

Nuclear Waste as Cultural Heritage of the Future – 14361

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ABSTRACT

Archaeology is accustomed to dealing with long term perspectives and to manage human legacies, the cultural heritage. Cultural heritage management and nuclear waste management share concerns with the permanent preservation of material items, long-term memory keeping, and knowledge transfer to future generations. Nuclear waste can be considered as a very particular kind of future cultural heritage. In this paper, we explore the affinities and differences between cultural heritage and nuclear waste through a discussion of the existing divergences of future consciousness in both realms. We argue that making nuclear waste management a question of heritage may contribute to making the inadvertent exposure of future human beings to radioactivity less likely. At the same time, it might contribute to appreciating nuclear waste not only as a threat but also a resource for future generations, thus allowing for perceptions, valuations and uses of this heritage in futures that will radically differ from today.

INTRODUCTION

Worldwide, there are now some 300,000 tons of high-level nuclear waste, with an additional 12,000 tons being added every year. The currently favoured method for discarding this waste is geologic disposal in mined tunnels drilled into stable geological formations several hundred meters below the surface. The process of selecting appropriate locations for such final repositories of high-level radioactive waste is now under way in several countries. The goal is to isolate nuclear waste from the human environment, near enough permanently. It takes at least 100,000 years before highly radioactive nuclear waste is no longer dangerous for humans. Present and future generations are therefore faced with the task of safeguarding this waste for a very long period of time involving, among other things, the transmission of information about the location, character, and content of these large but on the surface invisible, underground repositories.

Never before in the history of humankind has any comparably complex information been communicated to human beings living thousands or even hundreds of thousands of years in the future. Any physical marker at the location will struggle to exist over such long time periods, given the expected impact of major climatic changes including, for example, a new ice age during which massive layers of ice will abrade the surface of the land. Archives are kept all over the world but we cannot guarantee that they will survive long enough. Moreover, we know neither which written languages will be understood in the long-term future nor whether pictograms or symbols will be interpreted in the way we meant them. In fact, we cannot even be sure that the humans receiving our messages will belong to the species *Homo sapiens* which is not older than 200,000 years and may not exist in the same form a few hundred thousand years ahead. In this situation, some researchers have been recommending that the solution lies in creating cultural structures (e.g. continuing traditions or institutions) that may keep the memory alive and help transmitting them from one generation to the next (e.g. [1]).

The authors of this paper are both archaeologists with an interest in applying their academic expertise to challenges in contemporary and future society [2]. Since 2012 they have been working on an interdisciplinary research project entitled *One hundred thousand years back and forth. Archaeology meets radioactive waste*. The project is a collaboration between the Department of Cultural Sciences at Linnaeus University, Sweden, and the Swedish Nuclear Fuel and Waste Management Company (SKB) and will continue until the end of 2014. In the context of this project, both authors also participated in several workshops on Preservation of Records, Knowledge and Memory Across Generations of the OECD Nuclear Energy Agency in Paris, France (www.oecd-nea.org).

Archaeologists are accustomed to dealing with long term perspectives and to manage human legacies, the cultural heritage. In cultural heritage management, archaeologists are working to preserve places, environments, and associated values and knowledge for future generations. Arguably, nuclear waste can be considered as a very particular kind of cultural heritage of the future, providing information about our own time. The two realms of cultural heritage management and nuclear waste management share concerns with permanent and sustainable preservation, secure storage of material items, long-term memory keeping, and knowledge transfer to future generations. Both realms are characterized by a felt responsibility towards the future, which is manifested in a perceived duty not to leave a legacy harming or threatening future generations' quality of life, whether in the form of hazardous waste containing radioactive material that will survive for too long or in the form of valuable cultural heritage that will not survive long enough. We therefore argue that considering nuclear waste as cultural heritage of the future can be instructive in relation to records, knowledge and memory concerning geological repositories of nuclear waste.

This paper explores some such affinities between cultural heritage and nuclear waste, also indicating some significant differences between both realms that remain. In particular, we will discuss what can be learned from contemporary cultural heritage management and current thinking in Heritage Studies regarding the challenge of preserving cultural heritage and passing information to future generations. As we will see, possible lessons for long-term communication about final repositories of nuclear waste include the need of a stronger concern with different perceptions of the future in the present and in particular with changes in the perceptions, values and uses of "nuclear waste" and its repositories over time. The paper will provide some 'food for thought' for professionals working with long-term communication issues in relation to final repositories of nuclear waste.

FUTURE CONSCIOUSNESS IN THE CULTURAL HERITAGE AND NUCLEAR WASTE SECTORS

The concept of historical consciousness refers to the meaningful relations between past, present and future that govern – and are established and reproduced – in uses of the past. Historical consciousness is thus a concept that refers to the underlying thought structures that generate meaning when a particular historical perspective is actualized and given significance in the present, implying certain consequences for the future [3]. Similar thought structures can also be actualized and given significance by particular perspectives on the future, with certain consequences for how we see the past. Therefore, historical consciousness could equally well be called future consciousness. The concept of future consciousness is in line with so-called critical future studies which are framed by a constructivist and self-reflexive approach [4]. In relation to the cultural heritage sector, critical future studies typically involve

critiques of the assumption that future generations will appreciate what we preserve and conserve – which is more than appropriate as we do not know what future generations are going to appreciate [5].

Just as it is possible to analyze historical consciousness from the way it manifests itself in uses of the past, future consciousness can be analyzed from the way it manifests itself in uses of the future. In the case of nuclear waste management we can therefore ask: How do professionals in the field reflect upon how they use the future in their work? To what extent do the professionals appreciate how future consciousness affects and is reflected in their use of the future, and vice versa? How do they look at other people's future consciousness and possibly alternative uses of the future in relation to the same issues? These questions are still a virtually unexplored field, both within the cultural heritage sector and in the nuclear waste management industry.

Both the cultural heritage and the nuclear waste sectors preserve in the present potentially dangerous material culture for the future. Future generations will, in one way or another, find, make sense and possibly make use of this material. It is therefore interesting to ask whether or not professionals in both realms perceive of the future in the same way and what may account for any apparent differences. By the same token, how do any different perceptions of the future influence the respective working strategies in each sector in the present?

As part of our project we studied future consciousness in the cultural heritage sector. This work involved the study of strategy and policy documents mostly originating in Sweden, the UK and at global level (UNESCO), as well as interviews with circa 70 professionals working in the cultural heritage sector in Sweden (ca 50), England (7), at UNESCO (5) and in various other countries (9). The results remain to be analysed in detail but one trend is clear. The cultural heritage sector tends to perceive of a future that lies at the most 2-3 generations ahead (or an unspecified, infinite future that is “forever” or “until further notice”). The sector assumes that that future will essentially be a continuation of the present. We have not met many attempts to understand how the future may differ from today. Few in the cultural heritage sector have professionally thought very deeply about the future (see also [6] [7]). Indeed, some professionals do not see a need to consider a longer future in their work at all, an attitude which is comparable to standpoints held by lay-persons, indicating that it does not derive from professional considerations but from basic common opinions [8].

This contrasts sharply with the commitment and seriousness in addressing concerns that lie in the long-term future which we have come across in the nuclear waste sector. For example, the Swedish Nuclear Fuel and Waste Company unashamedly writes on one of its banners used in external representation: “Think about your future. That’s what we do. 100,000 years into the future.” These are more than slogans, as a number of comprehensive studies manifest which were initiated and supported by the nuclear waste industry in Sweden, the United States, and elsewhere (see e.g. [1], [9], [10], [11]; recent overviews in [12] and [13]).

NUCLEAR WASTE AS CULTURAL HERITAGE

Considering nuclear waste as cultural heritage of the future raises the question of what we can learn from this sharp contrast between the cultural heritage and the nuclear waste sectors regarding their concern for the long-term future. The implications for the cultural heritage sector of these differences we will explore in more detail elsewhere. In the present paper we will discuss some tentative lessons for the nuclear waste sector by addressing the following three questions:

Firstly, given the lack of future consciousness in the cultural heritage sector, what can explain its marked presence in the nuclear waste sector?

Secondly, given the extent to which the cultural heritage sector appears to perceive of the future as a mere continuation of the present, does the same risk exist for the nuclear waste sector?

Thirdly and finally, what kind of beneficial synergies might be created by coupling the discussion of the management of nuclear waste with that of the management of cultural heritage?

Why The Future Matters

As the case of cultural heritage management illustrates, the fact alone that many feel a responsibility towards the future and seek to preserve certain things securely so as to further future generations' quality of life does not in itself lead to serious attention being given to future issues. It seems rather that there are other considerations that have a bearing on the standing of future issues in every given present context. In particular, the degree of contentiousness in relation to each specific context may play an important role. Most people appear to be overall content and even happy with the idea that cultural heritage is being looked after and preserved in the way it is being done in present societies - although there is a considerable variability in what that means and what is considered acceptable in various circumstances.

Nuclear power, on the other hand, has been politically highly contested throughout its existence, and the recent nuclear catastrophe at Fukushima in Japan has brought many of the problems of that technology and the perceived need to find alternative sources of energy back to the fore. The fact that the future of nuclear power as such is very much at stake in contemporary society affects even the way in which nuclear waste is widely being seen: as yet another problem and future risk that comes along with the use of nuclear energy. Any engagement with the future of nuclear waste invariably addresses such concerns about nuclear technology in the present. Solutions proposed for final repositories of nuclear waste need to satisfy not only reasonable demands of knowledgeable experts but also the many worries of contemporary citizens. That may be one important reason why the cultural heritage and the nuclear waste sectors have so different attitudes towards the future, despite surprisingly many similarities in the nature and aims of their work. If nuclear waste was seen as merely another form of cultural heritage, or for that matter just another form of rubbish, we dare to speculate that not many experts would worry about what happens to it in 100,000 years from now.

Appreciating That The Future Will Differ From The Present

Many assumptions being made today in both sectors do not in fact build on an understanding of how the future will be different from today although, ironically, the fact that the future will differ from what we are used to in the present is undisputed as such. Rather, what we see is planning in ways that imply that key aspects of cultural heritage and nuclear waste in the present will not change greatly in the future. The tendency to assume a likeness of present and future is less likely the longer ahead you are planning for but it corresponds to the way people, as individuals, "expect to change little in the future, despite the fact that they have

changed a lot in the past” which in turn “bedevils their decision-making” [14]. Does the same tendency also bedevil decision-making in the cultural heritage and nuclear waste sectors?

We cannot be certain that cultural heritage is always going to be valued as a source of historic information or as a symbol of a collective past and that the various heritage objects and even entire landscapes we preserve will be appreciated by future generations for the stories they can tell about the past. We cannot know for certain if and how future generations will perceive, use and receive benefits from cultural heritage. Many if not all heritage objects have been reinterpreted regularly during the time of their existence [15]. Indeed, the very notion of a cultural heritage worth preserving in systematic fashion for the future has not been existing for much longer than about a couple of hundred years. The notion of cultural heritage, as we understand it today, is undoubtedly part of our history and thus, ironically, part of the future human heritage in itself [16]. The best we can do is make sure that certain things are preserved for one or, in certain circumstances, a few generations longer.

We cannot be certain either that nuclear waste will always be seen predominantly as hazardous waste posing a threat to humanity and that their physical properties, notably the radioactivity, will always be their most significant or most interesting characteristic. New technologies, such as transmutation, may allow using nuclear waste to generate further energy or for other purposes, so that this waste becomes a precious resource. Although radioactive substances can be very dangerous, for example when they enter the food chain or are used in dirty bombs, the locations of their storage or disposal do not have to be seen forever as areas of deadly threats but may, given time, be transformed into altogether different things. This is not to deny or ignore real dangers posed by radioactive material to future generations but more to look at these dangers in the present from a different perspective on their possible future context. Who would have thought back in the late 1980s that the area around the destroyed reactors at Chernobyl, although in places still radioactive, would become something of a nature reserve which it is now?

Radioactive material can also be a creative medium to be used in art (as exemplified most prominently by the work of James Acord). Alternatively, it may be a trace from which future archaeologists can learn a great deal about us. Incidentally, since it is not necessarily the radioactivity itself but first and foremost our attitudes towards it which become visible in the archaeological record of the future, radioactive material may, in the eyes of future researchers, become a highly appreciated, diagnostic feature of significant technological, social, psychological and ideological processes of our time [17]. The very notion of “nuclear waste” may not be understood in the future as we understand it today. Although radioactivity as a physical phenomenon will still exist, people may not be concerned about it in the same way we are, perhaps due to a confidence – rightly or wrongly – that they are able to protect themselves from its impact. It is all very well to inform and warn future generations of the potential impact of a strong but invisible force deep below the surface but we should not forget that most messages of a similar kind which we have received from the past are significant to us, too, as everything else but guidance for our thinking and actions. Arguably, we have to agree with David Lowenthal [18, p. 393] who argued that “nothing is less likely than a plausible future”. But how do you make plausible plans for an implausible future? The analogy with cultural heritage suggests that the best we can do is to make sure that certain important information is preserved for one or perhaps a few generations longer. After that the content and importance of any information will have to be re-evaluated and re-formulated in a process of continuous translation into new contexts in which our nuclear waste may acquire new meanings and uses.

Merging Discussions

We suggest that a strong future consciousness in the cultural heritage sector, especially when coupled with a recognition of nuclear waste as heritage, might in itself help keeping alive knowledge about nuclear waste depositories in the future.

If the cultural heritage sector was to develop a more elaborate and thought-through strategy concerning cultural heritage in the future and indeed the future of culture heritage, the case of nuclear waste might provide an interesting model and example. If that was the case, the explicit concern in the nuclear waste sector with a future of at least 100,000 years ahead of us and the comprehensive work that has already been undertaken in this field would give considerable currency to the presently perhaps still surprising analogy between cultural heritage and nuclear waste. As a result, nuclear waste might more widely be seen as a special case of cultural heritage of the future and the debate about its present management and future fate might become less affected by larger political concerns and worries about nuclear energy in general than is the case at present. Another important possible benefit of linking the concerns of the two sectors with each other might be a stronger institutionalization of the need to safeguard information about repositories of nuclear waste over long periods of time. If appropriate information would not only be stored in archives but also be referenced in collections and museums of cultural heritage (art, history, technology...) the chance might be higher that future generations will perceive a need to re-evaluate and re-formulate that information so that it will enter even those institutions that will eventually succeed our archives and museums.

Hopefully the combination of all of these effects of making nuclear waste management a question of cultural heritage will contribute to making the inadvertent exposure of human beings to radioactivity less likely and act at the same time both realistically and responsibly towards future generations.

CONCLUSIONS

Radioactive waste disposal management has the protection of future generations from inadvertent exposure to radioactivity as its principle objective. A waste disposal facility ought to be safe enough and warning systems reliable enough to ensure that nobody in the future risks coming close to it without knowing that it contains dangerous radioactive waste [19], [20]. We have no intention to question or change this principle objective. What we wanted to discuss in this paper is that this principle reflects the future consciousness of people involved in radioactive waste management and associated discussions, manifested in the way they talk about radioactive waste as something future generations should be protected from rather than benefit from. This perspective led to numerous studies, analyses and written scenarios which aim at avoiding inadvertent exposure to radioactive waste. Based on these works, proposals for action plans have been formulated on how to minimize risks of exposure [19]. However, this body of work rarely (if at all) discusses how to maximize the future benefits of the radioactive waste, i.e. how we today can best make sure that we will protect future generations from inadvertent exposure to radioactive waste without constraining future accessibility and uses of this heritage, for the benefit of human beings living then.

The assumptions made today about the meaning of cultural heritage and nuclear waste in the future can be seen as ways of making sense and “domesticating” the future in the present. Invariably, they tell us more about how we think in our own present than what will occur in the future. The cultural heritage and nuclear waste sectors have much in common but they

differ markedly in the significance they give to future issues. However, both sectors will need to put more emphasis on trying to understand that the future will hold profound changes and plan for scenarios that differ in profound ways from the way things are in the present. If nuclear waste was seen as another form of cultural heritage it could become a lot easier to persuade contemporary audiences that it might in the future be seen in a very different light than today so that even more realistic plans for its storage and disposal could be made.

We believe that there is much to be gained from looking at nuclear waste as cultural heritage of the future. In this paper, we offered some first thoughts on possible benefits from bringing the two realms closer together for accomplishing the important task of responsibly managing and taking care of nuclear waste for a long-term future.

REFERENCES

- 1 M. BUSER, "Hüte"-Konzept versus Enlagerung radioaktiver Abfälle: Argumente, Diskurse und Ausblick. Expertenbericht (1998).
- 2 C. HOLTORF and A. HÖGBERG, "Heritage Futures and the Future of Heritage." In: S. Bergerbrant and S. Sabatini (eds), *Counterpoint: Essays in Archaeology and Heritage Studies in Honour of Professor Kristian Kristiansen*, pp. 739-746. BAR Int. Ser. 2508. Oxford Archaeopress (2013).
- 3 J. RÜSEN, *What is Historical Consciousness? A Theoretical Approach to Empirical Evidence. Paper presented at Canadian Historical Consciousness in an International Context: Theoretical Frameworks*, Vancouver, BC, University of British Columbia (2001).
- 4 R. SLAUGHTER, *New Thinking for a New Millennium*. London: Routledge. (1996).
- 5 C. HOLTORF and O. ORTMAN, Endangerment and Conservation Ethos in Natural and Cultural Heritage: The Case of Zoos and Archaeological Sites. *International Journal of Heritage Studies* **14** (1), 74–90 (2008).
- 6 D. H. R. SPENNEMANN, "The Futurist Stance of Historical Societies: An Analysis of Position Statements," *International Journal of Arts Management* **9** (2), 4–15 (2007a).
- 7 D. H. R. SPENNEMANN, "Futurist Rhetoric in US Historic Preservation: A Review of Current Practice," *International Review on Public and Non Profit Marketing* **4** (1/2), 91–99 (2007b).
- 8 P. JOHANSSON and E. LISBERG JENSEN, *Identitet och trygghet i tid och rum - kulturteoretiska perspektiv på kärnavfallsfrågans existentiella dimensioner*. SKB Rapport R-06-119 (2008). Available at <http://www.skb.se/upload/publications/pdf/R-06-119.pdf>
- 9 J. LOMBERG and S. C. HORA, "Very Long Term Communication Intelligence. The Case of Markers for Nuclear Waste Sites," *Technological Forecasting and Social Change*, **56**, 171-188 (1997).
- 10 G. BENFORD, *Deep Time. How Humanity Communicates Across Millennia*, Avons, New York (1999), Part One.
- 11 G. BANDOLIN and S. SÖRLIN, *Laddade landskap - värdering och gestaltning av teknologiskt sublimes platser*. SKB Rapport R-07-14. (2007). Available at <http://www.skb.se/upload/publications/pdf/R-07-14.pdf>

- 12 IAEA (International Atomic Energy Agency), *Long Term Preservation of Information for Decommissioning Projects*. Technical Reports Serie no 467. IAEA, Vienna (2008). Available at http://www-pub.iaea.org/MTCD/publications/PDF/trs467_web.pdf
- 13 M. DRACK, *Ent-sorgt? Überlegungen zur Kommunikation betreffend radioaktiver Abfälle und zu den Ideen für die Markierung geologischer Tiefenlager*. Master Thesis in Communication Design, Hochschule der Künste Bern (2013).
- 14 J. QUOIDBACH, D. T. GILBERT and T. D. WILSON, "The End of History Illusion," *Science* **339**, 96-98 (4 Jan 2013).
- 15 C. HOLTORF, *Monumental Past: The Life-histories of Megalithic Monuments in Mecklenburg-Vorpommern (Germany)*. Electronic monograph. University of Toronto: Centre for Instructional Technology Development (2000-2008). Available at <http://hdl.handle.net/1807/245>.
- 16 C. HOLTORF, The Heritage of Heritage. *Heritage & Society* **5** (2), 153-173 (2012).
- 17 R. MAXWELL, "The Radium Water Works Fine until His Jaw Came Off" - The changing role of radioactivity in the 20th century," unpublished manuscript (2012).
- 18 D. LOWENTHAL, "The Forfeit of the Future," *Futures* **27** (4), 385-395 (1995).
- 19 M. BOWEN-SCHRIRE, H. JANDER and K. WANIEWSKA, Kunskapsbevarande för framtiden - Fas 1. SKB Rapport R-07-220. (2007). Available at <http://www.skb.se/upload/publications/pdf/P-07-220.pdf>
- 20 M. BOWEN-SCHRIRE, D. ECKERHALL, H. JANDER, K. WANIEWSKA, Bevarande av information om slutförvar för använt kärnbränsle - förslag till handlingsplan. SKB Rapport P-08-76. (2008). Available at <http://www.skb.se/upload/publications/pdf/P-08-76.pdf>

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