Pakistan, India, Israel, Korea, (Iran)). This shift somehow decreases the intensity of the nuclear question in the West, but at the same time reduced military tensions indirectly induced new public debate on the civil use of NT. The postmodern value shift included the decreasing credibility of experts’ systems so that the “normal accidents” thesis and similar ideas stopped the civil use of nuclear power becoming more popular. Therefore pro and anti nuclear discussion proliferates as well. With the change of the political systems in Eastern European countries, the civil use of nuclear technology has entered the political arena in this part of the world as well. The civil use of nuclear has become part of the international regional politics. If the terrorist threat contributes to a recent push towards a negative framing of the nuclear question, then global warming is an

increasingly important factor in reframing the nuclear question in a positive way, again seeing NT as a potential partial solution for the world energy shortage.

In the **UK** the failure of NIREX's technocratic management style provided the impetus for a move towards greater public and stakeholder engagement from 1997. NIREX began slowly to reframe RWM as an ethico-technical issue. The shift was also the result of the empowerment of local communities, and some other changes that supported local stakeholder involvement such as promised compensation, and a declared no victim strategy. The effect of the post 1997 labor government "third way" is also pertinent to understanding the shift towards an emphasis upon stakeholder involvement as well as the policy learning that occurred between countries, a process facilitated by participation in international networks. According to the new labor politics the responsibility was not to rest on NIREX only but also on government and stakeholders. As a result of these processes the move from an adversarial frame to a greater emphasis on partnership framing appeared. There were a number of institutional changes that attempted to ensure greater openness, transparency and accountability in the work of the RWMO and for some this enabled certain stakeholders to have a greater influence on the work of the organizations.

One early example was the national consensus conference in 1999 which tried to harmonize technical consensus framing and social consensus framing by declaring three principles in searching for future solutions: *Equity* – the decision must be viewed as 'fair' to all involved, that is to the community or communities affected, the UK as a whole, to future generations, etc; *Competence* – the underlying science and technology must be seen as correct, robust and safe; and *Efficiency* – there must be a proper balance in the use of resources, i.e. safety being paramount, but no 'gold-plating'(Simmons et al. 2007). New framing implies also the creation of new relations between the main actors, what usually proves to be more difficult than just merely issuing new organizational commitments to transparency and fairness. The change in the NIREX policy was so dramatic that it is possible to characterize British RWM policy and politics in terms of pre-1997 and post-1997 phases. In the second period framing was influenced strongly by a growing acceptance that some form of public and stakeholder participation is essential to finding a proper solution for RW. Hence the Managing Radioactive Waste Safely (MRWS) process was launched as a much more inclusive process than anything previously seen in the UK: *"We want to inspire public confidence in the decisions and the way in which they are implemented. To do that, we have to demonstrate that all options are considered; that choices between them are made in a clear and logical way: that people's values and concerns are fully reflected in this process; and that the information we provide is clear, accurate, unbiased and complete. ... To do this a strong independent and authoritative body" will be set up to advise Government"* (Defra 2001, cited in Simmons et al. 2007).

The Committee on Radioactive Waste Management (CoRWM), an advisory body, was established which developed a set of guiding principles: to be open and transparent; to uphold the public interest by taking full account of public and stakeholder views in our decision-making; to achieve fairness with respect to procedures, communities and future generations; to aim for a safe and sustainable environment both now and in the future: to ensure an efficient, cost-effective and conclusive process. A set of new tools was developed: a national stakeholder forum, nuclear site round tables, open meetings, discussion groups, written materials, open activities, invited activities: forums, panels, round tables etc. The Committee recommended a continuing public and stakeholder engagement process aimed at building trust and confidence in the proposed long-term management approach, including the siting of

facilities. A volunteer based approach, together with a package of community benefits, was seen as central to successful implementation. Finally, in order to ensure the legitimacy of the process, the key decisions at each stage should be ratified by the appropriate democratically elected body.
"*The project of public and stakeholders engagement activities developed by CoRWM has been perhaps the most ambitious set of consultative and participative processes engaged in by a public body in the UK"* (Simmons et al. 2007). This rethinking of policy which frames RWM is manifest in a number of institutional changes and in the adoption of the principles of openness and transparency.

It looks like the pendulum which for decades was at the far technocrat extreme has now reached the other extreme position. This of course triggers new critical observations about the feasibility of the new program and about its sincerity. Given the social concern that existed, implementation could last several decades. The new participatory framing marks a break with the traditional approach, but there is a strong danger of it being just a cynical strategy to exhaust participatory energy.

Recently two opposing lines of framing developed in the global environment. As result of the September 11 attack the security frame is getting stronger and adds some additional power to the old fears. On the other side the intensified debate on global warming is producing a new framing of NT such as "climate change and nuclear new build", "nuke is green", "nuclear technology produces less waste". It make sense to observe critically these renewed hopes in NT as the way to solve the energy problem: "*It is just recently that wide spread discussion on global warming has started to influence the discussion on nuclear energy as one of the possible solutions to the greenhouse fossil fuels problem. It is perhaps possible to reason that the sudden extreme attention of the global and local media to the global warming question is not the result of general concerns but it is also getting strong acceleration from pro Kyoto lobbies namely those interest groups who advocate the use and development of non fossil fuels"* (Simmons et al. 2007).

In **Sweden** the general and most intensive debate on the future of NT was already at an end. It was also clear at the beginning of 80s, that the technocratic approach reduced chances to implement a legitimate RW solution to a minimum. Therefore the new siting strategy should move away from the technocratic approach. Instead of physical geology the "social and political geology" should be considered. This logically leads to the turn to the communities already hosting nuclear technology. Final disposal of spent nuclear fuel has tended to become a thoroughly localized issue. In very intense debates between parties and the public on locations scientific questions became an important topic. On the other side there was the criticism that the question of justice never became a topic in SKB[15] studies the new strategy was underpinned by the following principles: all the facts on the table; genuine local influence; EIA as a platform; to make decisions together but independently; municipal council as reference group; concrete proposals which produce engagement and influence; environmental groups offer an important contribution; to pose the most difficult questions one needs to be properly informed. Although this new strategy looks fair enough it did not wipe away all suspicions. This strategy brought remarkable success compared to problems in other countries in building infrastructure: interim storage for waste fuel and a final repository for LILW. These successes were framed as clearing up the Swedish nuclear industry. It seems plausible to believe that the most important reason for the successes was trust building which

[15] SKB Swedish Nuclear Fuel and Waste Management Company.

started in the 70s. In these efforts the Swedes succeeded in balancing the social and physical geology and made possible the international, i.e. regional (Swede – Finnish) search for the best RW site. Recently also in Sweden the climate change question is playing an important role in the nuclear technology debate. The majority of Swedes, astonishing 87% of citizens consider an advantage of nuclear power that it produces less green-house gas emissions than other energy sources (Elam, Sundqvist, 2006). The present framing presents RW as the Achilles heel of the nuclear industry, therefore the future of NT depends on the sustainability of RW management. The comparative success in solving the RW question in Sweden brings another problem to the front. "*Even if no agreement could be reached on whether nuclear activities are good or bad for the nation, or on how and where to store the waste, everyone agrees that Sweden should not take care of waste from other nation's, but only take care of its own"* (Elam, Sundqvist, 2006).

Also in **Belgium** RWM is more and more positioned as a societal question with technical implications, rather then the other way around and here as well this was an incentive to develop a more participatory approach. This shift was most clear regarding the management of LILW and can be seen as the consequence of a crisis in technocratic methods used for the siting of a LILW repository. Confrontations with the public and (local) stakeholder reactions finally created awareness of the societal dimensions. In a first attempt to address the societal dimensions, these were treated technically and measured, neglecting the fact that socio-economical parameters differ from technical parameters. EIA and SIA (Social Impact Assessment) became the new philosophies and attempts were made to try and identify a short list of sites based on technical and societal criteria starting from the 98 original sites. The move from a purely technical to a societal approach was motivated by a supposed correlation between social acceptability and perceived socio-economic benefits. The motivation to move from a "scientific" (technocratic) to a negotiation (participative governance) approach was low and although failures were evident, the technocratic approaches persisted. Comparable to experience in other countries is also the focus on existing nuclear locations when siting a repository, in order not to bother other potentially suitable locations and also allowing federal government to remain as before rather passive in the nuclear energy debate. This is in line with a shift from a technocratic to a participatory approach where socio-political factors became more important rather than the idea of the geologically optimum site. The presence of RW in municipalities gives them a chance to trade the role of hostage for the role of hostage taker. The new method strengthens the position of the local people, who became stakeholders by default. The participatory program on LILW upholds a number of principles: communicating with the grassroots; communication through formal and informal channels, joint development of integrated projects; voluntary processes; veto right, broad range of local stakeholders; open dialog, autonomy, independence; sustainable stakeholder involvement. And here as well questioning of the new method existed: "how stable is the socio-technical framework?" NIDRA/ONDRAF recognized the "de facto" lack of dialogue as an urgent prerequisite for a solution without running the risk of not being able to implement it. Therefore a balance has to be found between the technical and social approaches. It looks like PR communication meets these criteria. Although the apparently consensual shift from a technocratic to a participatory approach and the practical implementation of the new approach confronts mentally, legally, financially and logistic orthodoxy.

The paradigm shift as regards the management of HLW and spent fuel, however, has thus far only manifested itself on a theoretical level. In its last state of the art report on the research program for long-lived and high level waste dating from 2000, NIRAS/ONDRAF introduced to some extent a societal dimension. An additional background document uses the frame of

sustainable development to announce the agency's plans to introduce a more participatory approach and it promises to integrate both the technical and social dimension in its future program: *"Institutional procedures are required to involve all stakeholders in a sustainable development strategy, not only scientists and technicians but also the general public, stakeholders and the relevant authorities. The objective is a responsible development and correct implementation – two key ingredients of sustainable development".* (from SAFIR II, cited in Bergmans, Van Steenberge, 2006). However, nothing concrete has so far sprung from these good intentions. Meanwhile a moratorium was put on the reprocessing of spent fuel in 1993, because Belgium upholds the principle that each country should take care of its own waste and because of the link between reprocessing and the French nuclear program.
As regards NT, apart from the (Flemish) social democrats and green parties, all political parties appear to be in favor of postponing the phase out of nuclear energy. There is less agreement on nuclear new build, but the global shift in framing, putting NE forward as (part of) the solution to global warming, has finally settled in Belgium as well.

During the period from 1989 in **Slovenia** the perception of NT was dramatic and turbulent. Partly this comes as compensation for a relative inert previous situation. The political changes reached their peak from 1988 to 1991, and stimulated criticism of almost all achievements often reframing them as failures. This was the fate of NT as well, even more so because this problem for the first time entered the political arena almost immediately after the Chernobyl accident and because the critics were under the strong influence of the foreign i.e. western civil movement activists. The politicization of the nuclear question proved to be fatal for the Green party. Although the majority of the public opinion was apparently against nuclear electricity, the campaign to close down the NPP which at the time produced app. 20% of the electricity consumed in Slovenia failed completely. Since then the Greens disintegrated and have never again enter the parliament. To explain this result, many other dimensions of nationalistic NT framing should also be considered. The support from Austrian anti nuclear activists given to the Slovene green party in its campaign against the Slovene NPP was in this respect very much counter productive. But of course the basic mistake of the Slovene green party was the fact that it was not possible to compare the situation in a rich Austria to a much worse situation in Slovenia at the time. This development did not mean that the nuclear option in Slovenia was not problematic. As in other countries the conflict nature of NT became evident with the first serious attempts to locate permanent RW facilities which was performed under absolute technocratic rule, neglecting any, even common sense interpretation of possible general social, especially local people's concerns. This arrogant approach is particularly indicative since Slovenia was a latecomer in the nuclear club and a lot of experiences of similar failures in other countries already existed. The result was the spectacular collapse of the field work which started without any communication to the concerned local people[16]. The searching was informally framed as "scientific geological investigation of possible water, mineral and even oil layers" and as a consequence some of the journalists coming to explain the real truth were kidnapped and for a few hours even held as hostages. This failure substantially changed the strategy and institutional organization of RW management but it also changed the framing patterns. At least on the surface the participative framing started to dominate, although it was often proved that the technocratic orthodoxy is difficult to transform into a more flexible and open approach, sometimes even when overloaded with participative governance. As in many other countries, a particular problem for the technocracy is how to accept new partners into the process. But the initial dramatic paradigmatic failure is still not possible to wipe out and therefore continues to reduce the level

[16] See more in Kos el al. 1999 and Kos, 2002.

of trust below the level necessary to make the new participative strategy feasible. Along with the substantial change came rather frenetic institutional changes which are difficult to follow especially from an outsider's point of view. In Slovenia also the RW problem became more or less a local or localized issue, avoided by national politics and parties. At the same time it remains prone to political instrumental use by ad hoc local civil initiatives. This is possible because the social construction of NT and RW safety is still rather unstable and "soft" i.e. easy to influence. With few oscillations technocratic arrogance in Slovenia seems as lasting as long lived RW. One of the side effects is a low motivation to learn. It prevents the technical experts from comprehending that the general public is becoming much more skeptical. In fact they still can't believe that people don't believe them as they used to and they think this skepticism weakly correlates with the quality of the expertise.
Therefore informal framings of the RW problem still range from explosive material to absolute safe materials which "could be stored even under the bed" as frankly declared once by a highly ranked nuclear expert. Somehow it is not surprising that in Slovenia new hopes for the development of nuclear energy are rising and are already included in governmental energy plans. It is also symptomatic that these new ideas emerged without adhering to the participatory standards established in the previous period. In spite of that the possibility of finding a sustainable RW site is zero, if a technocratic approach prevails in this process again.

In the last period the participative model of RW management became at least officially absolutely consensual. However, the differences between countries in this respect remain important and correspond to the time of its implementation and accumulation of experiences. But although Sweden opened up the decision-making process in the 80s from the local point of view, the problem of RW siting remains problematic even there. A lot of communicative and participative instruments were developed in this period but the legitimacy of RW siting remains a difficult task. The original sins still affect the attitudes of actors which all together got promoted and became "stakeholders". This impression is strengthened by the suspicions that the experts (technocrats) did not willingly accept the change of the technocratic decision-making model to a participative one. From their perspective this shift was the only way but not the best way to get out of the dead end. Recent post Kyoto aspirations of the nuclear industry are in line with these doubts. It looks like new technocratic temptations are on horizon.

5 Conclusions

The analysis of the RW framing in Belgium, Slovenia, Sweden and the UK reveals a number of similarities. In fact the general developmental pattern is universal: the move from the mysterious, elitist management of NT (and RW) at the time when the civil application of NT started to develop out of military nuclear programs was someplaces sooner and others later replaced by a more or less participative governance. The process of "civilizing" generated framings ranging from fascination to fear. At the beginning promising powerful technology fascinated people and this certainly supported technocratic approaches and framings. Later on the fascination was replaced by growing skepticism. In such a context the technocratic management became counter productive and was replaced by a much more communicative participative governance. It looks like that fascination turned to opposition. People who lost its utopian hopes became harsh opponents of the NT especially at the local level. This development was part of the general legitimacy crisis in modern societies. This explains why the timing of these changes is important. The early participation was effective (Sweden) but

this can not be said for later attempts (Belgium, Slovenia, the UK). On the basis of our analysis it seems plausible to explain the limited success of the participation decision-making model in these countries in comparison to Swedish results by its instrumental (read PR) nature. Instead of introducing genuine participation in decision-making the prevailing framings of RW reveal that under the surface of formally accepted participative approaches the technocratic paternalism remains strong. There are even indications that it is growing again.

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