Planning of Mega-Projects: Nuclear Contamination

by Melania Cavelli

L'auteure, qui a vécu près d'une des premières centrales nucléaires d'énergie, examine les problèmes non résolus de l'énergie nucléaire. Elle est persuadée que l'arrogance et les techniques abusives des chercheurs, les services d'électricité, les politiciens et les sciences dominées par les hommes sont complètement aveugles sur les risques que courent les humains, l'environnement et les enfants.

While in general it is possible to say that a traditional plant can contaminate only while it is functioning, and not create problems after it has been shut down, nuclear power plants are dangerously radioactive years after of shut-down.

For many years I have lived close to one of the world's first nuclear power plants, built at Garigliano (central Italy) in the year 1959. I have experienced the hidden costs of this emblematic technology of our century: in terms of resulting damage, disability, and disease. Recently, a new mega-project has been planned in the same area: a new gas plant with an adjacent gasoline deposit, and both are planned to be constructed 200 metres away from the nuclear waste deposit at Garigliano. This project, which will add new dangers in case of fire and explosion to the existing nuclear contamination (starting from the gas station and gasoline deposit and propagating to the radioactive wastes, according to the Environmental Impact Assessment (EIA), has so far no precedent in the world.

As a member of the Scientific Committee which represented the local administration (City of Sessa Aurunca) during the process of the Environmental Impact Assessment of this new gas plant project, I directly witnessed that only economic considerations led to the selection of that particular site.[1] In that way, it was thought possible to reduce the surveillance costs of the old power plant which still awaits dismantlement. And, as usual in current scientific evaluations, the costs of a major accident have not been included in that calculation. The result is that for the sake of reaping small benefits, the authorities are ready to put at high risk the physical well-being of many people.

In this article I would like to describe what I learned in many years of direct experience and studies on the nuclear issue at Garigliano.[2] At the end, I would like to raise some questions and considerations.

Hypothetical costs of nuclear plants

There are many hidden costs of nuclear energy, and our present knowledge does not permit us to calculate them. The discussion is still open with respect to the costs to the environment and to health. Little, however, has been said about one type of cost which, after 50 years of nuclear experience and more than 550 power plants constructed, should be sufficiently transparent: the cost to dismantle (or of "decommissioning") nuclear power plants. This is certainly not a minor cost due to the characteristics of the nuclear cycle which make it different from any other. While in general it is possible to say that a traditional plant can contaminate only while it is functioning, and not create problems after it has been shut down, nuclear power plants are dangerously radioactive even years after of shut-down.

Due to the breaking down of materials, the parts of the reactor which are subject to bombardment of neutrons become sources of radiation; therefore, the elements which must be removed are not only the fuel rods but the structure of the reactor itself. The presence of radioactive isotopes such as nickel and niobium, which have half-lives of tens of thousands of years in some components of the reactor, make solutions of reinforced concrete impracticable. No structure can remain intact for a very long time. After one or two centuries at most, the cement of the reactor starts to break down, and the steel begins to rust until radioactivity begins to leak out of the plant. The only way to stop this from happening is to dismantle the inactive reactors.

But not one commercial nuclear reactor has yet been dismantled in the world. Not one of the 34 countries which make use of nuclear energy have developed a reliable technology in this field. It is almost certain that the old cost estimated for decommissioning—which years ago were calculated around 10 per cent and recently around 30 per cent to 40 per cent of the cost of the construction of the nuclear plant—have to be changed (Pollock; Norman). In the light of the most recent experiences and difficulties of decommissioning the first-generation reactors, these estimates must be increased enormously. Such costs, according to the Battelle Pacific Northwest Laboratory, vary according to the design of the reactor and depend on the number of years elapsing between shut-down and decommissioning. The difficulties and problems are great and are surrounded by enormous uncertainty.

There are three stages in the decommissioning process to the complete dismantling of a nuclear plant.

and Health Risks at Garigliano, Italy

Stage I is the shut down of the reactor and the removal of the fuel rods. Stage II is the confining of radioactive materials inside a vessel. Stage III is the total removal of the remaining components (total dismantlement). As the American Nuclear Regulatory Commission advises, to reduce the surveillance costs it would certainly be better to reach Stage III as quickly as possible. This already creates difficulties for electrical companies which find themselves immediately having to face enormous and unknown problems. Judging by the case of the nuclear power plant of Garigliano, their strategy is to postpone the enormous and unresolved problems of total dismantelement by building a gas-fired plant in the same area.

Managing insecurity at Garigliano

At Garigliano, the gas plant project and the gasoline deposit adds new danger to an already critical situation.

From the year 1962 onwards (after the construction of the nuclear power plant), the population at Garigliano had to deal with many accidents, of which the gravity was only known later on (from secret surveys which were leaked) and, from 1968 on, even with plutonium experiments. These experiments were carried out by the Italian Electricity Generating Board (ENEL), in line with a program implemented in conjunction with Euratom. In a first refill two per cent plutonium-enriched fuel elements were inserted in the reactor—with a total of 12 elements—then another 46 elements (in 1975). It is well known that plutonium is a high-grade toxic substance with chemical and radiation effects; it is, furthermore, of high strategic military importance. The radioactivity of plutonium becomes halved after 24,000 years and it remains dangerous for more than 400,000 years. From a strategic and safety point of view, there exists, apart from the risk that countries importing fertilizing technologies[3] may be using plutonium to construct nuclear weapons, the danger that terrorist groups also have rudimental techniques for acquiring and manufacturing plutonium weapon devices.

Besides the plutonium experiments, the data on radioactivity in the environment were published with delay, the isotopes of plutonium and its discharges were not regularily measured, nor was this information made public. Disregarding any norm, the global dose of ingestion authorized at Garigliano was of seven man-rem/year (until August 27, 1974), whereas the international norm at that time was a maximum permissible dose of six man-rem/year.[4]

To have an idea of the large volumes of radioactive elements which were discharged, one can refer to many documents. In particular, a report by the National Organization of Alternative and Nuclear Energies (ENEA) (Brondi), maintains that the total area which is contamined by Cobalt 60 and Cesium 137 in the Gulf of Gaeta extends beyond 1,700 square kilometres (and concerns two Italian regions: Campania and Lazio).

The resulting damage of these plutonium experiments, bad management, and environmental contamination have been measured mostly by non-governmental epidemiological studies. Official epidemiological studies have never been made public, even though that was promised. However, the conclusions of the available non-governmental studies are alarming.

The frightful increase of cases of genetic malformations, observed in babies born in the area of the nuclear plant has reached a level which is objectively alarming. In fact, the rate which for the period 1971-1980 had been six per thousand, grew to 14 per thousand in 1982 and reached 19 per thousand in 1983 (Tibaldi 1985). And it was shown through research done by non-governmental and academic sources that a direct connection exists between teratological cases (malformation in animals) and the presence of the nuclear plant (Petteruti; Amarena, Contoli, and Cristaldi).

The problem of decommissioning

In 1979 the Garigliano plant was finally closed down. Yet, after 15 years of being shutdown, the nuclear reactor has not been dismantled.

The problem is that (with current knowledge) the dismantlement of used reactors is impossible to carry out, unless one risks human lives (it is not possible to calculate in a valuable manner the doses which workers would be subjected to), and the irreversible contamination of the site (because of the emanation of radioactive dust, etc....).[5]

Even decontamination, which

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could be necessary for both safety and the feasibility of dismantling, can create many problems. One problem is that decontamination efforts add enormously to the volume of waste produced by decommissioning, and frequently only move the radioactivity from one place to another. Today, electric utilities all over the world are facing incredible difficulties to find safe storage space for the thousands of tons of radioactive materials which would result from the decontamination and decommissioning of their nuclear plants. Italy, for example, has already recognized its inability to find such a place in the country.

The problem is caused by the high contamination of the nuclear reactor itself after years of functioning. For example, the doses found inside the nuclear reactor of Garigliano are enormous. Even 30 to 40 years after shutdown the activity remains at a very high level. These high doses have to be dealt with in the case of decommissioning (and total dismantlment).[6]

The phony calculations

The costs of the total dismantling operations are still unknown. Some estimates calculate a cost of 30 to 40 per cent of the construction costs. But it is very likely that none of these costs were calculated properly because of the uncertainty of this operation and because the practical decommissioning experience is limited to very small reactors which are not comparable to commercial ones (like the nuclear plant of Garigliano). Another reason is related to the variety of large reactors in operation, which make decommissioning costs and experience not easily transferable among utilities. Further hidden costs are related to the toxicity of high-level wastes which require that they be kept out of the biosphere for tens of thousands of years—longer than recorded history. It is unthinkable that anybody is able to calculate the costs of custody and surveillance in that respect. The result is that the cost of nuclear kilowatt-hours cannot be truly identified. It is surely much higher than the cost of soft energy sources.

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However, the same phony cost calculations are the official reason for the second mega-project at Garigliano: the gas plant which I have described at the beginning of this article. Learning from the Garigliano experience, many questions and considerations can be raised.

What are the reasons behind the increasing number of high-risk mega-projects (such the gas-powered plant at Garigliano) which, for the sake of reaping small benefits, add more risks to the already existing risks of the physical integrity of people and other species? Why—as the main studies on risk perception show—do men worry less about potential hazards (from nuclear to chemical)? Why are they still building new nuclear power plants which they do not know how to dismantle (or "decommission"), generating more nuclear waste which will endanger life for millennia? How can we deal with this unbalanced (from the gender point of view) and dangerous situation? How can we react against this technocratic arrogance, and stop this spread of homicide, genocide, and biocide around the planet?

One way is to formulate a strategy for imposing new limits on the abuse of technologies. This would require women to intervene in the political arena to assure a controlling presence in the "hard sciences," from military and civil nuclear research to biotechnologies. This is a necessity because never before have such a vast number of human beings lived at the mercy of such a minuscule minority of "experts," whose specialized knowledge seems only to increase the magnitude of their incompetence in the very areas of their professional specialization. This minuscule minority, especially in the area of nuclear research, consists almost exclusively of men. They have given birth to an "age of monstrous man-made disasters" (from Hiroshima to Chernobyl, from Seveso to Bophal) deciding (without any restriction and with the usual impunity) on topics which concern our everyday life, our bodies, and our children's future. Another point is more psychological: men and women have different perceptions of risk. Having worked for many years on the nuclear issue, I can see this difference very clearly. It is related to the irresistible male fascination with technology (see Easlea). I think we should reflect on this specific point, which opens (for all of us) a universe of new responsibilities for assuring a sustainable future to our precious, beautiful earth. And the creation of such a sustainable future clearly needs a stronger contribution of women at decision-making levels.

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[1]Many better sites, even in the same city and region, could have been found, eliminating at the same time the dangerous interferences between the new gas plant and the nuclear wastes.

[2]I carried out my University dissertation on the EIA of the nuclear power plant of Garigliano and did research on the decommissioning issue for the Italian World Wildlife Foundation (published as *Il veleno nella coda*).

[3]Fertilizing technologies are used in fast breeder reactors. The reactors are

designed to produce more fuel than they consume by converting large amounts of Uranium 238 into plutonium while generating electricity at the same time.

[4]On 27 August 1974, the Minister of Industry "considered illegal the risk linked to the exposure of many critical components to the maximum permissible doses" and that he modified the established limits of the quantity of waste. "Such regulation, the valididtiy of which was in a first moment limited to 18 months, has been successively lengthened" (Pretura di Sessa Aurunca, 1981).

[5]At Garigliano they calculated that the occupational doses of an immediate decommissioning will raise the level of 3,000 to 4,000 man-rem.

[6]The report by Goddaret *et al.* "Activation of Steel Components," says that: "... the dose at the centre of the vessel is due largely to the presence of the termal shield which even after 200 years of shut-down produces and intensity of about 15 millirem per hour; if the thermal shield is removed the dose intensity would be sustained by the stainless steel cladding adjacent to the core. An intensity of about 15 millirem per hour will exist 90 years after shut-down. The vessel alone would generate a comparable intensity after 45 years—the curve of dose intensity relative to the vessel alone shows a different form from the other components. This is due mainly to the low percentage of europium present in the vessel steel based on the analyses which were carried out. For the linear and thermal shield the dose intensity is due almost entirely to Cobalt 60 in the first 50 years; do to Europium 152 from 50 to 120 years and finally to Niobium 94 and Ag-108m. For the vessel, however, there is a rapid transition from a period dominated by Cobalt 60 to when Niobium 94 and Ag-108m become important."

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C. F. COACH

Observation in a Park

A husband's hands say so much
trailing lank and useless from summer
wrists
walking well behind his wife and her
mother
who are looking over the blooming rose
bushes.
He is waiting for his turn.

C. F. Coach lives in British Columbia.

JOANNA M. WESTON

Mirror, Mirror

This old woman
peers at me
some mornings
asking
"Who did you used to be?"

Joanna M. Weston lives beside a lake with her three sons, husband, and tortoiseshell cat.