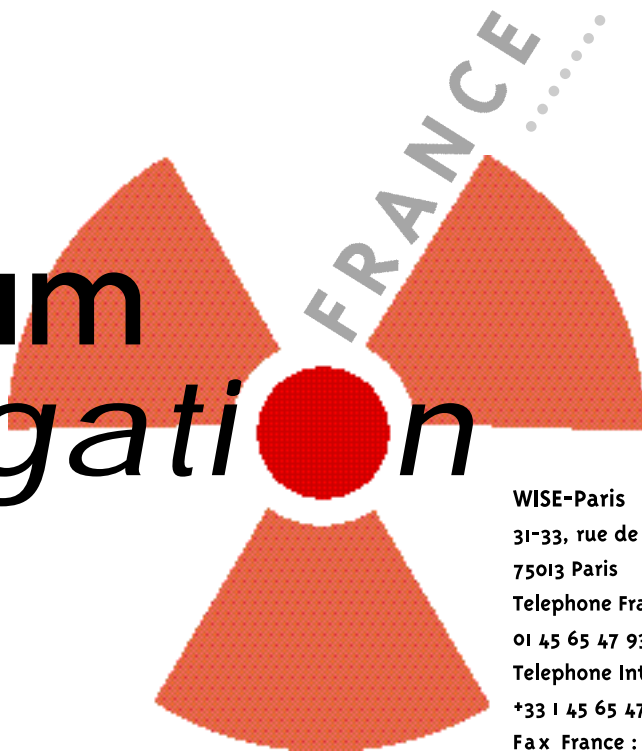


Plutonium *Investigation*

N°1 NOVEMBER 1997
Monthly - 20 FF



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EDITORIAL

France to begin with

France currently produces about 80% of the world's separated plutonium. Whereas the production of military plutonium is almost at a standstill in all the nuclear weapon countries, the production of civil plutonium is flourishing in France. While US and Russia are trying to find a solution for the management of about 100 tonnes of military plutonium from dismantled weapons, the amount of plutonium stored in France is increasing by 10 tonnes per year, and represented more than 65 tonnes at the end of 1996.

Bearing in mind that roughly 10 kg is enough to build a nuclear explosive device and that a few micrograms of inhaled plutonium can cause lung cancer, this evolution is particularly disquieting.

Moreover, decisions relating to plutonium are discussed behind the closed doors of industry and the higher civil service. Information is not freely available and members of parliament are permanently faced with fait accompli situations. *Plutonium Investigation*, with ten issues per year, each focused on a different country, is committed to exposing the issues at stake in the plutonium industry together with revealing information on the what's happening behind the scenes in this very special industry far removed from democratic controls.

FRANCE

During 1996, 77% of the electricity produced in France was generated by nuclear power. Only one large utility, Electricité de France (EDF), produces most of the electrical energy generated in France (94% of the total French production). In 1996 EDF exported 69 TWh, mostly to Germany, Italy and the United Kingdom. EDF is the largest electricity exporter in Europe. EDF currently operates 56 nuclear reactors of which a dozen are operated for export (!) Two more are planned to be put into service by the year 2000 (see map on page 6).

France was one of the first countries to develop a civil plutonium separation capacity, through reprocessing technology originally developed to produce plutonium for France's military programme. COGEMA operates today the largest commercial reprocessing plant in the World at La Hague in Normandy.

CONTINUED ON PAGE 2

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The first industrial scale reprocessing plant - UP1 - was built in 1958 at Marcoule. The UP1 plant - UP is a French abbreviation for plutonium factory - has mainly reprocessed fuel from the first type of reactors developed in France, magnox reactors.

The CEA began the construction of the La Hague reprocessing plants in 1960. The first plant to be built at La Hague was the UP2 plant, which began reprocessing magnox fuel in 1966. UP2 ceased to reprocess this type of fuel in 1987, after a total of 4,894 tonnes¹ had been reprocessed. A complementary facility to reprocess spent fuel from light-water reactors (LWR)² began operating at La Hague in 1976. The first French pressurised-water reactors, which were to progressively replace the existing magnox reactors, were built from 1970 onwards. The first French pressurised-water reactor, Fessenheim 1, began operation in 1977.

Another reprocessing plant, UP3, began operating at La Hague in 1990. This plant, with an 800 tonne per year capacity, was built for foreign clients: German, Japanese, Belgian, Swiss and Dutch utilities; the building and first decade operation of the plant was - in principle - completely prefinanced by these utilities on a cost-plus-fee basis.

The La Hague plants reprocess primarily foreign spent fuel. At the end of 1990, a total of 2,881 tonnes of spent LWR fuel had been reprocessed at La Hague, of which, 731 tonnes (only 25%) were from EDF. Nowadays, the French share of reprocessed spent fuel is larger. At the end of 1996, 10,087 tonnes of LWR spent fuel had been reprocessed, of which, almost 6,100 tonnes (60%) was of foreign origin.

Plutonium throughputs and plutonium stockpiles

When the French nuclear programme was boosted in 1974, EDF planned to reprocess LWR spent fuel and to use the extracted plutonium for the fabrication of fuel for fast-breeder reactors (FBRs). Although, at the time, only limited experience was available on either spent LWR fuel reprocessing or FBR operation, COGEMA committed itself to extensive programmes for both the UP2 and UP3 plants. At the same time a French led consortium, NERSA, committed itself to build the FBR reactor, Superphénix, in spite of considerable public opposition to the project.

The FBR programme did not develop as foreseen. As a result it became clear that reprocessing would lead to the stockpiling of separated plutonium as the amount of plutonium being produced exceeded FBR requirements.

In 1985, with the pretext of diminishing this unwanted stockpile of plutonium, EDF, subjected to considerable pressure from the plutonium lobbies of the CEA and COGEMA, set up a programme to use plutonium to produce MOX fuel (mixed uranium-plutonium oxides) for its PWRs (Pressurized Water Reactors). From then on, this programme became an alibi for the ongoing construction of plutonium plants at La Hague. The argument to reduce plutonium stockpiles through a MOX fuel strategy ultimately led to the opposite effect of increasing plutonium production and stockpiling.

At the end of the 1980s, when the stockpile of separated plutonium had reached about 3 tonnes, EDF came to the conclusion that "in order to avoid finding itself in a very difficult situation in the year 2000", it would be necessary to recycle more plutonium [in MOX fuel], or to reprocess less fuel"³. It was impossible to "recycle" more plutonium in MOX fuel because of an insufficient MOX fuel production capacity; the reprocessing throughput was not reduced either. Plutonium stockpiles continued to increase; the "very difficult situation" foreseen for the year 2000 is fast becoming a reality.

Officially, French government policy is to obtain throughput equality between the plutonium produced in reprocessing and the plutonium used for MOX production. According to the Ministry of Industry, in order to avoid the accumulation of stocks of separated plutonium, EDF "only reprocesses spent fuel if use can be made of the plutonium produced"⁴.

In practice, this is not so. Sixteen PWRs are currently licensed to use MOX fuel, whereas only fourteen are actually using MOX at the moment. Plutonium stockpiles are therefore still increasing very rapidly (see plutonium inventory, page 7). EDF has requested a license to use MOX in another four reactors at Chinon. It is clear that time is running out; the present context does not favour either comprehensive analysis or a democratic decision making process.

Fabrication of MOX Fuel

France has two operating MOX fabrication plants. The first one is the Cadarache plant, operated by the CEA. It has produced MOX

fuel for FBRs as well as LWRs. The Cadarache plant produced 32 tonnes of MOX fuel for LWRs in 1995, and the CEA is aiming at an annual production of 35 tonnes. The Cadarache plant was recently qualified to produce MOX fuel for German PWRs, and will be operated during the coming years almost exclusively for German customers. Logically, the former director of the Hanau MOX plant in Germany was appointed director of the Cadarache plant. Neither the German population, nor the Government of the Land of Hesse, wanted such a plant. The German nuclear industry chose to export the corresponding risk to France.

The other plant is the Melox plant at Marcoule, which was first operated in 1994. The Melox plant is licensed to produce 100 tonnes of MOX fuel for LWRs. In fact, the Melox plant was designed to produce MOX fuel only for PWRs, since EDF only operates this type of LWR. At the beginning of 1996 Melox requested authorisation from the safety authorities to add a workshop to the plant in order to produce MOX fuel for BWRs to satisfy the MOX fuel needs of foreign utilities. Melox is also planning to request another license to double its production capacity. Ms. Dominique Voynet, Minister of the Environment, declared that she is opposed to any enlargement of the plant for export: "I will not sign any Bill for the extension of the plant to produce more and export"⁵. At the end of 1996, the Melox plant had produced only 80 tonnes of MOX fuel. During the first six months of 1997, production however reached 45 tonnes.

Consequences of the use of MOX fuel in light water reactors

Currently, French nuclear safety authorities stipulate that no more than one third of the nuclear fuel used in LWRs should be MOX and that the plutonium contents of this fuel should not exceed more than about 7.5% and impose more stringent operating characteristics for MOX fuel than for uranium fuel. It is not only the MOX fabrication plants that become storage sites for a raw material which can be used for the fabrication of nuclear weapons but also the sites of the reactors in which MOX fuel is used. The management of MOX fuel implies protective measures similar to those employed for separated plutonium. The Ministries for Industry and the Environment of the second Juppé Government requested an official inter-

national evaluation of the economic and ecological consequences of different options for the management of spent fuel and radioactive waste. The first version of the report did not convince the staff of the new Minister of the Environment; a further report has been requested from the authors; this new report should be available over the next few months.

MOX and Fissile Material Management

Following denuclearisation treaties between the USA and the Russian Federation, large quantities of fissile material will have to be disposed of, so as to reduce or eliminate nuclear proliferation risks. Different solutions have been proposed for weapons grade plutonium, of which vitrification together with high-level radioactive waste and production of MOX fuel for standard reactors. Both solutions are being studied in the USA. France is participating in projects for the construction of a plant for the conversion of weapons grade plutonium (from a metallic alloy to oxide) and for a demonstration MOX fuel fabrication plant located in the Russian Federation.

Conclusion

A critical situation has been reached in France in the management of plutonium. On the one hand, stockpiles of separated plutonium are increasing. On the other hand, the national utility, EDF, has been endeavouring to burn more and more plutonium in order to decrease plutonium stockpiles; the utility has however been confronted with safety and security requirements which jeopardize cost efficiency. The fact that EDF has attributed a zero monetary value to its plutonium stocks speaks for itself. Plutonium has for a long time been a source of concern rather than a source of energy. There seems to be no logic in spending a lot of money to produce plutonium while generating very large quantities of radioactive effluents (the La Hague plants discharge 8,000 times more radioactivity to the environment than a standard French reactor !) and stocks of a highly toxic and proliferating material having a zero monetary value.

1 All tonnes mentioned in the bulletin are metric tonnes.

2 Both pressurised water reactors (PWRs) and boiling-water reactors (BWRs) are light-water reactors (LWRs).

3 EDF, « Combustible MOX, Aspects techniques, économiques et stratégiques », 24 November 1989.

4 Claude Mandil, Director for Energy at the Industry Ministry, 1996.

5 Politis, 18 September 1997.

PUBLIC ENQUIRIES FOR MOX FUEL

EDF envisaged using MOX fuel in twenty-eight of its thirty-four 900 MWe PWRs. The original operating licenses of sixteen of the first series of 900 MWe reactors permit the use of MOX fuel. The utility has not licensed its latest 900 MWe PWRs to use MOX fuel, nor has it licensed its more recent 1300 and 1,450 MWe PWRs to operate with MOX fuel. In order to use MOX fuel in the twenty-eight 900 MWe reactors, EDF would have to modify the operating licenses of 12 PWRs; such modification requires public enquiries.

A public enquiry to authorise the use of MOX in the four reactors of the Chinon plant took place during the 14 February to 17 March 1997 period; the enquiry did not arouse much interest. The Forum Plutonium was one of the only bodies to voice any opposition and requested that the procedures be postponed. For EDF, such procedures are merely a formality because public enquiries do not permit any serious confrontation of opinions because of the imbalance between the means available to the utility and the lack of means in terms of expertise and financial backing available to citizens. It is planned to use Mox fuel in Unit 4 of the Chinon plant at the end of 1997. Public enquiries were planned to follow for the use of MOX in Units 3 and 4 of the Le Blayais plant and Units 5 and 6 of the Gravelines plant. These two plants have already been using MOX fuel in other units; EDF had hoped that the requests for authorisation would be satisfied without any controversy. The last request for authorisation would have been for the four units of the Cruas-Meysses plant. However, there are indications that MOX production capacity limitations may incite EDF to only submit, for the time being, requests for MOX authorisation for the reactors at Chinon.

The French Fast-Breeder Programme

At the beginning of the 1970s, the nuclear industry envisaged an intensive development of fast-breeder reactors, which were to become standard reactors by the turn of the century. In parallel with its plutonium industry, France built two full scale FBRs, Phénix at Marcoule, and Superphénix at Creys-Malville - which is the largest FBR in the world.

Phénix

Phénix is a 250 MWe demonstration FBR operated by EDF and the CEA at Marcoule. Phénix went critical on 31 August 1973. At the end of 1995, it had only generated 22 TWh during 21 years of operation, which corresponds to a 27% capacity factor. Phénix has been undergoing major maintenance work since 7 April 1995. This long outage will enable a thorough analysis of the state of the reactor. The operator is also formulating a request for a further 10 year operating period. Both welding defects and stress cor-

rosion cracking have already been detected in the secondary cooling system. It is planned to replace parts of the secondary cooling system. Furthermore, the operator was to install a complementary emergency shut-down system. This decision follows - although there is no official connection - four emergency shutdowns of the reactor after abnormal abrupt spontaneous drops in core reactivity that took place in August and September 1989 and in September 1990. The reasons for these reactivity variations, which can theoretically lead to a Chernobyl type accident, are still not completely understood. A decision about whether Phénix would continue to operate or not is expected before the end of 1997. Safety authorities and the Ministry of Environment are not convinced about the wisdom of allowing the plant to re-operate and it could very well be definitively shut down.

Superphénix

Superphénix has a nominal 1,240 MWe power generating capacity. It was built and operated by NERSA, a consortium with the participation of EDF (France: 51%), ENEL (Italy: 33%) and SBK (German-Dutch-Belgian consortium: 16%). The British left the consortium at the beginning of 1997; the Italians announced at the end of October 1997 their intention to leave NERSA.

Superphénix first went critical on 7 September 1985. As of end of 1996, it had generated 8.2 TWh during eleven years operation, which corresponds to a capacity factor of less than 7%. This poor result, which is the worst capacity factor encountered with any power reactor, is the result of repeated shutdowns and time consuming repair and maintenance programmes. The longest outage lasted four years and required a completely renewed licensing procedure with a public enquiry. Superphénix was definitively shut down on 24 December 1996.

The last license for the operation of Superphénix was issued 11 July 1994. This license stipulates that the reactor can be used for research. This modification to the original objectives of the reactor was not accepted by the foreign partners of NERSA who requested and obtained compensation. At the end February 1997, the State Council (Conseil d'Etat) cancelled the 1994 license following a complaint filed for incompatibility between the status of the reactor and the objectives of the reactor's operating programme. Also, the final shut down of Superphénix was programmed in an electoral agreement between the Green and the Socialist parties prior to the June 1997 legislative elections. In his general policy declaration on 19 June 1997, the new Prime Minister Lionel Jospin confirmed this decision: "If the nuclear industry is an important asset for our country, it must not exempt itself from democratic rules, nor pursue projects of excessive cost and uncertain success: this is why the fast-breeder reactor, 'Superphénix', is to be abandoned." It is the end of a technological adventure, the cost of which has been estimated by the National Audit "Cour des Comptes" to be about FF 60 billion (about US\$ 10 billion).



Who's Who and Where's What?

STATE and INDUSTRY

CEA The *Commissariat à l'Energie Atomique (CEA)* is a state research and development organisation. Its budget for the year 1995 was FF 19.2 billion (US\$ 3.3 billion), of which 45% was spent on defense projects. CEA operates most of the nuclear research centers in France, and sells products and services to both the civil and private sectors. The largest CEA centers are at Saclay and Fontenay near Paris, at Valduc near Dijon, and at Marcoule and Cadarache in the South of France.

31-33, RUE DE LA FEDERATION 75752 PARIS CEDEX 15
FRANCE - TEL : + 33 (0)1 40 56 1000
FAX : +33 (0)1 40 56 29 70

COGEMA The *Compagnie Générale des Matières Nucléaires (COGEMA)* is a state controlled industrial group, with CEA (89.2%) and the "Total" oil company (10.8%) participation. Its budget for the year 1995 was FF 30.6 billion (US\$ 5.2 billion). COGEMA operates uranium mines, uranium enrichment facilities (the largest of which is the Eurodif plant at Tricastin), reprocessing plants at La Hague and Marcoule, and other nuclear facilities for both French and foreign clients.

2, RUE PAUL DAUTIER BP4
78141 VÉLIZY-VILLACOUBLAY CEDEX - FRANCE
TEL : +33 (0)1 39 26 35 50 - FAX : +33 (0)1 39 26 27 55

EDF *Electricité de France (EDF)* is the domestic electrical generating utility. EDF operates 56 reactors on 18 sites. Its annual budget for the year 1995 was FF 191 billion (US\$ 32 billion).

2, RUE LOUIS-MURAT 75384 PARIS CEDEX 08 - FRANCE
TEL : +33 (0)1 40 42 46 37 FAX : +33 (0)1 40 42 72 44

Melox Melox S.A. is a company owned half by COGEMA and half by the nuclear plant builder Framatome. This company was set up to operate a plant at Marcoule also called Melox which produces MOX fuel.

BP 124 - 30 203 BAGNOLS-SUR-CÈZE CEDEX - FRANCE
TEL: 33 (0)4 66 90 64 04 - FAX: 33 (0)4 66 90 64 39

DSIN The *Direction de la Sûreté des Installations Nucléaires (DSIN)* is the French nuclear installations safety authority. It is responsible to both the Ministry of Industry and the Ministry of Environment.

99, RUE DE GRENELLE - 75 353 PARIS CEDEX 07 - FRANCE
TEL: 33 (0)1 43 19 39 61 - FAX: 33 (0)1 43 19 47 80

IPSN The *Institut de Protection et de Sûreté nucléaire (IPSN)* is a CEA based institute concerned with the safety and security of nuclear facilities. A large share of IPSN research is made for DSIN. The institute's dissociation from the CEA is actively being discussed.

BP 6 - 92 265 FONTENAY-AUX-ROSES CEDEX - FRANCE
TEL: 33 (0)1 46 54 76 76 - FAX: 33 (0)1 46 54 84 51

OPPOSITION ACTIVITIES and CONTACT ADDRESSES

Forum Plutonium The *Forum Plutonium* is a network of organisations and individuals which was created in 1994 in order to promote the dissemination of information concerning the plutonium industry, and to initiate a counter-expertise on this activity, particularly in France.

JEAN-PIERRE MORICHAUD
LES OLIVIERS - 26 110 VENTEROL - FRANCE
TEL: 33 (0)4 75 27 97 69 - FAX: 33 (0)4 75 27 98 46
e-mail: forumpu.jpm@wanadoo.fr

ACRO The *Association pour le contrôle de la radio-activité dans l'Ouest (ACRO)* is an independent sampling laboratory. Its activity is mostly concentrated on the La Hague environment.

138, RUE DE L'EGLISE
14200 HÉROUVELLE SAINT-CLAIR FRANCE
TEL: +33(0)2 31 94 35 34 - FAX: 33 (0)2 33 52 53 26

CRILAN The *Comité de Réflexion, d'Information et de Lutte Antinucléaire* is one of the historical opponents of the La Hague reprocessing plant and the Flamanville nuclear power plant.

DIDIERANGER
10, ROUTE D'ETANG VAL 50340 LES PIEUX - FRANCE
TEL : +33 (0)2 33 52 45 59 FAX : +33 (0)2 33 52 53 26

CRII-RAD The *Commission de recherche et d'information indépendants sur la radioactivité* is an independent measurement laboratory which has drafted numerous reports on radioactive contamination caused by the nuclear industry in France.

471, AVENUE VICTOR HUGO - F-26000 VALENCE - FRANCE
TEL +33(0)4 75 81 26 48 - FAX +33(0) 75 81 26 48

Greenpeace Greenpeace continues its campaign against plutonium production and continues to draw attention to the alarming levels of radioactive contamination measured around the La Hague site.

21, RUE GODOT DE MAUROY 75009 PARIS - FRANCE
TEL : +33 (0)1 53 43 85 85 FAX : +33 (0)1 42 66 56 04

Plutonium

IN FRANCE

NUCLEAR POWER PLANTS

- 56 PWRs, of which 14 are loaded with MOX fuel
- 2 Fast-Breeder reactors
- 2 PWRs under construction - to be put into service by the year 2000

REPROCESSING PLANTS

- Two large reprocessing plants at La Hague (UP2 and UP3). Nominal capacity: 800 tonnes per year of LWR spent fuel for each plant.
- A reprocessing plant at Marcoule (UP1) to be definitively shut down before the end of 1997. Has mostly reprocessed magnox spent fuel from reactors which have now all been definitively shut down.

MOX FUEL FABRICATION

- Melox Plant (Marcoule): Nominal capacity 115 tonnes oxides (100 tonnes heavy metal) per year; the operator wishes to increase production in the coming years.
- CFCa Plant (Cadarache): Nominal capacity 35 tonnes per year.

FIGURES OF THE MONTH

The alarming evolution of non irradiated plutonium (Pu) stockpiles in France is shown in the table below (figures in tonnes). More than ten tonnes of plutonium will have been put on the shelf during the year 1996 alone.

CATEGORY	End of 1994	End of 1995	End of 1996
Separated Pu stored at reprocessing plants	27,8	36,1	43,6
Separated Pu undergoing process and Pu contained in non finished products at fuel manufacturing plants or at other plants	8,7	10,1	11,3
Pu contained in non irradiated MOX fuel or in other manufactured products at nuclear power plants or at other plants	1,8	3,6	5,0
Separated Pu at other plants	4,6	5,5	5,5
Total civil non irradiated Pu	42,9	55,3	65,4
- of which Pu owned by foreign organisations	21,6	25,7	30,0
- French Pu in foreign countries	0,6	0,2	0,2

Source : Secrétariat d'Etat à l'Industrie, 1997.

WHAT A WASTE

COGEMA is currently building a compacting facility for medium activity waste (hulls and nozzles) on the site of its reprocessing plant at La Hague. This is the latest invention of the geniuses of the CEA subsidiary... They sold a facility to their clients for FF 3 billion (about US\$ 500 million) - 59% of which is for EDF - to reduce the volume of this type of waste by a factor of four. It has been realised that the now half-built facility will only be able to reduce volumes by a factor of 2.5. In addition to this, ANDRA's, ill-fated managers of the future waste containers, have now indicated that an over-pack will no doubt be needed to provide biological protection around the compacted waste since concentrating volumes will increase radioactivity.

"We've been had", comments an EDF representative.

BEHIND THE SCENES

Low level radioactive waste, as well as some of the medium level radioactive waste, from the reprocessing of foreign spent fuel at La Hague will stay in France. Contrarily to what has been declared by representatives from industry and by the French government (notably by the former Minister of Industry and the present Minister for the Economy, Dominique Strauss-Kahn - who has personally stated that "every screw" would go back to its country of origin - COGEMA has committed itself to only returning high level radioactive waste and "some" medium level radioactive waste to client countries. In practice, this makes things less complicated, because, up until 1989, all low level radioactive waste was buried in the nearby La Manche disposal facility. Furthermore, COGEMA has reassured client countries that cemented radioactive waste would not be sent back before 2008. However, the 1991 decree on radioactive waste stipulates that "storage in France of imported radioactive waste (...) is forbidden" after the "technical storage" period associated with reprocessing; normally only high-level activity waste needs to be stored in this way; foreign customers are happy with this situation. The French have been "had" (again).

THE WORD OF THE MONTH

"For an unsophisticated proliferator, making a crude bomb (...) from reactor-grade plutonium would require no more sophistication than making a bomb from weapon-grade plutonium (...) Indeed, one Russian weapons-designer who has focused on this issue in detail criticized the information declassified by the US Department of Energy for failing to point out that in some respects it would actually be easier for an unsophisticated proliferator to make a bomb from reactor-grade plutonium (as no neutron generator would be required)".

Matthew Bunn - who directed the project by the US Academy of Sciences on the evaluation of weapons plutonium disposition options - during an IAEA Conference in June 1997.



WORTH READING

"La France Nucléaire, Matières et Sites, 1997",
by *Mary Byrd Davis*,
Published by WISE-Paris, 256 pages (in French).

"a work of reference", *Le Monde Diplomatique*.
"an encyclopaedic work", *Politis*
"a comprehensive digest of the whole French nuclear reality", *Vert-Contact*

At last a reference book to identify the location of sites and the characteristics of hundreds of nuclear installations and to discover the nuclear materials (plutonium, uranium...) and the industrial processes (enrichment, MOX fuel manufacturing, reprocessing...). An indispensable tool for journalists, scientists, activists of associations, trade-unions, teachers, political and industrial representatives.
To be ordered from WISE-Paris:
120 FF + 25 FF for postal charges.

"Comprehensive Impact Assessment of the Use of MOX Fuel in Light Water Reactors",
by *Jinzaburo Takagi et al.*, CNIC, Tokyo, 335 pages.
A team of independent specialists from Japan, Germany, France, the UK, the US and Russia have studied over a period of two years, the social impacts of the production and use of plutonium as MOX fuel in nuclear power plants. The results are fearful: increase of nuclear terrorism threat, undermining of democracies, decrease in reactor operation safety margins, serious adverse consequences for waste management, etc... This report is the conclusion of a two year research project under the direction of Jinzaburo Takagi and Mycle Schneider,

respectively directors of the Citizens' Nuclear Information Center (CNIC), Tokyo, and of WISE-Paris.
To be ordered from WISE-Paris.

THE AWARD

The "Right Livelihood Foundation" in Stockholm recently made public the names of the five recipients who will share this year's SEK 1.8 million (US\$ 0.24 million) prize. The 1997 "Alternative Nobel Prize", as it is often called, was awarded in particular to Mycle Schneider and Jinzaburo Takagi "for the scientific rigour of their research and the effectiveness of their dissemination of its results, which have served to alert the world to the unparalleled dangers of plutonium to human life". The award presentation will take place in the hall of the Swedish Parliament on 8 December 1997.

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Published by
WISE-Paris
Director:
Mycle Schneider
Chief Editor and Director of the Bulletin:
Mycle Schneider
Editor:
Mathieu Pavageau
Lay-out:
Nathalie Saigot and Jean-Luc Thierry
ISBN/CPPAP : en cours
Dépôt : II-97
The
Plutonium Investigator
project is supported by the
W. Alton Jones Foundation.