REMOVAL OF UNDERGROUND PIPING DECOMMISSIONING OF BURIED, RADIATION-CONTAMINATED PIPES

PROCEDURE USED AT THE LA HAGUE SPENT FUEL REPROCESSING PLANT (FRANCE)

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ABSTRACT

This report describes the procedure used to decommission buried, radiation-contaminated pipes at the La Hague spent fuel reprocessing plant in France. Between June 1988 and April 1990, 1085 linear meters of pipe were decommissioned, a further 1315 linear meters of pipe remain to be decommissioned in the third and final phase.

One goal of this decommissioning procedure was to ensure that the work was performed in complete safety with optimum containment and the best possible radiation protection for the personnel involved.

Cogema decided to divide the work into three phases in order to cut decommissioning costs and shorten the time required. The feedback from the first phase was very helpful to the second phase. Preliminary studies for the third phase are underway; they take into account the experience acquired during the previous two phases.

It could be said that the decommissioning is an on-going process of adapting existing means so as not to destabilize in-service pipes located near the pipes to be decommissioned.

INTRODUCTION

In 1981, COGEMA decided to decommission old contaminated buried pipes at its La Hague reprocessing plant. These pipes had in the past been used to discharge liquid waste into the sea after chemical treatment and decontamination.

This report only covers the decommissioning of 2400 linear meters of onshore pipe. The offshore section of pipe was decommissioned between 1982 and 1984.

The decommissioning work was divided into three phases to cut the cost of the operation and take advantage of feedback (Fig. 1). Phase 1 work (decommissioning of 450 linear meters of pipe) took place between June 1988 and April 1989. Phase 2 work (635 meters) was completed in April 1990; phase 3 work (1315 meters) has not yet begun (Appendix 1).

The purpose of the decommissioning is to remove, in complete safety, 2400 linear meters of concrete ducts and buried, radiation-contaminated pipe in their entirety, located close to in-service structures, without radioactive contamination being released into the environment (Fig. 2). When necessary, earth at the bottom of the excavations around the structures to be removed is decontaminated.

Cogema looked for the best possible technology available to perform this work. After analyzing various decommissioning-related constraints, COGEMA and EMCC/RADIACONTROLE, the company to whom the contract was awarded, developed a procedure that can be used to remove any buried nuclear installation, without a risk of radioactive contamination. This procedure is particularly well-suited to the decommissioning of linear installations such as concrete ducts, buried pipes, etc.

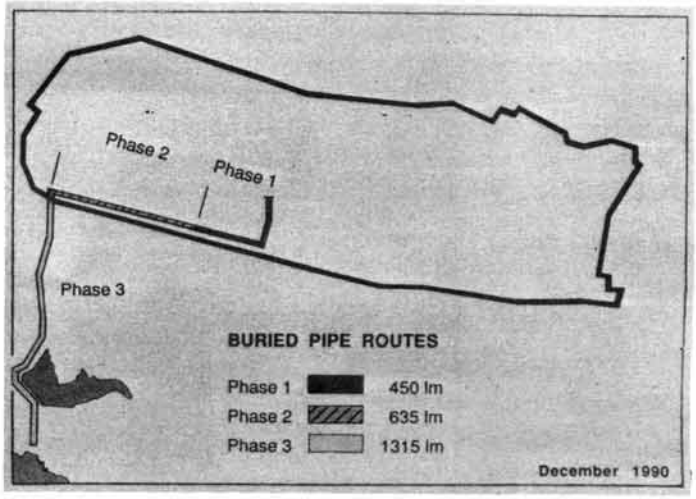


Fig. 1. LA HAGUE reprocessing plant: Location plot plan.

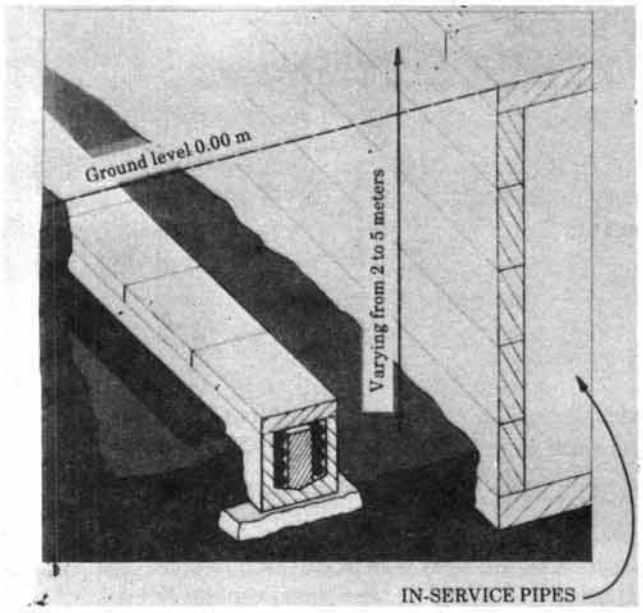


Fig. 2. Vertical section of pipes to be decommissioned.

DECOMMISSIONING WORK

The pipes to be decommissioned consist of:

- a buried concrete duct containing six to eight polyethylene pipes 80 mm in diameter;
- ordinary welded steel pipes, 165 mm in diameter, buried parallel to the duct.

The depth at which the pipes are buried depends on ground geometry, varying between 2 and 5 meters below ground level (Fig. 2).

The duct is covered with concrete slabs to prevent earth from penetrating it. Prefabricated in 6-meter-long sections, they were installed end to end during pipelaying.

The pipes to be decommissioned are located very close to some particularly sensitive structures, in-service pipes, instrumentation and control power supply, high voltage power supply, whose integrity must not be breached. There are also contaminated reinforced concrete inspection enclosures along the length of the pipes. Phase 3, not yet begun, will consist of work on heavily-sloped sections.

Pipe decommissioning phases include:

- clearing the land, over a distance of some 20 linear meters, using earthmoving equipment, to about 10 centimeters above the cover slabs of the duct to be decommissioned;
- consolidating structures located in the vicinity of the pipes to be decommissioned (in-service pipes, etc.);
- rainproofing excavations;
- installing supports for the intervention shop (in sufficient quantities to allow the shop to be moved three times);
- removing in a leaktight containment and using shop equipment, of:
  - earth close to the duct and pipes to be decommissioned,
  - two three linear meter long sections of duct and pipes;
- encapsulating or drumming decommissioning waste and contaminated earth in the intervention shop;
- moving and reinstalling the intervention shop (position 2) to decommission two new three linear meter long sections of duct and pipes;
- backfilling land upstream from the intervention shop and restoring it to its original condition.

Pipe decommissioning continues from position to position, the intervention shop is moved 6 meters at a time as the work advances.

The experience acquired during Phase 1 enabled the Phase 2 work to advance much more quickly. An average of 1.65 meters of pipe was decommissioned per day during Phase 1. This figure rose to 2.60 linear meters in Phase 2. Work progressed steadily at a rate of 6 linear meters per day in the final months of Phase 2.

This success should not overshadow the problems encountered in the decommissioning of 1085 linear meters of pipe, including:

- an encumbered environment (pipes beside others to be decommissioned, nearby 15,000 V and low current trenches, road culverts to be demolished, etc.);
- possible contaminated earth underneath the decommissioned pipes;
- radiation emitted by metal pipes to be decommissioned;
- frequent bad weather (torrential rain and strong winds).

In 1987, the forecast overall schedule called for the decommissioning of 2400 linear meters of buried pipe over a 5 year period (1988 to 1992). Thus far, two phases (1085 linear meters) have been completed within the forecast periods and under good conditions (Appendix 1).

PROCEDURE

The previous section described the method used for decommissioning.

- the procedure and means used for "radioactive" work once the "nonradioactive" work has been completed include:
  - a crane truck to position the intervention shop above the pipes and duct to be decommissioned;
  - an intervention shop equipped to:

* dig a pipe and duct pre-clearance trench along at least 6 meters,
* isolate the pre-cleared working area,
* complete pipe and duct clearing,
* remove and store the concrete closure slab and central duct section,
* cut the pipes in and outside the duct into sections,
* remove and store these sections in a 10-cubic-meter container,
* remove and cut the duct before taking it away and storing it in a container,
* encapsulate the waste in the container and remove it,
* ventilate the intervention shop,
* enable personnel to enter and leave the shop without breaching the containment,
* remove, when necessary, contaminated earth from the bottom of the excavation (Fig. 3).

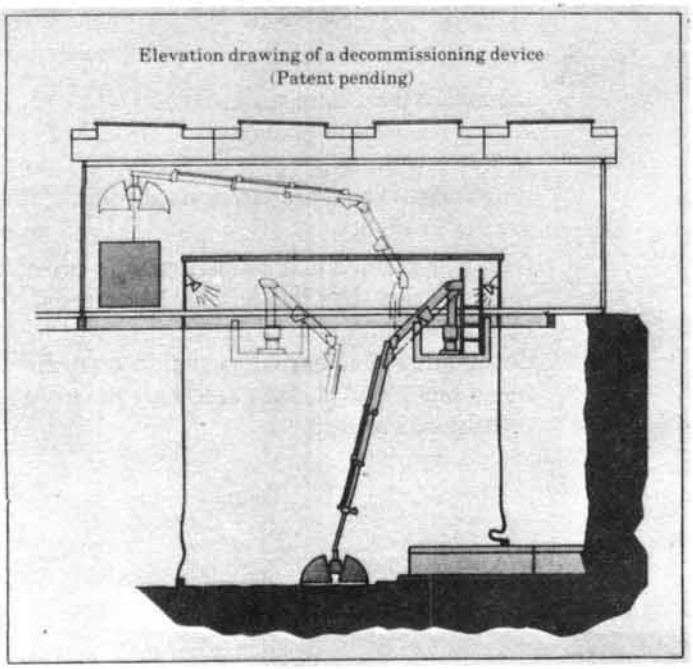


Fig. 3. Decommissioning of buried contaminated pipes.

WASTE PRODUCTION

- The decommissioning waste was mainly contaminated by beta gamma emitters.
- Dose rate measurements were performed on radioactive waste.
- The presence of beta/gamma emitters in this waste was not a constraint with regard to storage standards per se. Checks had to be made to ensure that package dose rates did not exceed 2 mSv on contact. Beta/gamma emitter radioactivity was calculated using a transfer function. Alpha emitter concentration was checked using an alpha-to-beta gamma radioactivity ratio established according to analyses of representative samples. The alpha-to-beta/gamma radioactivity ratio was 0.1 for this decommissioning.
- The main waste package types were:
  - 100-liter drums for compactable waste,
  - 5 or 10 cubic-meter containers for other waste.

A breakdown in solid and liquid waste production at the end of April 1990 when the first two decommissioning phases had been completed is given in Table 1.

- Total solid waste radioactivity, Phase 1: 1291 GBq.
- Total solid waste radioactivity, Phase 2: 5385 GBq.

RADIATION DOSES

- Personnel integrated doses are given on a monthly basis in man-millisieverts/linear meter of pipe decommissionined for Phases 1 and 2 (Appendix 2 and Appendix 3).
- Daily checking by the Radiation Protection Department of integrated doses per worker enabled this dose to be limited to the maximum value set at the La Hague Center.

1988 had the highest average individual dose. This corresponded to the startup of work, when techniques were still unfamiliar.

- Appendix 4 (radiation doses) shows the results of the efforts made to improve techniques to obtain ever-decreasing integrated doses by the workers:

Phase 1 (450 m)

Total integrated doses :

TABLE I

Buried Contaminated Pipe Decommissioning and Waste Production

1) SOLID WASTE

Phase 1	Phase 2

	Low-Level waste	Volume (m^3)	Volume ratio ($m^3.m^{-1}$)	Total radioactivity (GBq))
	100-L drums	69.80	0.155	3.00
	100-L drums	63.50	0.100	4.30
	$5m^3$ containers	450.00	1.000	30.00
	$5m^3$ containers	165.00	0.260	6.90
	$10m^3$ containers	330.00	0.735	1,258.00
	$10m^3$ containers	489.00	0.770	5,374.00
	TOTAL PHASE 1	849.40	1.890	1,291.00
	TOTAL PHASE 2	717.50	1.130	5,385.00

2) LIQUID WASTE

Phases 1 and 2

	Liquid waste	m^3	Total radioactivity	Destination
	Low-level	3.00	3.60 MBq	STE 2

- forecast 145 man.mSv
- actual 144 man.mSv (forecast met)

Phase 2 (635 m)

Total integrated doses :

- forecast 171 man.mSv
- actual 159 man.mSv (down of 7%)

Phase 3 (1315 m not yet decommissioned)

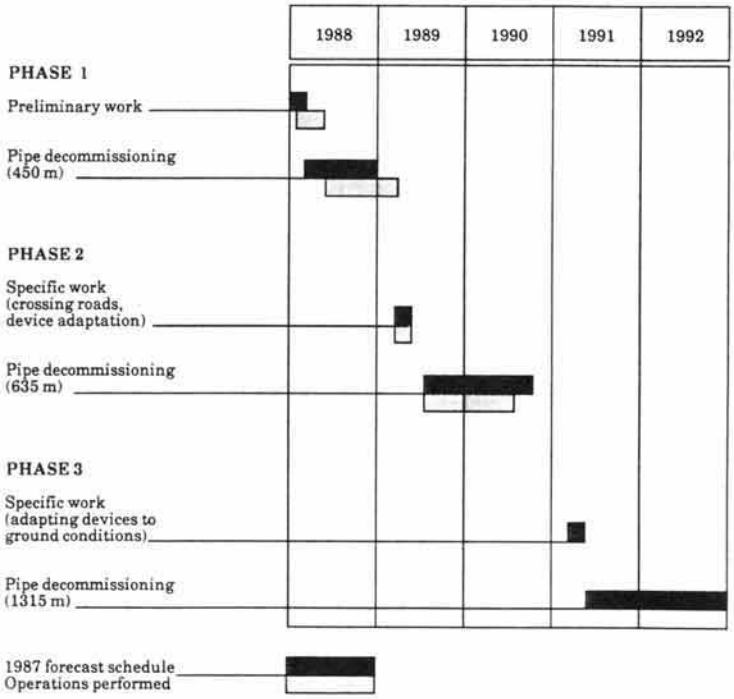
Total forecast integrated doses not exceeding 197 man.mSv.

CONCLUSION

- The initial decommissioning operations for buried, radiation-contaminated pipes (1085 linear meters out of a total of 2400) at La Hague were performed in complete safety within the scheduled timeframe and at acceptable radiological and financial costs.
- Several conclusions have already been drawn:
  - the means used were reviewed and adapted during decommissioning to deal with hard-to-forecast situations encountered; the planning and stringent preparations allowed greater flexibility;
  - feedback enabled decommissioning to progress faster than had initially been forecast; COGEMA now has experience with decommissioning buried, radiation-contaminated pipes, and plans to automate the main operations involved.

APPENDIX 1

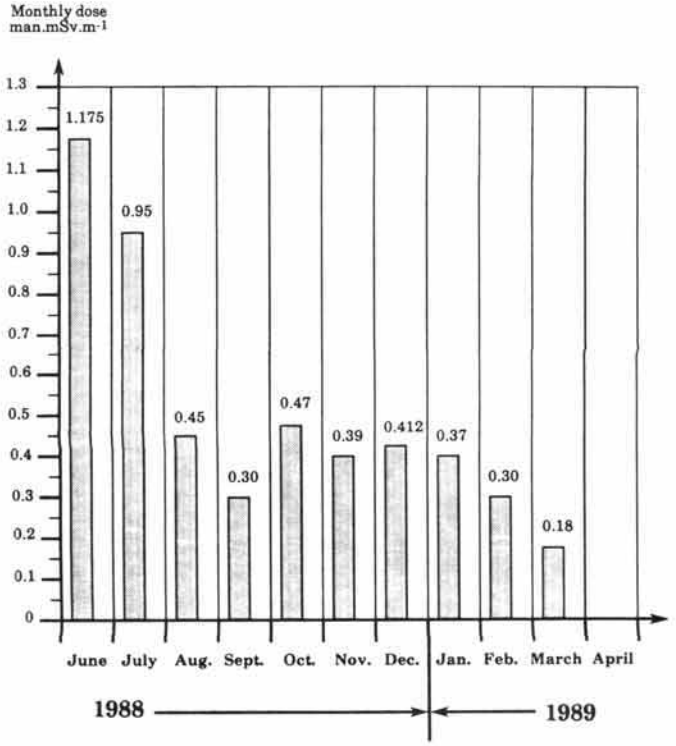
BURIED CONTAMINATED PIPE DECOMMISSIONING OVERALL DECOMMISSIONING SCHEDULE



APPENDIX 2

BURIED PIPE DECOMMISSIONING PHASE 1 (450 m)

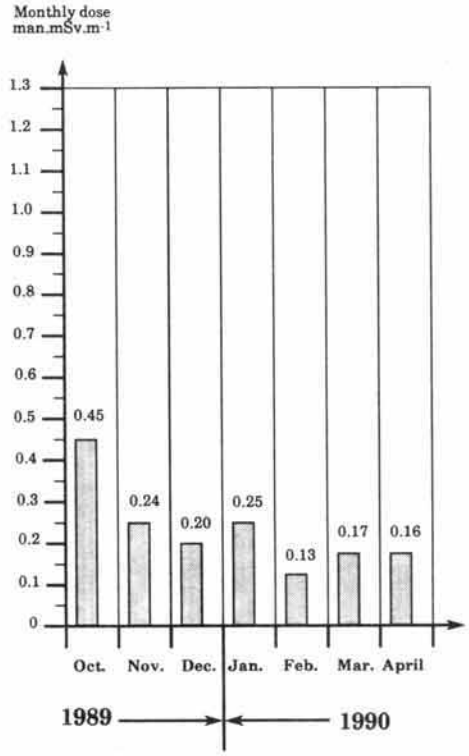
MONTHLY INTEGRATED COLLECTIVE DOSE PER LINEAR METER (man.mSv.m^{-1})



APPENDIX 3

BURIED PIPE DECOMMISSIONING
PHASE 2

MONTHLY INTEGRATED COLLECTIVE DOSE
PER LINEAR METER
(man.mSv.m^{-1})



APPENDIX 4

BURIED CONTAMINATED PIPE DECOMMISSIONING
RADIATION DOSES

(INTEGRATED DOSES PER LINEAR METER OF
DECOMMISSIONED PIPE)
(man.mSv.m^{-1})

Phase 1

- Total integrated doses
  - * Forecast : 145 man.mSv
  - * Actual : 144 man.mSv
- Total integrated doses per linear meter : 0.32 man.mSv.m^{-1}

Phase 2

- Total integrated doses
  - * Forecast : 171 man.mSv
  - * Actual : 159 man.mSv
- Total integrated doses per linear meter : 0.25 man.mSv.m^{-1}

Phase 3

- Total integrated doses * Forecast : 197 man.mSv
- Total integrated doses per linear meter : 0.15 man.mSv.m^{-1}